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Industry
Measurement and Control

Plan, Build, Operate

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Planning Fundamentals

Industrial Piping Systems

Planning Fundamentals

Industrial Piping Systems

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Preface

GF Industry & Infrastructure Flow Solutions is a major global provider of complete piping solutions for many demanding applications in various market segments. Founded in 1802, Georg Fischer started the first production of malleable iron fittings in 1864 and today is recognized as the pioneer in the development of corrosion-free plastic piping systems for the safe and reliable conveyance of liquids and gases. This technical handbook reflects more than 60 years of our experience and know-how in the designing and manufacturing of plastic piping systems. Today, our product portfolio consists of more than 60'000 products and we are supporting our customers with products and services day to day around the globe.

The scope of these planning fundamentals is to offer a valuable support in planning and selection of the proper materials and the most suitable product range for all main industrial applications. In addition, the handbook provides extensive information about all jointing technologies for plastic materials and gives technical advises in the installation of pipes, fittings, valves, measurements and control, as well as actuation.

We strongly believe that the professional planning and the proper use of our comprehensive product range are the base for reliability, safety and high quality.

We hope that, in this handbook, you will find the qualified support that you need for your daily work. In case of special applications our worldwide technical engineers will be glad to assist you.

We would like to thank everyone, who continues to support GF Industry & Infrastructure Flow Solutions in its mission to delivering more value to customers, through superior piping systems.

Schaffhausen, 09/2026

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System Selection Guide 8

System Selection Guide

This section provides tips and suggestions on how to choose just the right measurement system for your specific liquid application needs.

Step 1: Determine Application Requirements

Defining the following variables before building your system will ensure peak performance from your GF sensors and instruments:

- Measurement range
- Installation requirements
- Pipe size and material
- Chemical compatibility of all wetted parts to process chemicals
- System specifications (such as temperature and pressure)
- Performance requirements of sensor
- Particle and fiber load in fluid
- Viscosity of liquids
- Hazardous location requirements

Step 2: Select Sensor Technology

Based on the application requirements determined in Step 1, choose a sensor.

Determine your signal output requirement to allow you to match just the right instrument (see Step 3). If you're not purchasing an instrument, select the sensor electronics package that best suits your needs.

Step 3: Choose Instrument

Choose an instrument. Instruments are available in ¼ DIN size and offered in panel mount configurations. Field mount versions are also offered for certain types. Instruments are available with digital, analog, or analog/digital display. Various retrofit adapters and mounting accessories are also available (see Accessories section). In cases where the sensor feeds directly to a PLC or PC system, GF offers a wide range of instruments and sensors with 4 to 20 mA outputs.

Step 4: Determine Installation Requirements

GF Industry & Infrastructure Flow Solutions offers a wide selection of installation fittings for flow sensors and in-line pH/ORP electrodes. These fittings are specifically designed to ensure the proper placement of the flow sensor in the piping system to achieve optimum performance. Other pH/ORP electrodes as well as all temperature, pressure and conductivity/ resistivity electrodes use NPT or ISO standard fittings. All submersion electrodes require conduit piping and fixtures not supplied with unit.

i Please contact your local GF Industry & Infrastructure Flow Solutions sales and support office if you need assistance in choosing any one of these products.

Transmitters

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Introduction

Single and Multi-Parameter Specification Matrix

Type	9900	9900-1BC
		
Description	Single-Channel Multi-Parameter Transmitter	Single-Channel Single-Parameter Batch Controller
Modular Components	Yes	Yes
Number of Flow Totalizers	1 Permanent 1 Resettable	1 Permanent 1 Resettable
Max. Sensor Inputs	1	1
Mounting Options	Panel, Wall, Pipe, Tank	Panel, Wall, Pipe, Tank
Display	LCD with digital bar graph	LCD with digital bar graph
Analog Output types	2 Passive 4 to 20 mA 1 Standard, 1 Optional with 4 to 20 mA Output module HART optional with H COMM module	1 Passive 4 to 20 mA
Max. Relays / O.C.	1 open collector (standard) 2 relays (optional relay module)	1 open collector 2 relays
Derived Measurements	None	None
Languages	English	English
Ambient Temperature	-10 °C to 70 °C (14 °F to 158 °F)	-10 °C to 70 °C (14 °F to 158 °F)
Storage Temperature	-15 °C to 70 °C (5 °F to 158 °F)	-15 °C to 70 °C (5 °F to 158 °F)
Relative Humidity	0 to 100% condensing for (front only); 0 to 95% non-condensing (rear panel)	
Power Requirements	24 VDC input range: 10.8 to 35.2 VDC regulated	24 VDC input range: 10.8 to 35.2 VDC regulated
Standards and Approvals	CE, UKCA, FCC, UL, CUL, RoHS compliant, Lloyd's Register, China RoHS, NEMA TYPE 4X/IP65 (front face only on panel mount); field mount is 100% NEMA TYPE 4X/IP65	CE, UKCA, FCC, UL, CUL, RoHS compliant, Lloyd's Register, China RoHS, NEMA TYPE 4X/IP65 (front face only on panel mount); field mount is 100% NEMA TYPE 4X/IP65

Type	9950-1/-2	9950-10/11
		
Description	Two-Channel Multi-Parameter Controller	Six-Channel Multi-Parameter Transmitter
Modular Components	Yes	Yes
Number of Flow Totalizers	2 Permanent 2 Resettable	6 Permanent 6 Resettable
Max. Sensor Inputs	2 frequency or (S³L) inputs	2 frequency and 4 (S³L) or 6 (S³L) inputs
Mounting Options	Panel	Panel
Display	LCD, Dot matrix	LCD, Dot matrix
Analog Output types	2 Passive 4 to 20 mA Outputs, Standard. Up to 6 via optional modules	2 Passive 4 to 20 mA Outputs, Standard. Up to 6 via optional modules
Max. Relays / O.C.	4 dry contact relays or 2 mechanical and 2 solid state relays or 4 binary input and 2 dry contact relay (optional relay modules)	4 dry contact relays or 2 mechanical and 2 solid state relays or 4 binary input and 2 dry contact relay and/or 4 dry contact relays via the 3-8059 module (optional relay modules)
Derived Measurements	6 Derived Measurements Sum, Delta (Difference), Ratio, % Passage% Reject, % Recovery	6 Derived Measurements Sum, Delta (Difference), Ratio, % Passage% Reject, % Recovery
Languages	English, French, German, Spanish and Simplified Chinese	English, French, German and Spanish
Ambient Temperature	DC -10 °C to 70 °C (14 °F to 158 °F) AC -10 °C to 60 °C (14 °F to 140 °F)	DC -10 °C to 70 °C (14 °F to 158 °F) AC -10 °C to 60 °C (14 °F to 140 °F)
Storage Temperature	-15 °C to 70 °C (5 °F to 158 °F)	-15 °C to 70 °C (5 °F to 158 °F)
Relative Humidity	0 to 100% condensing for (front only); 0 to 95% non-condensing (rear panel)	
Power Requirements	DC - 24 VDC nominal (12 to 32 VDC, ±10% regulated) AC - 100 to 240 VAC, 50 to 60 Hz, 24 VA	DC - 24 VDC nominal (12 to 32 VDC, ±10% regulated) AC - 100 to 240 VAC, 50 to 60 Hz, 24 VA
Standards and Approvals	CE, UKCA, FCC, UL, CUL, RoHS compliant, China RoHS, NEMA TYPE 4X/IP65 (front face only on panel mount)	CE, UKCA, FCC, UL, CUL, RoHS compliant, China RoHS, NEMA TYPE 4X/IP65 (front face only on panel mount)

Compatibility Overview 9950 Transmitter



The 9950 Transmitter provides a single channel interface for

- Flow
- pH/ORP
- Conductivity/Resistivity
- Salinity
- Temperature
- Pressure
- Level
- Volume
- Other 4 to 20 mA
- Dissolved Oxygen

The 9950 is only available in a panel mount configuration.

Features and Benefits

One Instrument for Multiple Sensor types

- Use different sensors on any channel
- Use the same sensor on any channels

Configurable Display

- Derived Measurements
- Advanced Boolean Logic
- Units and Decimals

Optional Modules can be Added for Additional Capabilities.

USB Port for Field Upgrades Using Standard USB Flash Drive.

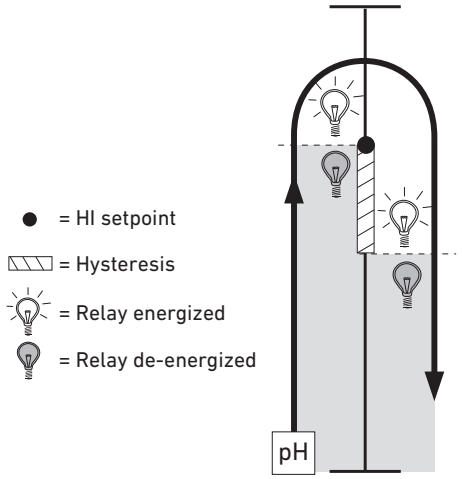
USB port is only available on the 9950-1/2 to update the firmware. 9950-10/11 firmware cannot be field upgraded.

Transmitter Technical Basics

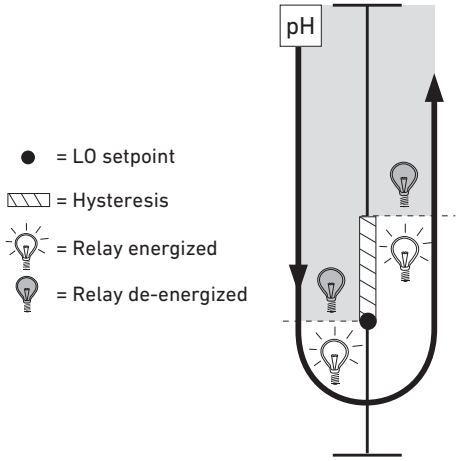
Relay Information

The two most common methods of controlling a process are “on/off” and “proportional” control. In on/off control, relay setpoints are defined as either high or low limits on the process variable. When the measurement value reaches a limit the relay is energized, typically for the purpose of opening a valve or starting a pump to introduce a chemical reagent to the process. This should cause the measurement value to change in the direction of the setpoint as shown in these on/off control diagrams:

High limit on/off relay control



Low limit on/off control



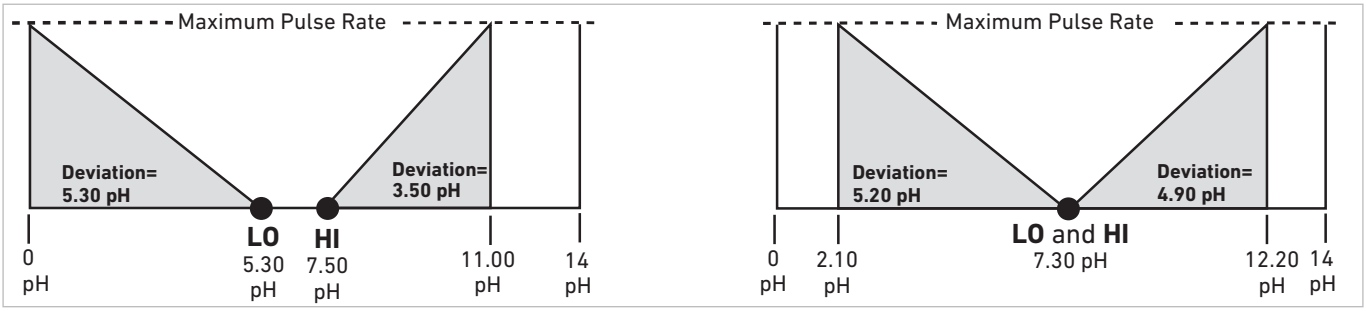
Notice the relay will not de-energize until the setpoint is exceeded by the hysteresis value. This is a programmable value and is primarily used to prevent ”relay chatter”, which occurs if a relay is set to energize and de-energize at the same value. Because of hysteresis, and because reagent delivery is fairly constant while the relay is energized, a condition known as “overshoot” is inherent to the on/off control method. Overshoot refers to the introduction of more chemical reagent than is absolutely necessary for achieving a desired adjustment to the process value, and can be expensive over time.

Proportional control is a popular alternative to the on/ off control method. This method typically makes use of variable-rate metering pumps to reduce overshoot and improve precision. Establishing a proportional control scenario requires the selection of setpoint(s), deviation range(s) and maximum pulse rates.

The example shown here illustrates how two relays in ”pulse mode” can be used to proportionally control pH within a desired range, or to a single setpoint. This is called “Dual Proportional Control”. Of course, a single relay in proportional pulse mode can be used to establish a high or low limit and will also reduce overshoot.

Metering pumps are idle at and between setpoints. When a setpoint is exceeded, the pump begins delivering reagent at a rate proportional to the difference between the measurement value and the setpoint. The larger the difference, the faster the delivery. The programmed deviation value defines how quickly the maximum pulse rate is reached. Depending on the input requirements of the metering pump, proportional control can also be accomplished with scaleable 4 to 20 mA outputs instead of pulsing relays or open collectors.

Dual proportional pulse relay control



Open Collector Output

Many GF instruments and sensors feature “Open Collector Outputs” for purposes of signal transmission, alarming, control signal output, etc. Although such outputs allow for a lot of wiring flexibility, care must be taken not to destroy the circuits via incorrect polarity, over-voltage, transients or current overload.

Below is an explanation of proper wiring and dimensioning of related circuit components. Please note that the following recommendations may or may not apply to other manufacturer’s equipment.

Function

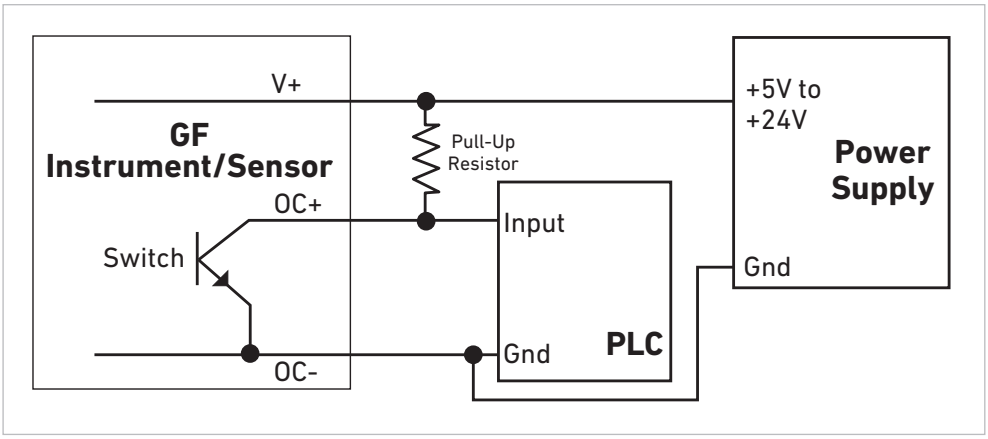
Open Collector (“OC”) outputs are low powered, solid state switches. Although the term “Open Collector” stipulates the use of bipolar transistors (NPN-type or PNP-type) as a switch, nowadays Field Effect Transistors (FET or MOSFET) are used. Unlike electromechanical switches (e.g. push buttons or dry contact relays) these OC switches are very fast, use little power, are inexpensive, do not bounce and do not wear.

However, OCs are also more limited in terms of voltage and current rating as well as being polarized (i.e. they have a “plus” and “minus” terminal and thus DC only switching capability). They are less tolerant to overload abuse than electromechanical devices. Usually these switches have higher resistance and voltage drop.

Sensor Wiring

A typical example of the need for high speed switching capability is the OC frequency output of GF flow sensors like types 2536 or 3-2540. Signal frequencies can reach several hundred pulses per second while voltage and current requirements are small enough, allowing the use of a transistor switch. For each output pulse this switch connects the signal output to the negative supply or ground terminal of the sensor and is therefore an “NPN” style output. GF does not produce sensors with PNP style outputs (which connect the signal output internally to the positive supply terminal).

Most indicating instruments or control system inputs require a signal voltage of 0 to 5 V (TTL or CMOS logic levels) or 0 to 24 V. Therefore, Open Collector output circuits must be complemented with a “Pull-Up-Resistor” to function properly. Please see the following example diagram for wiring with a PLC input:



Do not exceed the absolute maximum voltage rating of the OC output as listed in the sensor specifications, normally 27 or 30 Volt, DC only. This includes changes to power line fluctuations, transients or power supply instability, otherwise damage to the OC will occur.

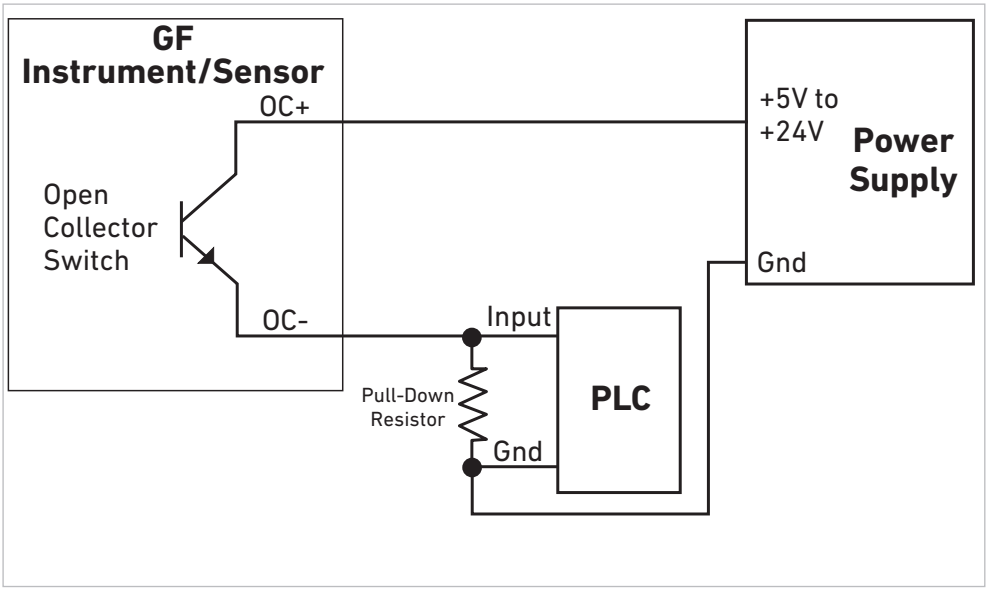
Please note that the voltage connected to the positive sensor supply (V+) must correspond to the required high-level PLC input voltage (i.e. if the high-input voltage of the PLC is 24 V, then the pull-up must be supplied with 24 V). If the input is “TTL-Level” or “CMOS-Level”, that means 5 V for high level, then the pull-up should not be connected with a supply higher than 5 V.

GF instruments already have the pull-up-resistor and the sensor power supply built into the instrument. No external pull-up-resistors are required.

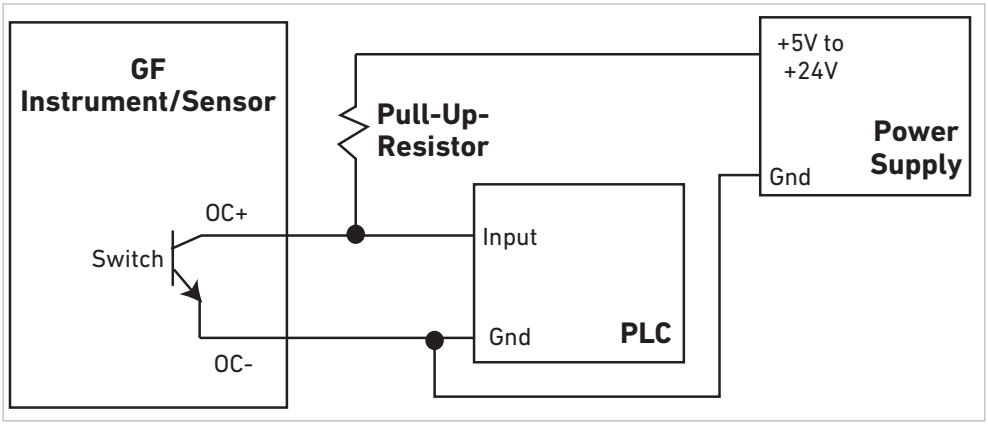
Instrument Output Wiring

Open collector control and alarm outputs on GF instruments (i.e. ProcessPro® or ProPoint® series) are electrically isolated from the instrument's powersupply. That means these can be used in the above mentioned NPN configuration as well as in PNP configuration, if required. Below are a few sample circuits:

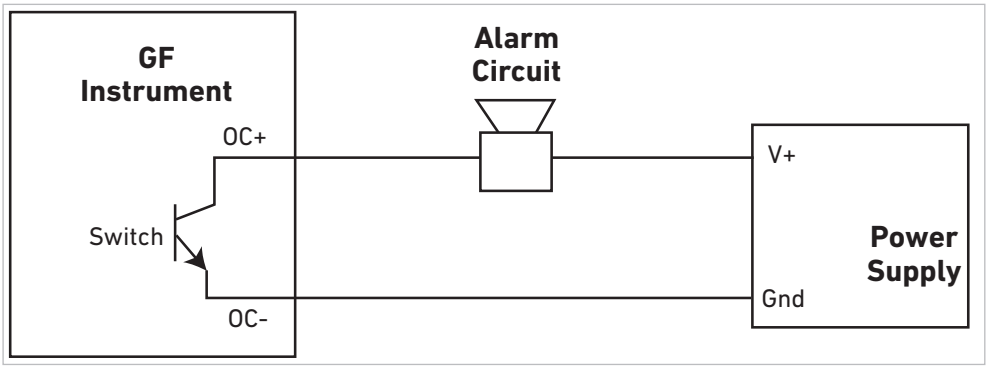
PLC Wiring "PNP" style



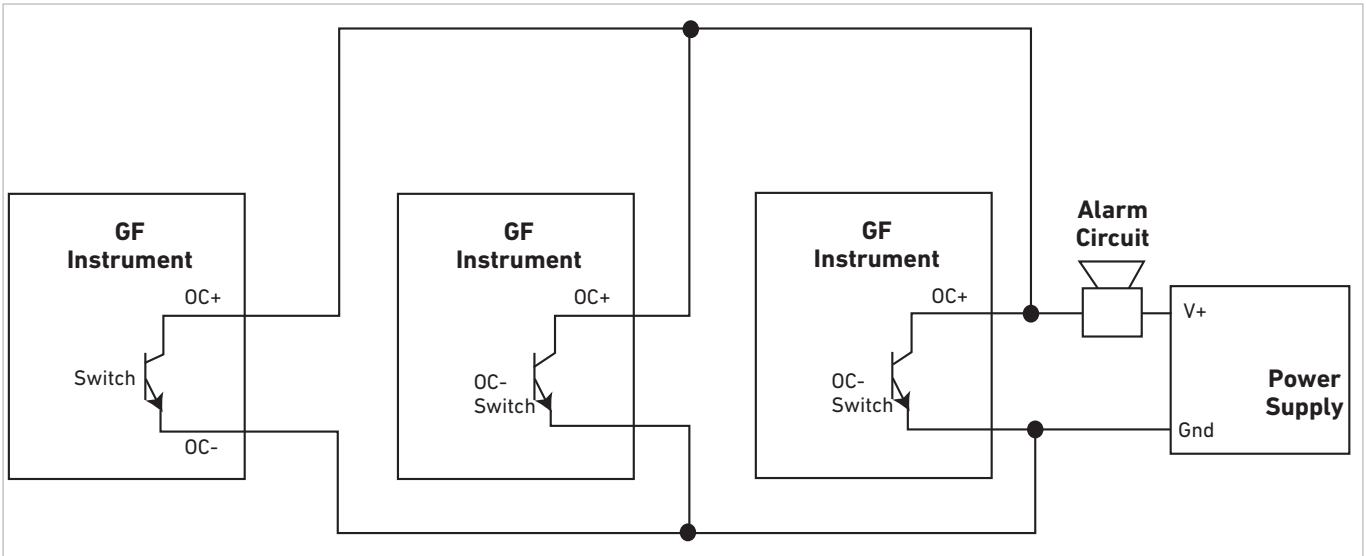
PLC Wiring "NPN" style



Alarm circuit or alarm lamp wiring to a single GF instrument



Alarm circuit or alarm lamp wiring to serve multiple GF instruments - Triggers the alarm if any one of the instruments open collector outputs are on.



Voltage and Current Limitation

As mentioned before, the supply voltage in the OC output circuit MUST be limited to the specified maximum OC voltage (see operating manual for specific instrument). The use of a quality regulated 5 V, 12 V or 24 V (depending on the application) power supply is recommended. The current through the Open Collector switch must be limited. Typical OC outputs allow only for 10 to 50 mA switch current (please consult manual). Exceeding this current limit can burn out the OC output components immediately. Please see the following section on how to dimension the loads.

Load and Pull-Up/Down Resistor Considerations

By utilizing basic arithmetic and Ohm's law, one can determine the safe limits of load resistance. When the OC switch is closed, almost the entire supply voltage is applied to the load, (i.e. the pull-up or pull-down resistor, the alarm horn input, a potential power relay coil or annunciator lamp). The resulting current through the load and through the OC switch, as well, can be calculated as:

$$\text{Current} = \frac{\text{Supply Voltage}}{\text{Load Resistance}}$$

Example 1

The supply voltage is 24 V and a pull-up-resistor of 10 k is used.

Current is 24 V /10,000 Ω = 2.4 mA

(If the OC current rating is 10 mA, then in this example, it would be considered safe.)

Example 2

The supply voltage is 12 V and a horn with a resistance of 100 is used.

Current is 12/100 = 120 mA

(Even if the OC current rating is 50 mA, this load will damage the instrument)

Transient Protection

There are several “difficult” load cases that must be considered:

- Inductive loads:
  These can be power relay or other solenoids, motors, alarm horn coils, etc. Such loads generate very high voltage spikes every time the load switches. If such a load is unavoidable, the use of transient suppression components, or GF RCfilters (3-8050.396), or snubbers, wired parallel to the load is required. This is critical, as a single transient pulse may destroy the output.
- Capacitive loads:
  This type of load should be rare but can occur if the load contains an internal power supply/ regulator that is fed from the output circuit. In such a case, it must be assured that the in-rush current does not exceed the OC current rating.
- **Incandescent lamps:**
  Such lamps have a very high start-up current until the filament glows and the current settles to the specified value. The use of incandescent lamps on an OC output is not recommended. An LED type annunciator should be used instead.

“Active High” and “Active Low” Setting

Depending on the desired function of the circuit attached to the OC output, it may be necessary to have the OC output switch turned “on” or “off” when the criteria for the activation of this output are met.

By default, GF instruments are set to operate in “active low” mode. This means when the user-defined condition for the activation is met (e.g. exceeding of an alarm limit) the OC switch is turned “on”.

If wired as standard “NPN-style” output (see previous page) the logic level of the attached control system or PLC input consequently becomes “low” logic level.

If a high input logic level is required for activation, it can be accomplished by changing the OC output function to “active high” in the menu system of the instrument. Most GF instruments allow for this option.

Fail-Safe Behavior

No matter what the setting, most OC outputs of GF instruments turn off when the instrument loses power. This must be taken into account when evaluating system failure consequences. If the system layout requires a “closed” or “on” condition for the output in case of power loss, a mechanical dry contact relay (NC contacts) must be used instead of the OC output.

Control Outputs

Many GF products offer control outputs that can be categorized into three categories: Mechanical Relay, Solid-State Relay and Open Collector. Each control output offers benefits and limitations based on the application requirements. See below for comparisons.

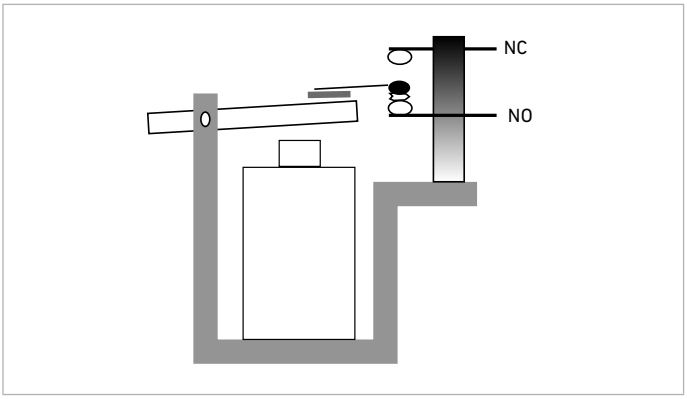
Control Output	Benefits	Considerations
Open collector	• Longer life than a Mechanical Relay • No moving parts • Can switch DC voltage only (typically < 30 VDC) • Faster ON/OFF switching capabilities than Mechanical Relays	• Can only be used with DC voltage • Polarity very important when wiring • Not recommended for use with inductive loads • Lower voltage and current ratings than Mechanical Relays • Typically should not apply current > 25 mA
Solid-State Relays	• Has isolated outputs (optically) • Can switch DC voltage (typically > 30 VDC) • Can switch AC voltage (typically > 42 VAC) 50 mA DC / 50 mA AC • Longer life than a Mechanical Relay • No moving parts • Faster ON/OFF switching capabilities (Equal rise/fall times)	• Not recommended for use with: inductive loads (ex. Solenoid, Pumps) • If using inductive loads, snubbers(RC Filter) can prevent relay damage • Lower voltage and current ratings than Mechanical Relays
Mechanical Relays	• Can switch line voltage (typically > 120 to 240 VAC) • Can switch DC voltage (typically < 30 VDC @ 5A) • Has a large current rating (typically 5 A) • Larger voltage and current ratings than Solid-State Relay and Open Collector Outputs	• Slower ON/OFF switching capabilities than Solid-State Relay and Open Collector Outputs • Mechanical contacts can burn/wear over time • Snubbers (RC Filter), GF RC Filter Kit 3-8050.396, can prolong contact life

RC Filter

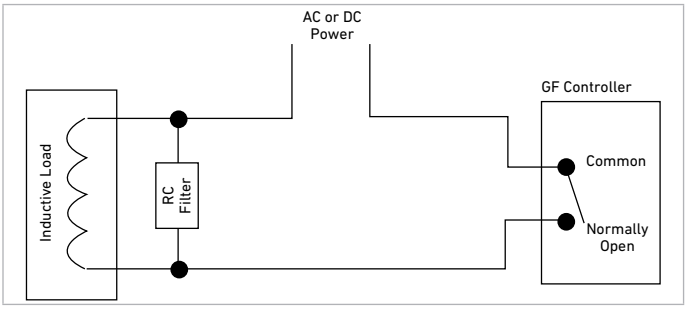
RC Filter kits are recommended when using a GF transmitter or controller with mechanical relays, and/or the external relay module 3-8059 to switch on and off inductive loads. GF RC filter kits provide protection and extend the life of the relay by preventing premature wearing of the relay contacts, usually caused by voltage/current arching and line noises generated by the activation and deactivation of mechanical relays.

RC filter kit (159000617 3-8050.396) comes with two RC filter assemblies.

During the activation and deactivation of a relay, a spark can be generated on the surface of the relay contacts. This spark, over a period of time, melts the surface of the contacts which will prevent the contacts from making a physical connection.

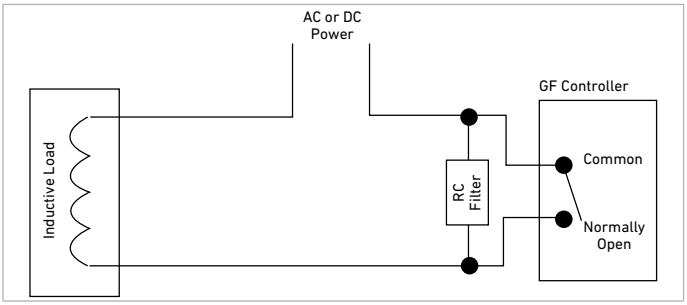


Suitable for AC and DC applications.



Suitable for AC and DC applications. However, if this configuration is used with an AC power source, verify that the impedance of the load is less than the impedance of the RC filter; current leak through the filter may occur and cause the device to be constantly on.

- R = 47 Ω
- C = 0.01 µF



Type 9900 Transmitter

Member of the SmartPro® Family of Instruments



Panel Mount | Field Mount

Product description

The type 9900 Transmitter provides a single channel interface for many different parameters including Flow, pH/ORP, Conductivity/Resistivity, Salinity, Pressure, Temperature, Level, Dissolved Oxygen, and other sensors that output a 4 to 20 mA signal. The 9900-1P Transmitter can also be used as a Batch Controller when a Batch Module and Relay Module are installed.

The 9900 is offered in both panel or field mount versions. Both configurations offer an extra large (3.90" x 3.90") auto-sensing backlit display features "at-a-glance" visibility that can be viewed at 4-5 times the distance over traditional transmitters. The highly illuminated display and large characters reduce the risk of misreading or misinterpreting the displayed values. The display shows separate lines for units, main and secondary measurements as well as a "dial-type" digital bar graph.

The 9900 can run on 12 to 32 VDC power (24 VDC nominal), and can also be loop powered with compatible sensors.

Rear Enclosure kits are available for the 9900-1P Panel Mount. Kit options include either a Hinged Cover (3-9900.399-1) for wall or pipe mount installations, or a Flat Cover
(3-9900.399-2) designed to fit inside a panel for waterproof protection.

The 9900 offers complete flexibility, plug-in modules allow the unit to easily adapt to meet changing customer needs. Optional modules include the new Modbus as well as the Relay, Direct Conductivity/Resistivity, H COMM, Batch, 4 to 20 mA Output, and a PC COMM Configuration Tool. The unit can be used with default values for quick and easy programming or can be customized with labeling, adjustable minimum and maximum dial settings, and unit of measure and decimal location choices.

Features

- Modbus Module supports RS485 Serial Modbus Communications
- Multiple sensor types supported with one instrument
- “Dial-type” digital bar graph
- Modules are field installable and replaceable anytime
- Optional Relay Module for addition of two drycontact relays
- Optional H COMM Module for two-way communication
- Optional Batch Module for Batch Control
- One 4 to 20 mA output in base unit. One additional 4 to 20 mA available with optional module
- Rear Enclosure Kits for panel, wall or pipe mounting
- Warning and Relay LED indicators for “at a glance” visibility
- Customizable features including digital label for custom identification
- Optional PC COMM configuration tool for configuration at a PC

Applications

- Wastewater Treatment
- Reverse Osmosis
- Deionization
  - Ultra Pure Water
  - Two Bed System
  - Mixed Bed System
- Chemical Manufacturing/Addition
- Metal and Plastic Finishing
- Fume Scrubber
- Cooling Towers
- Media Filtration

Specifications

General			
Input Channels		One	
Input types	Digital (S^3L)	Serial ASCII, TTL level, 9600 bps	
	Frequency	Range	0.5 to 1'200 Hz
		Accuracy	0.5% of reading
Measurement types		Flow, pH/ORP, Conductivity/Resistivity, Salinity, Pressure, Temperature, Level, Dissolved Oxygen, Batch or user-defined (via 8058)	

Enclosure and Display		
Case Material		PBT
Window		Shatter-resistant glass
Keypad		4 buttons, injection-molded silicone rubber seal
Display		Backlit, 7 and 14-segment
Update Rate		1 s
LCD Contrast		5 settings
Indicators		"Dial-type" digital bar graph. LEDs for Open Collector, Relays and Warning Indicator
Enclosure Size		¼ DIN
Mounting	9900-1P	
	Panel	¼ DIN, ribbed on four sides for panel mounting clip inside panel, silicon gasket included. Optional rear enclosure with flat cover available for waterproof protection when installed inside a panel.
	Wall	Options include 9900-1P installed in pre-wired NEMA enclosure, wall mount enclosure or inside of rear enclosure with hinged cover. (USA Only)
	Pipe	Optional Rear Enclosure with hinged cover and 9900-1P for pipe mount installation
Mounting	9900-1	
	Field (Integral)	Options include yellow universal or integral kits for installation with sensor

Display Ranges		
pH	0.00 to 15.00 pH	
pH Temperature	-99 °C to 350 °C	-146 °F to 662 °F
ORP	-1'999 to +1'999 mV	
Flow Rate	-9'999 to 99'999 units per second, minute, hour or day	
Totalizer	0.00 to 99'999'999 units	
Conductivity	0.0000 to 99'999 µS, mS, PPM and PPB (TDS), kΩ, MΩ	
Conductivity Temperature	-100 °C to 250 °C	–148 °F to 350 °F (application and sensor dependent)
Temperature	-99 °C to 350 °C	–99 °F to 350 °F
Pressure	-40 to 1000 psi	
Level	-9'999 to 99'999 m, cm, ft, in, %	
Volume	0 to 99'999 cm^3, m^3, in^3, ft^3, gal, L, lb, kg, %	
Salinity	0 to 99.97 PPT	
Dissolved Oxygen	PPM 0-50, % SAT 0-200, 0 to 999.9 TORR	
Dissolved Oxygen Temperature	-99 °C to 350 °C	–99 °F to 350 °F

Environmental		
Ambient Operating Temperature		
Backlit LCD	-10 °C to 70 °C	14 °F to 158 °F
Storage Temperature	-15 °C to 70 °C	5 °F to 158 °F
Relative Humidity	0 to 100% condensing for field mount; 0 to 95% non-condensing for panel mount	
Maximum Altitude	4.000 m (13,123 ft)	
Enclosure Rating	NEMA 4X/IP65 (front face only on panel mount); field mount is 100% NEMA 4X/IP65 when used with universal or integral installation kits	

Electrical Requirements

Power to Sensors

Voltage	+4.9 to 5.5 VDC @ 25 °C, regulated	
Current	1.5 mA max in loop power mode (up to 2.0 mA with 24 V @ 300 Ω max. loop impedance); 20 mA max when using DC power	
Short Circuit	Protected	
Isolation	Low voltage (< 48V AC/DC) to loop with DC power connected	
No isolation when using loop power only		
Terminal Blocks	Pluggable screw type	14 AWG or 2.5 mm² max wire gauge

Input Power

DC	10.8 to 35.2 VDC, regulated
9900 without Relay Module	200 mA @ 10.8 VDC to 35.2 VDC
9900 with Relay Module	300 mA @ 10.8 VDC to 35.2 VDC
Overvoltage Protection	48 Volt Transient Protection Device
Current limiting for circuit protection	
Reverse-Voltage Protection	

Loop Power

Loop Power Only

Max. Loop Impedance	50 Ω @ 12 V	325 Ω @ 18 V	600 Ω @ 24 V

With DC Power Input or with 2nd loop, all the time

Max. Loop Impedance	250 Ω @ 12 V	500 Ω @ 18 V	750 Ω @ 24 V

Relay Specifications

	Dry-Contact Relays (2)	Open Collector (1)
Type	SPDT	N/A
Form	C	N/A
Max. Current Rating	5 A resistive	50 mA DC
Max. Voltage Rating	30 VDC or 250 VAC	30 VDC
Hysteresis	Adjustable (absolute in engineering units) (EUs)	
Latch	Reset in test screen only	
Delay	9'999.9 seconds (max.)	
Test Mode	Set On or Off	
Cycle Time	99'999 seconds (max.)	
Maximum Pulse Rate	300 pulses/minute	
Proportional Pulse	400 pulses/minute	
Volumetric Pulse Width	0.1 to 3'200 s	
Pulse Width Modulation	0.1 to 320 s	

Input types

Digital (S^3L) or AC frequency

4 to 20 mA input via the 8058

pH/ORP input via the Digital (S^3L) output from the 2751 pH/ORP Sensor Electronics

Raw Conductivity/Resistivity input directly from GF Conductivity/Resistivity electrodes via Direct Conductivity/ Resistivity Module or via 2850

Input Specifications

Digital (S^3L)	Serial ACSII, TTL level, 9600 bps

Frequency Input

Sensitivity	80 mV @ 5 Hz, gradually increasing with frequency
Span	0.5 Hz to 1500 Hz @ TTL level input
Accuracy	± 0.5% or reading max error @ 25 °C
Resolution	1 µS
Repeatability	± 0.2% of reading

Power Supply

Rejection	±1 µA per volt

Input Specifications			
Short Circuit	Protected		
Update Rate	(1/frequency) + 150 ms		
Direct Conductivity/Resistivity Module (3-9900.394)			
Accuracy	Conductivity +/- 2% of Reading		
	Temperature 0.5 °C		
Resolution	Conductivity 0.1% of Reading		
	Temperature <0.2 °C		
Update Rate	2.5 Seconds		
Compatible Electrodes	All GF GF Sensors		

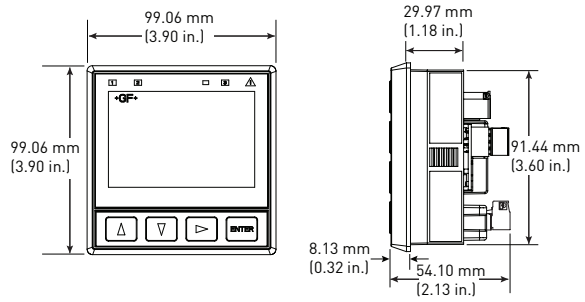
Output Specifications			
Current Output - One (1); Two (2) with 4 to 20 mA Output Module			
Current Loop Output Standard	ANSI-ISA 50.00.01 Class H		
Current Output	4 to 20 mA, isolated, fully adjustable and reversible		
Span	3.8 to 21 mA		
Zero	4.0 mA factory set; user programmable from 3.8 to 5.0 mA		
Full Scale	20.00 mA factory set; user programmable from 19.0 to 21.0 mA		
Accuracy	±32 µA max. error @ 25 °C @ 24 VDC		
Resolution	6 µA or better		
Temperature Drift	±1 µA per °C		
Power Supply Rejection	±1 µA per V		
Isolation	Low voltage (< 48 VAC/DC)		
Voltage	12 to 32 VDC ±10%		
Max. Impedance (with DC power input)	250 Ω @ 12 VDC	500 Ω @ 18 VDC	750 Ω @ 24 VDC
Max. Impedance (no DC power input)	50 Ω @ 12 VDC	325 Ω @ 18 VDC	600 Ω @ 24 VDC
Update Rate	150 mS nominal		
Short circuit and reverse polarity protected			
Adjustable Span	Reversible		
Error Condition	Selectable error condition 3.6 or 22 mA		
Actual update rate determined by sensor type			
Test Mode	Increment to desired current (range 3.8 to 21.00 mA)		

Shipping Weights		
Base Unit	0.63 kg	1.38 lb
Modbus Module	0.16 kg	0.35 lb
H COMM Module	0.16 kg	0.35 lb
Conductivity Module	0.16 kg	0.35 lb
Relay Module	0.19 kg	0.41 lb
Batch Module	0.16 kg	0.35 lb
4 to 20 Output Module	0.16 kg	0.35 lb
Rear Enclosure, Hinged cover	0.30 kg	0.65 lb
Rear Enclosure, Flat cover	0.28 kg	0.60 lb

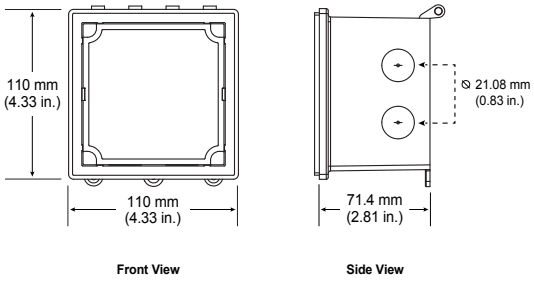
Standards and Approvals	
	CE, UL, CUL, FCC
	RoHS Compliant, China RoHS
	Lloyd's Register
	Manufactured under ISO 9001, ISO 14001 and ISO 45001

Dimensions

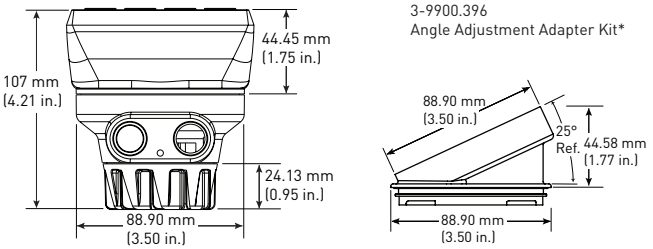
Panel Mount



Rear Enclosure



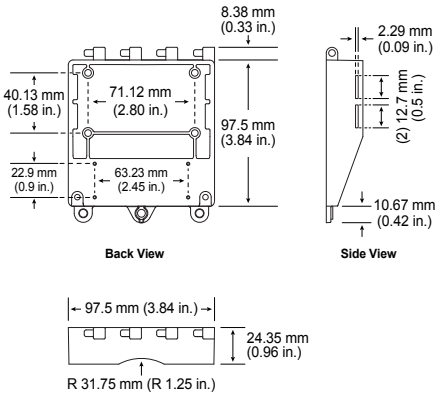
Integral Mount



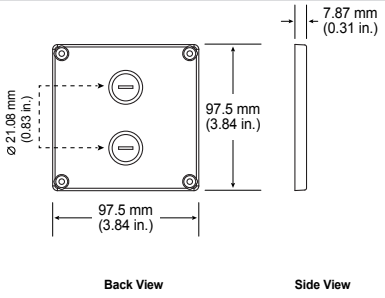
3-9900.396
Angle Adjustment Adapter Kit*

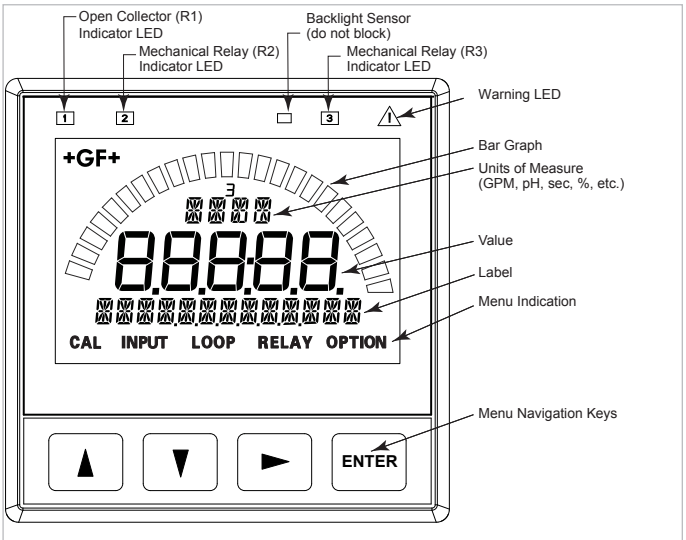
*Muss mit dem Leitfähigkeitsmodul eingesetzt werden

Hinged Cover



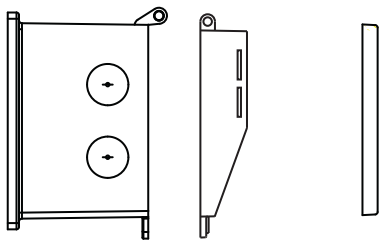
Flat Cover





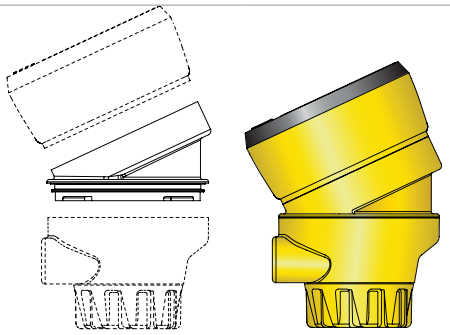
All possible segments shown in this illustration. The instrument's software controls which segments are shown at any particular time. Only the bar graph segment outline and GF logo are visible when the unit is turned off.

System Overview



3-9900.399-1
(159 001 834)
Rear Enclosure Kit,
hinged cover

3-9900.399-2
(159 001 835)
Rear Enclosure Kit,
flat cover



3-9900-1
(159 001 696)
Field Mount

3-9900-396
(159 001 701)
Angle Adjustment
Adapter Kit

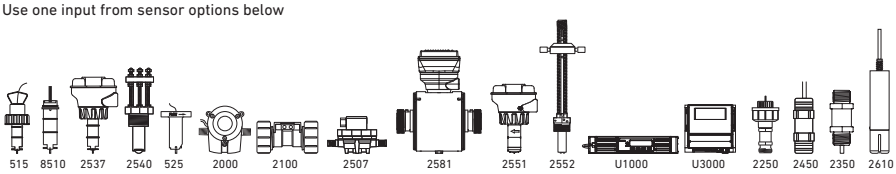
3-8051 (159 000 187)
3-8051-1 (159 001 755)
3-8051-2 (159 001 756)
Flow Sensor
Integral Mounting Kit

Panel Mount

9900 Transmitter
(Includes mounting bracket and panel gasket)



GF Sensors - Flow, Level, Temperature, Pressure, DO
Use one input from sensor options below



Fittings- Customer Supplied

Pipe, Tank, Wall Mount

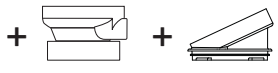
9900 Transmitter
with Rear Enclosure



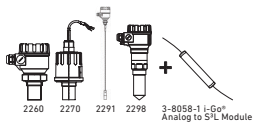
Field (Integral) Mount

9900 Transmitter
with Junction Box (varies with sensor and installation)





4-20mA level transmitter
Use i-Go® Analog to S³L Module for signals other than 4-20 mA



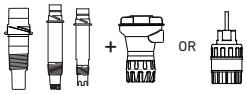
All Sold Separately

Panel Mount

9900 Transmitter
(Includes mounting bracket and panel gasket)



GF Sensors - pH/ORP
Use one input from sensor options below*
with 2751 Smart Sensor Electronics



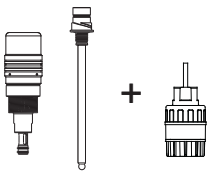
GF Fittings - See individual sensor data sheets

Pipe, Tank, Wall Mount

9900 Transmitter
with Rear Enclosure



GF Wet-Tap Electrode type 2756, 2757 and 3719
Wet-Tap with 2751 Smart Sensor Electronics



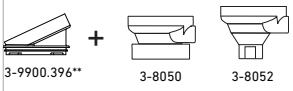
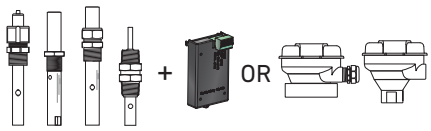
Field (Integral) Mount

9900 Transmitter
with Junction Box (varies with sensor and installation)





All Sold Separately

Panel Mount	Pipe, Tank, Wall Mount	Field (Integral) Mount	
9900 Transmitter (Includes mounting bracket and panel gasket)	**9900 Transmitter** with Rear Enclosure	**9900 Transmitter** with 3-9900.396 Angle Adapter and Junction Box (varies with sensor and installation)	
			
GF Sensors - Conductivity/Resistivity and Salinity Electrodes Use one input from electrode options below* with Conductivity Module or 2850-61 or 2850-51 Sensor Electronics 			
GF Fittings - See individual sensor data sheets			All Sold Separately

* See individual sensor datasheets for additional information
**3-9900.396 is required with the Conductivity Module and either 3-8050 or 3-8052 to provide sufficient clearance

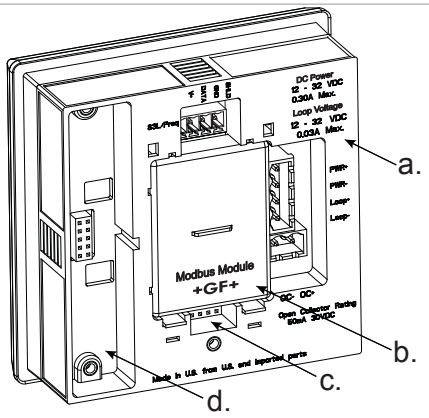
Plug in Modules

Optional modules and accessories are available for the 9900:

a. Base Unit (required)
b. Slot for optional H COMM or Modbus Modules
c. Slot for optional Conductivity/Resistivity, Batch, or 4 to 20 mA Output Module
d. Slot for optional Relay Module (not available on field mount)

Each item is ordered separately.

Modules are field-replaceable at any time.



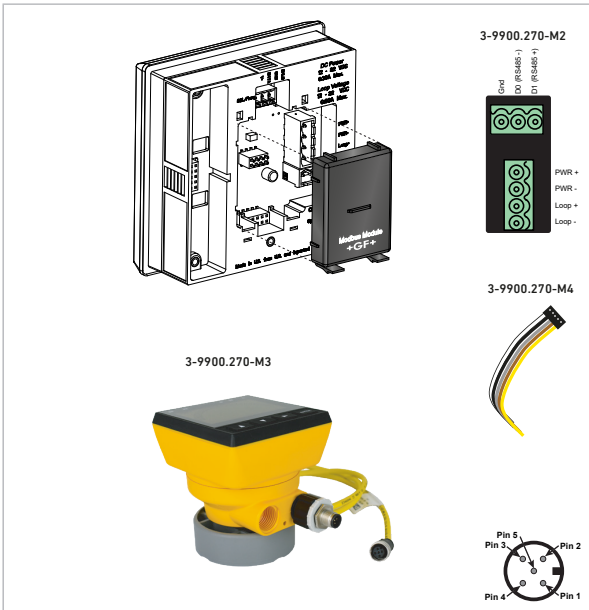
Modbus Modules (3-9900.270-MX)

These Modules allow the 9900 to communicate with Automation systems using the Modbus serial RS485 Protocol.

3-9900.270-M2 - Terminal Block Connections (Panel Mount Only)

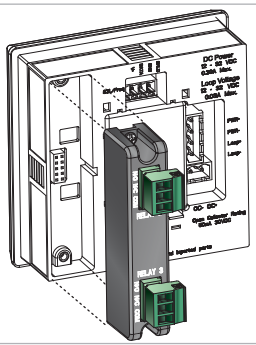
3-9900.270-M3 - M12 Connector (Field Mount Only)

3-9900.270-M4 - Modbus Module with 5 Wire Cable Assembly



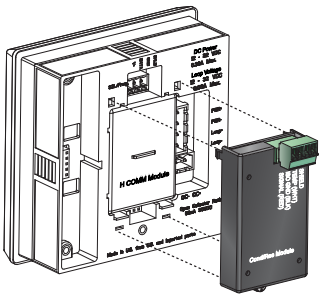
Relay Module (Panel Installations Only) (3-9900.393)

This module adds two programmable dry-contact relays to the standard Open Collector output in the base unit.



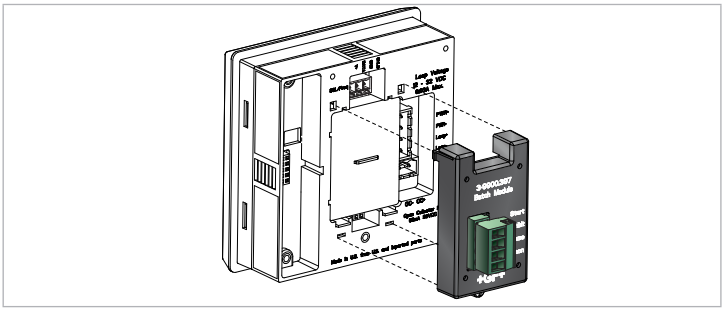
Direct Conductivity/Resistivity Module (3-9900.394)

The Direct Conductivity/Resistivity Module interfaces GF Conductivity electrodes directly to the 9900.



Batch Module (3-9900.397)

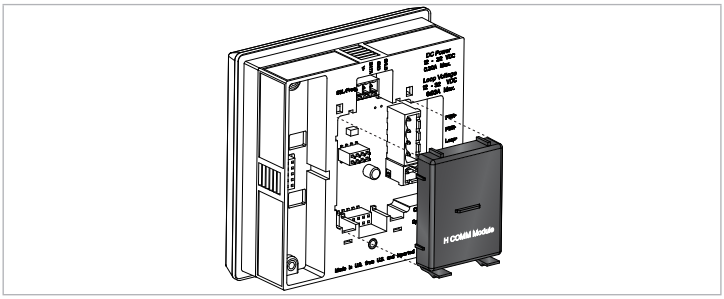
The Batch Module adds batch capability to the 9900 Transmitter (Generation II and newer). It is compatible with all GF flow sensors.



H COMM Module (HART®) (3-9900.395)

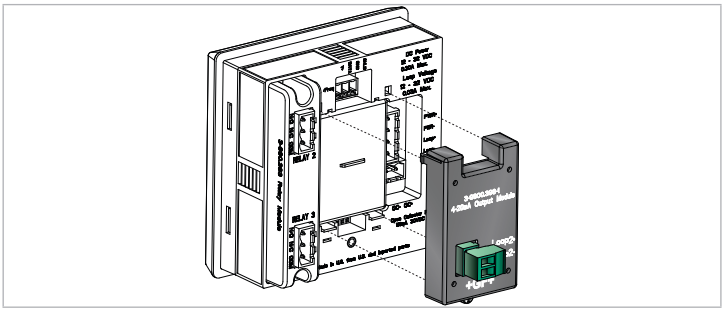
The H COMM Module enables communication between the 9900 and a HART® enabled device.

(Not available for use on 3-9900-1BC Batch Controller)



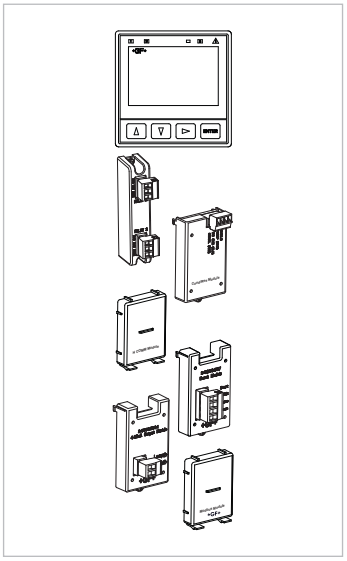
4 to 20 mA Output Module (3-9900.398-1)

The 4 to 20 mA Output Module adds a second 4 to 20 mA Output to the 9900 Transmitter (Generation III and later). Each of the outputs can be used to output the primary and/or secondary measurement.



Ordering Information

Mfr. Part No	Code	Description
9900 Base Unit - Single Channel, Multi-Parameter, 4 to 20 mA, Open Collector, DC power		
3-9900-1P	159 001 695	9900 Panel Mount Transmitter
3-9900-1	159 001 696	9900 Field Mount Transmitter
3-9900-1BC	159 001 770	Batch Controller System
Optional Accessory Modules		
3-9900.270-M2	159 200 121	Modbus Module with Terminal Block Assembly (Panel Mount Only)
3-9900.270-M3	159 200 122	Modbus Module with M12 Connector Assembly (Field Mount Only)
3-9900.270-M4	159 200 128	Modbus Module with 5 Wire Cable Assembly
3-9900.393	159 001 698	Relay Module - 2 DCR (Dry-contact relays)
3-9900.394	159 001 699	Direct Conductivity/Resistivity Module
3-9900.395	159 001 697	H COMM Module
3-9900.397	159 310 163	Batch Module
3-9900.398-1	159 001 784	4 to 20 mA Output Module*
3-8058-1	159 000 966	i-Go® Analog to S^3L Module, wire-mount
3-8058-3	159 070 106	i-Go® Analog to S^3L Module, module mount



* Module adds a second 4 to 20 mA output. One 4 to 20 mA output is included in the base unit.

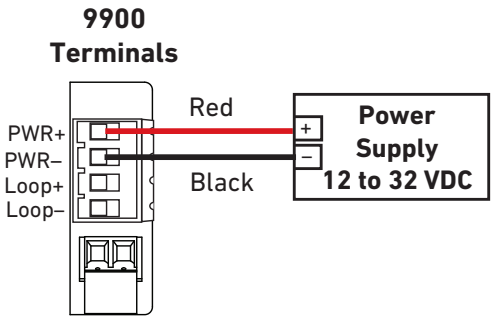
Accessories and Replacement Parts

Mfr. Part No	Code	Description
6682-0204	159 001 709	Conductivity Module Plug, 4 Pos, Right Angle
6682-1102	159 001 710	DC Power Plug, 2 Pos, Right Angle
6682-1103	159 001 711	Relay Module Plug, 3 Pos, Right Angle
6682-1104	159 001 712	Loop Power Plug, 4 Pos, Right Angle
6682-3104	159 001 713	Freq/S^{3}L Plug, 4 Pos, Right Angle
6682-3004	159 001 725	Terminal Block Plug
7310-1024	159 873 004	24 VDC Power Supply, 0.42 A, 10W
7310-2024	159 873 005	24 VDC Power Supply, 1.0 A , 24W
7310-4024	159 873 006	24 VDC Power Supply, 1.7 A, 40W
7310-6024	159 873 007	24 VDC Power Supply, 2.5 A, 60W
7310-7024	159 873 008	24 VDC Power Supply, 4.0 A, 96W
3-0252	159 001 808	0252 Configuration Tool
3-8050	159 000 184	Universal Mount Kit
3-8050.396	159 000 617	RC Filter kit (for relay use), 2 per kit
3-8051	159 000 187	Flow Sensor Integral Mounting Kit, NPT, Valox
3-8051-1	159 001 755	Flow Sensor Integral Mounting Kit, NPT, PP
3-8051-2	159 001 756	Flow Sensor Integral Mounting Kit, NPT, PVDF
3-8052	159 000 188	¾ in. Integral Mount Kit
3-9000.392-1	159 000 839	Liquid Tight Connector Kit, NPT (1 pc.)
3-9900.270-CB1	159 200 123	Replacement Cable Assembly for M1
3-9900.270-CB2	159 200 124	Replacement Terminal Block Assembly for M2
3-9900.270-CB3	159 200 125	Replacement M12 Connector Assembly for M3
3-9900.270-CB4	159 200 129	Replacement Cable Assembly for M4
3-9900.390	159 001 714	Standard Connector Kit, Right Angle, 9900 Transmitter
5541-5005	159 855 021	5 meter (16 ft) M12 cable
5541-5010	159 855 022	10 meter (32 ft) M12 cable
3-9900.391	159 001 715	Optional Connector Kit, In-Line, 9900 Transmitter
3-9900.392	150 300 351	Wall Mount Accessory Kit for 9900
3-9900.396	159 001 701	Angle Adjustment Adapter Kit (for Field Mounting)
3-9900.399-1	159 001 834	Rear enclosure kit, hinged cover
3-9900.399-2	159 001 835	Rear enclosure kit, flat cover

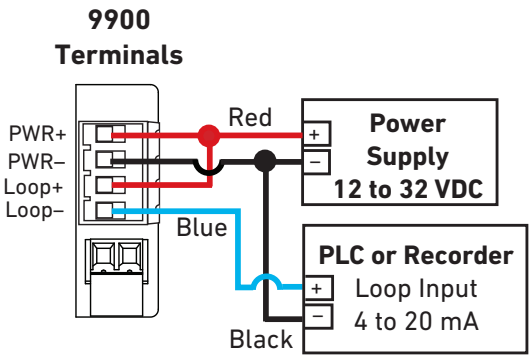
Wiring information

Rear Terminal Views type 9900 Transmitter

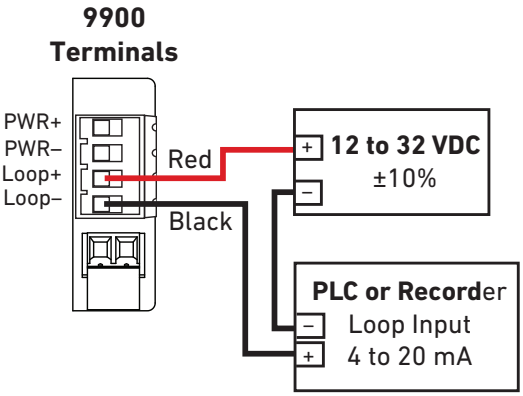
Stand Alone Application, no current loop used

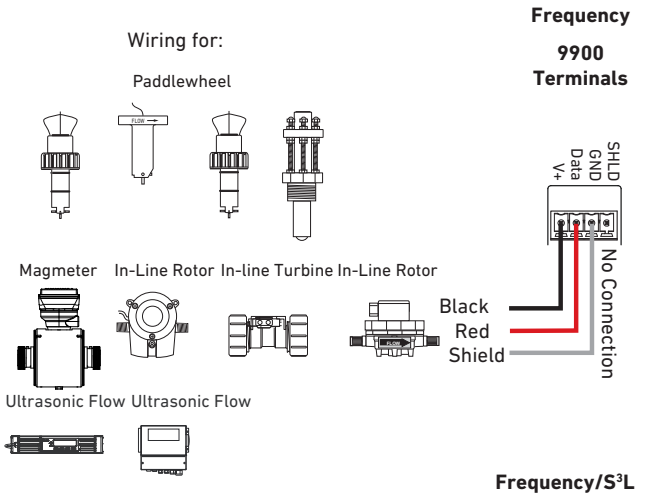


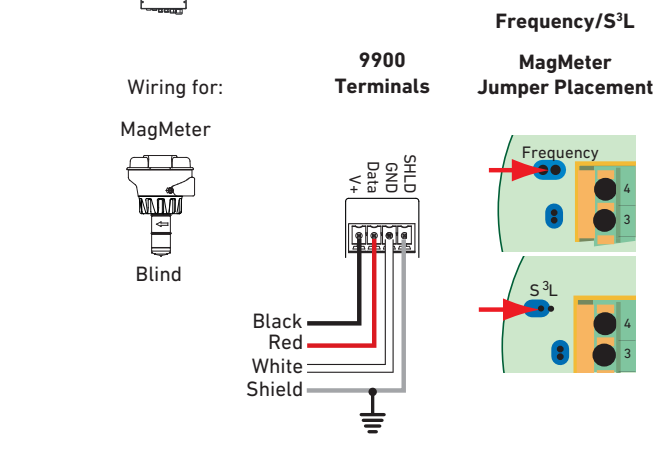
Connection to a PLC/Recorder, separate supply



Loop Powered







Note: Loop Power can be used to power types 515, 525, 2250, 2350, 2450, 2536, and 2540 sensors.

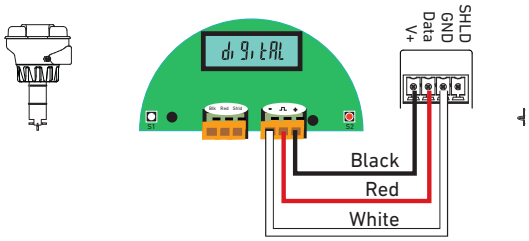
Rear Terminal Views type 9900 Transmitter

S³L

9900 Terminals

Wiring for:

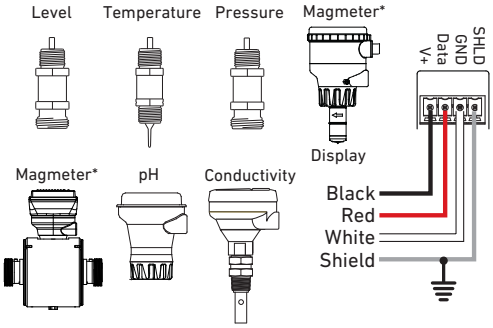
Paddlewheel



S³L

9900 Terminals

Wiring for:

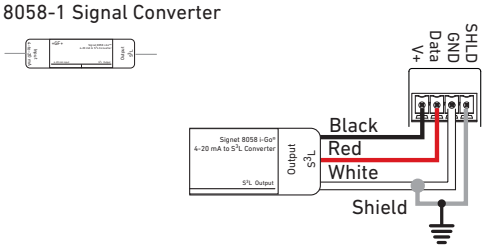


S³L

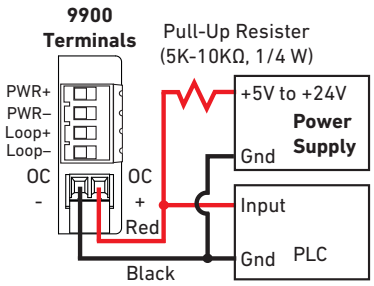
9900 Terminals

Wiring for:

8058-1 Signal Converter

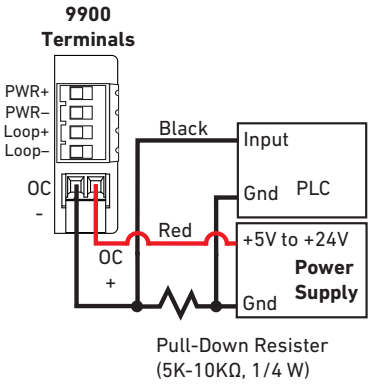


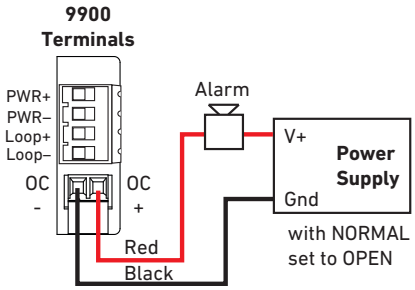
NPN Style Wiring



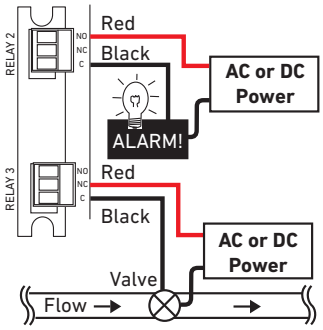
If PLC needs 0 logic input when relay is not energized, set NORMAL to CLOSED in the RELAY menu when using the Open Collector (R1) with NPN style wiring

PNP Style Wiring





Relay Module Wiring



The alarm is OFF during normal operation, and will go ON when relay energizes according to 9900 Relay settings.

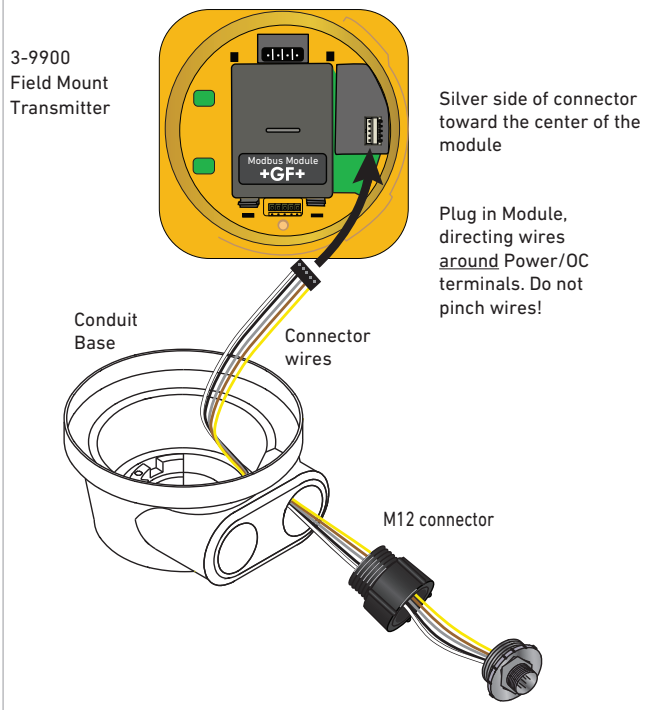
The valve is ON during normal operation, and will go OFF when relay energizes according to 9900 Relay settings

NO = Normally Open (closes when energized)
NC = Normally Closed (opens when energized)

Rear Terminal Views

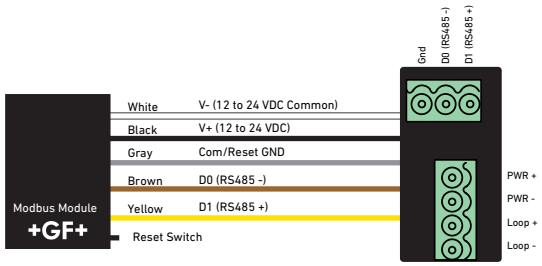
Type 9900 Transmitter Modbus Module (3-9900.270-MX)

Example showing M3 version



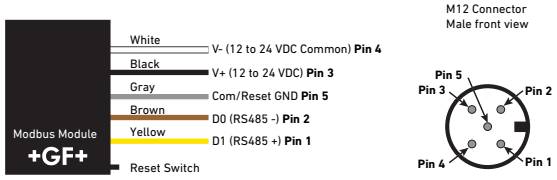
3-9900.270-M2 version: Terminal board (Panel Mount Only)

Cable assembly with 3" wires, inner-connect to board



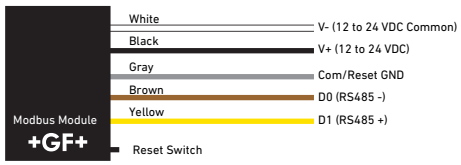
3-9900.270-M3 version: with M12 Connector (Field Mount Only)

Cable assembly with 6" wires with M12 Connector

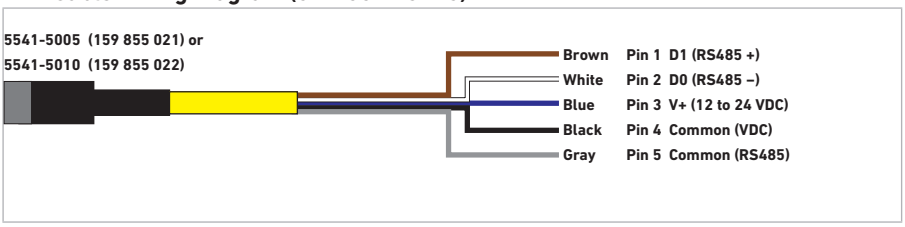


3-9900.270-M4 version: Wire Cable

Cable assembly with 6" Wires - pig tail



M12 Cable Wiring Diagram (3-9900.270-M3)



Type 9950 Multichannel Transmitter

Member of the SmartPro® Family of Instruments



Product description

The 9950 is a multi-channel, multi-sensor transmitter designed to meet and exceed the industry standards, and expectations for a small, compact, ¼" DIN Transmitter. The power and versatility of the 9950 allows the use of up to six GF sensors to manage complex water treatment applications.

The 9950 analyzer supports ALL like sensors or a mix of any GF sensors. Sensor types and accessories supported by the 9950 are GF Flow (Frequency and/or digital S^3L), pH/ORP,

Conductivity/Resistivity, Salinity, Temperature, Pressure, Level, Dissolved Oxygen, and any device that transmits a 4 to 20 mA signal when used with the 3-8058 iGo® Signal Converter.

The 9950 base unit comes complete with two each 4 to 20 mA output, two additional dual 4 to 20 mA output modules can be installed to increase the number of 4 to 20 mA outputs to a total of 6 outputs.

Four Conductivity sensor measurements are supported with either a single or dual channel conductivity module. If 6 conductivity sensors are required, the use of a 3-2850-X1-XX can be added to the main S^3L input terminals.

The 9950 supports any one of the following relay modules:

- Four Mechanical Relay Module
- Two Mechanical and Two Solid State Relay Module
- Two Mechanical Relays and Four Binary Inputs Module

The 3-9950.393-3 Relay Module provides four binary inputs that are compatible with any open collector or mechanical contacts, such as level switches, flow switches, pressure switches or other devices.
The 9950 offers advanced features such as derived functions, advanced multiple relay modes (Boolean logic), and timer-based relay functions.
The 9950 Modbus Module allows for remote access to primary and secondary measurements, derived functions, status of current loop outputs and relays, over a serial RS485 Modbus automation network.

Features

- Up to six different sensor types can be combined in one instrument
- Derived measurements - Delta, Sum, ratio, % recovery, % reject , % passage
- Advanced boolean logic -A | B | C, A & B & C, A | (B & C), A & (B | C)
- Single and Dual Channel Direct Conductivity/Resistivity Modules
- Up to four on board relays via optional modules, and up to 4 external DIN Rail mounted Relays via optional 8059 module (six input option only)
- Optional Modbus RTU Module for connections to Serial RS485 automation networks
- Configurable display
- Multiple language support for English, French, German and Spanish

Applications

- Wastewater Treatment
- Membrane and Media Filtration
- RO / DI Skids and Systems
- Chemical Manufacturing/Addition
- Metal and Plastic Finishing
- Fume Scrubber
- Cooling Towers
- Horticulture/ Vertical Farming
- Chemical Dosing/Injection
- Aquatic Life Support
- Pools & Fountains
- Rinse Tanks
- Chemical Neutralization
- Mining

Specifications

General	
Input Channels 9950-1,2	Two frequency or two (S^3L) inputs. Plus up to four Binary inputs
Input Channels 9950-10, 11	One frequency and five (S^3L) inputs, two frequency and four (S^3L) inputs or six (S^3L). Plus up to four Binary inputs

Enclosure and Display	
Case Material	PBT
Window	Shatter-resistant glass
Keypad	4 buttons, injection-molded silicone rubber seal
Display	Dot matrix, LCD
Indicators	Two horizontal digital bar graphs, four LED relay status indicators
Update Rate	1 s
LCD Contrast	5 settings
Size	¼ DIN

Mounting

Panel	¼ DIN, ribbed on four sides for panel mounting clip inside panel, silicon gasket included
Wall	Wall Mount enclosure (sold as an accessory)

Terminal Blocks		
Pluggable Screw type	Use minimum 105 °C rated wire	
Torque Ratings		
	All connectors	0.49 Nm (4.4 lb-in.)
Connector Wire Gauge		
	Power, Loop	12 to 22 AWG; 0.34 mm^2 to 4 mm^2
	Freq/S^3L	16 to 22 AWG; 0.34 mm^2 to 1.5 mm^2

Environmental		
Ambient Operating Temperature		
DC Power	-10 °C to 70 °C	14 °F to 158 °F
AC Power	-10 °C to 60 °C	14 °F to 140 °F
Storage Temp	-15 °C to 70 °C	5 °F to 158 °F
Relative Humidity	0 to 100% condensing for (front only); 0 to 95% non-condensing (rear panel)	
Maximum Altitude	4,000 m (13,123 ft)	
Enclosure Rating	NEMA 4X/IP65 (front face only)	

Performance Specifications	
System Accuracy	Primarily dependent upon the sensor
System Response	Primarily dependent upon the sensor. Transmitter adds a maximum of 150 ms processing delay to the sensor electronics.
	Minimum update period is 100 ms
	System response is tempered by the display rate, output averaging and sensitivity feature

Conductivity/Resistivity input directly from GF Conductivity/Resistivity electrodes via Direct Conductivity/Resistivity Module, 3-9950.394-1, or 3-9950.394-2, or 3-2850-51 electronics (Integral mount), 3-2850-61, and 3-2850-63 electronics (universal field mount)

Electrical Requirements	
Power to Sensors	
Voltage	+4.9 to 5.5 VDC @ 25 °C, regulated
Current	30 mA
Short Circuit	Protected
Isolation	Low voltage (< 48 V AC/DC)

Power Requirements	
DC (3-9950-1, 3-9950-10)	24 VDC nominal (12 to 32 VDC, ±10% regulated), UL 60950-1 or UL 61010-1 Power Supply rated for operation at 4000 m altitude
AC (3-9950-2, 3-9950-11)	100 to 240 VAC, 50 to 60 Hz, 24 VA
Maximum current	200 mA (without optional relay module)*
	500 mA (with optional relay module)*
*The current draw of the other modules and the sensors are minimal	
Current Loop (active)	12 to 32 VDC, ±10% regulated, 4 to 20 mA (30 mA max.)
Overvoltage protection	48 Volt Transient Protection Device (for DC ONLY)
Current limiting for circuit protection	
Reverse-Voltage protection	

Input types	
Digital (S3L), Open Collector or AC Frequency (flow sensors)	
4 to 20 mA input via the 3-8058-1 single input or 3-8058-2 double input iGo Signal Converter	
pH/ORP input via the Digital (S3L) output from the 2751 pH/ORP Smart Sensor Electronics	
Conductivity/Resistivity via the Digital (S3L) output from the optional direct Conductivity Module or 2850 Conductivity/Resistivity Sensor Electronics	
Sensor types	Flow, pH/ORP, Conductivity/Resistivity, Pressure, Temperature, Level/Volume, Salinity, Dissolved Oxygen, Other (4 to 20 mA)

Sensor Input Specifications	
Digital (S^3L)	Serial ASCII, TTL level, 9'600 bps
Frequency Flow Sensors	0.5 to 1'200 Hz
Sensitivity (for coil type sensors)	80 mV @ 5 Hz, gradually increasing with frequency to 2.5 V
Freq. Range (for square wave type sensors)	0.5 Hz to 1'200 Hz @ TTL level input or open collector
Direct Conductivity Module - 3-9950.394-1 (single input) and 3-9950.394-2 (dual input)	
Accuracy	Conductivity ± 2% of Reading
	Temperature 0.5 °C
Resolution	Conductivity 0.1% of Reading
	Temperature <0.2 °C
Update Rate	2.5 Seconds Single Channel, 5 Seconds Dual Channel
Compatible Sensors	All GF Conductivity Sensors

Current Loop Specifications			
Current Loop Out	ANSI-ISA 50.00.01 Class H (Passive, external voltage required)		
Voltage	12 to 32 VDC, ±10% regulated, UL 60950-1 or UL 61010-1 Power Supply rated for operation at 4000 m altitude		
Max. Impedance	250 Ω @ 12 VDC	500 Ω @ 18 VDC	750 Ω @ 24 VDC
Span	3.8 to 21 mA		
Adjustable Span, Reversible			
Error Condition	Selectable error condition 3.6 or 22 mA or None		
Analog Outputs	2 Passive 4 to 20 mA Outputs in Base Unit or 2 or 4 passive current loops by optional module(s)		

Relay Specifications	
Dry Contact Relays (3-9950.393-1, 3-9950.393-2, and 3-9950.393-3)	
Type	SPDT
Form	C
Max. Voltage Rating	30 VDC or 30 VAC
Max. Current Rating	0.050 A resistive
Solid-State Relays (3-9950.393-2)	
Type	SPDT
Form	C
Max. Voltage Rating	30 VDC or 30 VAC

Relay Specifications	
Max. Current Rating	0.050 A resistive
Hysteresis	Adjustable (absolute in Engineering Units)
On Delay	9'999.9 seconds (max)
Cycle Delay	99'999 seconds (max)
Test Mode	Set On or Off
Maximum Pulse Rate	0 to 300 pulses/minute
Proportional Pulse	0 to 300 pulses/minute
Volumetric Pulse Width	0.1 to 3'200 s
PWM Period	0.1 to 320 s

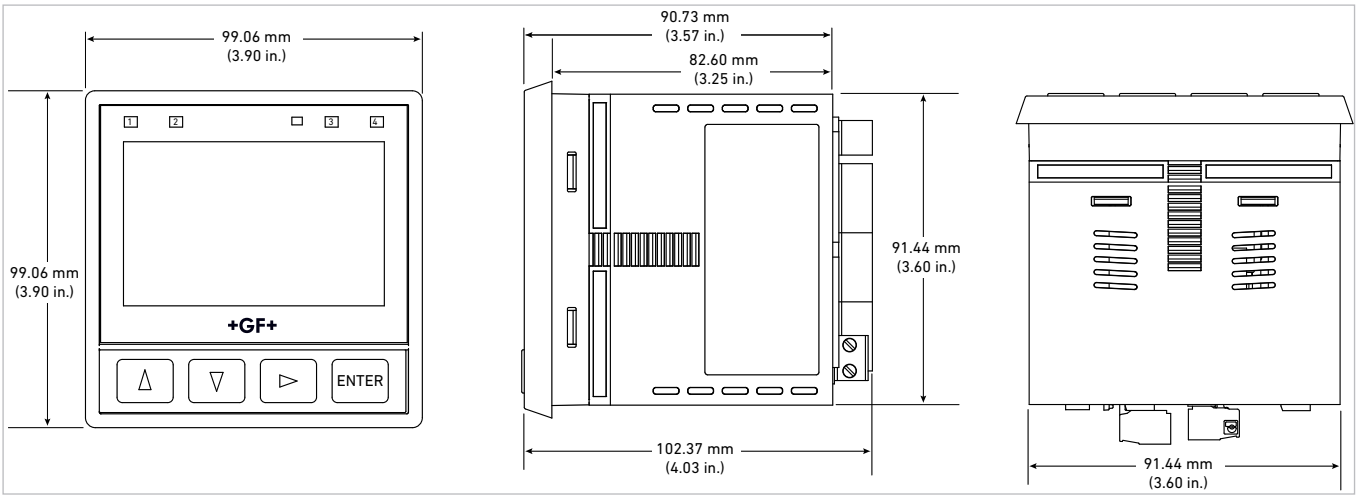
Binary Input (3-9950.393-3)	
Input Voltage Range (without damage)	-5 VDC to 30 VDC (No operation below 0 VDC)
Max. Current Rating	6.0 mA
Max. Voltage Rating	30 VDC
Maximum Input Voltage for signal "Off" (low or "0")	1.5 VDC
Minimum Input Voltage for signal "On" (high or "1")	3.0 VDC
Maximum Current Draw for Signal "0" (low)	≤ 500 µA DC
Minimum Current Draw for Signal "1" (high)	500 µA
Typical Current Draw for Signal "1" (high)	6.0 mA at 30 VDC, 4.8 mA at 24 VDC, 2.4 mA at 12 VDC, 1.0 mA at 5 VDC

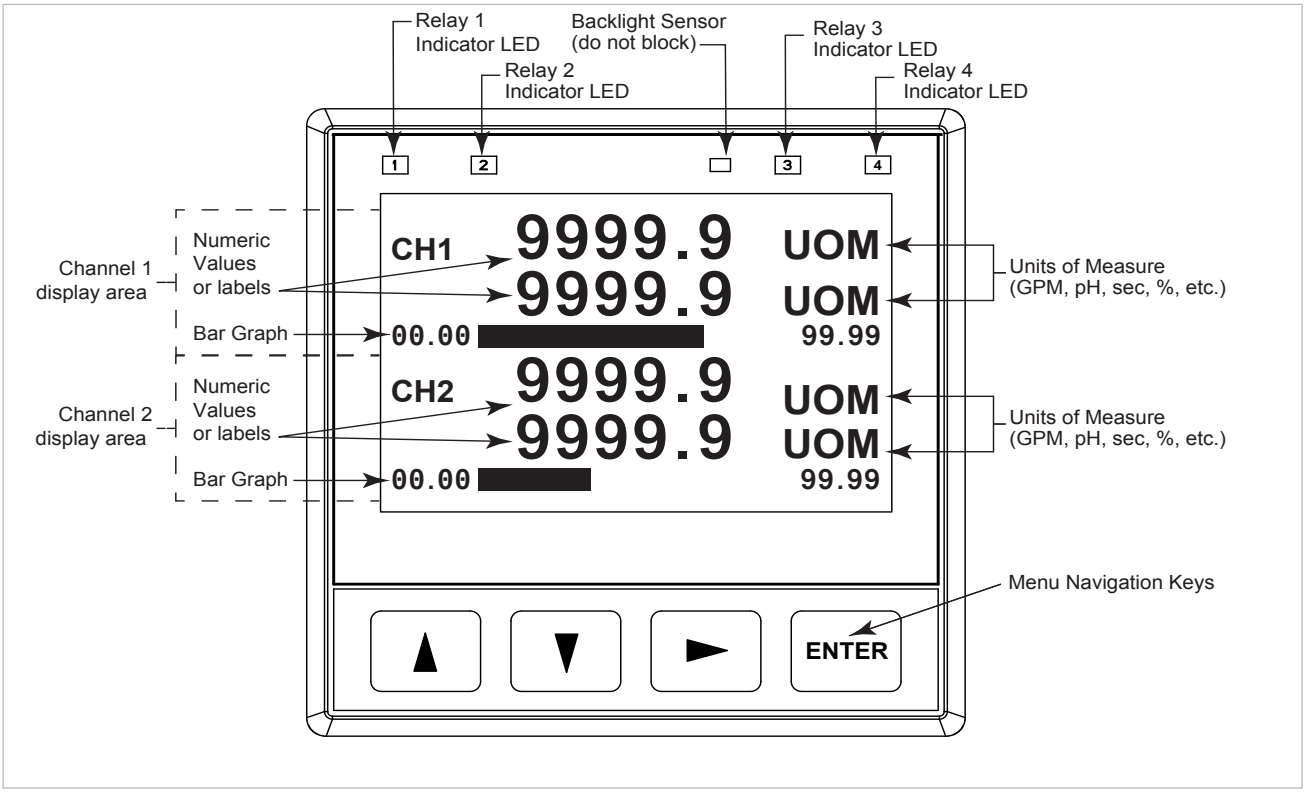
Display Ranges		
pH	-1.00 to 15.00 pH	
pH Temp.	-99 °C to 350 °C	-146 °F to 662 °F
ORP	-1'999 to +1'999.9 mV	
Flow Rate	-9'999 to 99'999 units per second, minute, hour or day	
Totalizer	0.00 to 99'999'999 units	
Conductivity	0.0000 to 99'999 µS, mS, PPM and PPB (TDS), kΩ, MΩ	
Cond. Temp.	-99 °C to +350 °C	-146 °F to 662 °F
Temperature	-99 °C to +350 °C	-146 °F to 662 °F
Pressure	-40 to 1000 psi	
Level	-9'999 to +99'999 m, cm, ft, in, %	
Volume	0 to 99'999 cm^3, m^3, in^3, ft^3, gal, L, lb, kg, %	
Salinity	0 to 100 PPT	
Dissolved Oxygen	0 to 50 mg/L, 0 to 200%	

Shipping Weights		
Base Unit	0.63 kg	1.38 lb
Relay Module	0.19 kg	0.41 lb
Single Module	0.075 kg	0.16 lb
Dual Channel Module	0.075 kg	0.16 lb
Modbus Module	0.075 kg	0.16 lb

Standards and Approvals	
	CE, UKCA, UL, CUL, FCC
	RoHS Compliant, China RoHS
	Manufactured under ISO 9001, ISO 14001, and ISO 45001

Dimensions


99.06 mm
(3.90 in.)
99.06 mm
(3.90 in.)
+GF+
ENTER
90.73 mm
(3.57 in.)
82.60 mm
(3.25 in.)
91.44 mm
(3.60 in.)
102.37 mm
(4.03 in.)
91.44 mm
(3.60 in.)


Relay 1
Indicator LED
Backlight Sensor
(do not block)
Relay 3
Indicator LED
Relay 2
Indicator LED
Relay 4
Indicator LED
1
2
3
4
Channel 1
display area
Numeric
Values
or labels
Bar Graph
CH1
9999.9
9999.9
00.00
UOM
UOM
99.99
Units of Measure
(GPM, pH, sec, %, etc.)
Channel 2
display area
Numeric
Values
or labels
Bar Graph
CH2
9999.9
9999.9
00.00
UOM
UOM
99.99
Units of Measure
(GPM, pH, sec, %, etc.)
Menu Navigation Keys
ENTER

Sensor type	Freq Output	Digital (S^3L) Output	Requires 8058
515	X		
525	X		
2000	X		
2100	X		
2250		X	
2350		X	
2450		X	
2507	X		
2536	X		
2537-5		X	
2540	X		
2551	X	X	
2552	X	X	
258X	X	X	
U1000 V2	X		
U3000	X		
2260			X
2270			X
2290			X
2291			X
2610-51		X	
2751		X	
2850-51-XX*		X	
2850-61*		X	
2850-63*		X	

* No conductivity module required

Channels 1 through 6 are identical.

The 9950 allows a total of six sensors to be used at a time and is compatible with all GF products listed.

- pH/ORP electrodes require the type 2751 DryLoc® Sensor Electronics (sold separately)
- Conductivity/Resistivity measurement requires the type 2850 Conductivity/ Resistivity electronics or a single or dual conductivity module and proper conductivity sensor (sold separately).

System Overview

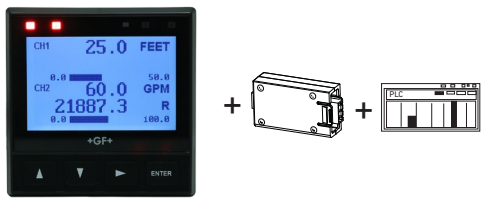
Panel or Wall Mount

Type 9950 Transmitter
(Includes mounting bracket and panel gasket)

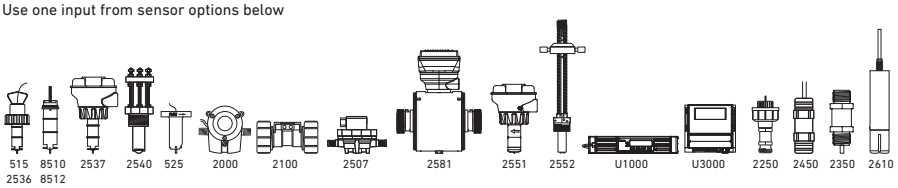


Automation System

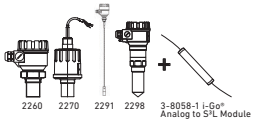
Type 9950 Transmitter with Modbus Module



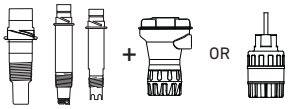
GF Sensors - Flow, Level, Temperature, Pressure, DO
Use one input from sensor options below



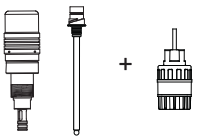
4-20mA level transmitter
Use 8058 i-Go™ Analog to S³L Module for signals other than 4-20 mA



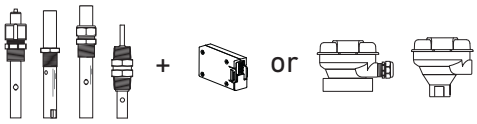
GF Sensors - pH/ORP
Use one input from sensor options below
with 2751 pH/ORP Smart Sensor Electronics



GF Wet-Tap Electrode type 2756, 2757 and 3719 Wet-Tap with
2751 pH/ORP Smart Sensor Electronics



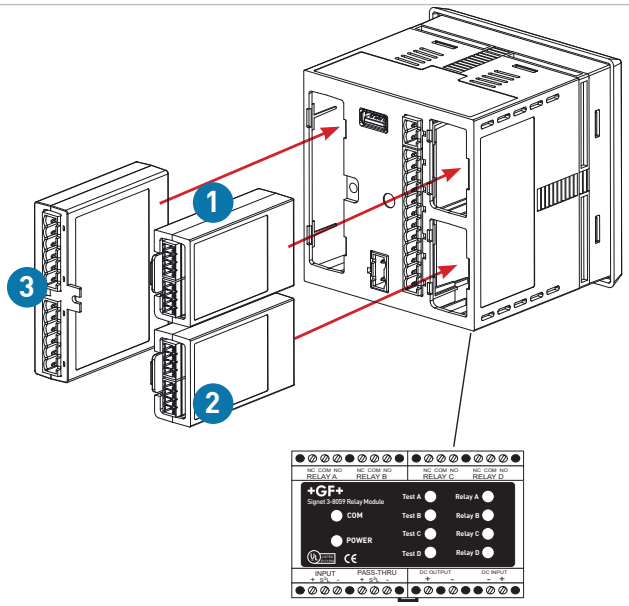
GF Sensors - Conductivity/Resistivity and Salinity Sensors Electrodes
Use either a single or duel input conductivity module one input and any GF conductivity sensor (3-2819 - 2823 or 2839 - 2842) from electrode options below with Conductivity Module or 2850 Sensor Electronics



GF Fittings - See individual sensor data sheets

All Sold Separately

Modular Design Changeable I/O Cards



8059 (4) Relay DIN Mount Module
9950-10/-11 only

1 Module 1 Access Point
2 Module 2 Access Point
3 Relay Module Access Point

(1) & (2) Module 1 Access Point	
3-9950.398-2	Dual Channel 4 to 20 mA output module
3-9950.394-1	Single Channel Conductivity module
3-9950.394-2	Dual Channel Conductivity module
3-9950.395-M	Modbus Module *

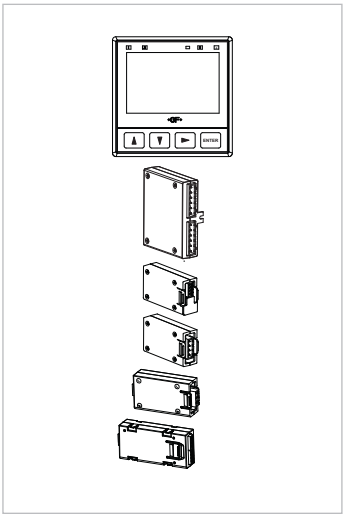
(3) Relay Module Access Point	
3-9950.393-1	Mechanical relays
3-9950.393-2	Mechanical relays and 2 solid state relays
3-9950.393-3	Mechanical relays and 4 binary inputs

* Only one module required for all outputs

Ordering Information

Mfr. Part No	Code	Description
9950 Base Unit - Multi-Channel, Multi-Parameter, AC Power and DC Power		
3-9950-1	159 001 841	9950 Base Unit – Two Channel Multi-Parameter Inputs, Two 4 to 20 mA Outputs, Panel Mount, 12/24 VDC
3-9950-2	159 001 842	9950 Base Unit – Two Channel Multi-Parameter Inputs, Two 4 to 20 mA Outputs, Panel Mount, 12/24 VDC or 100 - 240 VAC
3-9950-10	159 002 075	9950 Base Unit – Six Channel Multi-Parameter Inputs, Two 4 to 20 mA Outputs, Panel Mount, 12/24 VDC
3-9950-11	159 002 076	9950 Base Unit – Six Channel Multi-Parameter Inputs, Two 4 to 20 mA Outputs, Panel Mount, 12/24 VDC or 100 - 240 VAC
Optional Accessory Modules		
3-9950.393-1	159 310 268	Relay Module with 4 Mechanical Relays
3-9950.393-2	159 310 269	Relay Module with 2 Mechanical and 2 Solid State Relays
3-9950.393-3	159 310 270	Relay Module with 2 Mechanical Relays and 4 Binary Inputs
3-9950.394-1	159 001 846	Single Channel Direct Conductivity/Resistivity Module
3-9950.394-2	159 001 847	Dual Channel Direct Conductivity/Resistivity Module
3-9950.395-M	159 001 905	Modbus Module
3-9950.398-2	159 001 848	Dual Channel 4 to 20 mA Current Loop Output Module
3-8059-4*	159 000 772	12 to 24 VDC External DIN Mount, 4 Relay Module
3-8059-4AC*	159 000 773	100 to 240 VAC External DIN Mount, 4 Relay Module with 24 VDC Output

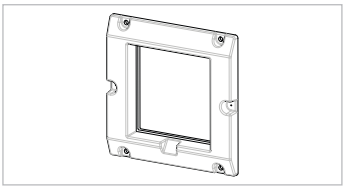
* Not compatiable with the 9950-1 or 9950-2



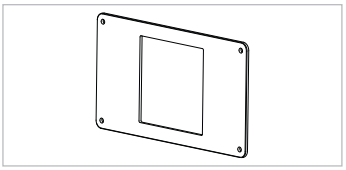
Accessories and Replacement Parts

Mfr. Part No	Code	Description
3-5000.399	198 840 224	5 x 5 inch Retrofit Adapter
3-8050.392	159 000 640	CR200 ¼ DIN Retrofit Adapter
3-8050.396	159 000 617	RC Filter Kit (for relay use), 2 per kit
3-8058-1	159 000 966	i-Go® Signal Converter, wire-mount
3-8058-2*	159 000 967	i-Go® Signal Converter, rail-mount
3-9950.391	159 310 278	Connector Kit, In-Line, 9950 Transmitter
3-9950.392	159 310 279	Relay Module Connector Kit, 9950 Transmitter
3-9900.392	159 001 700	Wall Mount Enclosure Kit
3-9000.392-1	159 000 839	Liquid Tight Connector Kit, NPT (1 pc.)

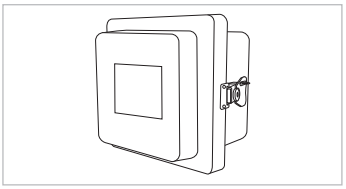
* Not compatiable with the 9950-1 or 9950-2



3-5000.399



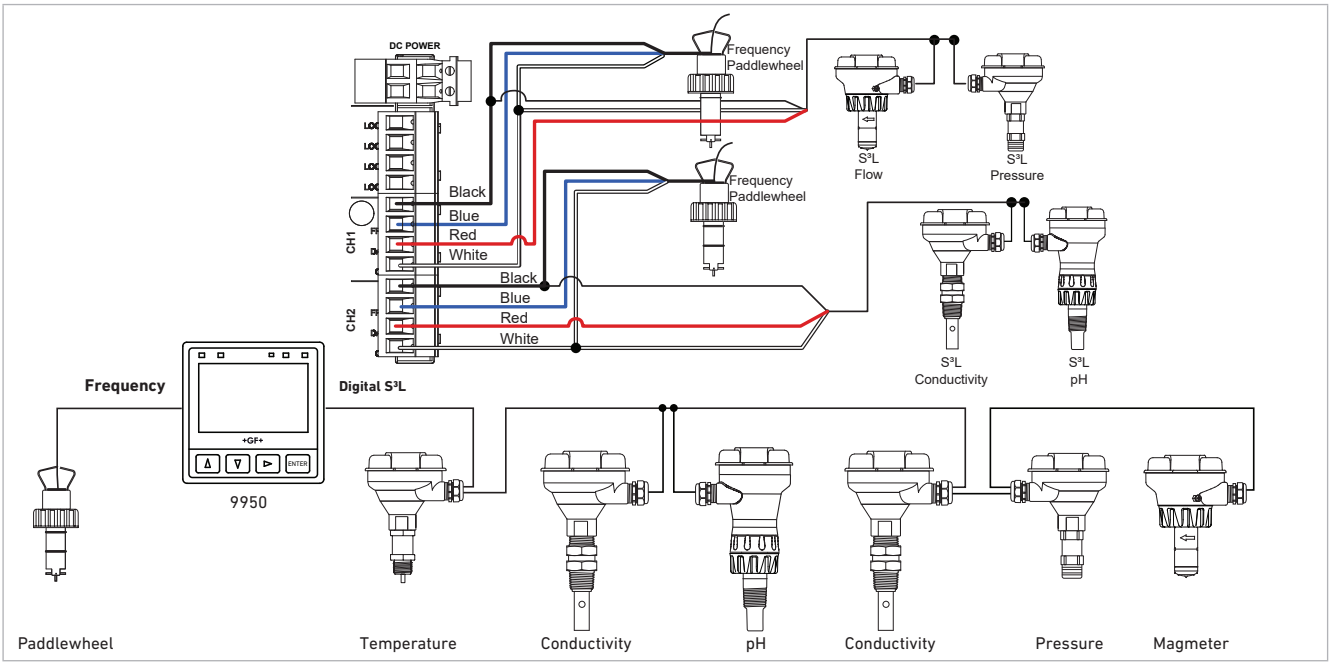
3-8050.392



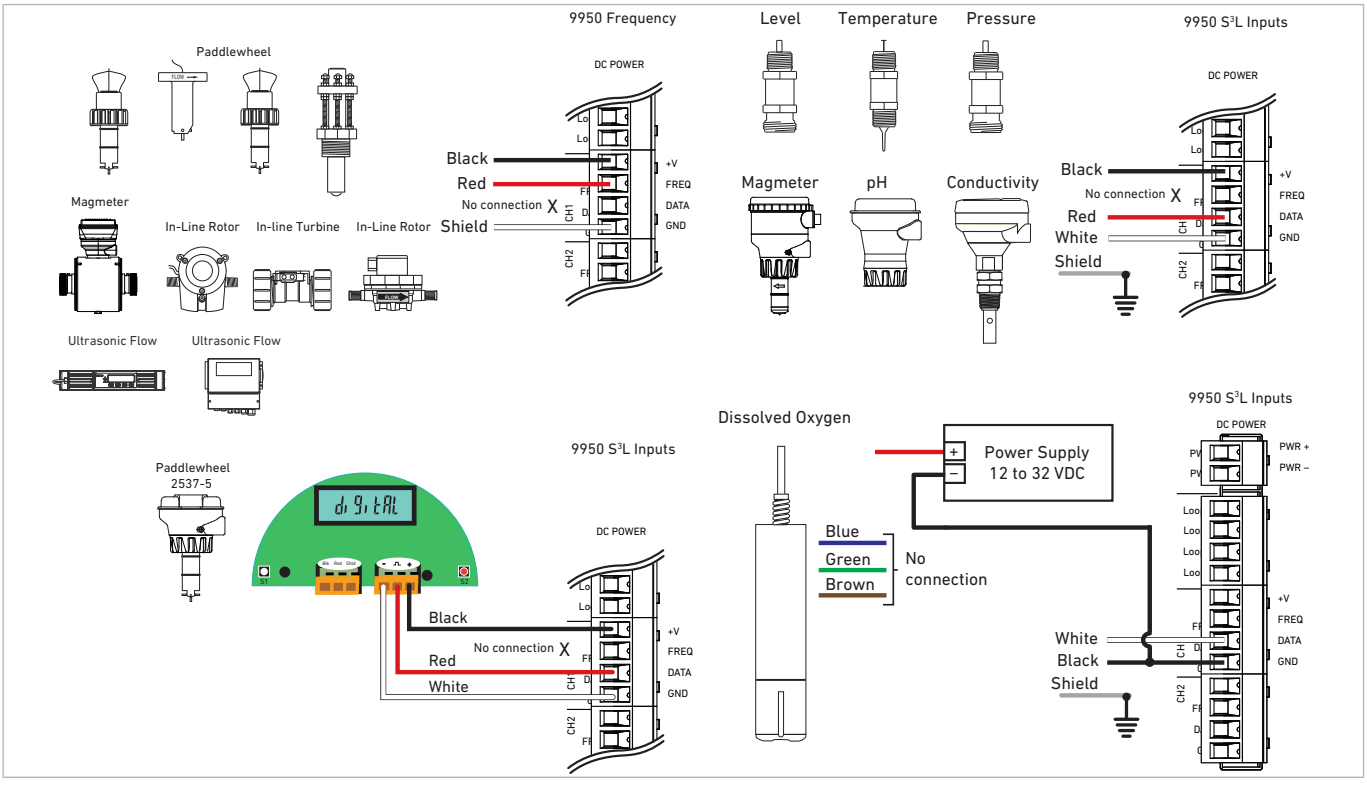
3-9900.392

Wiring information

Frequency sensors and S³L sensors



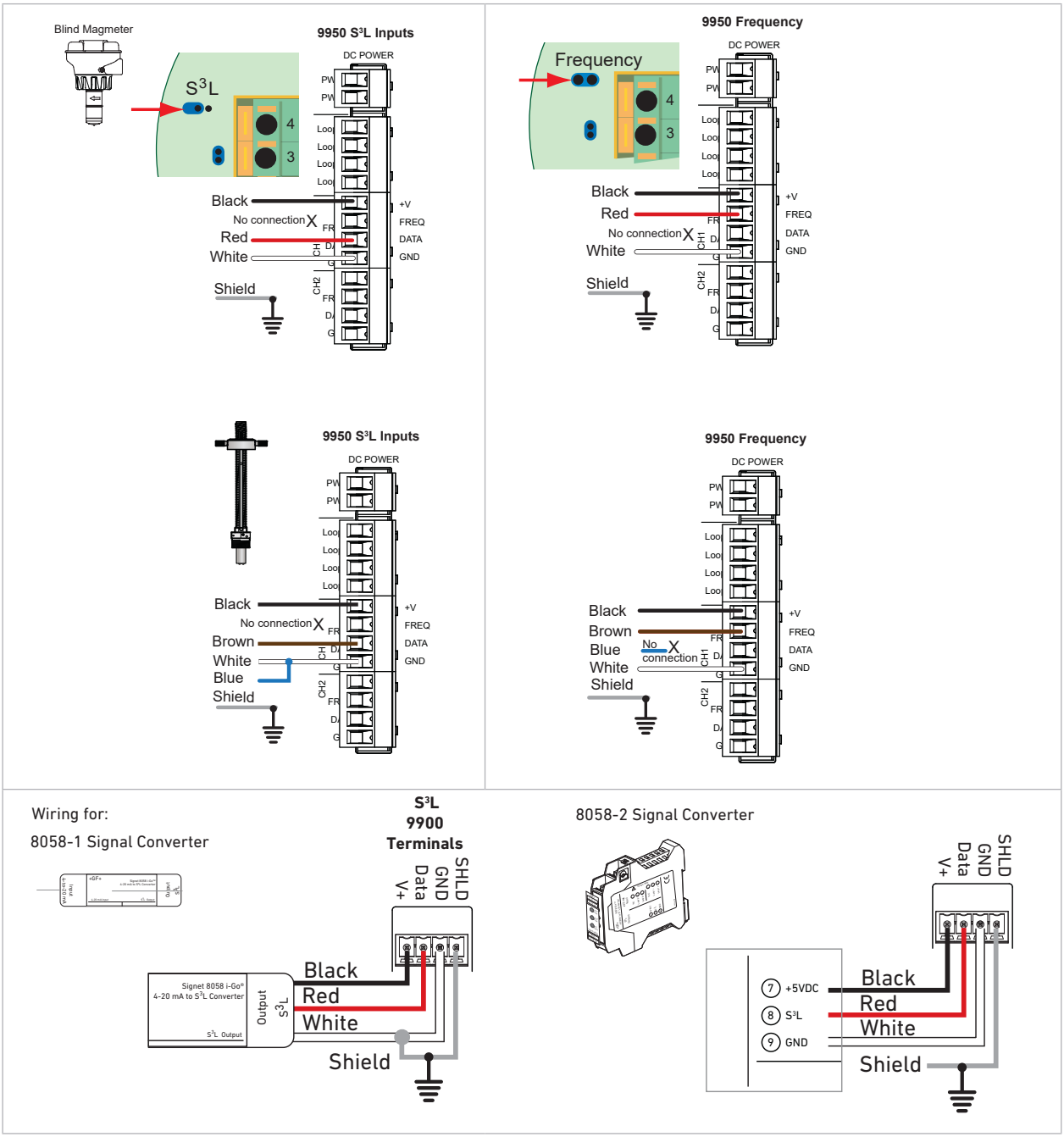
Rear Terminal Views GF Instruments



Important:

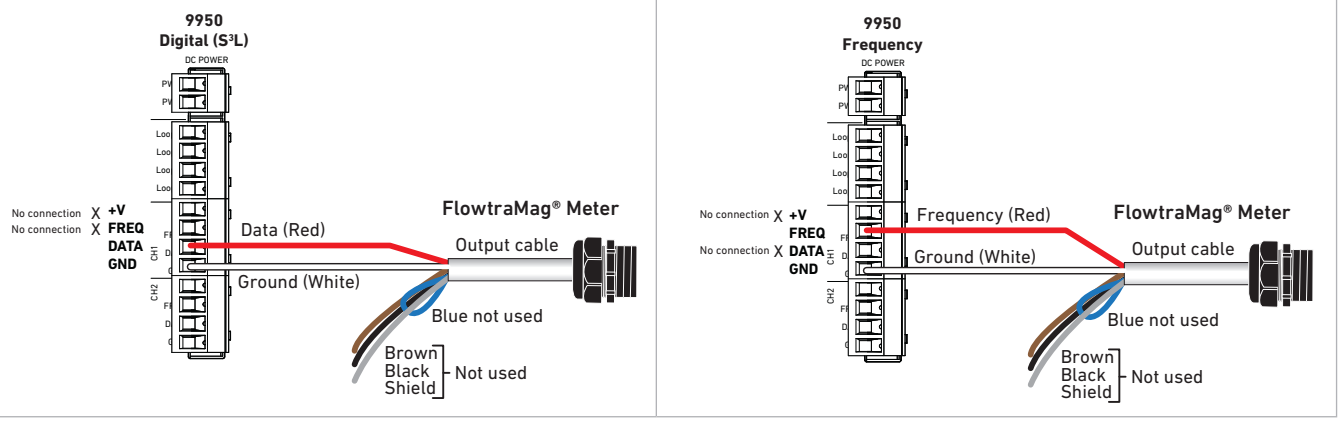
An external DC supply is needed for the 2610-51 Dissolved Oxygen sensor when the 9950 is AC powered. The 3-9950-2/11 with AC power will not supply power to the 2610-51 Sensor. A power supply of 12 to 24 VDC regulated is required.

Rear Terminal Views type 9950 Transmitter



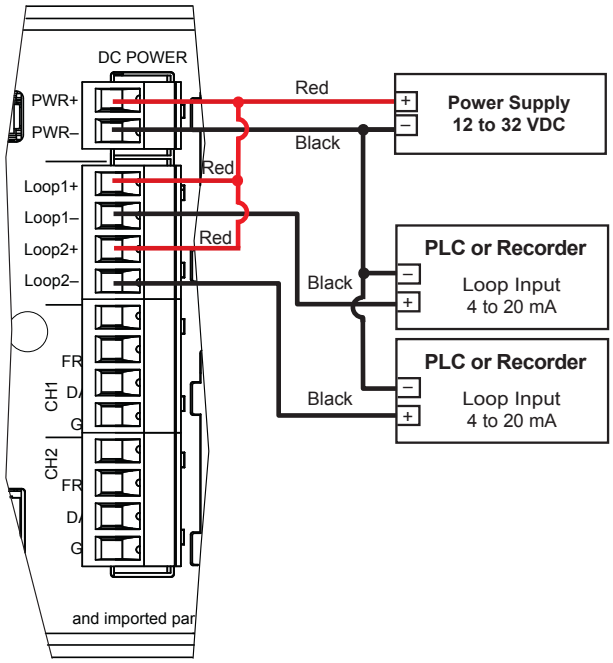
FlowtraMag® Meter Wiring to type 9950

GF Config Tool App set to S³L

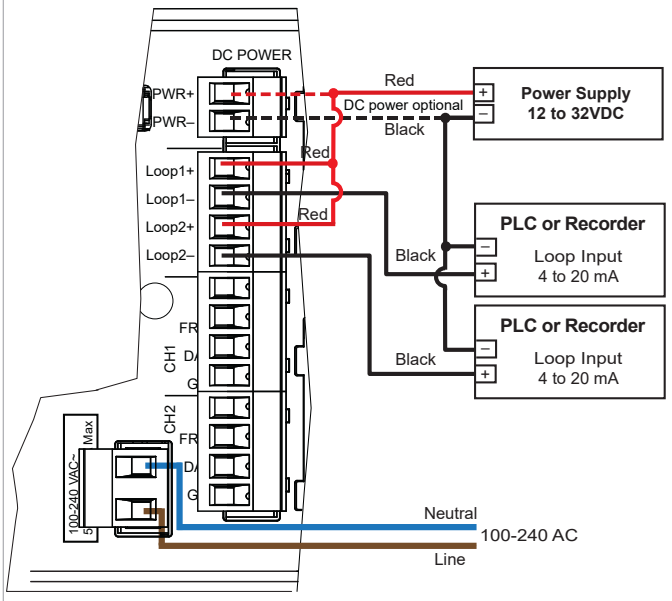


Power Wiring

3-9950 DC Power



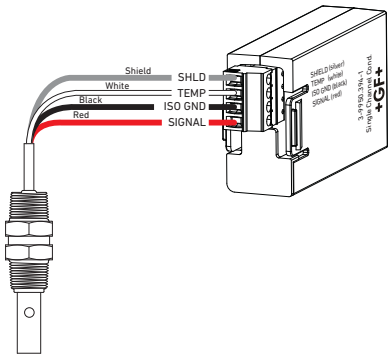
3-9950 AC Power



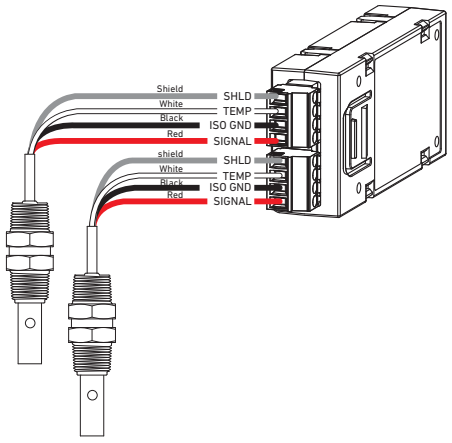
Important:

An external DC power supply is required for the 4 to 20 mA Loop Outputs. The 9950 does not supply power on the DC Power Terminals.

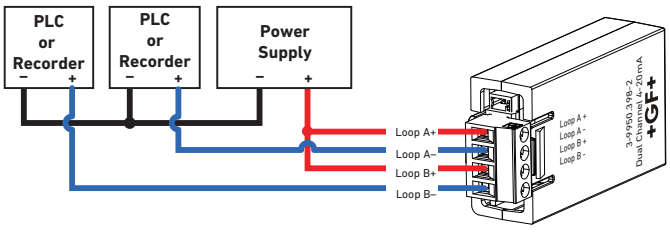
Single Channel Conductivity Module



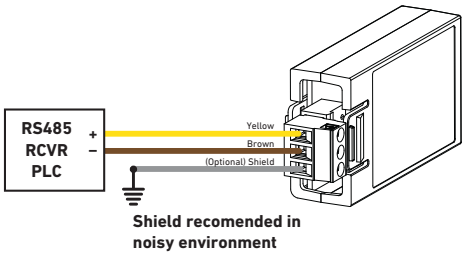
Dual Channel Conductivity Module



Dual Channel 4 to 20 mA Module

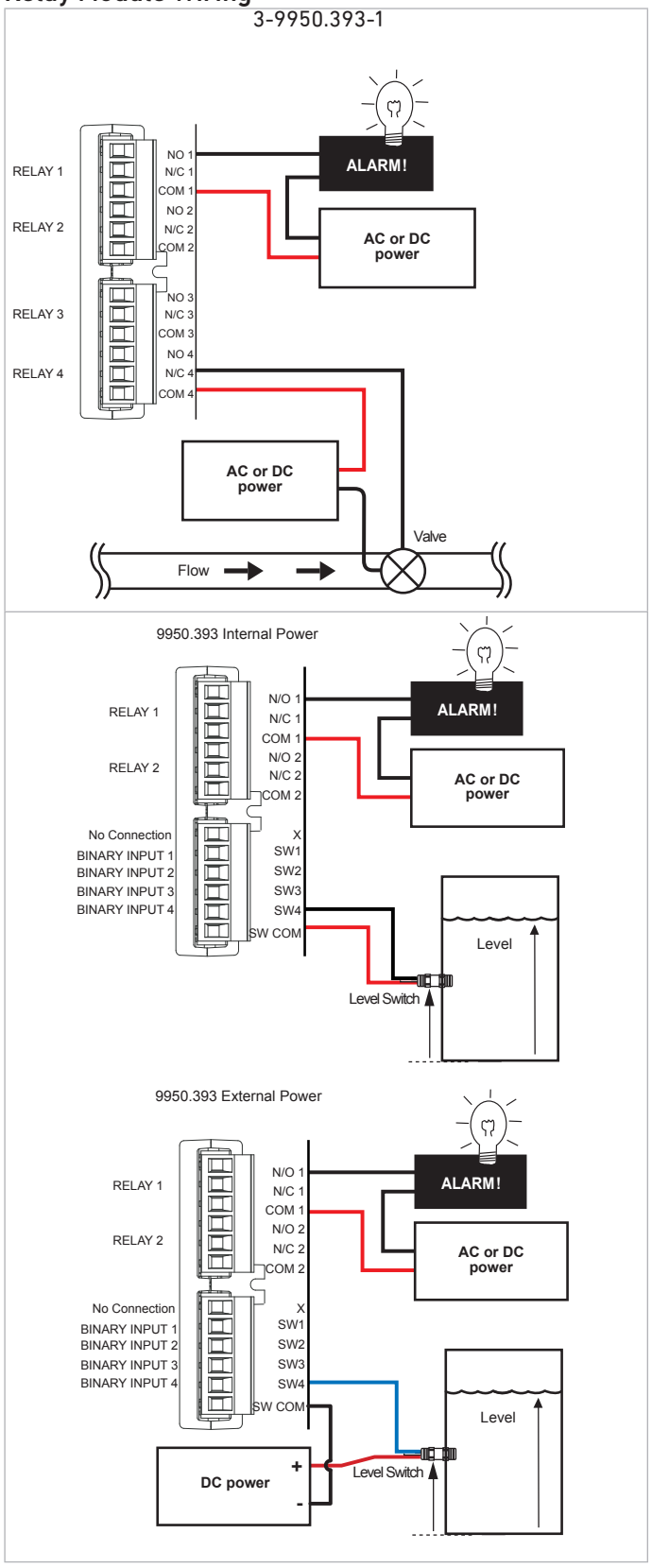


Modbus Module



Shield recomended in noisy environment

Relay Module Wiring



Type 9950-3/-4 Chlorine Controller

Member of the SmartPro® Family of Instruments



Product description

The type 9950-3/-4 Chlorine Controller is a two channel controller that can support two sensors in one instrument. The sensor types supported by the 9950-3/-4 are GF Free Chlorine (FCl), Chlorine Dioxide (ClO_2) and pH.

The 9950-3/-4 (which is used in the GF Chlorine panels) software, combined with smart electronics connected to the Chlorine sensor (FCl,ClO_2) and the pH electrode, delivers a real-time, accurate Chlorine measurement of the application process.

Includes improved calibration support by automatically time-stamping the successful single-point calibration of the Chlorine electrode and a two-point calibration of the pH electrode. An operator can enter the next calibration date and the 9950-3/-4 will display a message and illuminate the red background light to alert the operator when a calibration is due.

The new “Chemical Guard” relay mode for free chlorine ensures that the proper dosing of oxidants and pH-adjusting chemicals are delivered safely and accurately. When Chemical Guard mode is selected, the pH control and adjustment is always a priority over dosing oxidizing chemicals whose concentration is pH dependent.

The 9950-3/-4 comes standard with the 3-9950.393-3 Relay Module, comprising four binary inputs and two mechanical relays. Binary input #1 is dedicated to an external flow switch input which enables access to the new relay mode „Chemical Guard“ that disables the relays when there is no flow through the system. The 9950-3/-4 also supports the -1 and -2 relay modules without flow switch or Chemical Guard.

The 3-9950-3/-4 also comes standard with four, 4 to 20 mA outputs. The optional 3-9950.395-M Modbus module makes adding the GF Chlorine Controller / panel assembly into a new or existing communication network very simple.

Features

- One instrument for multiple sensor types: Free Chlorine, Chlorine dioxide, pH
- Multiple language support for Simplified Chinese, English, French, German, Italian and Spanish
- Two different sensor types can be combined in one instrument
- Chemical Guard (for free chlorine): software that controls relay actions to safely deliver oxidizing and pH adjustment chemicals
- Flow switch interrupt to disable alarms and chemical dosing when there is no flow to the system
- Four standard, 4 to 20 mA current loop outputs (2 in base unit, 2 in additional module)
- USB Port for Field Upgrades using standard USB Flash Drive
- Modbus Module for connections to Serial RS485 automation networks

Applications

- Water Distribution
- Ground Water
- Surface Water
- HVAC Applications (cooling water)
- Food and Beverage
- Swimming Pools
- Water Parks

NOTE: The 9950-3/-4 Chlorine Controller is not compatible with the standard 9950 controller.

Specifications

General	
Input Channels	Two Channels 3-2630-1 Free Chlorine Electrode, 0.02 to 2 ppm / 3-2650-7 Amperometric Electronics 3-2630-2 Free Chlorine Electrode, 0.02 to 5 ppm / 3-2650-7 Amperometric Electronics 3-2630-3 Free Chlorine Electrode, 0.05 to 20 ppm / 3-2650-7 Amperometric Electronics 3-2724-00 Flat pH Electrode, 0 to 14 pH / 3-2751-7 pH Sensor Electronics
Materials	
Enclosure and Display	
Panel	Black Acrylic
Flow Cell	Acrylic
Wiring Enclosure	Polycarbonate
Wetted materials	
Flow Cell	
Flow Cell, Spacer Rings	Acrylic
Flow Regulator Housing	Polycarbonate
Strainer, E-clip, Regulator Spring, Float	Stainless Steel
Valves, Vent	Polypropylene
Flow Cell O-rings, Diaphragm	EPR (EPDM), FKM
Chlorine Electrode	PVC, PTFE, FKM, Nylon, Silicone
pH Electrode	PPS, Glass, UHMWPE, FKM
Flow Switch	Polypropylene
Sealing Tape on Valves, Plug and Vent	PTFE
Plug	Polyethylene

Environmental		
Pressure/Flow ratings		
System Inlet Pressure Rating	1 to 8 bar	15 to 120 psi
Pressure Regulator	< 0.69 bar (10 psi) variation over all ranges of flow and pressure	
Flow Tolerance	± 15% or rated specification above	
Flow Rate Limits	30.24 to 45.36 LPH	8 to 12 gph (US)
Ambient Operating Temperature		
Operating temperature	-10 °C to 70 °C	14 °F to 158 °F
Storage Temp	-0 °C to 65 °C	32 °F to 149 °F
Relative Humidity	0 bis 95 %	
Maximum Altitude	4,000 m (13,123 ft)	
Enclosure Rating	NEMA 4X (with output wire glands sealed)	

Power Requirements	
DC (3-9950-3, 3-9950-5)	24 VDC nominal (12 to 32 VDC, ±10% regulated), UL60950-1 or UL61010-1 certified power supply rated for operation at 4,000 m (13,123 ft) altitude
AC (3-9950-4, 3-9950-6)	100 to 240 VAC,50 to 60 Hz.24 VA
3-9950-3 Relay Mode	Current draw up to 500 mA
Current Loop	12 to 32 VDC, ±10% regulated, 4 to 20 mA (30 mA max.)
Overvoltage Protection	Protection 48 Volt Transient Protection Device. Current limiting for circuit protection. Reverse-voltage protection.

Sensor Input Specifications	
Digital (S^3L) Sensors	Serial ASCII, TTL level, 9600 bps
Accuracy	± 0.5% of reading max error @ 25 °C
Resolution	1 µs
Repeatability	± 0.2% of reading

Input types	
Chlorine (FCl/ClO_2) input via the Digital (S^3L) output from the 2650 Amperometric Electronics	
pH input via the Digital (S^3L) input from the 2751-7 pH Electronics	
Sensor types	Chlorine and pH

Power Supply	
Rejection	No Effect ± 1 µA per volt
Short Circuit	Protected
Reverse Polarity	Protected

Binary Input (3-9950.393-3)	
Input Voltage Range (without damage)	-5 VDC to 30 VDC (No operation below 0 VDC)
Max. Current Rating	6.0 mA
Max. Voltage Rating	30 VDC
Maximum Input Voltage for signal “Off” (low or “0”)	1.5 VDC
Minimum Input Voltage for signal “On” (high or “1”)	3.0 VDC
Maximum Current Draw for Signal “0” (low)	≤ 500 µA DC
Minimum Current Draw for Signal “1” (high)	500 µA
Typical Current Draw for Signal “1” (high)	6.0 mA at 30 VDC
	4.8 mA at 24 VDC
	2.4 mA at 12 VDC
	1.0 mA at 5 VDC

Current Loop Specifications			
Current Loop Out	ANSI-ISA 50.00.01 Class H (Passive, external voltage required)		
Voltage	12 to 32 VDC, ±10% regulated, UL 60950-1 or UL 61010-1 Power Supply rated for operation at 4,000 m (13,123 ft) altitude		
Max. Impedance	250 Ω @ 12 VDC	500 Ω @ 18 VDC	750 Ω @ 24 VDC
Span	3.8 to 21 mA Adjustable, reversible		
Accuracy	± 32 µA max. error @ 25 °C @ 24 VDC		

Current Loop Specifications	
Resolution	6 µA or better
Temp. Drift	± 1 µA per °C
Isolation	Low voltage (< 48 VAC/DC)
Update Rate	100 mS nominal
Zero	4.0 mA factory set; user programmable from 3.8 to 5.0 mA
Full Scale	20.0 mA factory set; user programmable from 19.0 to 21.0 mA
Power Supply Rejection	± 1 µA per V
Actual Update Rate Determined by Sensor type	
Short Circuit and Reverse Polarity Protected	
Adjustable Span, Reversible	
Error Condition	Selectable error condition 3.6 or 22 mA or None
Test Mode	Increment to desired current (range 3.8 to 21.00 mA)
Analog Outputs	2 Passive

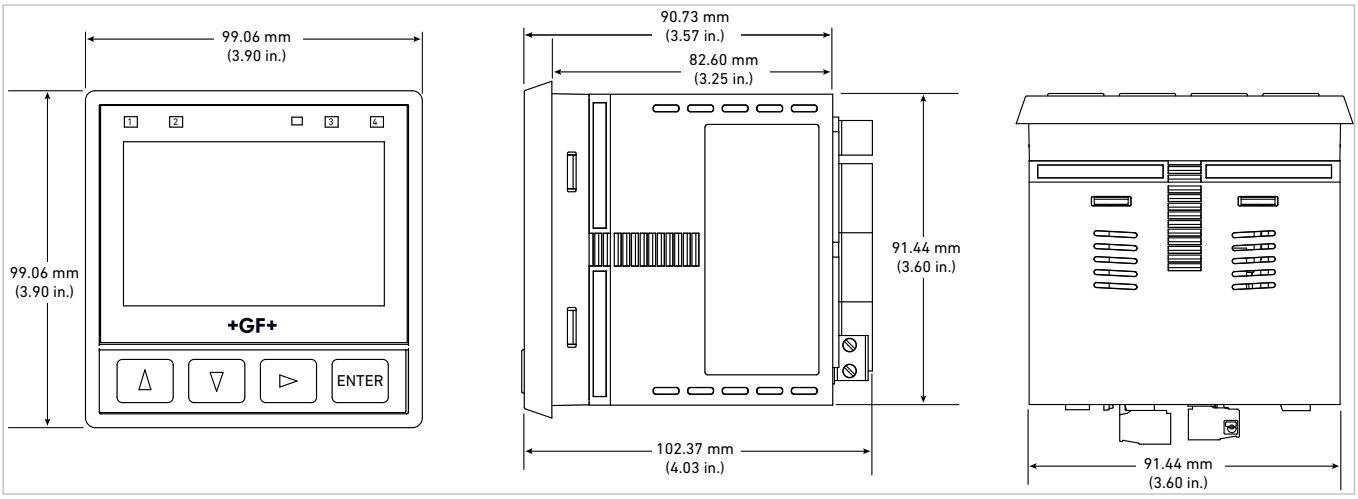
Relay Specifications	
Dry-Contact Relays	
Type	SPDT
Form	C
Max. Voltage Rating	30 VDC or 250 VAC
Max. Current Rating	5 A resistive
Solid-State Relay, Optional Relay Module	
Type	SPDT
Form	C
Max. Voltage Rating	30 VDC or 30 VAC
Max. Current Rating	0.050 A
Hysteresis	Adjustable (absolute in Engineering Units)
On Delay	9'999.9 seconds (max)
Test Mode	Set On or Off
Maximum Pulse Rate	300 pulses/minute

Display Ranges		
Free Chlorine (FCl)	0 to 20 ppm	
Chlorine Dioxide (ClO_2)	0 to 2 ppm	
pH	-1.00 to 15.00 pH	
pH Temp.	-99 °C to 350 °C	-146 °F to 662 °F

Shipping Weights		
Base Unit	0.63 kg	1.38 lb
9950-3/-4	1.0 kg	2.2 lb
9950-5	0.63 kg	1.38 lb
Relay Moduole	0.19 kg	0.41 lb

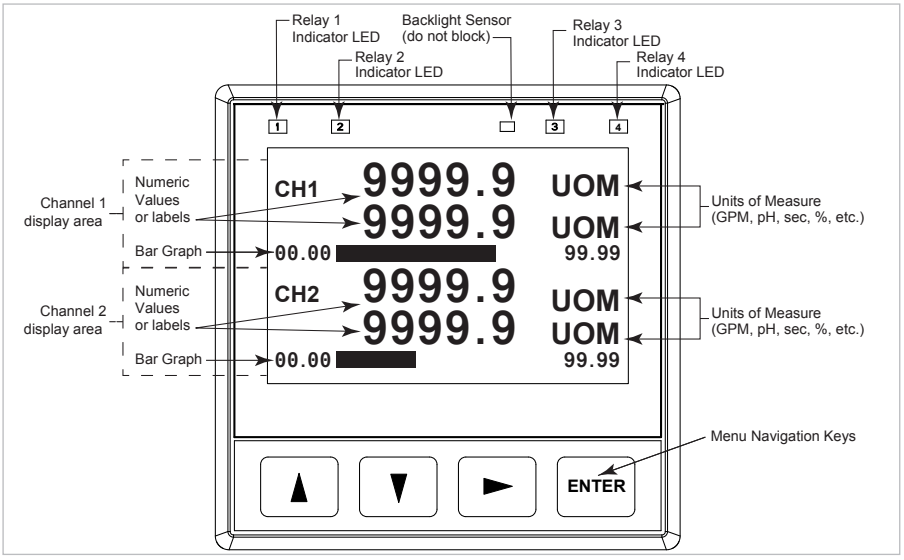
Standards and Approvals	
	UKCA, CE, UL, CUL, WEEE, FCC
	RoHS Compliant, China RoHS
	Manufactured under ISO 9001, ISO 14001 and ISO 45001

Dimensions

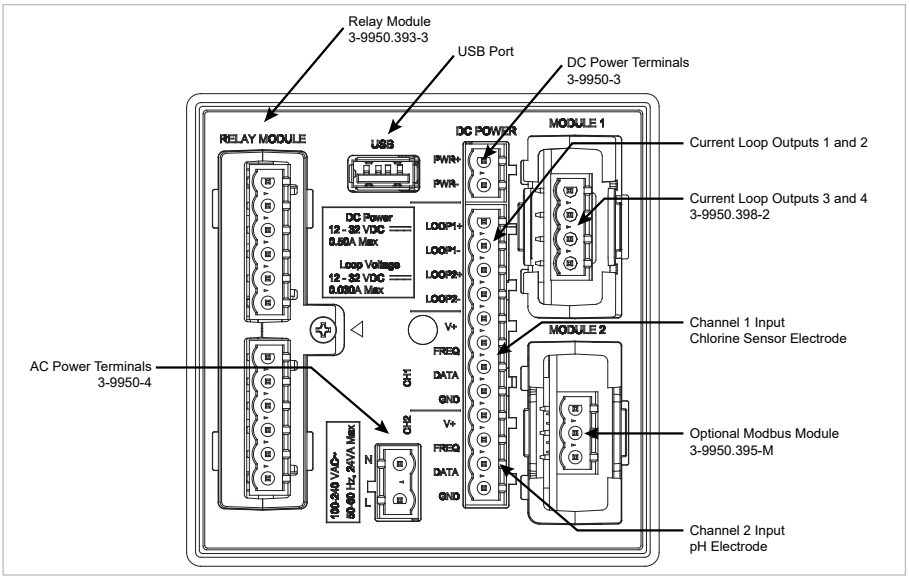


Graphical User Interface created with emWin licensed by SEGGER

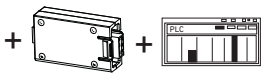
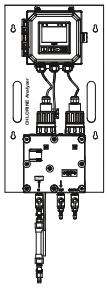
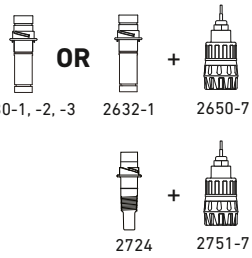
Operation



Terminal identification

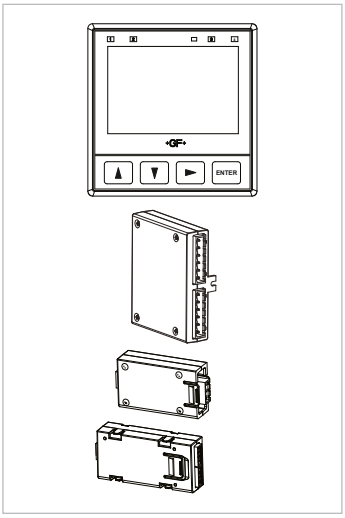


System Overview

Panel or Wall Mount	Automation System
Type 9950-3/-4 Transmitter **(Includes mounting bracket and panel gasket)**	**Type 9950-3/-4 Transmitter with Modbus Module** and - PLC (Customer supplied)
	 
GF Sensors - Chlorine, pH Use with 2751-7 or 2650-7 Smart Sensor Electronics	 
GF Fittings - See individual sensor data sheets	All Sold Separately

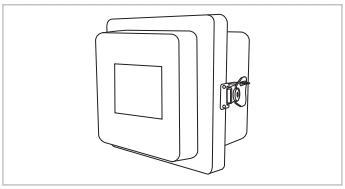
Ordering Information

Mfr. Part No	Code	Description
3-9950-3	159 001 954	9950 Base Unit, 2 Channel Input, 4 Passive 4 to 20 mA Output, 2 Mechanical Relays, 4 Binary Input, 12/24 VDC
3-9950-4	159 001 955	9950 Base Unit, 2 Channel Input, 4 Passive 4 to 20 mA Output, 2 Mechanical Relays, 4 Binary Input, 12/24 VDC or 100 - 240 VAC
3-9950-5	159 001 956	9950 Base Unit, 2 Channel Input, 2 Passive 4 to 20 mA Output, 12/24 VDC
3-9950-6	159 002 013	9950 Base Unit, 2 Channel Input, 2 Passive 4 to 20 mA Output, 12/24 VDC or 100 - 240 VAC
Optional Accessory Modules		
3-9950.393-1	159 310 268	Relay Module with 4 Mechanical Relays
3-9950.393-2	159 310 269	Relay Module with 2 Mechanical and 2 Solid State Relays
3-9950.393-3	159 310 270	Relay Module with 2 Mechanical Relays and 4 Binary Inputs
3-9950.395-M	159 001 905	9950 Modbus Module
3-9950.398-2	159 001 848	Dual Channel 4 to 20 mA Current Loop Output Module



Accessories and Replacement Parts

Mfr. Part No	Code	Description
3-8050.396	159 000 617	RC Filter Kit (for relay use), 2 per kit
3-9950.391	159 310 278	Connector Kit, In-Line, 9950 Transmitter
3-9950.392	159 310 279	Relay Module Connector Kit, 9950 Transmitter
3-9900.392	159 001 700	Wall Mount Enclosure Kit
3-9000.392-1	159 000 839	Liquid Tight Connector Kit, NPT (1 pc.)



3-9900.392

Type 9900-1BC Batch Controller System



Member of the SmartPro® Family of Instruments

Product description

The GF 9900-1BC Batch Controller system provides control capability and process fine-tuning in a familiar package. The programming interface uses a fourbutton keypad and an intuitive menu for adjusting a batching system to the best performance possible.
Choose between simple or advanced modes. In simple mode, relay outputs can be used for batching, external counter, missing signal alarm and 4 to 20 mA output can be used to indicate batch status. In advanced mode relays can also be used for end of batch pulse, twostage shutdown, overrun alarm, high flow detection, total volume or source volume alarm.

Automatic Overrun Compensation feature. The 9900-1BC can measure excess flow after a batch stops and use it to reduce flow to the next batch by de-energizing the batch relay early, thus closing the flow control valve, and eliminating batch overrun.

Designed for a variety of batch applications, the 9900-1BC can save up to 10 batch sizes for batching or blending a variety of liquid volumes. Customize batch names for easy distinction between batches. One K-Factor can be used for all batches, or use a different K-Factor for each batch for when different liquids are batched. User can choose to be prompted prior to starting a batch with a Yes/No or with a password to prevent inadvertently starting a batch.

The 9900-1BC operates on 10.8 to 35.2 VDC, regulated. Connect a remote start or stop switch for remote batch control. Use the end-of-batch pulse to trigger the next step in the process.

Features

- Rear Enclosure option means the 9900-1BC Batch Controller can be installed on a pipe or wall mounted in addition to panel mount installations
- Store up to 10 batch sizes for batching or blending a variety of liquid volumes
- Customize 10 batch names for easy distinction between batches
- Modular Design - Can be purchased as a complete system or add a Batch Module and Relay Module to an existing 9900 Transmitter (Generation II or later)
- Automatic Overrun Compensation can eliminate excess flow by automatically reducing the next batch size by the overrun value of previous batch.
- Remote control wiring with start, stop & resume terminals for remote batch control
- 3 programmable relays, one open collector, two dry-contact relays
- Two-stage control to prevent overfilling or to minimize water hammer
- Confirmation START/RESUME – Can prompt user prior to starting each batch with a Yes/No or password to prevent inadvertently starting a batch
- Enter 10 different K-Factors - one per batch for when different liquids are batched

Applications

- Batch Process
- Filter Backwash Initiation
- Chemical Addition
- Canning and Bottling
- Tank Filling
- Bulk Storage Transfer
- Chemical Processing
- Food and Beverage
- Life Sciences
- Water Treatment

Technical data

General		
Input Channels	One	
System response	Response time limited by sensor, maximum transmitter delay 300 mS	
Terminal Blocks	Pluggable screw type	16 AWG max wire gauge

Enclosure and Display		
Case Material	PBT	
Window	Shatter-Resistant Glass	
Keypad	4 buttons, injection-molded silicone rubber seal	
Display	Backlit, 7- and 14-segment	
Indicators	Dial-type digital bar graph	
Update Rate	1 s	
LCD Contrast	5 settings	
Enclosure size and color	¼ DIN	
Mounting Panel	¼ DIN, ribbed on four sides for use with mountingbracket for panel mount installations	
Wall	Large enclosure (sold as an accessory) that encases the panel mount transmitter	
Pipe	Using optional rear enclosure	

Environmental Requirements		
Ambient Operating Temperature		
Backlit LCD	-10 °C to 70 °C	14 °F to 158 °F
Storage Temperature	-15 °C to 70 °C	5 °F to 158 °F
Operating Temperature	-10 °C to 70 °C	14 °F to 158 °F
Relative Humidity	0 to 100% condensing for field and panel mount (front only); 0 to 95% non-condensing for panel mount back side	
Maximum Altitude	4.000 m (13,123 ft)	
Enclosure Rating	Designed to meet NEMA 4X/IP65 (front face only)	

Input Power	
DC	24 VDC input; range: 10.8 to 35.2 VDC regulated
Overvoltage Protection	48 Volt transient protection device
Current limiting for circuit protection	
Reverse-Voltage Protection	

Input Specifications	
Digital (S^3L)	Serial ASCII, TTL level, 9'600 bps
Accuracy	Determined by sensor
Frequency	
Sensitivity	80 mV @ 5 Hz, mV threshold gradually increasing with frequency
Range	0.5 Hz to 1'500 Hz @ TTL level input for open collector
Accuracy	± 0.5% of reading max error @ 25 °C
Repeatability	± 0.2% of reading
Resolution	1 µs
Update Rate	150 ms nominal
Power to Sensors	
Voltage	+4.9 to 5.5 VDC @ 25 °C, regulated
Current	20 mA max.
Short Circuit	Protected
Power Supply	
Reverse Polarity	Protected

Output Specifications

Relay Specifications

	Dry-Contact Relays (2)	Open Collector (1)	
Type	SPDT	NPN	
Form	C	N/A	
Max. Voltage Rating	30 VDC or 250 VAC	30 VDC	
Max. Current Rating	5 A	50 mA	
Hysteresis	Adjustable (absolute in Engineering Units)		
Latch	Reset in test screen or view mode		
Delay	9'999.9 seconds (maximum)		
Test Mode	Set On or Off		
Maximum Pulse Rate	400 pulses/minute		
Volumetric Pulse Width	0.1 s to 3'200 s		
4 to 10 mA Current Loop Output	ANSI-ISA 50.00.01 Class H (passive: external power required)		
Output	1		
Span	3.8 to 21 mA		
Zero	4.0 mA factory set; user programmable from 3.8 to 4.2 mA		
Full Scale	20.00 mA factory set; user programmable 19.0 to 21.0 mA		
Accuracy	± 32 µA max. error @ 25 °C @ 24 VDC		
Resolution	6 µA or better		
Temperature Drift	± 1 µA per °C		
Power Supply Rejection	± 1 µA per V		
Isolation	Low voltage (< 48 VAC/DC)		
Voltage	10.8 to 35.2 VDC		
Max. Impedance	250 Ω @ 12 VDC	500 Ω @ 18 VDC	750 Ω @ 24 VDC
Update Rate	150 ms nominal		
Short circuit and reverse polarity protected			
Adjustable span	Reversible		
Error Condition	Selectable error condition 3.6 or 22 mA or NONE		
Actual update rate determined by sensor type			
Test Mode	Increment to desired current (range 3.6 to 21.00 mA)		

Shipping Weights

Base Unit	0.63 kg	1.38 lb
Batch Module	0.16 kg	0.35 lb
Relay Module	0.19 kg	0.41 lb

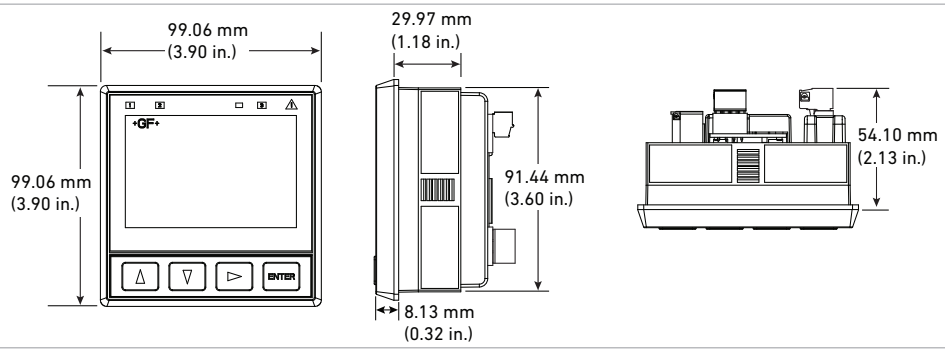
Standard and Approvals

CE, UL, CUL, FCC

RoHS compliant, China RoHS

Manufactured under ISO 9001, ISO 14001 and ISO 45001

Dimensions



System Overview

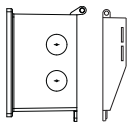
Panel Mount	Pipe, Tank, Wall Mount
9900-1BC **Batch Controller System** (Includes mounting bracket and panel gasket)	**9900-1BC Batch Controller System** with Wall Mount Accessory or Rear Enclosure





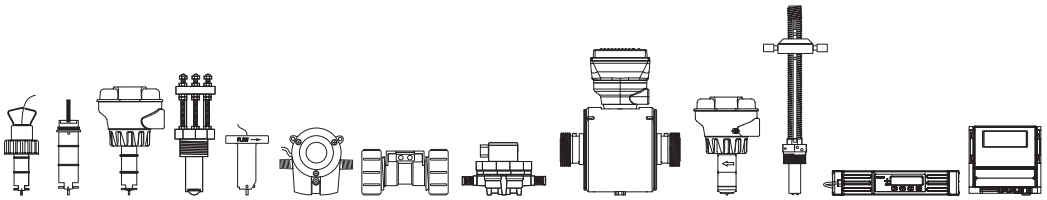


3-9900.392
(power supply sold separately)



3-9900.399-1

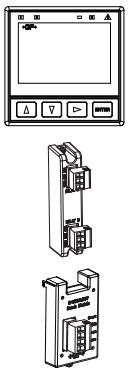
GF Sensors - Flow



GF Fittings - See individual sensor data sheets	All sold separately

Ordering Information

Mfr. Part	No. Code	Description
3-9900-1BC	159 001 770	Batch Controller System
3-9900-1P	159 001 695	9900 Panel Mount Transmitter
3-9900.393	159 001 698	Relay Module – 2 DCR (dry-contact relays)
3-9900.397	159 310 163	Batch Module



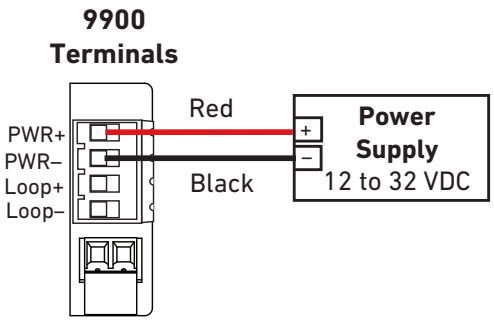
Accessories

Mfr. Part	Code	Description
6682-1102	159 001 710	DC Power Plug, 2 Pos, Right Angle
6682-1103	159 001 711	Relay Module Plug, 3 Pos, Right Angle
6682-1104	159 001 712	Loop Power Plug, 4 Pos, Right Angle
6682-3004	159 001 725	Freq/(S^3L) Plug, 4 Pos, In-Line
6682-3104	159 001 713	Freq/(S^3L) Plug, 4 Pos, Right Angle
7310-1024	159 873 004	24 VDC Power Supply, 10W, 0.42 A
7310-2024	159 873 005	24 VDC Power Supply, 24W, 1.0 A
7310-4024	159 873 006	24 VDC Power Supply, 40W, 1.7 A
7310-6024	159 873 007	24 VDC Power Supply, 60W, 2.5 A
7310-7024	159 873 008	24 VDC Power Supply, 96W, 4.0 A
3-9900.390	159 001 714	Standard Connector Kit, Right Angle
3-9900.391	159 001 715	Connector Kit, In-Line
3-9900.392	159 300 351	Wall Mount Accessory
3-9000.392-1	159 000 839	Liquid Tight Connector Kit, NPT (1 pc.)
3-9900.399-1	159 001 834	Rear Enclosure Hinged Cover
3-9900.399-2	159 001 835	Rear Enclosure Flat Cover
3-0252	159 001 808	Configuration Tool
3-8050.396	159 000 617	RC Filter Kit (for relay use, inductive loads), 2 per kit

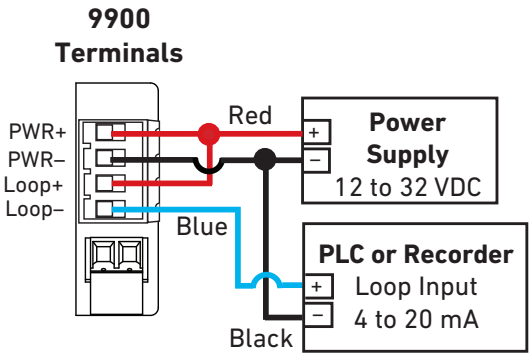
Wiring information

Rear Terminal Views type 9900-1BC Batch Controller

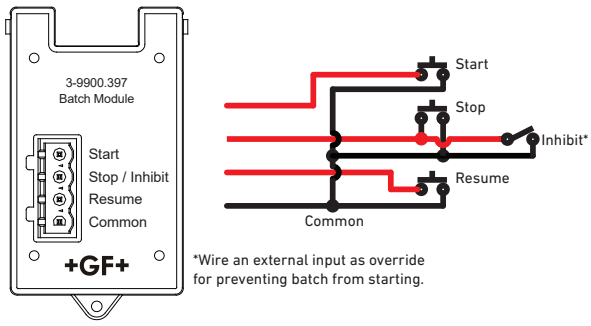
Stand Alone Application, no current loop used



Connection to a PLC/Recorder, separate supply



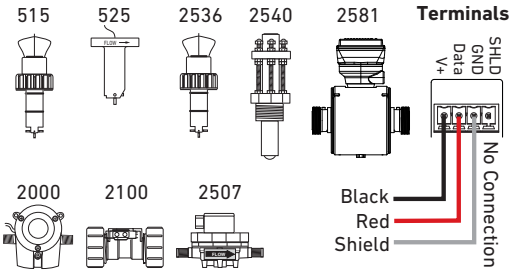
9900.397 Batch Module Wiring

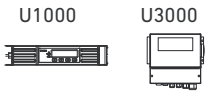


*Wire an external input as override for preventing batch from starting.

Frequency

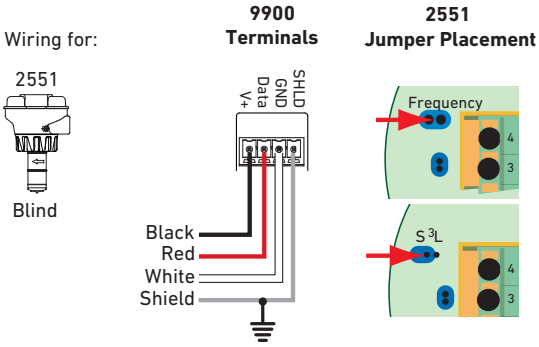
Wiring for:





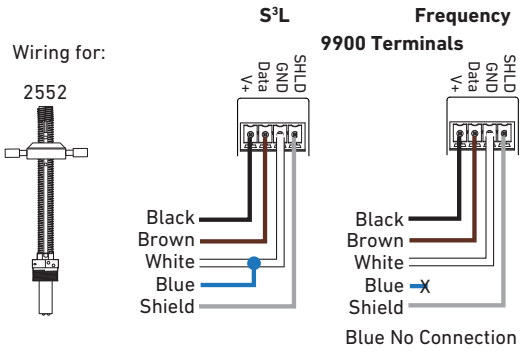
Frequency/S³L

Wiring for:



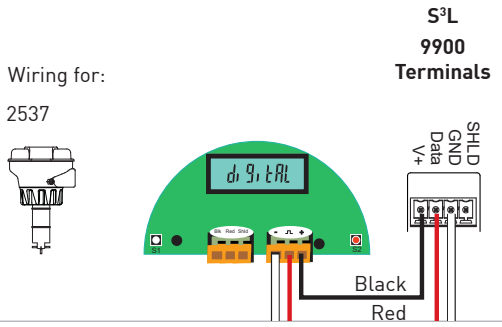
S³L

Wiring for:



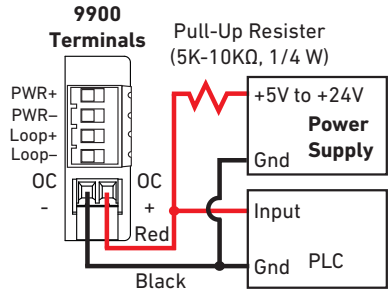
S³L

Wiring for:



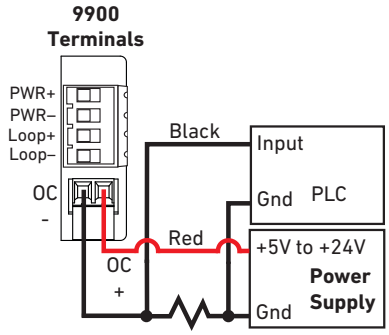
Rear Terminal Views type 9900-1BC Batch Controller

NPN Style Wiring

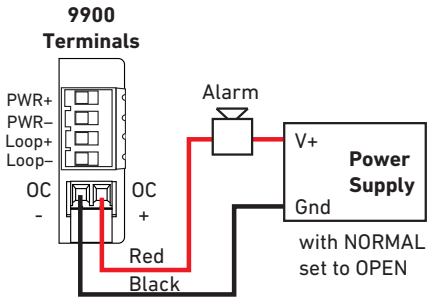


If PLC needs 0 logic input when relay is not energized, set NORMAL to CLOSED in the RELAY menu when using the Open Collector (R1) with NPN style wiring

PNP Style Wiring

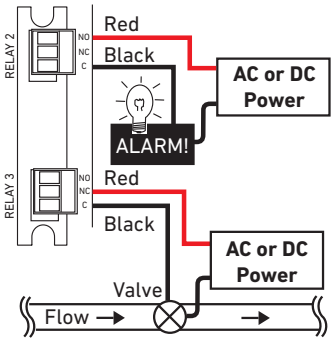


Pull-Down Resister
(5K-10KΩ, 1/4 W)



with NORMAL set to OPEN

Relay Module Wiring



The alarm is OFF during normal operation, and will go ON when relay energizes according to 9900 Relay settings.

The valve is ON during normal operation, and will go OFF when relay energizes according to 9900 Relay settings

NO = Normally Open (closes when energized)
NC = Normally Closed (opens when energized)

Signet 9900/9950 Instrument Enclosure Assembly



Standard enclosure
with Signet 9900 or 9950 Transmitter



Compact enclosure
with Signet 9900 or 9950 Transmitter



Custom enclosure
with Signet 9900 or 9950 Transmitter

Product description

The Signet 9900/9950 Instrument Enclosure Assembly with Transmitter is a fully assembled, factory-tested, and weather-resistant solution, designed to protect instrumentation while streamlining the integration of GF automation systems. Featuring a durable, NEMA 4X-rated enclosure, it ensures reliable performance in harsh industrial and outdoor environments, resulting in time savings and reduced installation costs.

The enclosure includes a 9900 Single Channel or 9950 Dual Channel SmartPro® Transmitter for measuring Flow, pH/ORP, Conductivity, Salinity, Pressure, Temperature, Level, and Dissolved Oxygen. When combined with the 3-8058-1 i-Go® Analog to (S³L) Module, it also supports any sensor with a 4-20 mA output. Each NEMA 4X-rated enclosure comes pre-wired with a transmitter, connected to a clearly labeled and easily accessible terminal block, simplifying installation and field wiring.

The unit is available in 24 VDC or 120/240 VAC configurations and includes a 2.4 m (8-foot, 3-poles 120 vac) input power cable along with 3 to 8 additional cable glands for sensor connections, optional 4-20 mA output, and relay output. Designed for easy mounting, it attaches directly to a sturdy surface, providing protection against moisture, dust, and mechanical impact.

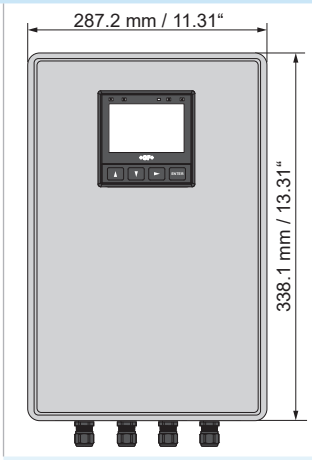
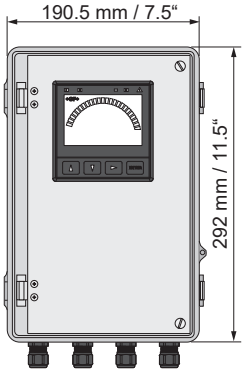
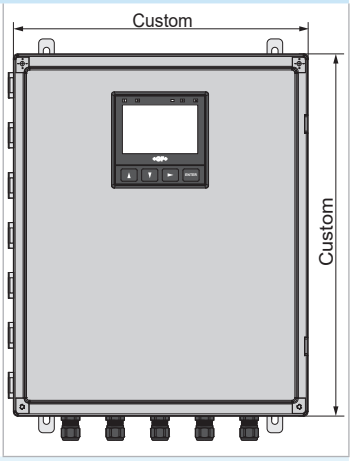
Features

- Incorporating multi-parameter technology with a choice of single channel 9900, dual channel 9950, or a customized six channel 9950/9900 Transmitter (Flow, pH/ORP, Conductivity/Resistivity, Salinity, Pressure, Temperature, Level, and Dissolved Oxygen)
- Pre-wired 9900 or 9950 Transmitter to an easily accessible terminal block for quick installation
- Available in 24 VDC or 100-240 VAC with fuse protection on AC types
- With additional modules, extra 4–20 mA outputs as well as Modbus or HART communication can be enabled
- NEMA 4X-rated enclosure for weather and corrosion resistance, with a pad-lockable clear door
- 2.4 m (8 ft) power cable included with AC versions
- Customizable for multiple transmitters, recorders, data logging, visual and audible alarms, switches, latching and timer relays, remote monitoring, and more
- DIN-rail grounding and wiring terminals for 16–22 AWG conductors
- Terminal layout and wiring diagram included for simplified installation

Applications

- Agriculture / CEA
- Aquatic / Animal life support
- Chemical batching / dosing
- Metal and Plastic Finishing
- Fume Scrubbers
- Cooling Towers
- Media Filtration
- pH Neutralization
- Industrial Waste Treatment
- Industrial Water Treatment
- Rinse Tank Control
- Scrubbers
- Compliance Monitoring

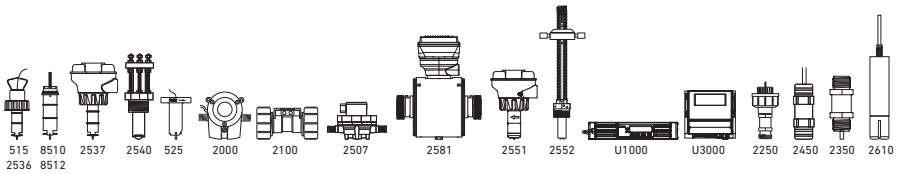
Technical data

Enclosure type		Standard enclosure	Compact enclosure	Custom enclosure
Dimensions				
Materials	**Main body**	Fiberglass reinforced Polyester (UV stabilized)	ABS/PC blended plastic UL94-5VB flammability rating	Customized
	Door	Fiberglass reinforced Polyester (UV stabilized)	Clear Polycarbonate	Customized
	Door hinges/ latches/ Wall Mount Hardware	Stainless steel		Customized
	Cable glands	TPE and/or Buna N liquid-tight		
Dimensions	**Width**	287.2 mm (11.31")	190.5 mm (7.5")	Customized
	Height	338.1 mm (13.31")	292 mm (11.5")	Customized
	Depth	141.7 mm (5.58")	152.5 mm (6")	Customized
Power Supply	**DC version**	24 VDC Regulated (300 mA max.)		24 VDC (as required)
	AC version	100-240 VAC (1 amp fuse protection) 2.4 m (8 ft) cable supplied		100-240 VAC, 50/60 Hz
Standards and Approvals		NEMA 4X, UL (upon request)		

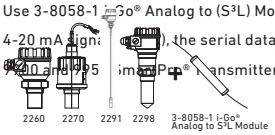
Compatibility

Compatible GF sensors

GF Sensors - Flow, Level, Temperature, Pressure, DO



Use 3-8058-1 i-Go® Analog to (S³L) Module to convert any 4-20 mA signal, the serial data format used by the 7400 and 7405 smart pH® transmitters



Ordering Information

Use the configurator below to modify the transmitter and housing to your needs and receive them fully assembled and ready for installation.

Enclosure with 9950 Dual Channel Transmitter

Example Part Number
3-9950A-S201220

	Enclosure	Input power	Relay Module	Module Slot 1	Module Slot 2	4-20 mA to (S³L) Converter	Data Logger
3-9950A-							
Enclosure							
Standard enclosure, 13.3 x 11.3 x 5.6 in.	S						
Compact enclosure, 11.5 x 7.5 x 6 in.	E						
Custom enclosure	C						
Input power							
DC powered 24 VDC		1					
AC powered 100-240 VAC		2					
Relay Module							
No Module			0				
4 Mechanical Relays, 3.9950.393-1			1				
2 Mechanical Relays and 2 Solid State Relays, 3-9950.393-2			2				
2 Mechanical Relays and 4 Binary Inputs, 3-9950.393-3			3				
Module Slot 1							
No Module				0			
Dual Channel 4-20 mA output, 3-9950.398-2				1			
Single Channel Conductivity Module, 3-9950.394-1				2			
Two Channel Conductivity Module, 3-9950.394-2				3			
Modbus Module, 3-9950.395				4			
Module Slot 2							
No Module					0		
Dual Channel 4-20 mA output, 3-9950.398-2					1		
Single Channel Conductivity Module, 3-9950.394-1					2		
Two Channel Conductivity Module, 3-9950.394-2					3		
Modbus Module, 3-9950.395					4		
4-20 mA to (S³L) Converter							
No Module						0	
i-Go Analog to (S³L) Module, Wire Mount, 3-8058-1						1	
2x i-Go Analog to (S³L) Module, Wire Mount, 3-8058-1						2	
Data Logger							
No Data Logger							0
Single Channel Data Logger							1
2x Single Channel Data Logger							2

Enclosure with 9900 Single Channel Transmitter

Example Part Number **3-9900-S211210**	Enclo-sure	Input power	Module Slot 1	Module Slot 2	Output Module	4-20 mA to (S³L) Converter	Data Logger
3-9900-							
Enclosure							
Standard enclosure, 13.3 x 11.3 x 5.6 in.	S						
Compact enclosure, 7.5 x 11.5 x 6 in.	E						
Custom enclosure	C						
Input power							
DC powered 24 VDC		1					
AC powered 100-240 VAC		2					
Module Slot 1							
No Module			0				
Relay Module, 3-9900.393			1				
Module Slot 2							
No Module				0			
Conductivity Module, 3-9900.394				1			
*4-20 mA Output Module, 3-9900.398-1				2			
Output Module							
No Module					0		
Modbus Module, 3-9900.270-M2					1		
HART Module, 3-9900.395					2		
4-20 mA to (S³L) Converter							
No Data Logger						0	
i-Go Analog to (S³L) Module, Module Mount, 3-8058-3						1	
Data Logger							
No Data Logger							0
Single Channel Data Logger							1

*Module adds a second 4-20 mA Output. One 4-20 mA is included in the base unit.

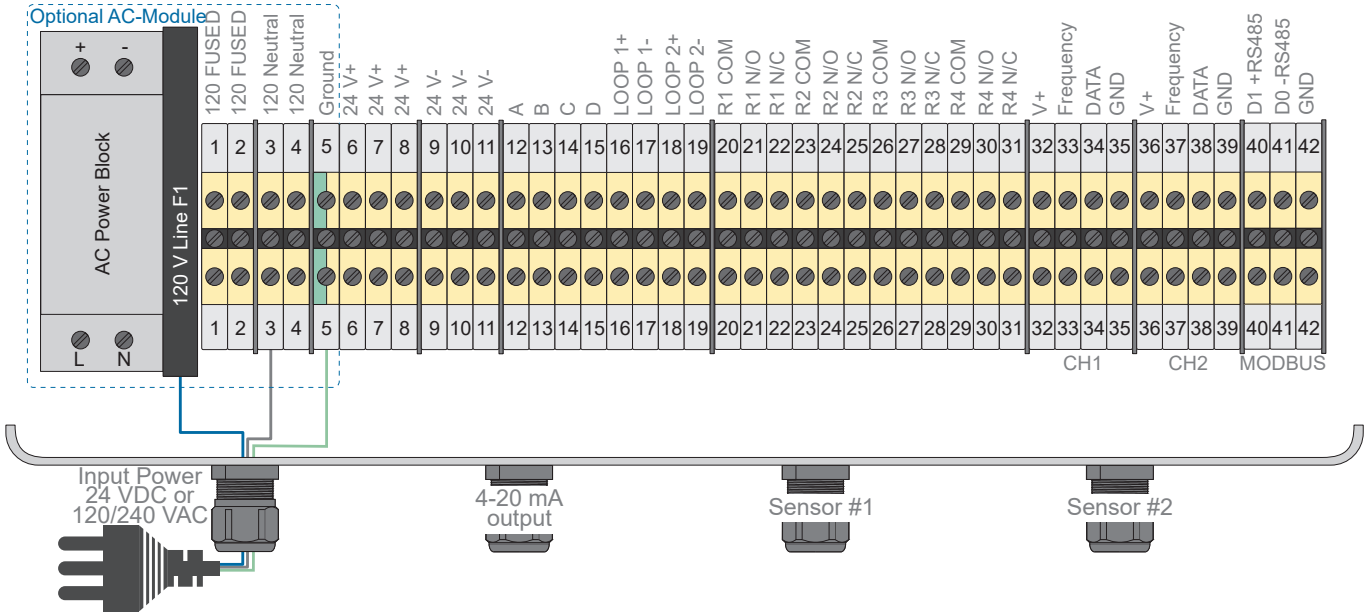
Enclosure with 9900 Batch Controller

Example Part Number **3-9900BC-S2**	Enclo-sure	Input power
3-9900BC-		
Enclosure		
Standard enclosure, 13.3 x 11.3 x 5.6 in.	S	
Standard enclosure, with large push buttons	I	
Input power		
DC powered 24 VDC		1
AC powered, 85-264 VAC, 47 - 63 Hz		2

Standard enclosure



Wiring



Reference illustration only; wiring differs by model. Contact us for details.

Standard enclosure with 9950 Dual Channel Transmitter

Mfr. Part No	Code	Description
3-9950A-S100000		9950, DC PWR, (2) Input, (2) 4-20 mA
3-9950A-S110000		9950, DC PWR, (2) Input, (2) 4-20 mA, (4) Mech Relays
3-9950A-S120000		9950, DC PWR, (2) Input, (2) 4-20 mA, (2) Mech Relays, (2) Solid State Relays
3-9950A-S130000		9950, DC PWR, (2) Input, (2) 4-20 mA, (2) Mech Relays, (4) Binary Inputs
3-9950A-S102000		9950, DC PWR, (2) Input, (4) 4-20 mA, (1) Single Channel Conductivity
3-9950A-S103000		9950, DC PWR, (2) Input, (4) 4-20 mA, (1) Dual Channel Conductivity
3-9950A-S104000		9950, DC PWR, (2) Input, (4) 4-20 mA, (1) Modbus Module
3-9950A-S100002		9950, DC PWR, (2) Input, (4) 4-20 mA, (2) Single Channel Data Logger
3-9950A-S101020		9950, DC PWR, (2) Input, (4) 4-20 mA, (2) i-Go Modules
3-9950A-S200000	150 399 010	9950, AC PWR, (2) Input, (2) 4-20 mA
3-9950A-S210000	150 399 011	9950, AC PWR, (2) Input, (2) 4-20 mA, (4) Mech Relays
3-9950A-S220000	150 399 012	9950, AC PWR, (2) Input, (2) 4-20 mA, (2) Mech Relays, (2) Solid State Relays
3-9950A-S230000	150 399 013	9950, AC PWR, (2) Input, (2) 4-20 mA, (2) Mech Relays, (4) Binary Inputs
3-9950A-S202000		9950, AC PWR, (2) Input, (4) 4-20 mA, (1) Single Channel Conductivity
3-9950A-S203000		9950, AC PWR, (2) Input, (4) 4-20 mA, (1) Dual Channel Conductivity
3-9950A-S205000		9950, AC PWR, (2) Input, (4) 4-20 mA, (1) Modbus Module
3-9950A-S200002		9950, AC PWR, (2) Input, (4) 4-20 mA, (2) Single Channel Data Logger
3-9950A-S201020		9950, AC PWR, (2) Input, (4) 4-20 mA, (2) i-Go Modules



Standard enclosure with 9900 Single Channel Transmitter

Mfr. Part No	Code	Description
3-9900-S100000		9900, DC PWR, (1) OC output, (1) 4-20 mA output
3-9900-S110000		9900, DC PWR, (1) OC output, (1) 4-20 mA output, (2) Mech Relays
3-9900-S111000		9900, DC PWR, (1) OC output, (1) 4-20 mA output, (2) Mech Relays, Conductivity Module
3-9900-S101000		9900, DC PWR, (1) OC output, (1) 4-20 mA output, Conductivity Module
3-9900-S102000		9900, DC PWR, (1) OC output, (2) 4-20 mA output, (Module added)
3-9900-S112000		9900, DC PWR, (1) OC output, (2) 4-20 mA output, (Module added) , (2) Mech Relays
3-9900-S110001		9900, DC PWR, (1) OC output, (1) 4-20 mA output, (2) Mech Relays, Data Logger
3-9900-S100010		9900, DC PWR, (1) OC output, (1) 4-20 mA output, With i-Go Module
3-9900-S200000	150 399 001	9900, AC PWR, (1) OC output, (1) 4-20 mA output
3-9900-S210000	150 399 002	9900, AC PWR, (1) OC output, (1) 4-20 mA output, (2) Mech Relays
3-9900-S211000	150 399 003	9900, AC PWR, (1) OC output, (1) 4-20 mA output, (2) Mech Relays, Conductivity Module
3-9900-S201000	150 399 004	9900, AC PWR, (1) OC output, (1) 4-20 mA output, Conductivity Module
3-9900-S202000	150 399 005	9900, AC PWR, (1) OC output, (2) 4-20 mA output, (Module added)
3-9900-S212000	150 399 006	9900, AC PWR, (1) OC output, (2) 4-20 mA output, (Module added) , (2) Mech Relays
3-9900-S210001		9900, AC PWR, (1) OC output, (1) 4-20 mA output, (2) Mech Relays, Data Logger
3-9900-S200010		9900, AC PWR, (1) OC output, (1) 4-20 mA output, With i-Go Module

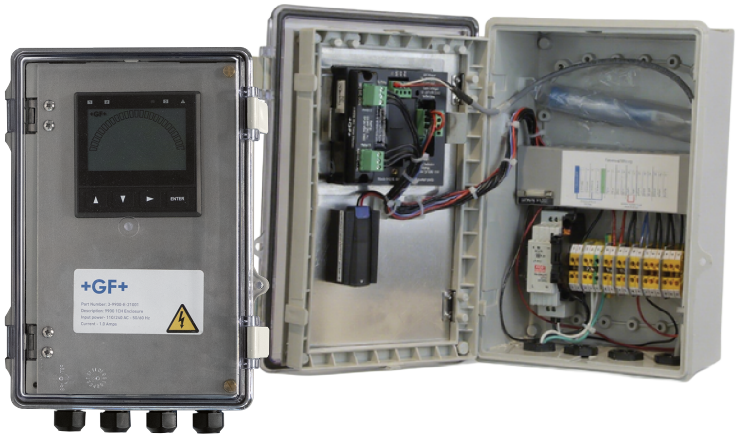


Standard enclosure with 9900 Batch Controller

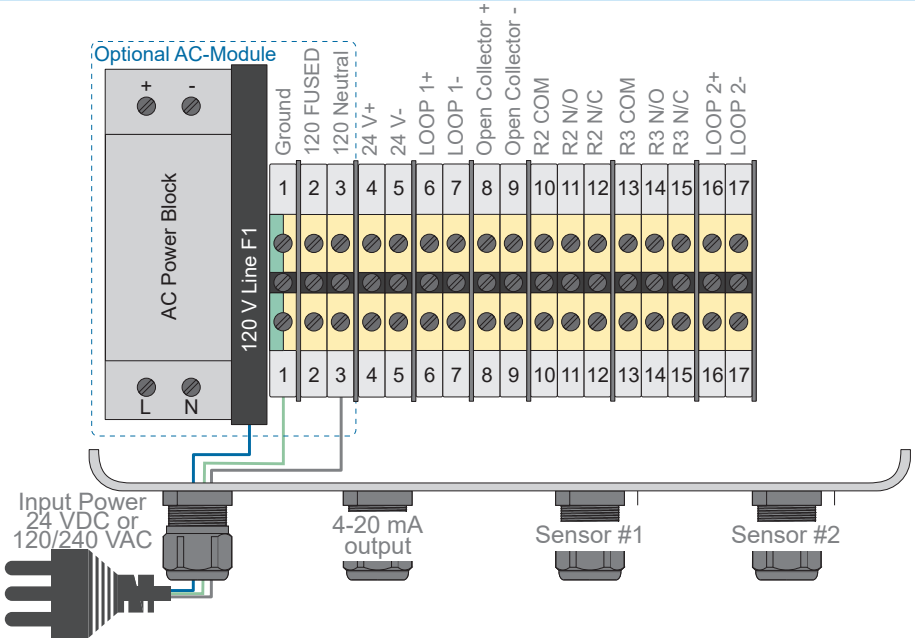
Mfr. Part No	Code	Description
3-9900BC-S1		9900-BC Batch controller, DC PWR, (1) OC output, (1) 4-20 mA output, (2) Mech Relays
3-9900BC-S2	150 399 014	9900-BC Batch controller, AC PWR, (1) OC output, (1) 4-20 mA output, (2) Mech Relays



Compact enclosure



Wiring



Reference illustration only; wiring differs by model. Contact us for details.

Compact enclosure with 9950 Dual Channel Transmitter



Mfr. Part No	Code	Description
3-9950A-E100000		9950, DC PWR, (2) Input, (2) 4-20 mA
3-9950A-E110000		9950, DC PWR, (2) Input, (2) 4-20 mA, (4) Mech Relays
3-9950A-E120000		9950, DC PWR, (2) Input, (2) 4-20 mA, (2) Mech Relays, (2) Solid State Relays
3-9950A-E130000		9950, DC PWR, (2) Input, (2) 4-20 mA, (2) Mech Relays, (4) Binary Inputs
3-9950A-E102000		9950, DC PWR, (2) Input, (4) 4-20 mA, (1) Single Channel Conductivity
3-9950A-E103000		9950, DC PWR, (2) Input, (4) 4-20 mA, (1) Dual Channel Conductivity
3-9950A-E104000		9950, DC PWR, (2) Input, (4) 4-20 mA, (1) Modbus Module
3-9950A-E100002		9950, DC PWR, (2) Input, (4) 4-20 mA, (2) Single Channel Data Logger
3-9950A-E101020		9950, DC PWR, (2) Input, (4) 4-20 mA, (2) i-Go Modules
3-9950A-E200000		9950, AC PWR, (2) Input, (2) 4-20 mA
3-9950A-E210000		9950, AC PWR, (2) Input, (2) 4-20 mA, (4) Mech Relays
3-9950A-E220000		9950, AC PWR, (2) Input, (2) 4-20 mA, (2) Mech Relays, (2) Solid State Relays
3-9950A-E230000		9950, AC PWR, (2) Input, (2) 4-20 mA, (2) Mech Relays, (4) Binary Inputs
3-9950A-E202000		9950, AC PWR, (2) Input, (4) 4-20 mA, (1) Single Channel Conductivity
3-9950A-E203000		9950, AC PWR, (2) Input, (4) 4-20 mA, (1) Dual Channel Conductivity
3-9950A-E205000		9950, AC PWR, (2) Input, (4) 4-20 mA, (1) Modbus Module
3-9950A-E200002		9950, AC PWR, (2) Input, (4) 4-20 mA, (2) Single Channel Data Logger
3-9950A-E201020		9950, AC PWR, (2) Input, (4) 4-20 mA, (2) i-Go Modules

Compact enclosure with 9900 Single Channel Transmitter



Mfr. Part No	Code	Description
3-9900-E100000	159 079 003	9900, DC PWR, (1) OC output, (1) 4-20 mA output
3-9900-E110000	159 079 002	9900, DC PWR, (1) OC output, (1) 4-20 mA output, (2) Mech Relays
3-9900-E111000	159 079 005	9900, DC PWR, (1) OC output, (1) 4-20 mA output, (2) Mech Relays, Conductivity Module
3-9900-E101000	159 079 006	9900, DC PWR, (1) OC output, (1) 4-20 mA output, Conductivity Module
3-9900-E102000	159 079 007	9900, DC PWR, (1) OC output, (2) 4-20 mA output, (Module added)
3-9900-E112000	159 079 008	9900, DC PWR, (1) OC output, (2) 4-20 mA output, (Module added) , (2) Mech Relays
3-9900-E110001	159 079 009	9900, DC PWR, (1) OC output, (1) 4-20 mA output, (2) Mech Relays, Data Logger
3-9900-E100010	159 079 010	9900, DC PWR, (1) OC output, (1) 4-20 mA output, With i-Go Module
3-9900-E200000	159 079 004	9900, AC PWR, (1) OC output, (1) 4-20 mA output
3-9900-E210000	159 079 011	9900, AC PWR, (1) OC output, (1) 4-20 mA output, (2) Mech Relays
3-9900-E211000	159 079 012	9900, AC PWR, (1) OC output, (1) 4-20 mA output, (2) Mech Relays, Conductivity Module
3-9900-E201000	159 079 013	9900, AC PWR, (1) OC output, (1) 4-20 mA output, Conductivity Module
3-9900-E202000	159 079 014	9900, AC PWR, (1) OC output, (2) 4-20 mA output, (Module added)
3-9900-E212000	159 079 015	9900, AC PWR, (1) OC output, (2) 4-20 mA output, (Module added) , (2) Mech Relays
3-9900-E210001	159 079 016	9900, AC PWR, (1) OC output, (1) 4-20 mA output, (2) Mech Relays, Data Logger
3-9900-E200010	159 079 017	9900, AC PWR, (1) OC output, (1) 4-20 mA output, With i-Go Module

Custom enclosure



GF offers fully configurable instrument enclosures designed for fast installation, reliable performance, and long service life. Each enclosure is pre-wired, factory-tested, and delivered ready for integration – saving time and reducing installation risks. With a wide range of visual alarms, switches, relays, communication modules, and enclosure materials, configurations can be tailored to match your exact application requirements.
No other industrial piping systems manufacturer combines the same breadth of options with proven quality, flexibility, and ease of use. Consult with our technical experts for support.

Custom Options

Visual alarms
- Pilot LED lights (red/green)
- LED beacon
- LED light stack

Switches
- HOA selector (SP/DP)
- On/Off multi-selector

Audible alarm
- Silence button option

Recording & communication
- Recorder
- Cellular modem (for GF Remote Dashboard)
- Modbus (Module)
- 8058 i-Go signal converter

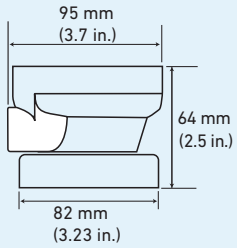
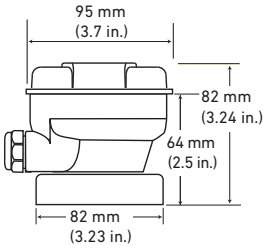
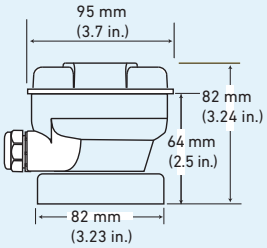
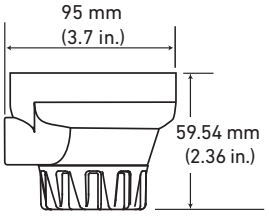
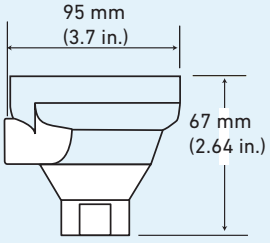
Relays (DIN mounted)
- Time delay
- Latching
- Contactor

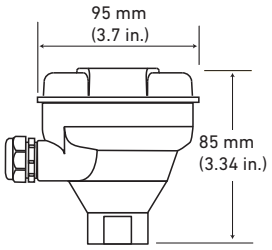
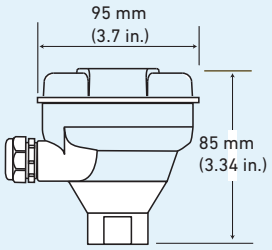
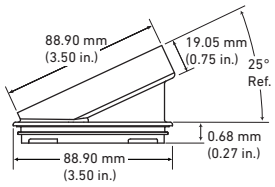
Heating & protection
- Heaters with thermostat

Enclosure options
- Stainless steel
- Clear polycarbonate door
- Solid door
- Swing panel

Accessories for Instruments

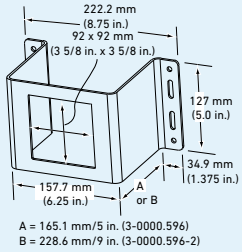
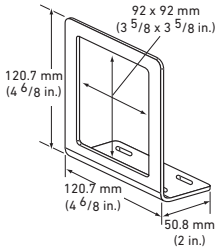
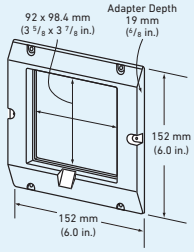
Instrument Junction Boxes

Mfr. Part No.	Code no.	Description	Compatibility	
3-8050	159 000 184	The Universal Mount Kit mounts a 9900 field mount instrument onto a wall, pipe, or tank. Includes: transmitter base, universal mounting plate and bracket.	8150-1 9900	
3-8050-1	159 000 753	The Universal Mount Junction Box contains two terminal blocks that enable cable extensions for pH, ORP, flow, temperature, pressure, and conductivity sensors/electrodes. This kit mounts on a wall, pipe, or tank. Includes: top cover, transmitter base, universal mounting plate and bracket, liquid tight connector kit.	Sensors/Electrodes: 2751-1 2751-3 2751-4 2839-2842 (-1, -1D versions) 2350 2450	
3-8050-2	159 000 754	The pH/ORP Universal Mount Junction Box contains two terminal blocks that enable cable extension of pH or ORP sensors. It features an EasyCal board for simple, push-button pH or ORP calibration. This kit mounts on a wall, pipe, or tank. Includes: top cover, transmitter base, universal mounting plate and bracket, liquid tight connector kit.	Sensor electronics 2751-1 2751-3 2751-4	
3-8051 3-8051-1 3-8051-2	159 000 187 159 001 755 159 001 756	The Integral mounting kit is designed to mount a field mount instrument directly on top of a flow sensor. Includes: transmitter base locking nut.	Instruments: • 8150-1 • 9900 Sensors: • 8510-P0, -P1, -T0, or -V0 • 8512-P0, -P1, -T0, or -V0	
3-8052	159 000 188	3/4 in. Integral Mount Kit is designed to mount a ProcessPro® field mount instrument directly on top of a conductivity/resistivity, temperature, or pressure or level sensor. Includes: transmitter base, sensor adaptor.	Instruments: 9900-1 Sensors/Electrodes: 2839-1V(D) - 2842-1V(D) (NPT)) 2350 2450	

3-8052-1	159 000 755	3/4 in. NPT mount Junction Box contains two terminal blocks that enable cable extension for pH, ORP sensors. Includes: top cover, transmitter base, sensor adaptor, liquid tight connector kit.	Sensor electronics/Electrodes: 2839-2842 (NPT or ISO) 2350 2450	
3-8052-2	159 000 756	¾ in. NPT mount Junction Box contains two terminal blocks that enable cable extension for pH or ORP sensors. It features an EasyCal board for simple, push-button pH or ORP calibration. This kit mounts on a wall, pipe, or tank. Includes: top cover, transmitter base, sensor adaptor, liquid tight connector kit.	Sensors/Electrodes: 2751-1 3-2751-3 3-2751-4	
3-9900.396	159 001 701	The Angle Adjustment Adapter kit is for additional wiring clearance or to adjust the mounting angle of the instrument. Includes: transition adaptor and O-ring.	Junction Boxes • 8050 • 8050-2 • 8052 • 8050-1 • 8051 • 8052-1 The angle adapter is required when using a conductivity module on a 9900-1 field mount	

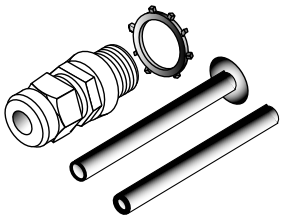
Instrument Accessories and Replacement Parts

Note: Not all accessories shown pictorially.

Mfr. Part No.	Code no.	Description	Compatibility	
3-0000.596	159 000 641	Heavy Duty Wall Mount Bracket	For all instruments (panel mount version)	 A = 165.1 mm/5 in. (3-0000.596) B = 228.6 mm/9 in. (3-0000.596-2)
3-5000.598	198 840 225	Mounting Bracket	All instruments (panel mount version)	
3-5000.399		5 x 5 Adapter Kit		
3-8050	159 000 184	Universal Mount Kit	9900	
3-8051	159 000 187	Flow Sensor Integral Mount Kit	9900	
3-8052	159 000 188	¾ in. Integral Mount Kit	9900	

Liquid Tight Connector Kits (for all instruments and junction boxes.)

Note: Not all accessories shown pictorially.

Mfr. Part No.	Code no.	Description	Compatibility	
3-9000.392	159 000 368	Liquid Tight Connector Kit for Rear Cover (includes 3 connectors)	All instruments	
3-9000.392-1	159 000 839	Liquid Tight Connector Kit, NPT (1 pc.)	All instruments	
3-9000.392-2	159 000 841	Liquid Tight Connector Kit, PG13.5 (1 pc.)	All instruments	
3-9000.392-3	159 310 101	Liquid Tight Connector Kit NPT (2 pc.)	All instruments	

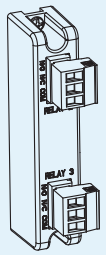
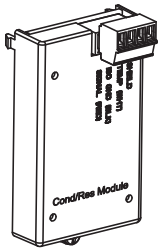
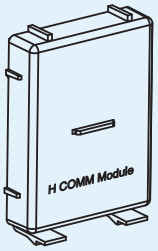
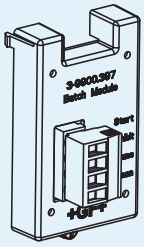
Power Supply, RC Filter, Batteries, and 4 to 20 mA to Digital Signal Converter

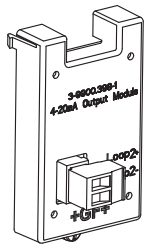
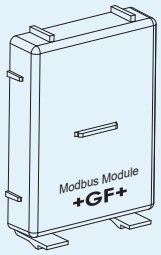
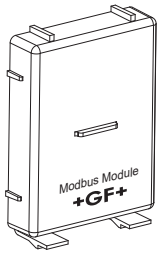
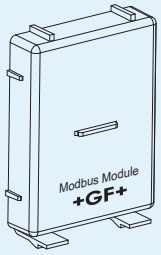
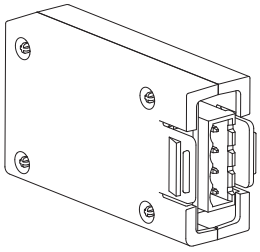
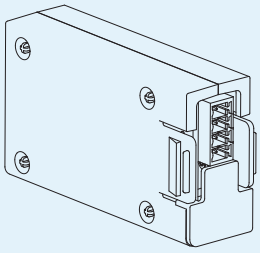
Note: Not all accessories shown pictorially.

Mfr. Part No.	Code no.	Description	Compatibility
7310-1024	159 873 004	24 VDC Power Supply, 10W, 0.42 A	See instrument specifications
7310-2024	159 873 005	24 VDC Power Supply, 24W, 1.0 A	See instrument specifications
7310-4024	159 873 006	24 VDC Power Supply, 40W, 1.7 A	See instrument specifications
7310-6024	159 873 007	24 VDC Power Supply, 60W, 2.5 A	See instrument specifications
7310-7024	159 873 008	24 VDC Power Supply, 96W, 4.0 A	See instrument specifications
3-8050.396	159 000 617	RC Filter Kit - 2 per kit (for use with relays)	9900, 9950-1/2
7400-0011	159 000 935	3.6 V Lithium Replacement Battery (2 required)	8150
3-8058-1	159 000 966	4 to 20 mA to Digital	9900, 9950-1/2
3-8058-2	159 000 967	4 to 20 mA to Digital	3-9950-10/11 ONLY

Miscellaneous Instrument Accessories and Replacement Parts

Note: Not all accessories shown pictorially.

Mfr. Part No.	Code no.	Description	Compatibility	
3-9900.390	159 001 714	Standard Connector Kit, right angle	9900	
3-9900.391	159 001 715	Optional Connector Kit, In-line	9900	
3-9900.392	159 001 700	Wall Mount Accessory Kit	9900	
3-9900.392-1	159 000 839	Liquid Tight Connector Kit, NPT (1 pc.)	9900	
3-9900.393	159 001 698	Relay Module	9900	
3-9900.394	159 001 699	Direct Cond./Resist. Module	9900	
3-9900.395	159 001 697	H COMM Module	9900	
3-9900.396	159 001 701	Angle Adjustment Adapter Kit	9900	
3-9900.397	159 310 163	Batch Module	9900 (Generation III or later), 9900-1BC	

3-9900.398-1	159 001 784	4 to 20 mA Output Module	9900	
3-9900.270-M2	159 200 121	Modbus Module with Terminal Block Assembly (Panel Mount Only)	9900	
3-9900.270-M3	159 200 122	Modbus Module with M12 Connector Assembly (Field Mount Only)	9900	
3-9900.270-M4	159 200 128	Modbus Module with Wire Cable Assembly	9900	
3-9950.394-1	159 001 846	Single Channel Direct Conductivity/ Resistivity Module	9950	
3-9950.398-2	159 001 848	Dual Channel 4 to 20 mA Current Loop Output Module	9950	
3-9950.393-1	159 310 268	Relay Module with 4 Mechanical Relays	9950	
3-9950.393-2	159 310 269	Relay Module with 2 Mechanical and 2 Solid State Relays	9950	
3-9950.393-3	159 310 270	Relay Module with 2 Mechanical Relays and 4 Binary Inputs	9950	
3-9950.394-2	159 001 847	Dual Channel Direct Conductivity/ Resistivity Module		
3-9950.395-M	159 001 905	Modbus Module	9950	

Rear Enclosure Kit for 9900 Transmitter



Panel Mount Transmitter



Hinged Cover



Flat Cover

Product description

The Rear Enclosure Kit allows the 9900 Transmitter to be mounted just about anywhere. The design features make it suitable for installations onto walls, pipes, struts or inside panels. There are two kits available, Rear Enclosure with hinged cover or with flat cover. Kits can be installed on any generation of the 3-9900-1P Panel Mount Transmitter. They can also be used with the 3-9900-1BC Batch Controller System.

The hinged cover version is suitable for wall or pipe mount installations. The kit is equipped with necessary wall mounting hardware. Plastic tie wraps or metal hose clamps (customer supplied) can be used for pipe mount installations. Two slots are available up to 12.7 mm (0.5 in.) wide. The hinged cover design allows for easy access to the back of the 9900 Transmitter for wiring and module installation. The user can install the hinged door to swing down, up or side-to-side.

The flat cover is designed to fit inside a panel for waterproof protection.

Both options have sufficient space for all 9900 Transmitter modules. Enclosures have hole markers on all sides, so users can drill holes and position the wires on the top, bottom or sides.

Features

- Compatible with all existing 9900-1P Transmitters
- NEMA TYPE 4X/IP66 rated for indoor or outdoor installations
- Spacious for any 9900 Transmitter accessory module
- Hinged cover design for easy to access wiring
- Hinged cover suitable for wall mount or pipe mount installations
- Use inside a panel for waterproof protection
- Drill holes on any side for flexible wiring orientation

Applications

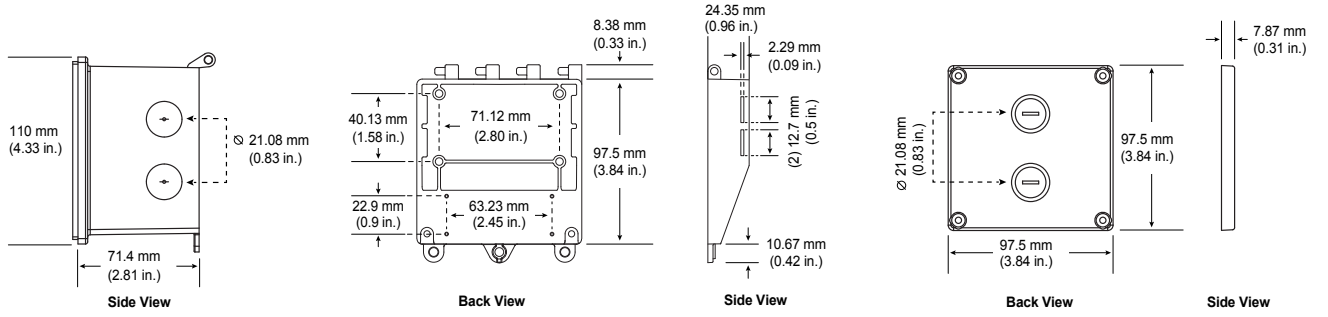
- Wastewater Treatment
- Reverse Osmosis
- Deionization
  - Ultra Pure Water
  - Two Bed System
  - Mixed Bed System
- Chemical Manufacturing/Addition
- Metal and Plastic Finishing
- Fume Scrubber
- Cooling Towers
- Media Filtration
- Aquatic
- Municipalities

Specifications

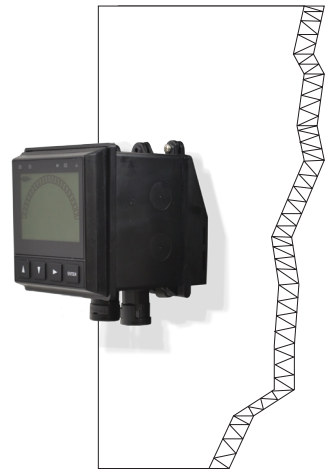
General			
Case Material		PBT-PC alloy	
Rear Enclosure Gasket		Silicone molded gasket	
Front Gasket		Hinged Cover Kit - Silicone molded gasket	
		Flat Cover Kit - Polyurethane die-cut foam gasket	
Brass Inserts and Stainless Steel Screws			
Mounting	Panel	Rear Enclosure, Flat	
	Wall	Rear Enclosure, Hinged cover	
	Pipe	Rear Enclosure, Hinged cover	
Environmental			
Ambient Operating Temperature		-10 °C to 70 °C	14 °F to 158 °F
Rating		NEMA TYPE 4X/IP66	
Shipping Weights			
Rear Enclosure, Hinged cover		0.30kg	0.65 lb
Rear Enclosure, Flat cover		0.28 kg	0.60 lb
Standards and Approvals			
		RoHS Compliant, China RoHS	
		Manufactured under ISO 9001, ISO 14001 and ISO 45001	

Dimensions

Dimensions

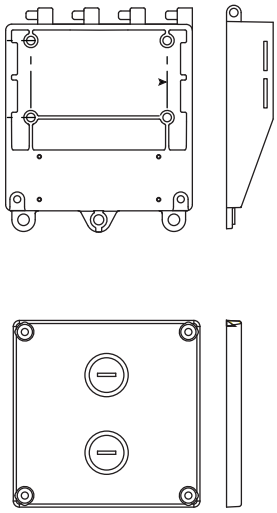


System Overview

Panel Mount Installation	Pipe, Post, Strut Installation	Panel Mount Installation
		

Ordering Information

Mfr. Part No	Code	Description
3-9900.399-1	**159 001 834**	Rear Enclosure Hinged Cover
3-9900.399-2	**159 001 835**	Rear Enclosure Flat Cover



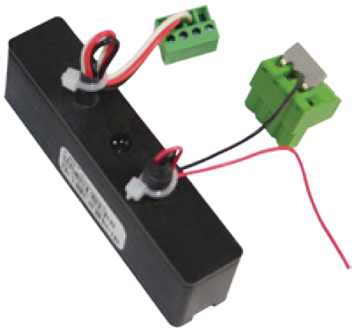
GF 8058 i-Go® Analog to S³L Module



3-8058-1
Wire mount



3-8058-2
DIN-rail mount



3-8058-3
Module mount

Product description

The GF 8058 i-Go® Analog to S³L Module accepts any 4 to 20 mA signal and converts it into the GF digital (S³L) format, the serial data format used by the type 9900 and 9950 instruments and 0486 Profibus Concentrator. When used with the 9900 or 9950 Transmitter or the 0486 Profibus Concentrator, the measurement type and operating range are defined in the setup menu.

The wire-mount single-channel version 3-8058-1 is easily mounted anywhere in the interconnecting wiring between the sensor and any type 9900 or 9950 Transmitter.

The 3-8058-2 version is designed for mounting on DIN rails and has two 4 to 20 mA inputs for converting these into S³L signals in conjunction with the GF 9950-10/-11 transmitters.

The 3-8058-3 is mounted directly into the relay module slot of the 9900-1P transmitter.

Features

- Dual 4 to 20 mA input (9950-10/-11 only)
- Single 4 to 20 mA sensor input
- Connects any external product with 4 to 20 mA output
- In-line wire
- 3-8058-2 DIN rail mount
- 3-8058-3 installs into the 9900-1P relay module port

Applications

- Tank Level Monitoring (ultrasonic and radar to 9900 or 9950)
- Any product with 4 to 20 mA output

Transmitter Compatibility

Module type	4 to 20 mA Input	Mounting Type	Transmitter compatibility			
			9900-1	9900-1P	9950-1/-2	9950-10/-11
3-8058-1	1	Wire	X	X	X	X
3-8058-2	2	DIN-rail				X
3-8058-3	1	Module		X		

Transmitter Type	Max Number of S³L Inputs	GF 8058 i-Go® Analog to S³L Module Configuration Options
9900-1	1	Supports one 3-8058-1 module connected to the S³L terminal.
9900-1P	1	Supports one 3-8058-1 or 3-8058-3 module connected to the S³L terminal.
9950-1/2	2	Supports one or two 3-8058-1 modules, each connected to one of the two S³L terminals.
9950-10/11	6	Supports a combination of 3-8058-1 and 3-8058-2 modules, with a maximum of six inputs, freely assigned to two S³L terminals.

Specifications

General			
Input	4 to 20 mA current loop, passive (external power required)		
Input Range	3.6 to 22.1 mA		
Output	Digital (S^3L) output		
Accuracy	±32 µA @ 25 °C		
Resolution	< 16 µA		
Update Rate	500 mS		
Temperature Drift	±1 µA per °C, max.		
Electrical			
Power Requirement	4.5 to 6.5 VDC < 3.0 mA		
Maximum Voltage	35 VDC		
Maximum Current	40 mA		
Isolation	Up to 48 VAC/DC		
Voltage Drop	5 VDC max.		
	Reverse polarity protected		
Cable			
3-8058-1	400 mm (15 in.) input, 200 mm (8 in.) output		
3-8058-2	No cable provided (customer supplied)		
3-8058-3	No cable		
Max. Recommended Cable Extensions			
Loop in	305 m (1,000 ft)		
Digital (S^3L) out	per digital (S^3L) guidelines		
Environmental			
Operating Ambient Temperature	-10 °C to 55 °C	14 °F to 131 °F	
Storage Temperature	-20 °C to 85 °C	-4 °F to 185 °F	
Relative Humidity	3-8058-1: 0 to 100%, condensing		
	3-8058-2: 0 to 90%, non-condensing		
Shipping Weight			
	3-8058-1	0.09 kg	0.20 lb
	3-8058-2	0.11 kg	0.25 lb
	3-8058-3	0.09 kg	0.20 lb
Standards and Approvals			
	CE, UKCA, FCC		
	RoHS compliant, China RoHS		

Ordering Information

Mfr. Part No	Code	Description
3-8058-1	**159 000 966**	GF 3-8058-1 i-Go® Analog to S^3L Module, wire-mount, for use with any GF 9900 and 9950 transmitters
3-8058-2	**159 000 967**	GF 3-8058-2 i-Go® Analog to S^3L Module, DIN-rail mount, dual 4 to 20 mA inputs to S^3L converter, for use with GF 9950-10/-11 transmitters only
3-8058-3	**159 070 106**	GF 3-8058-3 i-Go® Analog to S^3L Module, module mount, for use with GF 9900-1P transmitters only

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Chlorine Analyzer Systems **192**

Turbidity **228**

Dissolved Oxygen (DO) **241**

Planning Fundamentals

of Measurement and Control

pH/ORP

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Type 2744-2747 Differential DryLoc® pH/ORP Electrodes 112
Type 2774-2777 DryLoc pH/ORP Electrodes 118
Type 3719 pH/ORP Wet-Tap Assembly 124
Type 2756-2757 pH/ORP Wet-Tap Electrodes 128
Type 2751 DryLoc® pH/ORP Smart Sensor Electronics 133

Introduction

pH/ORP Electrodes Specification Matrix

Type	2724 2726	2725	2734 2736	2735
				
Operation Range	0 to 14 pH	±2000 mV	0 to 14 pH	±2000 mV
Connector Style	DryLoc®			
Compatible Preamps/Sensor Electronics	2751 Sensor Electronics			
Temperature Range	-10 °C to 85 °C (14 °F to 185 °F)		10 °C to 100 °C (50 °F to 212 °F)	
Pressure Range	6.9 bar @ -10 to 65 °C (100 psi @ 14 to 150 °F) 4 bar @ 65 to 85 °C (58 psi @ 150 to 185 °F)		6.9 bar @ -10 to 65 °C (100 psi @ 14 to 150 °F) 4 bar @ 65 to 100 °C (58 psi @ 150 to 212 °F)	
Pipe Size Range for In-line	2724-2727 pipe size range ½ in. to 4 in. GF fittings or a variety of ¾ in. fittings		2734-2735 pipe size range ½ in. to 4 in. GF fittings or a variety of ¾ in. connections	
Process Connection for Submersible	¾ in. NPT threads or ISO 7-1/R ¾ in. (using threads from submersible 2751)		¾ in. NPT threads or ISO 7-1/R ¾ in. (using threads from submersible 2751)	
Wetted Materials – Body	PPS			
Wetted Materials – Reference Junction Material	Porous UHMW Polyethylene		PTFE	
Wetted Materials – O-rings	FKM			
Wetted Materials – Sensing Element	Glass (pH) or Platinum (ORP)			
Mounting Position	Any angle, even upside down			
Sensor Technology	Standard			
Compatible GF Instruments	9900, 9950, 0486 Profibus Concentrator			
Application Usage	General purpose; also options available for use in HF (< 2%) and low conductivity liquids (<100 µS)		General purpose and harsh process liquids: also options available for use in HF (< 2%)	
Standards and Approvals	RoHS compliant, China RoHS		CE, UKCA, FCC, RoHS compliant, China RoHS	

Type		2744 2746	2745 2747	2756 Wet-Tap	2757 Wet-Tap	2774 2776	2775 2777
							
Operation Range		0 to 14 pH	±2000 mV	0 to 14 pH	±1500 mV	0 to 14 pH	±2000 mV
Connector Style		DryLoc®					
Compatible Preamps/ Sensor Electronics		2751 Sensor Electronics					
Temperature Range		10 °C to 100 °C (50 °F to 212 °F)		0 °C to 85 °C (32 °F to 185 °F)		0 °C to 85 °C (32 °F to 185 °F)	
Pressure Range		0 to 6.9 bar @ 10 °C to 65 °C (0 to 100 psi @ 50 °F to 149 °F) 6.9 to 4.0 bar @ 65 °C to 100 °C (100 to 58 psi @ 149 °F to 212 °F)		6.89 bar (100 psi)		6.9 bar (100 psi) maximum	
Pipe Size Range for In-line		1 in. and up		2½ in. to 12 in.		¾ in. and up	
Process Connection for Submersible		¾ in. NPT threads or ISO 7-1/R 3/4 in. (using threads from 2751)		N/A		¾ in. NPT threads or ISO 7-1/R 3/4 in. (using threads from 2751)	
Wetted Materials	Body	PPS		Plastic		PPS	
	Reference Junction Material	PTFE					
	O-rings	EPDM		FKM		EPDM	
	Sensing Element	Glass (pH) or Platinum (ORP)					
Mounting Position		Angle is minimum +15° from horizontal		Any angle, even upside down			
Sensor Technology		Differential		Standard			
Compatible GF Instruments		9900, 9950, 0486 Profibus Concentrator					
Application Usage		Harsh Chemicals (heavy metals, Hg++, Cu+, Pb++, ClO4-, Br-, I-, CN-, S2- and other chemicals that react with Ag+ or KCl.)		General purpose; sensor accessible without process shutdown		General purpose and harsh process liquids: options for higher temperatures are available, 110 °C (230 °F) @ 150 PSI	
Standards and Approvals		ISO 9001 and ISO 45001					

pH/ORP Application Matrix

Chart Key	
Ø	Not Recommended
**	Compatible
***	Good
*****	Better
Special	Special Order Product

Type	2724 2726	2724-HF 2726-HF	2726-LC	2725	2734 2736	2734-HF 2736-HF
Measurement						
pH	*****	*****	*****		*****	*****
ORP				*****		
Application						
Low Temperature < 10 °C	*****	Ø	*****	*****	Ø	Ø
High Temperature > 85 °C	Ø	Ø	Ø	Ø	*****	*****
General Purpose	*****	*****	*****	*****	***	***
Harsh Application	**	**	**	**	*****	*****
Low Conductivity (< 100 uS)	Ø	Ø	*****	Ø	Ø	Ø
Chemical Compatibility						
Hydrofluoric Acid (HF) < 2%	Ø	*****	Ø	Ø	Ø	*****
Mercury (Hg2+)	**	**	Ø	**	***	***
Copper (Cu+)	**	**	Ø	**	***	***
Lead (Pb2+)	**	**	Ø	**	***	***
Perchlorate (ClO4-)	**	**	Ø	**	Ø	Ø
Bromine (Br-)	**	**	Ø	**	***	***
Iodine (I-)	**	**	Ø	**	***	***
Cyanide (CN-)	**	**	Ø	**	***	***
Sulfide (S2-)	**	**	Ø	**	***	***
Silver Sulfide (Ag2S)	**	**	Ø	**	***	***
Silver Bromide (AgBr)	**	**	Ø	**	***	***
Silver Iodide (AgI)	**	**	Ø	**	***	***
Silver Cyanide (AgCN)	**	**	Ø	**	***	***
Mounting						
Submersible	*****	*****	*****	*****	*****	*****
GF Fitting	*****	*****	*****	*****	*****	*****
Wet-Tap	Ø	Ø	Ø	Ø	Ø	Ø
3/4 in. NPT	*****	*****	*****	*****	*****	*****
1 in. NPT	***	***	***	***	***	***
ISO 7/1-R 3/4	*****	*****	*****	*****	*****	*****

Chart Key	
Ø	Not Recommended
**	Compatible
***	Good
*****	Better
Special	Special Order Product

Type	2735	2756-WT	2757-WT	2744 2746	2745 2747	2774 2776	2775 2777
Measurement							
pH		*****		*****		*****	
ORP	*****		*****		*****		*****
Application							
Low Temperature < 10 °C	***	*****	*****	*****	*****	*****	*****
High Temperature > 85 °C	*****	Ø	Ø	Ø	Ø	special	special
General Purpose	***	****	****	**	**	***	***
Harsh Application	***	Ø		*****	*****	***	***
Low Conductivity (< 100 uS)	Ø	Ø	Ø	Ø	Ø	Ø	Ø
Chemical Compatibility							
Hydrofluoric Acid (HF) < 2%	Ø	Ø	Ø	Ø	Ø	Ø	Ø
Mercury (Hg2+)	***	Ø	Ø	*****	*****	***	***
Copper (Cu+)	***	Ø	Ø	*****	*****	***	***
Lead (Pb2+)	***	Ø	Ø	*****	*****	***	***
Perchlorate (ClO4-)	Ø	Ø	Ø	*****	*****	***	***
Bromine (Br-)	***	Ø	Ø	*****	*****	***	***
Iodine (I-)	***	Ø	Ø	*****	*****	***	***
Cyanide (CN-)	***	Ø	Ø	*****	*****	***	***
Sulfide (S2-)	***	Ø	Ø	*****	*****	***	***
Silver Sulfide (Ag2S)	***	Ø	Ø	*****	*****	***	***
Silver Bromide (AgBr)	***	Ø	Ø	*****	*****	***	***
Silver Iodide (AgI)	***	Ø	Ø	*****	*****	***	***
Silver Cyanide (AgCN)	***	Ø	Ø	*****	*****	***	***
Mounting							
Submersible	*****	Ø	Ø	*****	*****	*****	*****
GF Fitting	*****	Ø	Ø	Ø	Ø	Ø	Ø
Wet-Tap	Ø	*****	*****	Ø	Ø	Ø	Ø
3/4 in. NPT	*****	Ø	Ø	Ø	Ø	*****	*****
1 in. NPT	***	Ø	Ø	*****	*****	***	***
ISO 7/1-R 3/4	*****	Ø	Ø	Ø	Ø	Special	Special

pH/ORP System Compatibility

The chart below outlines the compatibility between GF pH/ORP electrodes, instruments and sensor fittings. Refer to individual product pages and fittings section of the catalog for more information.

	Electrodes			
	2724 2726	2734-2736	2744-2747	2774-2777
2751 pH/ORP Smart Sensor Electronics	✓	✓	✓	✓
9900 Transmitter with Sensor Electronics or Module	✓	✓	✓	✓
9950 Dual Channel Transmitter with Sensor Electronics or Module(s)	✓	✓	✓	✓
9950-10/11 transmitter with 2751-X	✓	✓	✓	✓
Fittings - Customer Supplied				
¾ in. process connections	✓	✓		✓
ISO 7/1-R3/4 process connections	✓	✓		
1 in. process connections			✓	
GF Fittings For use with fittings up to DN100 (4 in.) only				
SFMT0XX Metric PVDF Union Tee	✓	✓		
MPV8T0XXF PVC SCH 80 Tee	✓	✓		
MPV8T0XX PVC SCH 80 Tee w/pipe	✓	✓		
MCPV8T0XXF PVC-C SCH 80 Tee	✓	✓		
MCPV8T0XX PVC-C SCH 80 Tee w/pipe	✓	✓		
PV8S0XX PVC Clamp-on Saddle	✓	✓		
FPT0XX Fiberglass Glue-On Tee	✓	✓		
IR4T0XX Iron Threaded Tee (NPT)	✓	✓		
IR8SXXX Iron Strap-On Saddle	✓	✓		
CUKT0XX Copper Sweat-On Tee	✓	✓		
BR4BXXX Brass Brazolet	✓	✓		
CS4T0XX Carbon Steel Tee (NPT)	✓	✓		
CS4WXXX Carbon Steel Weldolet	✓	✓		
CR4T0XX 316 SS Threaded Tee (NPT)	✓	✓		
CR4WXXX 316 SS Weldolet	✓	✓		
BR4T0XX Brass Threaded Tee (NPT)	✓	✓		
PVMT0XX/PVAT0XX Metric/BSP PVC Union Tee*	✓	✓		
PVMS0XX/PVAS0XX Metric/BSP PVC Saddle*	✓	✓		

* Available only through your local GF Industry & Infrastructure Flow Solutions sales office.

pH/ORP Technical Basics

Choosing the Correct pH/ORP Electrode

Choosing the right pH/ORP electrode is important and unique for each application.

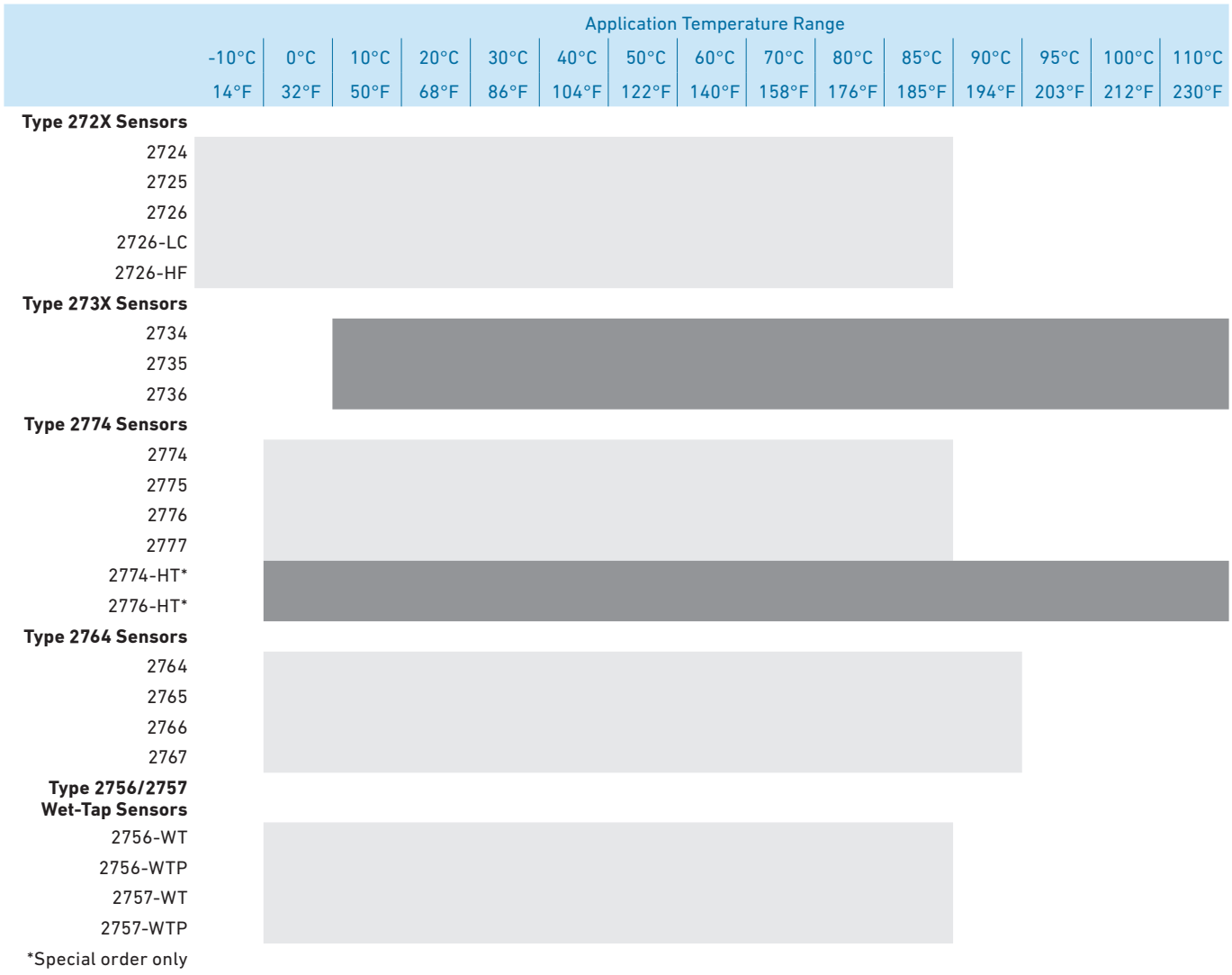
Electrode	Application
Type 2724	For all general purpose, mild applications
Type 2734	High performance electrode used for general purpose and aggressive applications
Type 2774	For more aggressive applications with ions such as mercury, copper, lead and perchlorate
Type 2744	For more aggressive applications with ions such as mercury, copper, lead and perchlorate, bromides, iodides, cyanides, and sulfides

Refer to the application matrix for assistance in your selection:

Application	2724-2726 DryLoc® Electrodes	2734-2736 DryLoc® Electrodes	2774-2777 Electrodes	2744-2747 Differential Electrodes	Application	2724-2726 DryLoc® Electrodes	2734-2736 DryLoc® Electrodes	2774-2777 Electrodes	2744-2747 Differential Electrodes
Aquatic Animal Life Support Systems	✓	?	X	X	Fruit and Vegetable Rinsing	✓	?	?	?
Boiler Make-Up Water (20 µS)	✓	X	X	X	Greenhouses	✓	?	X	X
Brackish Water Influent	✓	?	X	?	Heavy Metal Recovery	X	?	✓	?
Chemical Injection, Mixing Tank	✓	?	X	?	Influent Monitoring (to neutralization processes)	✓	?	X	?
Chemical Processing	✓	?	?	?	Neutralization Systems	✓	?	?	?
Chlorine Dioxide Control Effluent	✓	?	X	?	Ozone Injection Effluent	✓	?	X	X
Chrome Reduction	X	?	✓	?	Plating Baths	✓	?	?	?
Circuit Board Etching	X	?	✓	?	Process Control (verify chemical compatibility)	✓	?	X	?
Circuit Board Film Processing	X	?	✓	?	Pulp and Paper	X	X	X	✓
Coagulation and Flocculation	✓	?	X	?	Reverse Osmosis	✓	?	X	X
Commercial Aquariums	✓	?	X	?	Rinse Water	✓	?	X	?
Commercial Swimming Pools	✓	?	X	X	Scrubbers	✓	?	X	?
Cooling Towers	✓	?	X	X	Sulfur Recovery	✓	?	X	?
Cyanide Destruction	X	X	X	✓	Surface Finishing	X	?	✓	?
Dechlorination Monitoring	✓	?	X	X	Textile Dye Process	X	?	✓	?
Desalination Plantseffluent	✓	?	X	X	Toxics Destruction	X	?	✓	?
Desalination Plantsinfluent	✓	?	X	X	Wastewater Neutralization Tanks	✓	?	X	?
Dialysis	✓	?	X	X	Wastewater Treatment	✓	?	X	?
Drinking Water Quality	✓	?	X	X	Water Parks	✓	?	X	?
Effluent Monitoring (discharge to local water sources)	✓	?	X	X	Water Treatment (boilers, cooling towers, pH neutralization, make-up water)	✓	?	X	X
Fish Farming	✓	?	X	?	Wholesale Nurseries	✓	?	X	X
Food and Beverage Manufacturing	✓	?	X	?	Zoo Exhibit Water Treatment	✓	?	X	?

✓ Best choice for this application
X DO NOT use this electrode; it is not required or it is an incorrect choice
? In certain applications, this is a good alternative to the “best choice” option

Refer to following guide to choose the right sensor for your application temperature range:



Technical Reference Section: pH/ORP

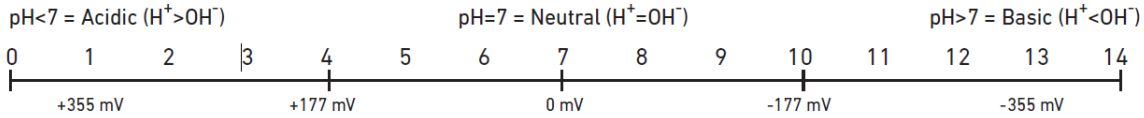
Information in this section addresses frequently asked questions regarding pH and ORP and is provided as REFERENCE ONLY to supplement procedures and recommendations specifically outlined in individual product instruction manuals. All manuals, data sheets, and additional helpful information are available at www.gfps.com.

Definition of pH

pH is defined as the negative logarithm of the Hydrogen ion concentration in aqueous solutions. The common pH scale ranges from 0 to 14, with 7 being neutral water (H2O). At pH 7, Hydrogen ions (H+) exist in equal concentration to Hydroxyl ions (OH-). A solution is considered to be acidic if the concentration of H+ exceeds that of OH-, and is indicated by pH values below 7. Conversely, a solution is considered to be basic if the concentration of H+ is less than that of OH-, and is indicated by pH values above 7.

Common Acids		Common Bases	
1M HCl	0.0 pH	Egg Whites	7.5 pH
Sulfuric Acid	0.3 pH	Seawater	8.0 pH
Lemon Juice	2.0 pH	Sodium Bicarbonate	8.4 pH
Vinegar	3.0 pH	Ammonia	11.6 pH
Wine	3.5 pH	Photo Developer	12.0 pH
Beer	4.5 pH	0.1M NaOH	13.0 pH
Milk	6.0 pH	Lye	14.0 pH

pH Scale



(Theoretical: 59.16 mV/pH @ 25 °C)

Definition of ORP

ORP is an abbreviation for Oxidation-Reduction Potential. Oxidation is a term used to denote the occurrence of a molecule losing an electron. Reduction occurs as a molecule gains an electron. The “potential” is simply an indication of a solution’s propensity to contribute or accept electrons. ORP reactions (sometimes referred to as REDOX) always take place simultaneously. There is never oxidation without reduction, and ORP electrodes are used to detect electrons exchanged by molecules as these reactions occur.

Both pH and ORP electrodes produce voltages that depend on the solutions in contact with their sensing ends. Most pH electrodes, including the GF brand, are designed to produce 0 mV at pH 7, positive mV below pH 7 (associated with the charge of the Hydrogen ion, H+) and negative mV above pH 7 (associated with the charge of the Hydroxyl ion, OH-). According to the Nernst Equation, the interval between each pH unit is approximately 59.16 mV at 25 °C. This “raw” output is converted to a pH value by the display instrument.

The ORP scale is typically -1000 mV to +1000 mV, and the electrodes produce these values directly.

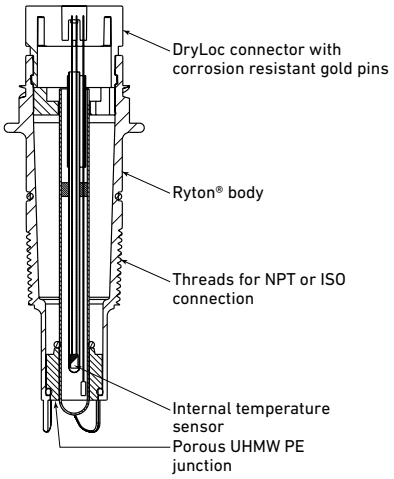
Whereas pH is a specific measure of the Hydrogen ion concentration in solution, ORP only provides relative measures of chemicals and cannot discriminate one from another. Although non-specific, it is a very useful and inexpensive method of monitoring and controlling the activity of such compounds as chlorine, ozone, bromine, cyanide, chromate, and many other chemical reactions.

It is worth noting that Temperature Compensation, very important for accurate pH measurement, is NOT used in ORP measurements. Temperature does indeed affect the reactionary potential of all chemicals, some to a greater extent than others. But even if the effects of temperature could be precisely known in all of the many different REDOX reactions, it would not be desirable to remove them from the measurement. True ORP is the direct measurement of electrons in transit during Oxidation-Reduction reactions, regardless of temperature.

Principle of Operation

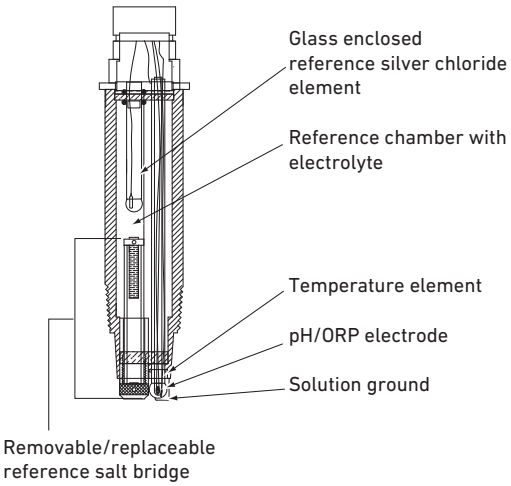
Standard pH/ORP electrodes are also commonly called combination electrodes; a pH/ORP measuring electrode and a reference measuring electrode are combined in a single body. The pH/ORP sensor measures the amount of hydrogen ions in the liquid. The pH signal is measured against the steady reference signal. Various chemical elements leaching through the porous reference junction can react with the reference electrolyte, dilute the electrolyte solution, or attack the silver chloride element; in either case, it will disturb the steady reference signal. Stray electrical currents will also affect the steady reference signal. A temperature element is also built into the pH combination electrode. Instruments interpret the temperature compensated pH signal into a pH reading at 25 °C (77 °F). ORP values are not temperature dependent; GF ORP sensors do not have temperature compensation.

Cutaway of 2724 pH electrode



Differential pH/ORP electrodes function similar to the standard (combination) electrodes, but the reference design is modified and there is a third electrode, the solution ground. The pH and reference electrodes are measured against the solution ground. The solution ground drains stray currents away from the reference element, hence maintaining a steady signal at all times. The reference salt bridge slows or stops various chemical elements from leaching into the reference chamber. Chemicals that leach in may dilute the electrolyte but will not react with the glass-encased reference silver chloride element. The reference electrolyte can be refreshed if it is diluted or depleted. The temperature element is embedded in the pH/ORP electrode for an extremely quick response.

Cutaway of 2744 pH electrode



Standard Versus Differential pH/ORP Electrodes

GF offers what is called combination pH/ORP electrodes; a combination of three or four electrodes built into one common body that measures the pH or ORP of the solutions. These electrodes are the pH/ORP sensing element, temperature sensing element (pH only), the reference, and sometimes a solution ground. An electrical path between the process solution, reference electrode, and the pH/ORP sensing electrode must always be present to complete the measuring circuit. When the circuit is broken or interrupted, the result is a faulty reading. There are only a few things in a chemical process that would affect the glass-sensing element. These include concentrations of HF, constant high temperatures, and particles that can break the glass. On the other hand, there are many problems that can occur with the reference electrode. The reference silver chloride sensing element (wire) is exposed to the process liquid via the primary porous reference junction, which is in constant contact with the process and allows liquid to pass through to the reference electrolyte. Because of the direct contact with the process liquid, the reference electrolyte and reference silver chloride sensing element can react with chemicals in the process. Many application liquids do not chemically react with the reference and therefore a standard electrode will perform well in this scenario. However, there are other process chemicals that will easily attack the reference and therefore, a differential style electrode should be used.

There are three advantages of the differential electrode:

1. If the process chemicals attack the KCl electrolyte, the reference electrolyte chamber is refillable.
2. If the reference junction becomes clogged by chemical reactions between the KCl and the process chemicals, the reference salt bridge is replaceable.
3. If there are stray currents or if there are process chemicals that attack the silver chloride wire in the standard electrodes, it will not attack it in the differential electrode because the wire is encased in a glass electrode.

A general rule of thumb is to use a differential electrode if you have mercury, copper, lead, chlorate, bromine, iodine, cyanide, or sulfide compounds in the process liquid. Differential electrodes may also be useful in processes where oil, grease, and dirt build up on the reference junction because it is easily replaced.

Important Application Tips

- It is important that the sensing end of pH and ORP electrodes remain wet, for it may be permanently damaged if allowed to dehydrate. This is true for both in-line and submersible installation configurations. However, be careful to keep the electrical interconnection between electrode and preamplifier dry and clean at all times. Moisture in this area can also cause permanent damage.
- pH control is best when performed in a tank. This is especially true in neutralization applications since it is very important for reagents to mix thoroughly with waste fluids, and to be allowed adequate time for the reactions to occur. Limiting adjustments to fewer than 3 pH units per stage, and sizing tanks to provide at least 10 minutes retention time, will increase the probability of producing safe effluents.
- For bulb-style pH and ORP electrodes, significant natural self-cleaning by turbulent eddies is achieved at velocities of 1.5 m/s or more (5 ft/s). Flat surface electrodes get adequate self-cleaning at velocities of 0.3 to 0.6 m/s (1 to 2 ft/s). In all cases, exposure to velocities greater than 3 m/s (10 ft/s) can cause excessive measurement noise and electrode wear and should be avoided.
- The aging of pH and ORP electrodes (i.e., reference depletion and decreased glass sensitivity) results from a series of chemical reactions. And as a general rule, the rates of chemical reactions double with every increase of 10 °C or 18 °F. This means shorter life expectancy for all pH and ORP electrodes as application temperatures increase.
- HF acid and strong caustics etch pH glass. High concentrations, especially at high temperatures, destroy electrodes quickly. For applications containing trace quantities of HF (< 2%), use the 2726-HF electrode. This electrode has a polymeric constituent in the pH glass that resists attack by HF and extends the service life considerably over “normal” electrodes.
- In applications where process temperatures will drop below 10 °C (50 °F), use the bulb-style electrodes in place of the flat style electrode. This is a function of the electrical impedance of the glass that increases dramatically as temperature decreases.
- Proper electrode placement within a tank is also very important. Electrodes should be mounted in well-mixed areas, away from reagent and waste introduction. It is usually advisable to position the electrode near the discharge outlet of the tank.
- In-line pH control is not recommended because it is very difficult to determine the amounts of reagent necessary to achieve a desired reaction if both pH and flow are variables. However, in-line pH monitoring is very common and useful.

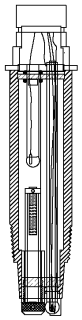
Maintenance Tips

- Cleaning pH and ORP electrodes and calibrating the systems should be done regularly. The required frequency is application-dependent, but once/week for cleaning, and twice/month for calibration is recommended.
- Isopropyl alcohol may be used for removing mild grease and oils from the pH sensitive glass or from the metallic tips of ORP electrodes. Use 5% HCl on porous reference junctions clogged with hard water deposits, or other solvents/detergents as necessary. Always consider the electrode's materials of construction when selecting a cleanser.
- The purpose of calibration is to compensate the system for the continual changes occurring within the electrodes. Like batteries, all pH and ORP electrodes eventually deplete and must be replaced. A good time to determine the condition of an electrode is after cleaning and during calibration. Note the mV readings in pH buffers and replace the electrode if its actual mV output differs more than 50 mV from these theoretical values: pH 7 = 0 mV, pH 4 = +177 mV, pH 10 = -177 mV. Replace an ORP electrode if its actual mV output differs more than 50 mV from the theoretical values in the table below:

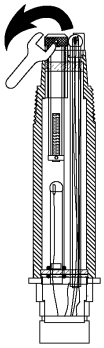
Differential Electrodes: Replacing the salt bridge and refill the electrolyte chamber

Differential electrodes have a replaceable salt bridge and the electrolyte chamber can be refilled. The electrolyte chamber should be full. If any fluid is audible when shaken, the chamber should be refilled. Refill the electrolyte chamber when the electrode offset exceeds 40-45 mV. Replace the salt bridge when performance becomes sluggish or if the output is erratic or inaccurate.

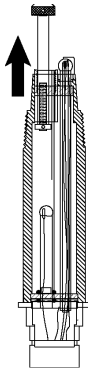
1 Remove pH/ORP differential electrode from mounting.



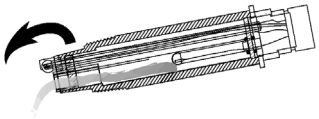
2 Hold electrode upside down and unscrew salt bridge using a pair of small pliers. Be careful not to damage the glass bulb!



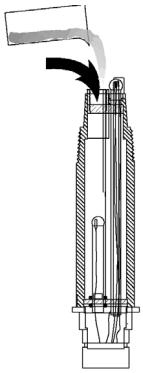
3 Carefully remove salt bridge.



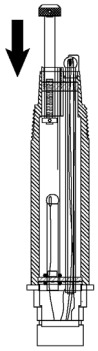
4 Drain the depleted reference solution and dispose of properly.



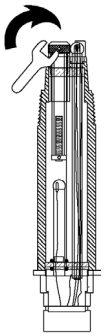
5 Fill reference chamber with fresh reference solution (approx. 30 ml).



6 Replace salt bridge and screw finger tight. Solution will drip out while screwing in salt bridge.



7 Use pliers to turn approximately ¼ turn past finger-tight.



Perform calibration (standard and slope) before returning the system to service.

NOTE:
The refillable electrolyte chamber in 274X series differential electrodes may leak during storage and shipping. Check the fluid and refi ll before installation if necessary.

ORP Values of Standard pH Buffers Saturated with Quinhydrone

	pH 4			pH 7		
Temperature (°C)	20	25	30	20	25	30
ORP Value (mV)	268	264	258	92	87	79

- The typical shelf-life recommendation for GF pH and ORP electrodes is 12 months at 25 °C (77 °F).
- Refrigeration will extend this period, but do not allow them to freeze! Expansion of internal solutions during freezing can cause permanent damage to the electrodes.
- The risk of putting older electrodes into service is the possible disappointment of shorter than expected service-life. All GF pH and ORP electrodes are marked with date codes to identify the date of manufacture.

Type 2724-2726 pH/ORP Electrodes

General Purpose

Compatible with ALL pH/ORP instruments and SmartPro transmitters



Product description

The 2724-2726 pH and ORP electrodes are general purpose sensors ideal for a wide range of applications. These feature a patented reference design and uses the unique foul-proof patented DryLoc® connector. The large area PE reference junction and pathway is constructed

to increase the total reference effectiveness and ensures long service life.

The DryLoc® connector with corrosion resistant gold plated contacts readily connects the sensor to the mating 2751 pH/ORP Smart Sensor Electronics. The robust PPS threaded sensor body and choice of flat pH, bulb pH, or flat ORP sensing elements allows a broad

range of chemical and mechanical compatibility for a wide variety of applications.

There are two optional pH sensing versions available, HF and LC. The HF version is for applications where traces of hydrofluoric acid (2% or less) will attack standard pH

glass. The LC version can be used for low conductivity fluids 20–100 µS/cm nominal.

The 2724-2726 electrodes incorporate o-ring seal for use with ½" to 4" GF Installation fittings. They can also be mounted directly into reducing tees, DN20 to DN100 (¾ to 4 inch). Sensor tip must be in flow path.

Features

- Patented reference design for exceptional performance and prolonged life
- UHMW polyethylene reference junction
- Memory chip enabled for access to a wide range of unique features when connected to the 2751 pH/ORP Smart Sensor Electronics
- PPS body for broad range of chemical compatibility
- Patented DryLoc® connector with gold plated contacts
- Special design allows for installation at any angle, even inverted or horizontal
- Mounts in GF standard installation fittings from DN15 to DN100 (½ to 4 in.)
- ¾" NPT or ISO 7/1-R 3/4 threaded sensors for use with reducing tees DN20 to DN100 (¾ to 4 in.)
- Quick temperature response
- Bulb and flat HF resistant glass available for trace HF, in less than 2% concentration applications
- Low conductivity sensor available for liquids from 20–100 µS/cm



* U.S. Patent Nos.: 6,666,701, 7,799,193 B2, 7,867,371 B2 and 8,211,282 B2

Applications

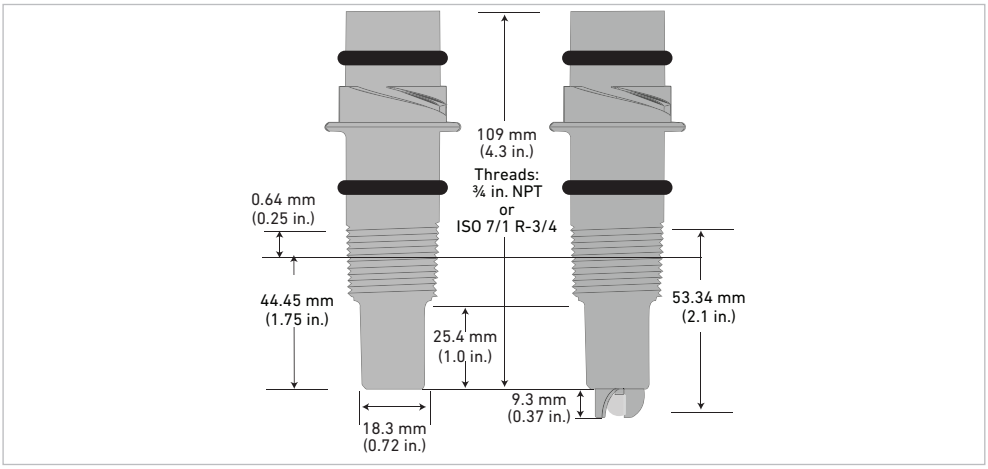
- Monitoring
- Industrial Water Treatment
- Municipal Water Treatment
- Aquaculture
- Aquatic Life Support System
- Agriculture
- Water Parks

Specifications

General			
Performance	Efficiency	>97% @ 25 °C (77 ° F)	
Operating Range	pH	0 to 14 pH	
	ORP	±2000 mV	
	3-2726-LC	Low conductivity fluids; 20 - 100 µS/cm nominal < 20 µS; flow must be less than 150 ml/min in a properly grounded system	
	3-2724-HF, 3-2726-HF	Hydrofluoric acid resistant glass, pH 6 or below; trace HF <2%	
Compatibility			
	2751 Smart Sensor Electronics (for 9900, 9950, 4 to 20 mA or Profibus Concentrator),		
Temperature Sensor			
	Pt1000 versions	Compatible with 2751 pH/ORP Smart Sensor Electronics for connection to a PLC or to the 9900 or 9950 instruments	
Process Connection			
	¾ in. NPT	ISO 7/1-R 3/4	Mounts into fittings
Wetted Materials			
	pH	PPS, glass, UHMW PE, FKM	
	ORP	PPS, glass, UHMW PE, FKM, Platinum	
Max. Temperature/Pressure Rating			
Operating Temperature Range*	bulb tip design	0 °C to 85 °C	32 °F to 185 °F
	flat tip design	-10 °C to 85 °C	14 °F to 185 °F
Operating Pressure Range*	bulb tip design	6.8 bar @ 0 to 65 °C (100 psi @ 32 to 150 °F) 4 bar @ 65 to 85 °C (58 psi @ 150 to 185 °F)	
	flat tip design	6.8 bar @ -10 to 65 °C (100 psi @ 14 to 150 °F) 4 bar @ 65 to 85 °C (58 psi @ 150 to 185 °F)	
*Best performance for 2724-HF, 2726-HF sensors is above 10 °C (50 °F)			
Recommended Storage Temperature			
		0 °C to 50 °C	32 °F to 122 °F
The electrode glass will shatter if shipped or stored at temperature below 0 °C (32 °F)			
The performance life of the electrode will shorten if stored at temperatures above 50 °C (122 °F)			
Mounting			
In-line Mounting	Use GF Installation fittings ½" to 4"		
	Reducing tees ¾"–4". Sensor tip must be in flow.		
	Sensor can be mounted at any angle		
Submersible Mounting	Use threads on model 2751-3/-4		
	Requires ¾ inch NPT or ISO 7/1-R 3/4 male threaded liquid tight extension conduit.		
Shipping Weight			
	0.25 kg	0.55 lb	
Standards and Approvals			
	RoHS compliant, China RoHS		
	Manufactured under ISO 9001, ISO 14001 and ISO 45001		

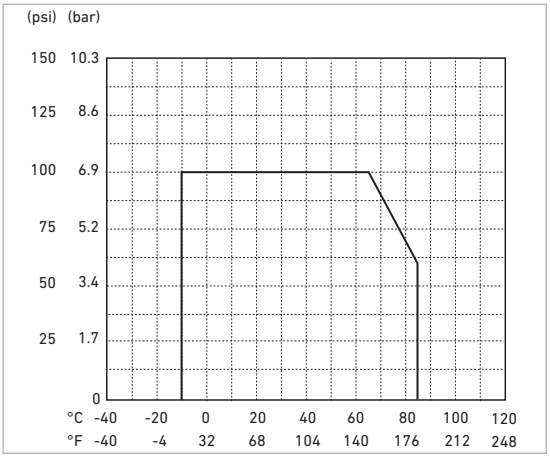
See pressure-temperature diagrams for more information.

Dimensions

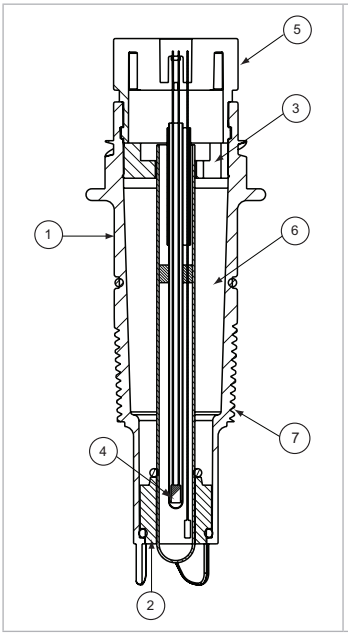


Pressure-temperature diagram

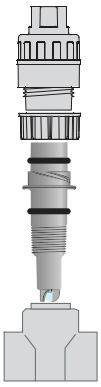
The pressure-temperature diagram are specifically for the sensor. During system design the specifications of all components must be considered. In the case of a metal piping system, a plastic sensor will reduce the system specification.



Electrode Key Features and Benefits:



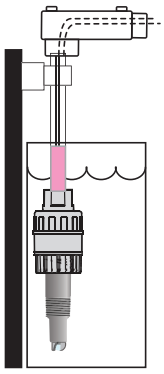
Dual-patented reference design for long life in conductivity or chemicals.



(7) Sensor in threaded reducing tee



(8) Sensor in fitting



(9) Sensor submersible installation

1. PPS body for chemical compatibility with most harsh chemicals.
2. Porous UHMW PE (ultra high molecular weight polyethylene) junction resists fouling and build-up.
3. Memory chip enabled for convenient data storage and access (calibration data, operational data, and manufacturing data), electrode health monitoring via glass impedance measurement when used in connection with the 2751 pH/ORP Smart Sensor Electronics.
4. Internal temperature sensor located in the glass stem for a quick temperature response.
5. DryLoc® connector with corrosion resistant gold plated pins for quick and easy sensor removal. Resists moisture and dirt intrusion.
6. Dual-patented reference design with a 406 mm (16 in.) reference pathway for prolonged life in harsh environments. This enables the sensor to last significantly longer than other standard pH/ORP electrodes in most applications.

6a. With the patented reference design, the 2726-LC version performs better in low conductivity water between 20 - 100 µS and lasts longer than previous “DI” electrodes.

6b. The 2726-LC sensor also performs in applications with extremely low (less than 20 µS) conductivity. Special precautions must be taken to avoid measurement complications.
Please note the following.
- Electrostatic charges (streaming potentials) can cause dramatic offsets in a system with very low conductivity water. To minimize this, sensors should be placed in a well grounded system.
- To enhance performance, a low flow cell is recommended to provide a steady flow rate (150 ml/minute). Sensors placed in high flow applications will experience noisier readings due to streaming potential.

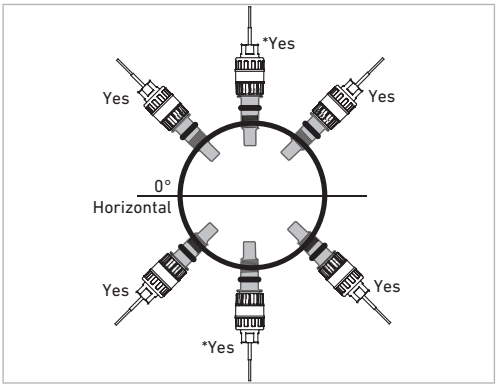
7. Threads for NPT or ISO process connection into reducing tees.
- Use off-the-shelf reducing tees DN20 to DN100 (¾ to 4 in.). Sensor tip must be in flow.

8. Mounts directly into GF installation fittings (½ to 4 in.).
9. Mount submersed into a tank via the 2751-3(-4), ¾“ F-NPT back threads.

Application Tips

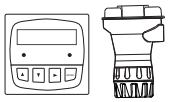
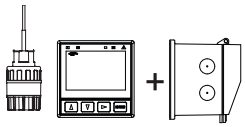
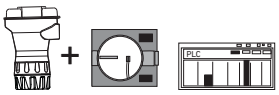
- Use the flat glass electrodes when a self-cleaning feature is desired; especially useful in applications with abrasive chemicals for in-line installations.
- Use bulb protected electrodes for low temperature applications or where fast response is required.
- ORP electrodes are generally used for chemical reaction monitoring, not control.
- Ensure that sensor materials are chemically compatible with the process liquid.
- Keep electrode tip wet, avoid air pockets and sediment.

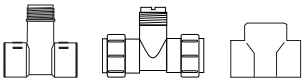
Mounting Angle



Types 2724-2726 may be mounted at any angle without affecting the performance.
*Avoid locations with air pockets and sediment.

System Overview

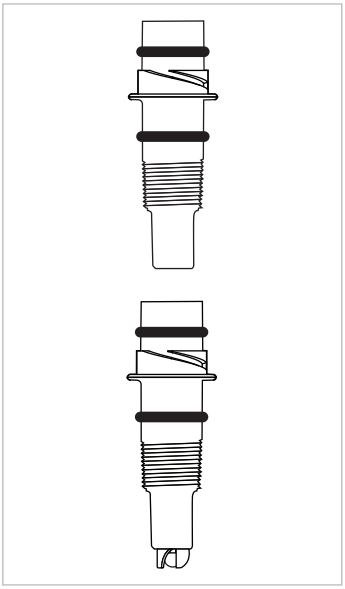
Panel Mount	Pipe, Tank, Wall	4 to 20 mA Output	Automation System
GF Instruments with 2751 Smart Sensor Electronics - 9900 - 9950	GF Instruments with 2751 Smart Sensor Electronics - 9900 and Rear Enclosure	2751 Smart Sensor Electronics with - Customer Supplied Chart Recorder or Programmable Logic Controller or - Programmable Automation Controller	2751 Smart Sensor Electronics with - 0486 Profibus Concentrator and Customer Supplied Programmable Logic Controller or - Programmable Automation Controller
			
Type 2724-2726 DryLoc® pH/ORP Electrodes			All sold separately

In-Line Installation -	Submersible Installation -
GF and threaded ½ in to 4 in fittings only Reducing tees ¾"–4". Sensor tip must be in flow.	Customer supplied pipe extension or conduit with ¾ in. NPT or ISO 7/1-R ¾ threads
	

Ordering Information

Type 2724-2726 Ordering Notes

Mfr. Part No.	Code	Tip Design	Process Connection Thread Options
pH Electrodes			
Temperature element Pt1000; use with 2751 pH/ORP Smart Sensor Electronics*			
3-2724-00	159 001 545	Flat	¾ in. MNPT, Thread
3-2724-01	159 001 546	Flat	ISO 7/1-R 3/4 Thread
3-2724-HF-01	159 000 154	Flat, HF Resistant[1]	¾ in. MNPT, Thread
3-2724-HF-00	159 000 155	Flat, HF Resistant[1]	ISO 7/1-R 3/4 Thread
3-2726-00	159 001 553	Bulb	¾ in. MNPT, Thread
3-2726-01	159 001 554	Bulb	ISO 7/1-R 3/4 Thread
3-2726-HF-00	159 001 549	Bulb, HF Resistant[1]	¾ in. MNPT, Thread
3-2726-HF-01	159 001 550	Bulb, HF Resistant[1]	ISO 7/1-R 3/4 Thread
3-2726-LC-00	159 001 557	Bulb, Low Conductivity[2]	¾ in. MNPT, Thread
3-2726-LC-01	159 001 558	Bulb, Low Conductivity[2]	ISO 7/1-R 3/4 Thread
ORP Electrodes; Compatible with the 2751 pH/ORP Smart Sensor Electronics*			
3-2725-60	159 001 561	Flat	¾ in. MNPT, Thread
3-2725-61	159 001 562	Flat	ISO 7/1-R 3/4 Thread



* The 2751 pH/ORP Smart Sensor Electronics has a digital (S^3L) output which is used with 9900 or 9950 instruments, and the Profibus Concentrator. It also has a 4 to 20 mA output for connections to PLC's, data recorders, etc.

[1] HF resistant ≤2%HF

[2] Low conductivity applications, 20 - 100 µS/cm recommended

Buffer Solutions

The GF pH buffers are ideal for calibration. The liquid solutions are conveniently packaged in one pint (473 ml) bottles. pH buffer kits in powder pillows are available for mixing fresh solutions with water at the time of use.
All pH buffes are color coded for easy identifiation; 4.01 pH is red, 7.00 pH is yellow, and 10.00 pH is blue.
All pH buffers are traceable to NIST standards. The 4.01 and 7.00 buffer solutions can be used to calibrate ORP sensors when saturated with quinhydrone.

Mfr. Part	Code	Description
3822-7004	159 001 581	Buffer solution pH 4.01, 1 pint (473 ml) bottle
3822-7007	159 001 582	Buffer solution pH 7.00, 1 pint (473 ml) bottle
3822-7010	159 001 583	Buffer solution pH 10.00, 1 pint (473 ml) bottle
3822-7115	159 001 606	Quinhydrone 20 gm bottle for ORP calibration (must use pH 4.01 and/or pH 7.00 buffer solutions)





Accessories and Replacement Parts

Mfr. Part No.	Code	Description
1220-0021	198 801 000	O-ring, FKM (2 required per sensor)
3-2700.395	159 001 605	Calibration kit: includes 3 polypropylene cups, box used as cup stand, 1 pint pH 4.01, 1 pint pH 7.00
3822-7115	159 001 606	20 gm bottle quinhydrone for ORP calibration (must use pH 4.01 and/or pH 7.00 buffer solutions)
3-2759	159 000 762	pH/ORP System Tester (adapter cable sold separately)
3-2759.391	159 000 764	2759 DryLoc adapter cable (for use with 2751)
3-0700.390	198 864 403	pH Buffer Kit (1 each 4, 7, 10 pH buffer in powder form, makes 50 ml of each)
3822-7004	159 001 581	pH 4.01 buffer solution, 1 pint (473 ml) bottle
3822-7007	159 001 582	pH 7.00 buffer solution, 1 pint (473 ml) bottle
3822-7010	159 001 583	pH 10.00 buffer solution, 1 pint (473 ml) bottle
3800-5000	159 838 107	3.0M KCl storage solution for pH and ORP, 1 pint (473 ml) bottle
3-2700.397	159 001 870	Protective cap for pH/ORP electrodes, 5 pieces
3-2700.398	159 001 886	O-ring lubricant Kit (5 packs of Super Lube®, 1cc each)

Type 2734-2736 pH/ORP Electrodes

Industrial



Product description

The GF 2734-2736 pH and ORP electrodes are ideal for a wide range of harsh applications with low concentrations of poisoning ions, and chemicals that react with silver ion, Ag+. The superior glass formulation provides excellent chemical resistance in acidic and alkaline/caustic environments. The large area PTFE reference junction, salt bridge and reference electrode are constructed to increase the total reference effectiveness, resist chemical attack, help resist coating, and ensure long service life in harsh applications.
The DryLoc® connector with corrosion resistant gold plated contacts readily connects the sensor to the mating 2751 pH/ORP Smart Sensor Electronics. The robust PPS threaded sensor body and choice of flat, bulb pH, or flat ORP sensing elements provide a broad range of chemical compatibility for a wide variety of applications.
There is an optional pH sensing version available for applications with HF. The HF version is for applications where traces of hydrofluoric acid (2% or less) will attack standard pH glass.
The quick temperature response is available in a Pt1000 temperature sensor and allows compatibility with the GF 9900 and 9950 instruments.
The sensors incorporate o-ring seal for use with ½" to 4" GF Installation fittings. They can also be mounted directly into reducing tees, DN20 to DN100 (¾ to 4 inch).
Sensor tip must be in flow path.

Features

- Enhanced reference formulation to resist chemical poisoning and prolong the life of the electrodes in harsh environments
- PTFE reference junction resists fouling and chemical attack
- Superior pH glass (bulb style) formulation for excellent chemical resistance in acidic and alkaline/caustic environments
- PPS body for broad range of chemical compatibility
- Memory chip enabled for access to a range of unique features when connected to the GF 2751 pH/ORP Smart Sensor Electronics
- Patented reference design for exceptional performance*
- Patented DryLoc® connector with gold plated contacts
- Mounts in GF standard installation fittings from DN15 to DN100 (½ to 4 in.)
- NPT or ISO 7/1-R 3/4 threaded sensors for use with reducing tees DN 20 to DN100 (¾ to 4 in.)
- Special design allows for installation at any angle, even inverted or horizontal
- Quick temperature response
- Bulb and flat HF resistant glass available for trace HF, in less than 2% concentration applications

* U.S. Patent Nos.: 6,666,701, 7,799,193 B2, 7,867,371 B2 and 8,211,282 B2

Applications

- Water & Wastewater Treatment
- Neutralization Systems
- Plating Baths
- Air Scrubbers
- Metal Removal
- Process Control
- Cooling Towers

Technical Data

General

General			
Performance	Efficiency	>95% @ 25 °C (77 ° F)	
Operating Range	pH	0 to 14 pH	
	ORP	±2'000 mV	
	3-2734-HF, 3-2736-HF	Hydrofluoric acid resistant glass, pH 6 or below; trace HF ≤2%	
Compatibility	2751 pH/ORP Smart Sensor Electronics (for 9900, 9950, Profibus Concentrator, 4 to 20 mA)		
Temperature Sensor	Pt1000	Compatible with type 2751 pH/ORP Smart Sensor Electronics for connection to a PLC or to the type 9900 or 9950 instruments and 0486 Profibus Concentrator	
Process Connection	¾ in. NPT	ISO 7/1-R ¾	Mounts into GF fittings

Wetted Materials	
pH	PPS, glass, PTFE, FKM
ORP	PPS, glass, PTFE, FKM, Platinum

Max. Temperature/Pressure Rating		
Operating Temperature Range	10 °C to 100 °C	50 °F to 212 °F
Operating Pressure Range	0 to 6.9 bar (0 to 100 psi) @ 10 °C to 65 °C (50 °F to 149 °F)	
	Linearity Derated 6.9 to 4.0 bar (100 to 58 psi) @ 65 °C to 100 °C (149 °F to 212 °F)	

Recommended Storage Temperature		
	0 °C to 50 °C	32 °F to 122 °F

The electrode glass will shatter if shipped or stored at temperature below 0 °C (32 °F)

The performance life of the electrode will shorten if stored at temperatures above 50 °C (122 °F).

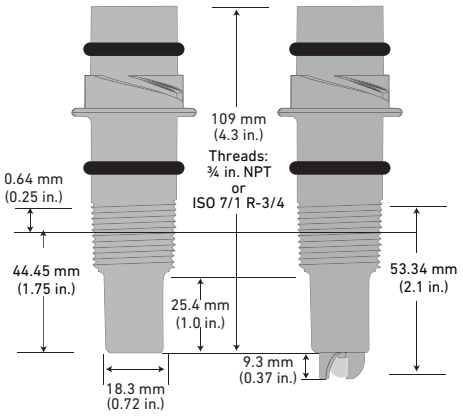
Mounting	
In-line/Vertical Mounting	Use the sensor threads
	Use a GF standard fitting ½ to 4 in.
	Sensor can be mounted at any angle
Submersible Mounting	Use threads on type 2751
	Requires ¾ in. NPT or ISO 7/1-R ¾ male threaded liquid tight extension conduit.

Shipping Weight	
0.25 kg	0.55 lb

Standards & Approvals
CE, UKCA, FCC, RoHS compliant, China RoHS
Manufactured under ISO 9001, ISO 14001 and ISO 45001

See pressure-temperature diagrams for more information.

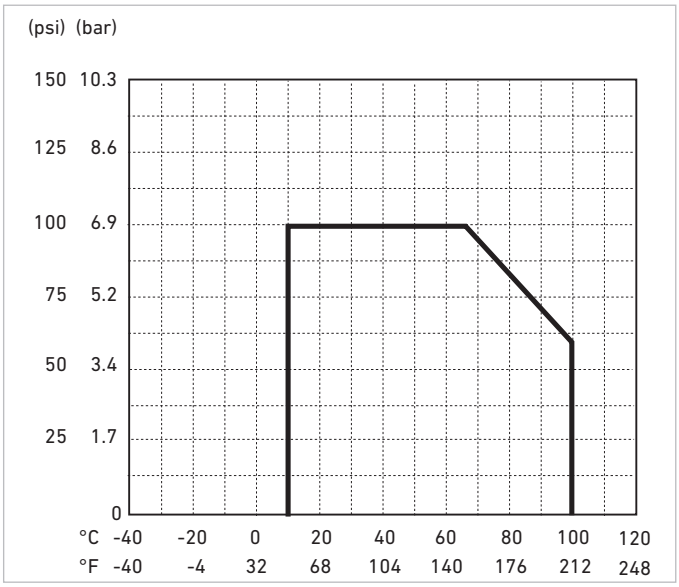
Dimensions



Pressure-temperature diagram

Note

The pressure-temperature diagram is specifically for the GF sensor. During system design the specifications of all components must be considered. In the case of a metal piping system, a plastic sensor will reduce the system design the specifications of all components must be considered. In the case of a metal piping system, a plastic sensor will reduce the system specification.



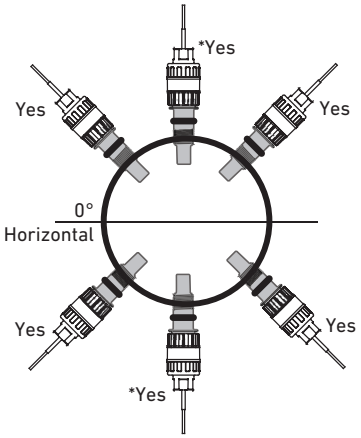
Application Tips

- Use the flat glass electrodes when a self-cleaning feature is desired; especially useful in applications with abrasive chemicals, in-line installations.
- Use the 2736-0X bulb protected electrodes in high pH alkaline/caustic applications (10 to 14 pH) or in applications of low pH range (0 to 3 pH).
- ORP electrodes are generally used for chemical reaction monitoring, not control.
- Ensure that sensor materials are chemically compatible with the process liquid.
- Keep electrode tip wet, avoid air pockets and sediment.

Mounting angle using GF Fittings

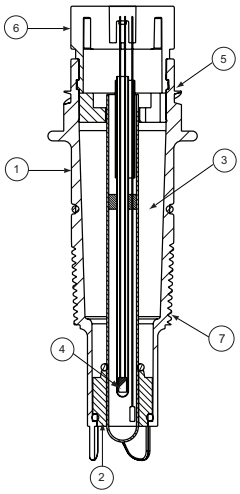
Types 2734-2736 may be mounted at any angle without affecting the performance

Avoid locations with air pockets and sediment

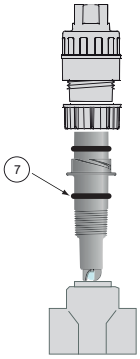


Electrode Key Features and Benefits:

1. PPS body for chemical compatibility with most harsh chemicals.
2. Porous PTFE junction resists fouling, chemicals, and build-up.
3. Enhanced reference chemistry to resist poisoning and to prolong the life of the electrodes in harsh media applications.
4. Internal temperature sensor located in the glass stem for a quick temperature response.
5. Memory chip enabled for convenient data storage and access (calibration data, operational data, and manufacturing data), electrode health monitoring via glass impedance measurement when used in connection with the 2751 pH/ORP Smart Sensor Electronics.
6. DryLoc® connector with corrosion resistant gold plated pins for quick and easy sensor removal. Resists moisture and dirt intrusion.
7. Threads for NPT or ISO process connection into reducing tees. Use off-the-shelf GF reducing tees DN20 to DN100 (¾ to 4 in.). Sensor tip must be in flow.
8. Mounts directly into GF fittings (½ in. to 4 in.).
9. Mount submersed into a tank via the 2751 pH/ORP Smart Sensor Electronics.



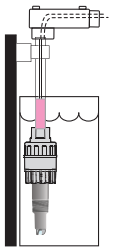
Dual-patented reference design for long life.



(7) Sensor in threaded reducing tee

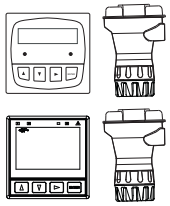
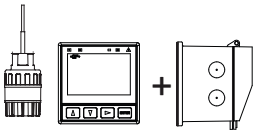
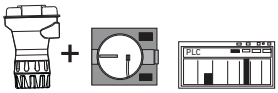
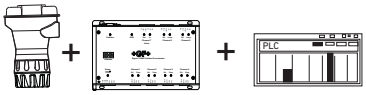


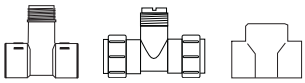
(8) Sensor in GF fitting



(9) Sensor in submersible installation

System Overview

Panel Mount	Pipe, Tank, Wall	4 to 20 mA Output	Automation System
GF Instruments with 2751 Smart Sensor Electronics - 9900 - 9950	GF Instruments with 2751 Smart Sensor Electronics - 9900 and Rear Enclosure	2751 Smart Sensor Electronics with - Customer Supplied Chart Recorder Programmable Logic Controller, or - Programmable Automation Controller	2751 Smart Sensor Electronics with - 0486 Profibus Concentrator and Customer Supplied Programmable Logic Controller or - Programmable Automation Controller
			
Type 2734-2736 DryLoc® pH/ORP Electrodes			All sold separately

In-Line Installation - GF and threaded ½ in to 4 in fittings only Reducing tees ¾"–4". Sensor tip must be in flow.	Submersible Installation - Customer supplied pipe extension or conduit with ¾ in. NPT or ISO 7/1-R ¾ threads
	

Ordering Information

Mfr. Part No.	Code	Tip Design	Temperature Element
pH Electrodes - Temperature element Pt1000; use with 2751 pH/ORP Smart Sensor Electronics*			
3-2734-00	159 001 774	Flat	3/4 in. NPT, Thread
3-2734-01	159 001 775	Flat	ISO 7/1-R 3/4 Thread
3-2734-HF-00	159 001 776	Flat, HF Resistant[1]	3/4 in. NPT, Thread
3-2734-HF-01	159 001 777	Flat, HF Resistant[1]	ISO 7/1-R 3/4 Thread
3-2736-00	159 001 778	Bulb	3/4 in. NPT, Thread
3-2736-01	159 001 779	Bulb	ISO 7/1-R 3/4 Thread
3-2736-HF-00	159 001 780	Bulb, HF resistant[1]	3/4 in. NPT, Thread
3-2736-HF-01	159 001 781	Bulb, HF resistant[1]	ISO 7/1-R 3/4 Thread
ORP Electrodes - Compatible with 2751 pH/ORP Smart Sensor Electronics			
3-2735-60	159 001 782	Platinum, Flat, 10 KΩ ID, ¾ in. NPT	3/4 in. NPT, Thread
3-2735-61	159 001 783	Platinum, Flat, 10 KΩ ID, ISO 7/1 R¾	ISO 7/1-R 3/4 Thread





* The 2751 Sensor Electronics has a digital (S^3L) output which is used with 9900 or 9950 instruments, and 0486 Profibus Concentator.
It also has a 4 to 20 mA output for connections to PLCs, data recorders, etc.

[1] HF resistant ‹2% HF

! The 2734 and 2736 pH electrodes are not compatible with the type 2760 Preamplifier.

Buffer Solutions

Buffer Solution	Quinhydrone
3822-7004 3822-7007 3822-7010	3822-7115





The GF pH buffers are ideal for calibration. The liquid solutions are conveniently packaged in one pint (473 ml) bottles. pH buffer kits in powder pillows are available for mixing fresh solutions with water at the time of use.
All pH buffes are color coded for easy identifiation; 4.01 pH is red, 7.00 pH is yellow, and 10.00 pH is blue.
All pH buffers are traceable to NIST standards. The 4.01 and 7.00 buffer solutions can be used to calibrate ORP sensors when saturated with quinhydrone

Accessories and Replacement Parts

Mfr. Part	Code	Description
1220-0021	198 801 000	O-ring, FKM (2 required per sensor)
3-2700.395	159 001 605	Calibration kit: includes 3 polypropylene cups, box used as cup stand, 1 pint pH 4.01, 1 pint pH 7.00
3822-7115	159 001 606	20 gm bottle quinhydrone for ORP calibration (must use pH 4.01 and/or pH 7.00 buffer solutions)
3-2759	159 000 762	pH/ORP System Tester (adapter cable sold separately)
3-2759.391	159 000 764	2759 DryLoc adapter cable (for use with 2751)
3-0700.390	198 864 403	pH Buffer Kit (1 each 4, 7, 10 pH buffer in powder form, makes 50 ml of each)
3822-7004	159 001 581	pH 4.01 buffer solution, 1 pint (473 ml) bottle
3822-7007	159 001 582	pH 7.00 buffer solution, 1 pint (473 ml) bottle
3822-7010	159 001 583	pH 10.00 buffer solution, 1 pint (473 ml) bottle
3800-5000	159 838 107	3.0M KCl storage solution for pH and ORP, 1 pint (473 ml) bottle
3-2700.397	159 001 870	Protective cap for pH/ORP electrodes, 5 pieces
3-2700.398	159 001 886	O-ring lubricant Kit (5 packs of Super Lube®, 1cc each)

Type 2744-2747 Differential DryLoc® pH/ORP Electrodes

High Performance



Protected Bulb **Flat Glass**

Product description

The GF 2744-2747 Differential pH and ORP electrodes are high performance sensors built with the DryLoc® connector, a PPS body, and PTFE reference junction to handle the most extreme and harshest of chemical applications.
These differential electrodes use a field-proven 3-electrode differential technique: the pH and reference electrodes are measured against a ground electrode, ensuring a steady and stable signal.
A key feature is the reference electrode, which is housed in a glass half-cell embedded in the reference chamber and is protected from compounds that may contain sulfides (S2-) and metals. To ensure long service life, the reference features a refillable electrolyte chamber and a replaceable equitransferant salt bridge, both easily serviced in the field. The patented porous PTFE reference junction resists fouling, clogging and chemical attack.
Other elements of the design are the solution ground, the pH/ORP electrodes, and the temperature element.
The solution ground eliminates noisy measurements by draining electrical current away from the reference electrode. The pH/ORP electrodes are designed with a flat or bulb surface, and a temperature device positioned at the tip of the measurement surface for a quick temperature response.
The electrodes are used with the GF 2751 Smart Sensor Electronics, which provide a blind 4 to 20 mA output or use the digital (S³L) output to connect the GF 9900 or 9950 instruments, and the 0486 Profibus Concentrator.

Features

- Differential design for stable measurements in the most aggressive applications
- Long service life even in severe or difficult chemical applications
- Memory chip enabled for access to a wide range of unique features when connected to the type 2751 pH/ORP Smart Sensor Electronics
- High performance glass that can withstand high pH caustic media as well as elevated temperature applications
- PPS body for broad range of chemical compatibility
- Watertight DryLoc® connector with foul-proof gold plated contacts*
- Porous PTFE reference junction resists fouling and chemical attack
- Rebuildable reference electrode
- Solution ground
- Temperature sensor (pH)
- Easy sensor replacement using DryLoc electrode connector
- Quick temperature response
- Compatible with all GF instruments

*U.S. Patent No.: 6.666.701

Applications

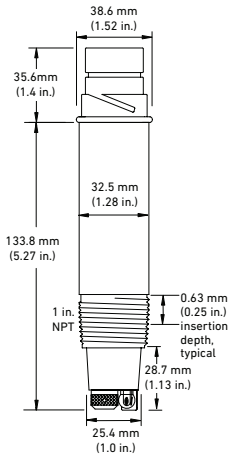
- Cyanide Destruction
- Chrome Reduction
- Landfill Leachate
- Ground Water Remediation
- Plating Baths
- High Temp

! See Technical Reference section for assistance in choosing the correct sensor.

Specifications

General		
Compatibility	Type 2751	
Operating Range	2744/2746	0 to 14 pH
	2745/2747	±1500 mV (ORP)
Process Connection	1 in., MNPT. For use in reducing tees. Up to 1.5“ insertion depth	
Wetted Materials		
Body	PPS	
Reference Junctions	PTFE	
Sensing Surface	pH	Glass membrane
	ORP	Platinum
O-rings	EPDM	
Solution Ground	Carbon graphite	
Max. Temperature/Pressure Rating		
Operating Temperature	-10 °C to 100 °C	14 °F to 212 °F
Operating Pressure Range	0 to 6.9 bar (0 to 100 psi) @ 10 °C to 65 °C (50 °F to 149 °F)	
	Linearity Derated 6.9 to 4.0 bar (100 to 58 psi) @ 65 °C to 100 °C (149 °F to 212 °F)	
Recommended Storage Temp.		
	0 °C to 50 °C	32 °F to 122 °F
The electrode glass will shatter if shipped or stored at temperature below 0 °C (32 °F).		
The performance life of the electrode will shorten if stored at temperatures above 50 °C (122 °F).		
Mounting		
In-line/Vertical Mounting	Use sensor 1 in. threads. Sensor must be mounted at least 15 degrees above the horizontal axis.	
Submersible Mounting	Use threads on type 2751-3/-4; requires ¾ in. NPT or ISO 7/1-R 3/4 in. male threaded extension.	
Reference		
	Electrolyte	Buffered KNO_3 liquid
	Element	pH half-cell
Temperature Sensor	pH	PT1000 RTD
	ORP	10K ID Resistor
Shipping Weight		
	0.25 kg	0.55 lb
Standards & Approvals		
	Manufactured under ISO 9001, ISO 14001 and ISO 45001	

Dimensions

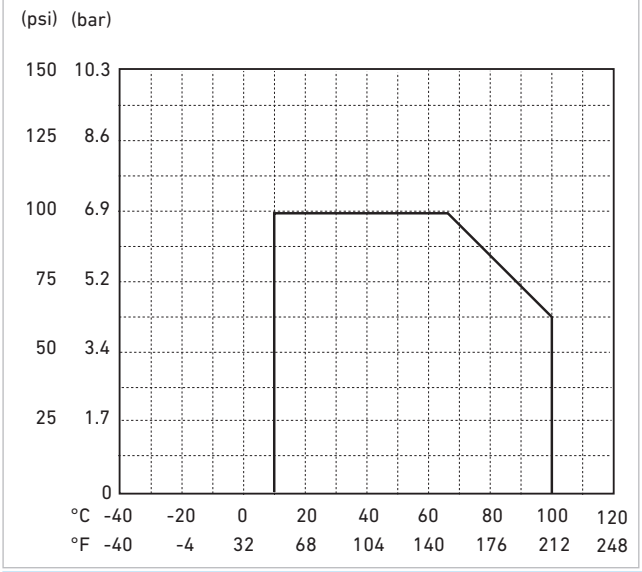


Flat and Bulb versions
have the same dimensions

Pressure-temperature diagram

Note

The pressure-temperature diagram are specifically for the GF sensor. During system design the specifications of all components must be considered. In the case of a metal piping system, a plastic sensor will reduce the system specification.

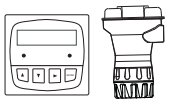
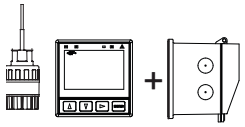
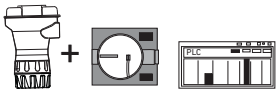
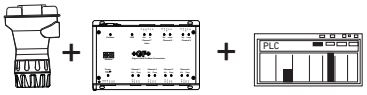


Ion	Ion name	Ion	Ion name	Compound	Compound name
Br^-	Bromide	Hg^{2+}	Mercury	KCL	Potassioum chloride
Cu^+	Copper iron	$CL0_4$	Perchlorate	Ag_2S	Silver sulfide
CN^-	Cyanide	AG^+	Silver	AgBr	Silver bromide
I^-	Iodide	S^{2-}	Sulfide	AgI	Silver jodide
PB^{++}	Lead			AgCN	Silver cyanide

Application Tips

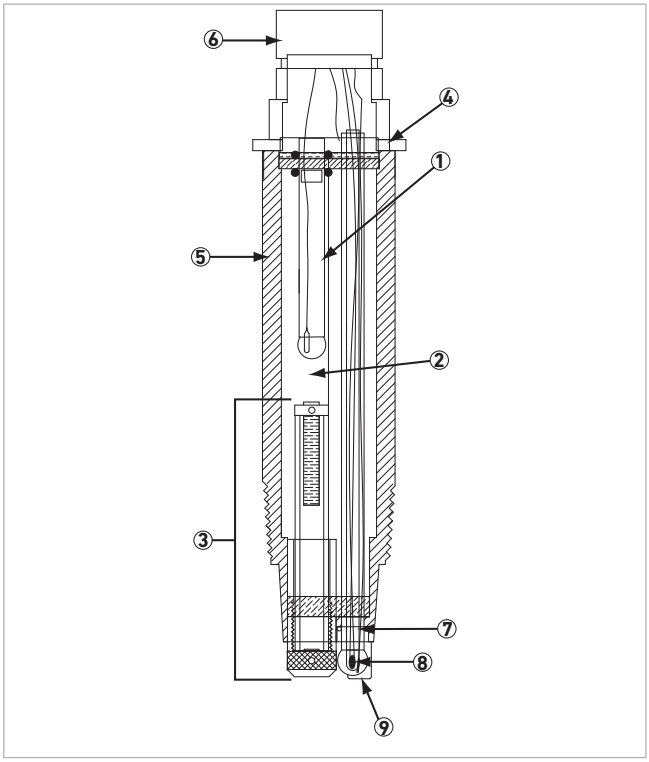
- Use the flat glass electrodes when a self-cleaning feature is desired; especially useful in applications with abrasive chemicals for in-line installations.
- Use bulb protected electrodes for low temperature applications where a fast response is required.
- Ensure sensor materials are chemically compatible with the process liquid.
- Keep electrode tip wet, avoid air pockets and sediment.

System Overview

Panel Mount	Pipe, Tank, Wall	4 to 20 mA Output	Automation System
GF Instruments with 2751 Smart Sensor Electronics - 9900 - 9950	GF Instruments with 2751 Smart Sensor Electronics - 9900 and Rear Enclosure	2751 Smart Sensor Electronics with - Customer Supplied Chart Recorder Programmable Logic Controller, or - Programmable Automation Controller	2751 Smart Sensor Electronics with - 0486 Profibus Concentrator and Customer Supplied Programmable Logic Controller or - Programmable Automation Controller
			
Type 2744-2747 DryLoc® pH/ORP Electrodes			All sold separately
In-Line Installation - Reducing tees with 1" FNPT branch		Submersible Installation - Customer supplied pipe extension or conduit with 3/4 in. NPT or ISO 7/1-R 3/4 threads*	

Electrode Key Features and Benefits

1. Glass encased reference electrode protects the Ag/AgCl (silver/silver chloride) element from reacting with certain chemical compounds that typically leach into the reference chambers. Keeps the pH/ORP reading stable.
2. Large volume reference electrolyte chamber resists dilution over time for a long service life. Chamber is refillable. Holds approximately 30 ml of electrolyte.
3. Salt Bridge serves as a double reference junction and is the first line of defense to keep out process chemicals from the reference electrolyte chamber. It is built with a double porous PTFE reference junction which is highly compatible to chemicals, resists fouling and build-up of dirt.
4. Memory chip enabled for convenient data storage and access (calibration data, operational data, and manufacturing data), electrode health monitoring via glass impedance measurement when used in connection with the 2751 pH/ORP Smart Sensor Electronics.
5. PPS body for chemical compatibility to most harsh chemicals. Also able to withstand high temperatures.
6. DryLoc connector with corrosion resistant gold plated pins for quick and easy sensor removal.
7. Capillary TC (temperature sensor) embedded in tip of pH/ORP electrode for quick temperature response.
8. Measuring pH/ORP electrode.
9. Solution Ground electrode eliminates noisy measurements by draining electrical current away from the reference electrode.



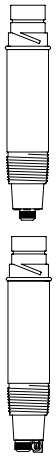
A Differential Electrode solves many common problems typically experienced by standard pH/ORP electrodes at troublesome measuring points. See the table below to find the common problem, cause and effect, and the Differential pH/ORP Electrode solution.

If the general purpose or industrial pH/ORP sensor experiences the following:	The cause and effect of the problem may be:	Use a 274X Differential Electrode to solve the problem because:
• Reading slowly drifts over time • Sensor responds slowly	Chemical attack from Hg^{2+}, Cu^{+}, Pb^{2+}, ClO_4^- or other compounds which react with or dilute the KCl reference electrolyte.	Salt bridge will slow or stop attack. If attacking ions penetrate the salt bridge and affect the reference, simply refill reference solution.
	Reference junction gets clogged from oils, grease, or dirt from the process.	Readings do not drift due to stable differential reference design, however may require cleaning or replacement of the salt bridge if electrode gets too dirty.
• Reading slowly drifts over time • Sensor reading becomes erratic	Chemical attack of the Ag^+ reference billet from Br^-, I^-, CN^-, and S_2^- compounds	Will not affect electrode due to Ag^+ element protected in glass encased reference electrode.
	Clogged reference and slowed reading from silver compounds forming on the inside of the reference electrode from Ag+ of reference element reacting and precipitating Ag_2S, AgBr, AgI, AgCN, or other silver compounds.	Will not affect electrode due to Ag^+ element protected in glass encased reference electrode.
• Reading suddenly jumps to a new value • Reading unexpectedly changes	Stray electrical currents in the process liquid; Ag^+ reference element picks up current and shifts reference reading, resulting in shifted pH reading. The Ag^+ element will eventually become totally stripped. Process must be properly grounded or place metal rod close to electrode.	Will not affect electrode due to Ag^+ element protected in glass encased reference electrode; also, electrode has a built in solution ground, so if there is a stray current, it will not be seen by the electrode.

Ordering Information

Mfr. Part No.	Code	Tip Design	Temperature Element
pH Differential Electrode			
3-2744-2	159 001 910	Flat	Pt1000[1]
3-2746-2	159 001 912	Bulb with protection	Pt1000 RTD[1]
ORP Differential Electrode			
3-2745-1	159 001 913	Flat	10 KΩ Balco[1]
3-2747-1	159 001 914	Bulb with protection	10 KΩ Balco[1]

For use with the Multi-Parameter instruments, and Profibus Concentrator when used with the 2751 Smart Sensor Electronics. The 2751 Smart Sensor Electronics has a digital (S^3L) output which is used with the Multi-Parameter instruments. It also has a 4 to 20 mA output for connections to PLCs, data recorders, etc.



Buffer Solutions

The GF pH buffers are ideal for calibration. The liquid solutions are conveniently packaged in one pint (473 ml) bottles. pH buffer kits in powder pillows are available for mixing fresh solutions with water at the time of use.
All pH buffes are color coded for easy identifiation; 4.01 pH is red, 7.00 pH is yellow, and 10.00 pH is blue.
All pH buffers are traceable to NIST standards. The 4.01 and 7.00 buffer solutions can be used to calibrate ORP sensors when saturated with quinhydrone.

Mfr. Part	Code	Description
3822-7004	159 001 581	Buffer solution pH 4.01, 1 pint (473 ml) bottle
3822-7007	159 001 582	Buffer solution pH 7.00, 1 pint (473 ml) bottle
3822-7010	159 001 583	Buffer solution pH 10.00, 1 pint (473 ml) bottle
3822-7115	159 001 606	Quinhydrone 20 gm bottle for ORP calibration (must use pH 4.01 and/or pH 7.00 buffer solutions)



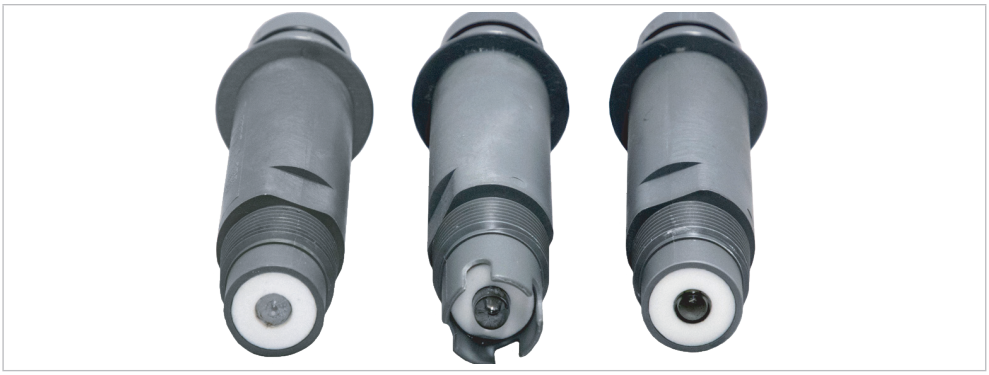


Accessories and Replacement Parts

Mfr. Part	Code	Description
3-2700.395	159 001 605	Calibration kit: includes 3 polypropylene cups, box used as cup stand, 1 pint pH 4.01, 1 pint pH 7.00
3822-7115	159 001 606	20 gm bottle quinhydrone for ORP calibration (must use pH 4.01 and/or pH 7.00 buffer solutions)
3800-4340	159 001 948	Replacement salt bridge in black
3864-0001	159 001 007	Replacement salt bridge in gray
3864-0002	159 001 008	Replacement reference electrolyte solution, 500 mls
2120-0015	159 001 009	PVC-C adapter: 1.5 in. MNPT to 1 in. FNPT
2122-0015	159 001 010	PVDF adapter: 1.5 in. MNPT to 1 in. FNPT
3-0700.390	198 864 403	pH Buffer Kit (1 each 4, 7, 10 pH buffer in powder form, makes 50 ml of each)
3822-7004	159 001 581	pH 4.01 buffer solution, 1 pint (473 ml) bottle
3822-7007	159 001 582	pH 7.00 buffer solution, 1 pint (473 ml) bottle
3822-7010	159 001 583	pH 10.00 buffer solution, 1 pint (473 ml) bottle
3-2759	159 000 762	pH/ORP System Tester (adapter cable sold separately)
3-2759.391	159 000 764	Adapter cable (for use with 2751 and 2760)
3800-5000	159 838 107	3.0M KCl storage solution for pH and ORP, 1 pint (473 ml) bottle
3-2700.398	159 001 886	O-ring lubricant kit (5 packs of Super Lube®, 1cc each)

Type 2774-2777 DryLoc pH/ORP Electrodes

General Purpose / Industrial



Product description

The type 2774-2777 pH and ORP electrodes are high performance sensors ideal for a wide range of applications. The unique foul-proof DryLoc® connector with gold-plated contacts is designed specifically for use with the type 2751 pH/ORP Smart Sensor Electronics. These dependable and highly responsive electrodes feature a PTFE double reference junction with potassium nitrate (KNO3) in the front chamber to block various poisoning ions such as Copper (CU2+), Lead (Pb2+), Mercury (Hg2+), and a large reference chamber that combine to extend the service-life.
The positioning of the temperature element embedded in the pH sensing tip allows the temperature response to be quick and accurate. The electrodes are offered with either flat or bulb style sensing elements. The flat versions allow sediment and particles to sweep past the measurement surface, minimizing risks of abrasion, breakage and coating. The bulb versions can be used for low temperature applications or where fast response is required. Due to the specially designed chambers which keep electrolyte in place, all sensor models can be installed at any angle, even inverted.
The quick temperature response is available in either a Pt1000 or 3KΩ temperature sensor and allows compatibility with all GF pH/ORP instruments.

Features

- Double reference PTFE junction to block various poisoning ions and resist fouling and dirt buildup
- PPS body for broad range of chemical compatibility
- Memory chip enabled for access to a wide range of unique features when connected to the GF 2751 pH/ORP Smart Sensor Electronics
- Patented DryLoc® connector with gold plated contacts*
- Special design allows for installation at any angle, even inverted or horizontal
- Temperature sensor (pH)
- Quick temperature response
- Easy sensor replacement using DryLoc electrode connector
- High temperature versions available
- Mounts into standard ¾ inch threads
- Compatible with all GF instruments

* U.S. Patent No.: 6,666,701

Applications

- Water Treatment & Water Quality Monitoring
- Cooling Tower and Boiler Protection
- Aquatic Animal Life Support System
- Pool and Spa Control
- Neutralization Systems
- Process Control

Specifications

General			
Compatibility	Types 2751		
Operating Range	2774/2776	0 to 14 pH	
	2775/2777	±1'500 mV (ORP)	
Process Connection	¾" MNPT. For use in reducing tees. Up to 1" insertion depth.		
Reference	Electrolyte	KNO_3/KCl polyacrylamide gel	
	Element	Ag/AgCl	

Wetted Materials			
	Body	PPS	
	Reference junctions	PTFE	
	Sensing surface	pH	Glass membrane
		ORP	Platinum
	O-rings	FKM	

Max. Temperature/Pressure Rating		
Operating Temperature	0 °C to 85 °C	32 °F to 285 °F
Max. Operating Pressure	6.9 bar	100 psi

Higher temperature and pressure sensors are available upon request

Recommended Storage Temperature		
	0 °C to 50 °C	32 °F to 122 °F

The electrode glass will shatter if shipped or stored at temperature below 0 °C (32 °F)

The performance life of the electrode will shorten if stored at temperatures above 50 °C (122 °F)

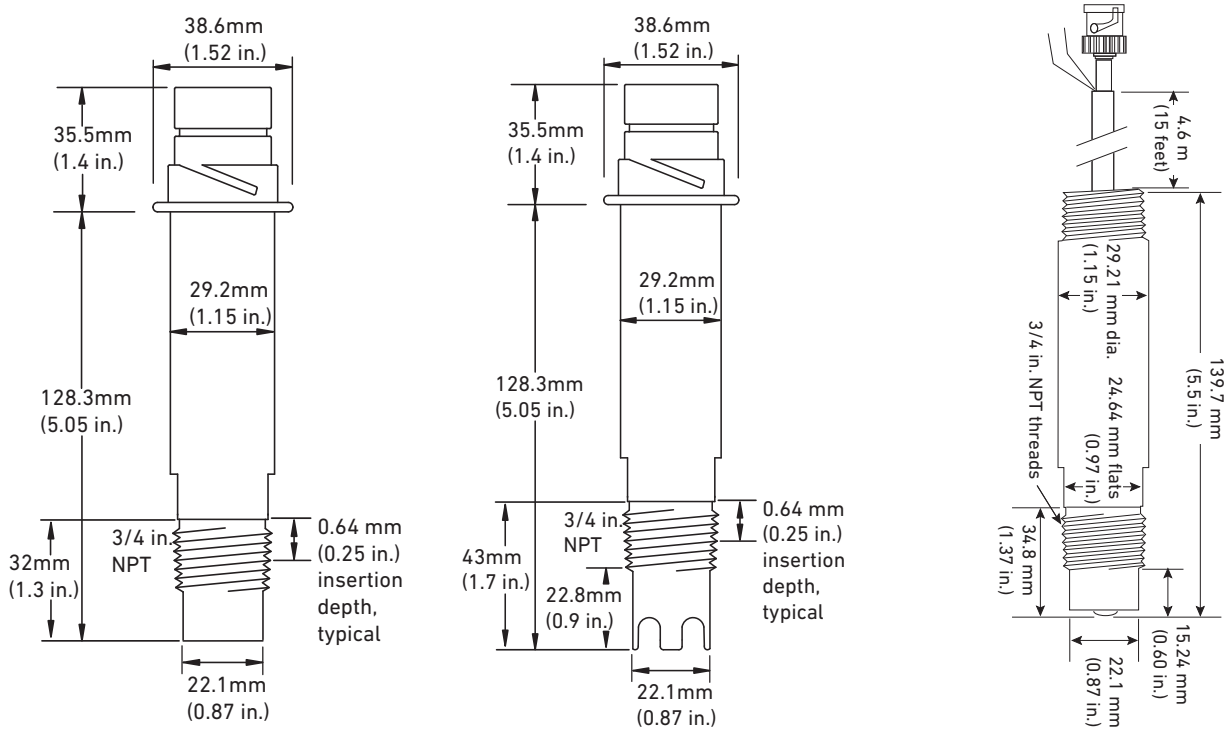
Mounting		
In-line/Vertical Mounting	Use the electrodes ¾ inch threads to install into pipe fitting. Electrode can be mounted at any angle.	
Submersible Mounting	Use threads on type 2751 or 2760; requires ¾ inch NPT or ISO 7/1-R 3/4 male threaded extension.	
Temperature Sensor	pH	PT1000 RTD
	ORP	none

Shipping Weight		
	0.25 kg	0.55 lb

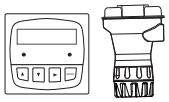
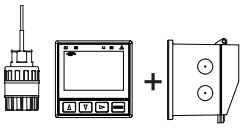
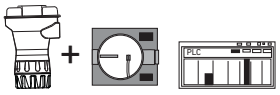
Standards and Approvals	
	Manufactured under ISO 9001, ISO 14001 and ISO 45001

Dimensions

Flat Electrode	Bulb Electrode	Submersible Installation



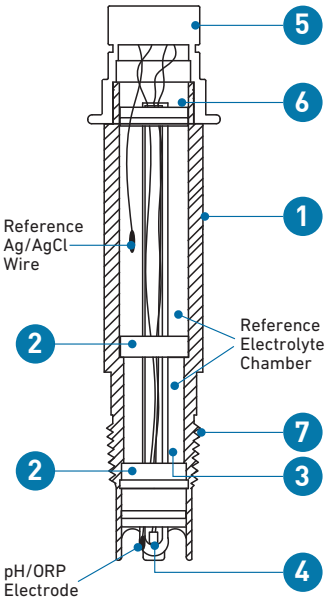
System Overview

Panel Mount	Pipe, Tank, Wall	4 to 20 mA Output	Automation System
GF Instruments with 2751 Smart Sensor Electronics - 9900 - 9950	GF Instruments with 2751 Smart Sensor Electronics - 9900 and Rear Enclosure	2751 Smart Sensor Electronics with - Customer Supplied Chart Recorder Programmable Logic Controller, or - Programmable Automation Controller	2751 Smart Sensor Electronics with - 0486 Profibus Concentrator and Customer Supplied Programmable Logic Controller or - Programmable Automation Controller
			
Type 2774-2777 DryLoc® pH/ORP Electrodes			All sold separately
In-Line Installation - threaded fittings only 		Submersible Installation - Customer supplied pipe extension or conduit with 3/4 in. NPT or ISO 7/1-R 3/4 threads and pipe assembly* 	

* Refer to the GF Submersion Kit brochure (3-0000.707) located on our website for installation suggestions and options.

Electrode Key Features and Benefits

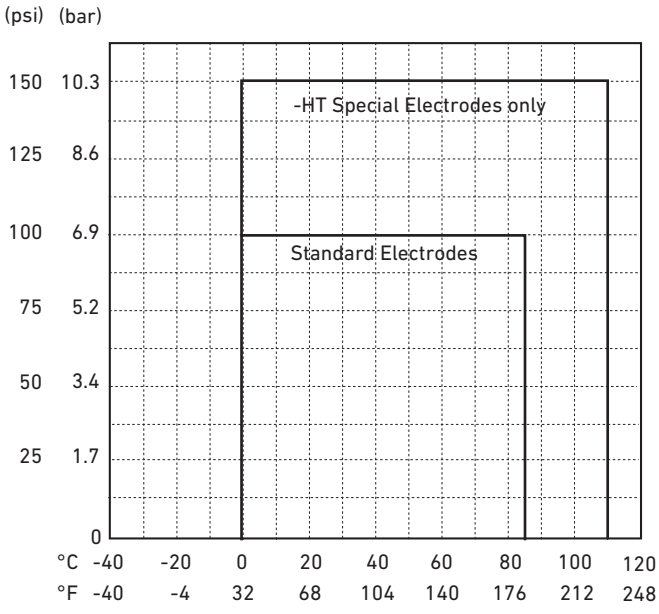
1. PPS body for chemical compatibility to resist most harsh chemicals. Also able to withstand high temperatures.
2. Porous PTFE junction resists fouling, chemicals, and build-up.
3. First reference chamber with KNO_3 protects Ag/AgCl wire for a prolonged sensor life.
4. Capillary TC (temperature sensor) embedded in tip of pH/ORP electrode for quicker temperature response.
5. DryLoc connector with corrosion resistant gold plated pins for quick and easy sensor removal.
6. Memory chip enabled for convenient data storage and access (calibration data, operational data, and manufacturing data), electrode health monitoring via glass impedance measurement when used in connection with the 2751 pH/ORP Smart Sensor Electronics.
7. Threads for NPT process connection into reducing tees. Use off the shelf GF reducing tees DN20 to DN100 (¾ to 4 in.).



Pressure-temperature diagram

Note

The pressure-temperature diagram are specifically for the GF sensor. During system design the specifications of all components must be considered. In the case of a metal piping system, a plastic sensor will reduce the system specification.



Application Tips

- Use the flat glass electrodes for in-line pH sensor applications when a self-cleaning feature is desired; especially useful in applications with abrasive chemicals in in-line applications.
- Use bulb protected electrodes for low temperature applications or where fast response is required.
- ORP electrodes are generally used for chemical reaction monitoring, not control.
- Ensure that sensor materials are chemically compatible with the process liquid.
- Keep electrode tip wet, avoid air pockets and sediment.

Buffer solutions

Buffer Solution	Quinhydrone
3822-7004 3822-7007 3822-7010	3822-7115





The GF pH buffers are ideal for calibration. The liquid solutions are conveniently packaged in one pint (473 ml) bottles. pH buffer kits in powder pillows are available for mixing fresh solutions with water at the time of use.
All pH buffes are color coded for easy identifiation; 4.01 pH is red, 7.00 pH is yellow, and 10.00 pH is blue.
All pH buffers are traceable to NIST standards. The 4.01 and 7.00 buffer solutions can be used to calibrate ORP sensors when saturated with quinhydrone

Please refer to Wiring, Installation, and Accessories sections for more information.

Ordering Information

Mfr. Part No.	Code	Tip Design	Temperature Element
pH Electrodes			
3-2774-1	159 000 956	Flat	PT1000 RTD[1]
3-2776-1	159 000 960	Bulb with Protec-	PT1000 RTD[1]
3-2774-HT	159 001 796	tion	3 KΩ Balco RTD, High Temperature [3]
3-2774-HT-C	159 001 795	Flat	BNC connector, 3 KΩ Balco RTD, NPT,
		Flat	High Temperature [3][4]
3-2774-HT-ISO	159 001 794		3 KΩ Balco, High Temperature [3]
		Flat	
ORP Electrodes			
3-2775	159 000 957	Flat	10 K ID resistor[2]
3-2777	159 000 961	Bulb with Protec-	10 K ID resistor[2]
		tion	

1 Pt1000 RTD for connection to the 9900, 9950 or 0486 Profibus Concentrator when used with the 2751 Smart Sensor Electronics. The 2751 has a digital (S^3L) output which is used with the 9900, or 9950 transmitter, and the 0486 Profibus Concentrator. It also has a 4 to 20 mA output for connection to PLC's, data recorders, etc.

2 10 KΩ ID resistor for connection to the 9900 or 9950 when used with the 2751 pH/ORP Smart Sensor Electronics

3 -HT pH electrode, flat glass, high temperature (110 °C, 230 °F), 3/4" NPT, 3KΩ TC, in-line install only.
-HT-C pH electrode, flat glass, high temperature (110 °C, 230 °F), 3KΩ TC, BNC connector, NPT, 15 ft cable, no memory chip.
-HT-ISO pH electrode, flat glass, high temperature (110 °C, 230 °F), 3/4" ISO, 3KΩ TC, in-line install only.

4 Option -HT-C can only be connected to the 2751 sensor electronics if used with the 3-2722 BNC adapter.

Special Order Options - Please consult the factory.

Additional ordering information

Additional possible configurations are listed below. For variants, combinations, and orders, please contact the local GF sales company.

Example Part Number **3-2776-HT-C**		Electrode		Special Feature		Cable Option
	3-277		**-**		**-**	
Electrode						
pH - Flat tip design		**4**				
ORP - Flat tip design		**5**				
pH - Bulb tip design with protection		**6**				
ORP - Bulb tip design with protection		**7**				
Special Feature						
High Temperature in-line applications (pH)*				**HT**		
Hydrofluoric acid applications <3% (pH)				**HF**		
Gold Electrode (ORP only)				**AU**		
Cable Option						
In-line sensor, NPT						**-**
In-line sensor, ISO						**ISO**
Cable end for high temperature submersible applications only						**C**

* Requires the 3-2722 BNC to Dryloc adapter to electronics

Accessories and Replacement Parts

Mfr. Part	Code	Description
3-2700.395	159 001 605	Calibration kit: includes 3 polypropylene cups, box used as cup stand, 1 pint pH 4.01, 1 pint pH 7.00
3822-7115	159 001 606	Quinhydrone 20 mg bottle for ORP calibration (must use pH 4.01 and/or pH 7.00 buffer solutions)
3-0700.390	198 864 403	pH Buffer Kit (1 each 4, 7, 10 pH buffer in powder form, makes 50 ml of each)
3822-7004	159 001 581	pH 4.01 buffer solution, 1 pint (473 ml) bottle
3822-7007	159 001 582	pH 7.00 buffer solution, 1 pint (473 ml) bottle
3822-7010	159 001 583	pH 10.00 buffer solution, 1 pint (473 ml) bottle
3-2759	159 000 762	pH/ORP System Tester (adapter cable sold separately)
3-2759.391	159 000 764	2759 DryLoc adapter cable (for use with 2750 and 2760)
3-2722	159 070 088	BNC adapter
3800-5000	159 838 107	3.0M KCl storage solution for pH and ORP, 1 pint (473 ml) bottle
3-2700.398	159 001 886	O-ring lubricant kit (5 packs of Super Lube®, 1cc each)

Type 3719 pH/ORP Wet-Tap Assembly



3719 Assembly



2756, 2757 Wet-Tap
Electrodes
(Sold Separately)

Product description

The type 3719 pH/ORP Wet-Tap allows installation and removal of pH or ORP electrodes under process pressure, without the need for process shutdown during routine electrode maintenance and calibration.
Process isolation is achieved during electrode retraction with two sets of double O-ring seals on a unique and compact retraction assembly. No separate valve is therefore required.
The Wet -Tap body design allows full access to the plunger and internal O-rings, to easily perform maintenance such as lubrication/replacement of O-rings and the cleaning of the internal plunger/housing.
A patented cam-activated automatic locking mechanism, SafeLoc™, and the short stroke design help to assure operator safety.
The wet-tap unit can be mounted at any angle and can be used with the GF DryLoc® Wet-Tap electrodes.

Features

- Electrode removal without process shutdown
- Space saving 45 mm (1.75 in.) short-stroke design
- SafeLoc™: Cam-activated automatic locking mechanism
- Protects electrode sensing surface from breakage
- Suitable for mounting in any orientation
- Process threaded connection NPT or ISO
- Fully serviceable internal O-rings

Applications

- Aquatic Animal Life Support Systems
- Recreational Water Monitoring
- Water & Wastewater Treatment
- Sanitization Systems
- Pool and Spa Control

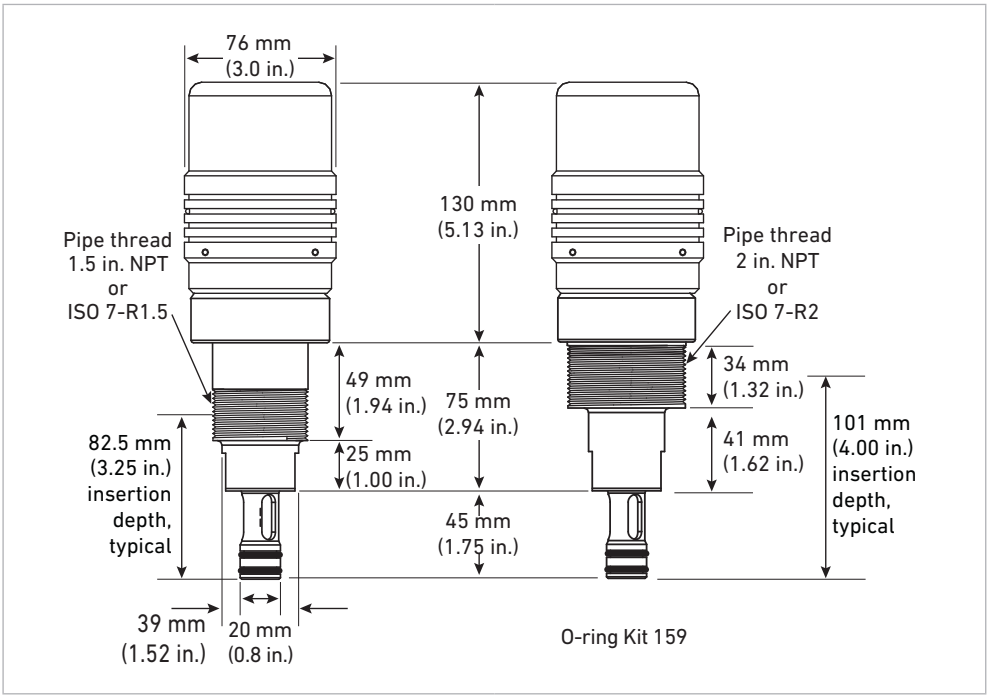
NOTE: This product is assembled using Synthetic grease with PTFE.

Specifications

Specifications		
General		
Compatible DryLoc® Electrodes	2756-WTP, 2756-WTP-1	Plastic
	2757-WTP	Plastic
Process Connection	3719-11	NPT 1½ in.
	3719-21	NPT 2 in.
	3719-12	ISO 7/1 - R 1.5
	3719-22	ISO 7/1 - R 2
Maximum Flow Velocity	3 m/s	10 ft/s
Materials		
Retraction Housing (Wetted)	CPVC	
O-rings (Wetted)	FKM (O-Rings are lubricated with Super Lube® multi-purpose grease with PTFE)	
Locking Shroud	PVC	
Hardware	316 stainless steel	
Max. Temperature/Pressure Rating		
Operating Pressure	100 psi (6.9 bar) maximum @ 25 °C	
Shipping Weight		
	1.2 kg	2.7 lb
Standards/Approvals		
	Manufactured under ISO 9001, ISO 14001 and ISO 45001	

See pressure-temperature diagrams for more information.

Dimensions

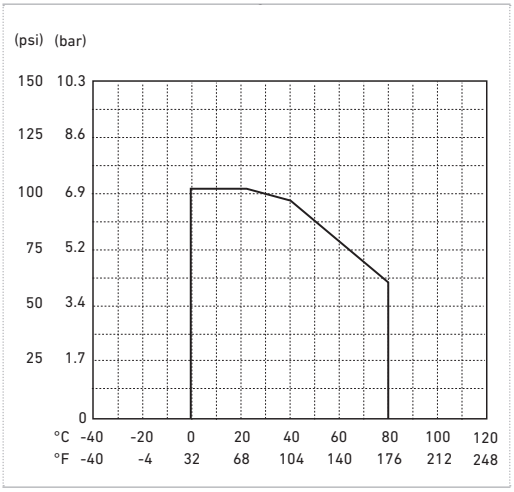


Assembly 3719-1X
For pipe sizes 2½ in. to 4 in.
(DN65 to DN100)

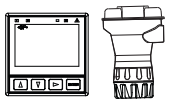
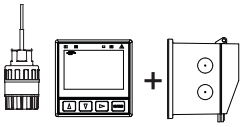
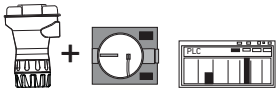
Assembly 3719-2X
For pipe sizes 6 to 12 in.
(DN150 to DN300)

Pressure-temperature diagram

The pressure-temperature diagram are specifically for the GF sensor. During system design the specifications of all components must be considered. In the case of a metal piping system, a plastic sensor will reduce the system specification.



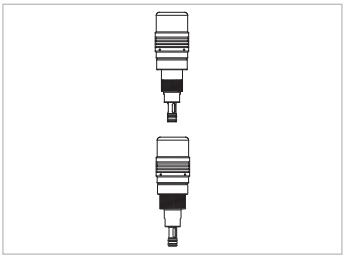
System Overview

Panel Mount	Pipe, Tank, Wall	4 to 20 mA Output	Automation System
GF Instruments with 2751 Smart Sensor Electronics - 9900 - 9950	GF Instruments with 2751 Smart Sensor Electronics - 9900 and Rear Enclosure	2751 Smart Sensor Electronics with - Customer Supplied Chart Recorder Programmable Logic Controller, or - Programmable Automation Controller	2751 Smart Sensor Electronics with - 0486 Profibus Concentrator and Customer Supplied Programmable Logic Controller or - Programmable Automation Controller
			
Type 3719 Wet-Tap Assembly with Wet-Tap Electrode 3-2756-WTP or 3-2757-WTP			
Customer supplied tees and fittings			All sold separately

Ordering Information

Wet-Tap Assembly

Mfr. Part No.	Code	Process Thread Connection	For Pipe Size
3-3719-11	159 000 804	1½ inch NPT	2½ to 4 in. (DN65-DN100)
3-3719-12	159 000 806	ISO 7/1-R 1.5	2½ to 4 in. (DN65-DN100)
3-3719-21	159 000 805	2 inch NPT	6 to 12 in. pipes (DN150-DN300)
3-3719-22	159 000 807	ISO 7/1-R 2	6 to 12 in. pipes (DN150-DN300)



Ordering Information

1) Use a mounting saddle or a standard threaded part to mount Wet-Tap assembly.
2) ASTM fittings are available to order; metric fittings are customer supplied.
3) Use -11 or -12 versions for pipe sizes 2½ in. to 4 in. (DN65-DN100
4) Use -21 or -22 versions for pipe sizes 6 in. to 12 in. (DN150-DN300)

Accessories and Replacement Parts

Mfr. Part No.	Code	Description
3-3719.390	159 000 855	3719 locking shroud (spare part)
3-3719.392	159 310 304	O-ring service kit
3-3719.398	159 001 886	O-ring Lubricant Kit (5 packs of Super Lube®, 1cc each)

Type 2756-2757 pH/ORP Wet-Tap Electrodes

General Purpose



Product description

The type 2756-2757 Wet-Tap pH and ORP electrodes are general purpose sensors ideal for a wide range of applications where the installation and removal of the electrode can be performed without the need for system shutdown.

The type 3719 pH/ORP Wet-Tap Assembly allows installation and removal of pH or ORP electrodes, even under process pressure, without the need for process shutdown during routine electrode maintenance and calibration. Process isolation is achieved during electrode retraction with two sets of double O-ring seals on a unique and compact retraction assembly; no separate valve is required.

The DryLoc connector with corrosion resistant gold plated contacts readily connects the sensor to the mating 2751 pH/ORP Smart Sensor Electronics. The robust polyarylsulphone (PAS) body and choice of bulb pH or ORP sensing elements allow a broad range of chemical compatibility for a wide range of applications.

The quick temperature response is achieved using a Pt1000 temperature sensor and allows compatibility with all GF pH/ORP instruments.

The Wet-Tap assembly unit can be mounted at any angle and can be used with the GF DryLoc® Wet-Tap pH and ORP electrodes.

Features

- PTFE reference junction resists fouling
- Polyarylsulphone (PAS) body for broad range of chemical compatibility
- General purpose bulb pH glass suitable in a wide range of applications
- Patented DryLoc connector with gold plated contacts
- Pt1000 temperature sensor for quick temperature response
- Electrode removal without process shutdown when installed in the GF 3719 pH/ORP Wet-Tap Assembly
- Memory chip enabled for access to a wide range of unique features when connected to the GF 2751 pH/ORP Smart Sensor Electronics
- Special design allows for installation at any angle, even inverted or horizontal

Applications

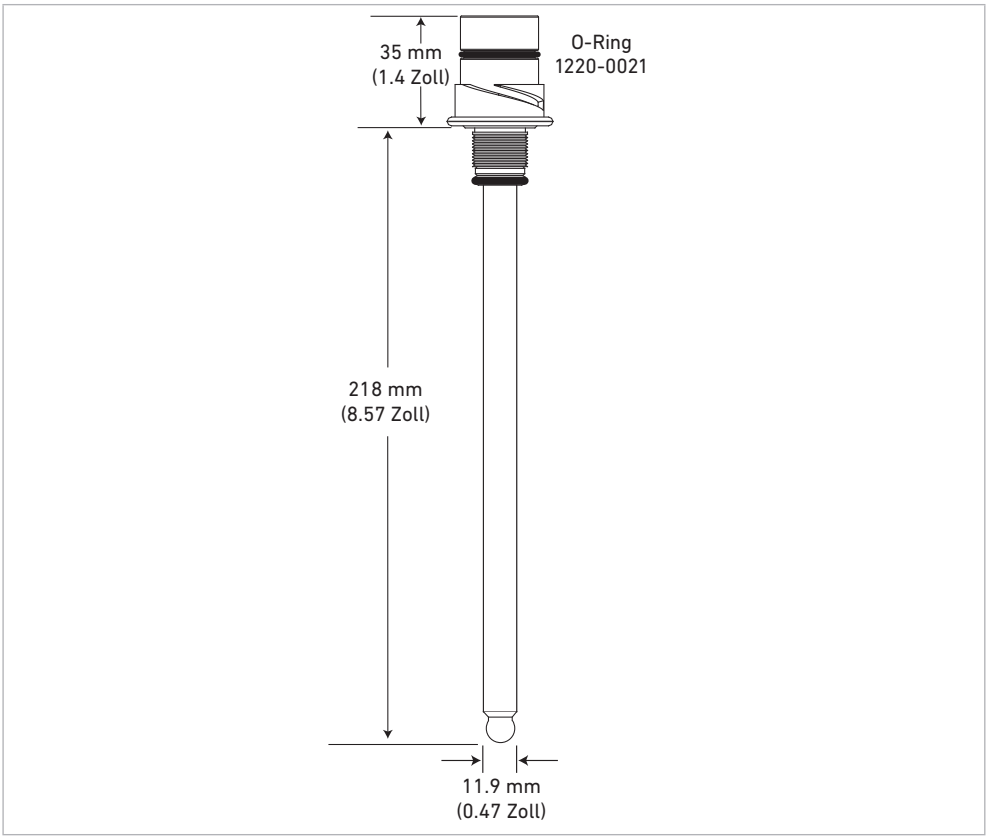
- Aquatic Animal Life Support Systems
- Recreational Water Monitoring
- Water & Wastewater Treatment
- Effluent Monitoring
- Sanitization Systems
- Pool and Spa Control

Specifications

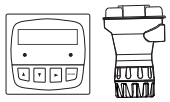
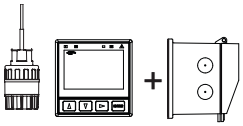
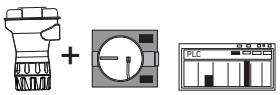
Specifications		
General		
Compatibility	Type 3719 Wet-Tap Assembly, 2751 Smart Sensor Electronics	
Operating Range	pH	0 to 14 pH
	ORP	±1500 mV
Connector	CPVC	DryLoc
Temperature Sensor (pH)	Pt1000	
Reference Junctions	Porous PTFE	
	Electrolyte	Saturated KCl
	Elements	Ag/AgCl
Response Time		
	pH	< 5s for 95% of signal change
	ORP	Application dependent
Impedance (pH)	< 150 MΩ @ 25 °C	
Wetted Materials		
Body	PAS (Polyarylsulphone)	
Reference Junction	Porous PTFE	
Sensing Surface	pH	Glass membrane
	ORP	Platinum
O-rings	FKM	
Connector	CPVC	
Max. Temperature Rating		
Operating Temperature	0 °C to 85 °C	32 °F to 185 °F
Recommended Storage Temperature		
	0 °C to 50 °C	32 °F to 122 °F
The electrode glass will shatter if shipped or stored at temperature below 0 °C (32 °F)		
The performance life of the electrode will shorten if stored at temperatures above 50 °C (122 °F)		
Mounting		
	Any angle is acceptable. Use with 3719 Wet-Tap assembly for mounting electrodes.	
Shipping Weight		
	0.2 kg	0.4 lb
Standards and Approvals		
	Manufactured under ISO 9001, ISO 14001 and ISO 45001	

Dimensions

Electrodes 3-2756 Wet-Tap pH, 3-2757 Wet-Tap ORP

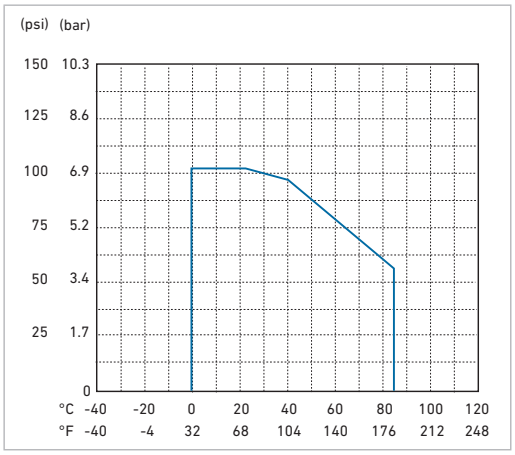


System Overview

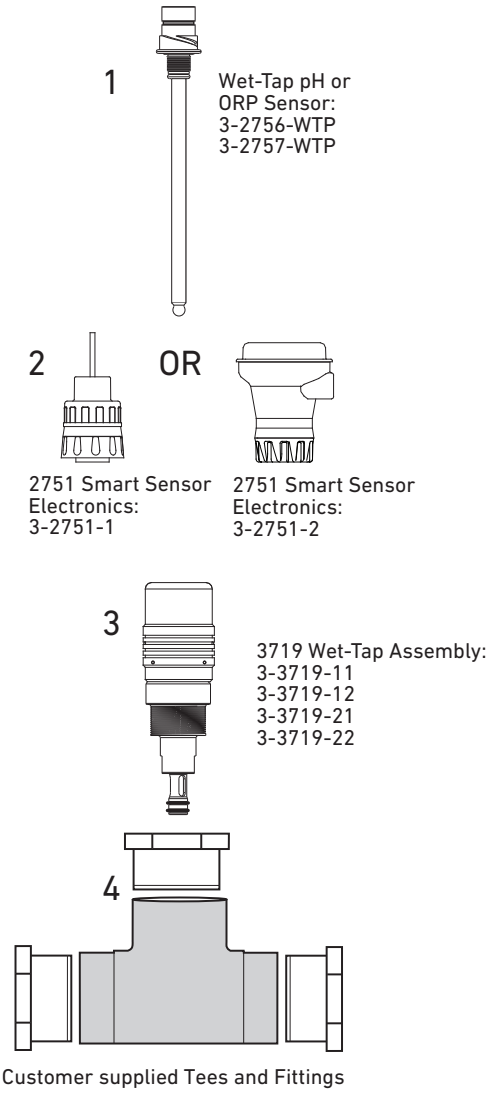
Panel Mount	Pipe, Tank, Wall	4 to 20 mA Output	Automation System
GF Instruments with 2751 Smart Sensor Electronics - 9900 - 9950	GF Instruments with 2751 Smart Sensor Electronics - 9900 and Rear Enclosure	2751 Smart Sensor Electronics with - Customer Supplied Chart Recorder - Programmable Logic Controller, or - Programmable Automation Controller	2751 Smart Sensor Electronics with - 0486 Profibus Concentrator and Customer Supplied Programmable Logic Controller or - Programmable Automation Controller
			
Wet-Tap Electrode 3-2756-WTP or 3-2757-WTP with type 3719 Wet-Tap Assembly			
Customer supplied tees and fittings			All sold separately

Pressure-temperature diagram

The pressure-temperature diagrams are specifically for the GF sensor. During system design the specifications of all components must be considered. In the case of a metal piping system, a plastic sensor will reduce the system specification.



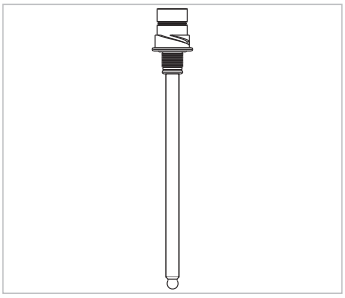
Product Selection Guide



Step 1 - Choose sensor
Step 2 - Choose preamplifier or sensor electronics
Step 3 - Choose Wet-Tap assembly
Step 4 - Choose a customer supplied mounting option

Ordering Information

Mfr. Part No.	Code	Tip design	Temperature Element	Use With
DryLoc pH Electrodes				
3-2756-WTP	159 001 390	Bulb	Pt1000	2751 Smart Sensor Electronics
DryLoc ORP Electrodes				
3-2757-WTP	159 001 391	Flat	N/A	2751 Smart Sensor Electronics



The 2751 Smart Sensor Electronics has a digital (S³L) output which is used with the 9900 or 9950 instruments, and the Profibus Concentrator. It also has a 4 to 20 mA output for connections to PLC's, data recorders, etc.

Type 2756-2757 Ordering Notes

1) pH and ORP electrodes require connection to type 2751-1 or 2751-2

Additional ordering information

Additional possible configurations are listed below. For variants, combinations, and orders, please contact the local GF sales company.

Example Part Number
3-2756-WTP-LC

DryLoc pH Electrodes 3-2756-WTP-	Feature
Feature	
Hydrofluoric Acid (pH only)	**HF**
Low Conductivity, 0 to 100 µs	**LC**

Example Part Number
3-2757-WTP-LC

DryLoc ORP Electrodes 3-2757-WTP-	Feature
Feature	
Low Conductivity, 0 to 100 µs	**LC**
Gold Electrode	**G**
HDPE reference junction for aquariums/salt water	**HDPE-PR**

Accessories and Replacement Parts

Mfr. Part No.	Code	Description
3-2700.395	159 001 605	Calibration kit: includes 3 polypropylene cups, box used as cup stand, 1 pint pH 4.01, 1 pint pH 7.00
3822-7115	159 001 606	20 gm bottle quinhydrone for ORP calibration (must use pH 4.01 and/or pH 7.00 buffer solutions)
1220-0021	198 801 000	O-ring, FKM
1220-0114	159 000 854	3719 O-ring, FKM (spare part)
3-0700.390	198 864 403	pH buffer kit (1 each 4, 7, 10 pH buffer in powder form, makes 50 ml of each)
3822-7004	159 001 581	pH 4 buffer solution, 1 pint (473 ml) bottle
3822-7007	159 001 582	pH 7 buffer solution, 1 pint (473 ml) bottle
3822-7010	159 001 583	pH 10 buffer solution, 1 pint (473 ml) bottle
3-2759	159 000 762	pH/ORP system tester kit for all pH instruments
3-2759.391	159 000 764	Adapter cable for use with 2751
3800-5000	159 838 107	3.0M KCl storage solution for pH and ORP, 1 pint (473ml) bottle
3-2700.398	159 001 886	O-ring Lubricant Kit (5 packs of Super Lube®, 1cc each)

Type 2751 DryLoc® pH/ORP Smart Sensor Electronics



In-line
2751-1



In-line EasyCal
2751-2



Submersible
2751-3 or 2751-4

DryLoc® Electrodes sold separately

Product description

The type 2751 pH/ORP Smart Sensor Electronics featuring the DryLoc® connector, is the solution for field-free calibration, out of range glass impedance and broken glass detection, alerting the operator to probe failure or maintenance needs.
The 2751 features two different outputs: a two-wire 4 to 20 mA loop output with optional EasyCal function or a digital (S³L) output which allows for longer cable lengths and is compatible with all types 9900, 9950-1/2*, 9950-10/-11 instruments or in blind, 4 to 20 mA.
The pH/ORP Smart Sensor Electronics will allow for calibration of electrodes in a laboratory setting and installation of pre-calibrated probes in the field, reducing system downtime. Memory chip enabled electrodes will store operational data such as minimum and maximum pH/mV readings, runtime, minimum and maximum temperature (pH only), for troubleshooting and operational evaluation. To take full advantage of all features and benefits of the 2751, use with types 9900 (Generation IV or later), 9950 Transmitter or 0486 Profibus Concentrator.
The 2751 self-configures for pH or ORP operation via automatic recognition of the electrode type. The optional EasyCal feature allows simple push-button calibration and includes an LED indicator for visual feedback.
The 2751 pH/ORP Smart Sensor Electronics available for submersible and inline installations. Can be used with GF installation fittings ½" to 4".

Features

- Probe health monitoring, glass impedance and broken glass detection
- Memory chip interface that allows for transferable calibration, runtime data, and manufacturing information
- In-line integral mount and submersible installation versions
- Automatic pH temperature compensation
- Auto configuration for pH or ORP operation
- Optional EasyCal calibration aid with automatic pH buffer recognition for 4, 7 and 10 pH and ORP solutions: quinhydrone saturated pH 4 or 7 buffers and Light's Solution +469 mV
- Patented DryLoc® connector provides a quick and secure connection to the sensor**

* Users of 9950 Gen I and 9950 (Gen 2a) should update to 9950 (Gen 2b or later) to take full advantage of the 2751 features and benefits. Visit www.gfps.com for the latest software update.

** U.S. Patent No.: 6,666,701

Applications

- Water and Wastewater Treatment
- Neutralization Systems
- Scrubber Control
- Effluent Monitoring
- Surface Finishing
- Flocculent Coagulation
- Heavy Metal Removal and Recovery
- Toxics Destruction
- Sanitization Systems
- Pool & Spa Control
- Aquatic Animal Life Support Systems

Specifications

General				
Compatible Electrodes				
DryLoc® pH and ORP Electrodes, types 2724-2726, 2734-2736, 2744-2747, 2756-2757 Wet-Tap, 2774-2777				
Operating Range	pH		-1 to 15 pH	
	ORP		±2'000 mV	
Response Time	pH		Electrode dependent	
	ORP		Application dependent	
Materials	In-line		PBT (thermal plastic polyester) and polypropylene (retaining nut)	
	Submersible		CPVC	
Electrical				
Cable	4.6 m	15 ft	3-conductor shielded (3-2751-1 in-line and the 3-2751-3 or -4 submersible sensor electronics only) See ordering information for additional cable sizes	
	22 AWG		For 9900, 9950 and 4 to 20 mA max. cable length is 305 m (1'000 ft.).	
Power	12 to 24 VDC		±10%, regulated for 4 to 20 mA output	
	5 to 6.5 VDC		±5% regulated recommended, 3 mA max., for digital (S^3L) output	
Current Output	pH		Fixed 4 to 20 mA, isolated, = 0 to 14 pH (custom scaling available with 0252 tool)	
	ORP		Fixed 4 to 20 mA, isolated, = -1'000 to +2'000 mV (custom scaling available from ± 2000 mV with 0252 tool)	
Max Loop Resistance	100 Ω max. @ 12 V		325 Ω max. @ 18 V	600 Ω max. @ 24 V
Accuracy	±32 µA			
Resolution	±5 µA			
Update Rate	0.5 seconds			
Error Indication	3.6 mA, 22 mA, or none			
Digital (S^3L) Output	Serial ASCII, TTL level 9600 bps			
Accuracy	pH		± 0.02 pH @ 25 °C	± 0.02 pH @ 77 °F
	ORP		± 1.5 mV @ 25 ° C	± 1.5 mV @ 77 °F
	Temperature		≤ 0.4 °C	0.72 °F
Resolution	pH		≤ 0.01 pH	
	ORP		1.5 mV	
Update Rate	0.5 seconds			
Available Data	Raw mV, pH or ORP, Temperature (pH), Glass Impedance (pH), Minimum mV (pH), Maximum mV (pH), Minimum Temperature (pH), Maximum Temperature (pH), type Number, Serial Number, Manufacturing Date, Runtime, Slope pH/mV, Measurement Offset, and Temperature			
Error Indication	Open input diagnostic, broken glass detection (pH), High Impedance			
Input Impedance, Z	$>10^{11}\Omega$			

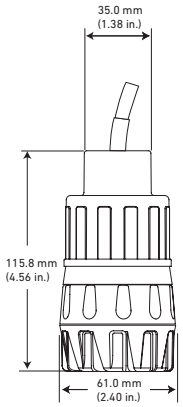
Environmental		
Enclosure	3-2751-1 & -2	NEMA 4X/IP65 with electrode connected
	3-2751-3 & -4	NEMA 6P/IP68 with electrode and watertight conduit and/or extension pipe connected

Max. Temperature/Pressure Rating		
Operating Temperature		
Submersible	0 °C to 85 °C	32 °F to 185 °F
In-line	0 °C to 85 °C	32 °F to 185 °F
Storage Temperature	-20 °C to 85 °C	-4 °F to 185 °F
Relative Humidity	0 to 95%, non-condensing (without electrode connected)	

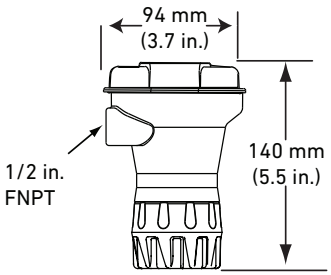
Shipping Weight			
	2751-2	0.75 kg	1.65 lb
	2751-1, -3 & -4	0.64 kg	1.41 lb

Standards and Approvals
CE, UKCA, FCC
RoHS compliant, China RoHS
Manufactured under ISO 9001, ISO 14001 and ISO 45001

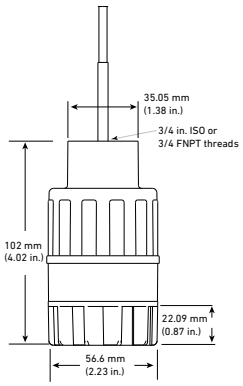
Dimensions



3-2751-1

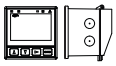
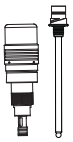
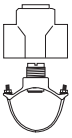
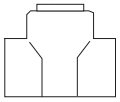
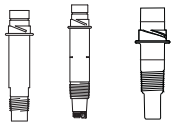


3-2751-2



3-2751-3, -4

System Overview

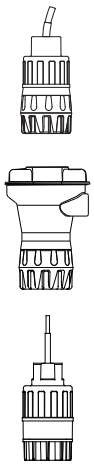
Panel Mount	Pipe, Tank, Wall Mount	4 to 20 mA Output*	Automation System
GF Instruments - 9900 - 9950  Digital (S^3L) output from sensor electronics	GF Instruments - 9900 and Rear Enclosure  Digital (S^3L) output from sensor electronics	Type 2751 Smart Sensor Electronics with - Customer Supplied Chart Recorder or Programmable Logic Controller or - Programmable Automation Controller  4-20mA Output from sensor electronics	- 0486 Profibus Concentrator and - Customer Supplied Programmable Logic Controller or - Programmable Automation Controller  Digital (S^3L) output from sensor electronics
In-Line Installation type 2751 Smart Sensor Electronics		**In-Line Installation type 2751 Smart Sensor Electronics** **OR**	
 3-2751-1	 3-2751-2 with EasyCal	 2751-3 (Digital [S^3L] output from sensor electronics	 2751-3 (4-20mA Output from sensor electronics)
GF Electrodes - 2724-2726 - 2734-2736 	3719-xx 275x 1½" or 2" MNPT 	2744-2747 1" MNPT **OR** 	2744-2747 ¾" MNPT 
½" to 4" GF Installation Fitting 	¾" FNPT Reducing Tee 	1½" or 2" FNPT Reducing Tee or Saddle 	1"FNPT Reducing Tee 	¾" FNPT Reducing Tee 
Submersible Installation GF 2751 Smart Sensor Electronics			
OR			
 2751-3 (Digital [S^3L] output from sensor electronics		 2751-3 (4-20mA Output from sensor electronics)	
GF Electrodes 2724-2726 2734-2736 2744-2747 2774-2777  All sold separately			

* See fittings section for more information.
**Refer to the GF Submersion Kit brochure (3-0000.707) located on our website for installation suggestions and options.

Application Tips

- The EasyCal feature automatically recognizes standard 4.0, 7.0, and 10.0 pH buffer or ORP quinhydrone solutions of +87 and +264 mV or Light's Solution, +469 mV, and simplifies calibration. For EasyCal ORP only single point calibration is used.
- Frequency of calibration of electrodes is dependent upon the application.
- It is recommended to clean and condition pH/ ORP electrodes prior to recalibration. See instruction manual for cleaning and conditioning recommendations.

Ordering Information



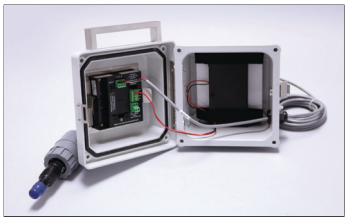
Mfr. Part No.	Code	Description
In-line pH/ORP Smart Sensor Electronics (yellow body)		
3-2751-1	159 001 804	with 4.6 m (15 ft) cable, recommended for 9900 or 9950 instruments
3-2751-1-025	159 070 110	with 7.6 m (25 ft) cable, recommended for 9900 or 9950 instruments
3-2751-1-050	159 070 111	with 15.2 m (50 ft) cable, recommended for 9900 or 9950 instruments
3-2751-1-100	159 070 112	with 30.5 m (100 ft) cable, recommended for 9900 or 9950 instruments
3-2751-2	159 001 805	with junction box and EasyCal, recommended for 4 to 20 mA use
Submersible pH/ORP Smart Sensor Electronics (gray body)		
3-2751-3	159 001 806	with 4.6 m (15 ft) cable and ¾ in. NPT threads - when 4 to 20 mA is required use the 3-8050-2 junction box with EasyCal
3-2751-3-025	159 070 113	with 7.6 m (25 ft) cable and ¾ in. NPT threads - when 4 to 20 mA is required use the 3-8050-2 junction box with EasyCal
3-2751-3-050	159 070 114	with 15.2 m (50 ft) cable and ¾ in. NPT threads - when 4 to 20 mA is required use the 3-8050-2 junction box with EasyCal
3-2751-3-100	159 070 115	with 30.5 m (100 ft) cable and ¾ in. NPT threads - when 4 to 20 mA is required use the 3-8050-2 junction box with EasyCal
3-2751-4	159 001 807	with 4.6 m (15 ft) cable and ISO 7/1-R 3/4 threads - when 4 to 20 mA is required use the 3-8050-2 junction box with EasyCal

Sensor Electronics with preamplified signal and Digital (S^3L) output (for use with the SmartPro Instruments) or 4 to 20 mA output - power supplied to unit dictates output type.

The 2751 Smart Sensor Electronics is compatible with 9900 and 9950 SmartPro Transmitters, and type 0486 Profibus Concentrator. To take full advantage of the 2751 features, use 9900 (Generation IV or later), 9950 or 0486 Profibus Concentrator.

9900 pH/ORP Calibrator (150 399 007)





The 9900 battery operated calibrator is built to enhance the user experience with the new line of 2751 Smart pH/ORP sensor electronics. This unit can be kept in a lab or taken in to the field. The calibration storage capability of the pH/ORP electrodes when used with the 2751 Smart sensor electronics, allows the user the ability to rotate electrodes, meaning unplug an aged/ dirty electrode replacing with a pre-calibrated electrode.

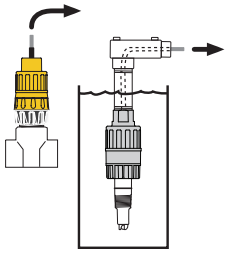
With larger installations, all collected dirty and uncalibrated electrodes can be taken to a central well organized location where proper cleaning and calibration can be performed. This improves efficiency of this process resulting more stable readings, higher sensitivity, faster response time, and overall more accurate readings. Runs on (8) AA Alkaline batteries (included).

Accessories and Replacement Parts

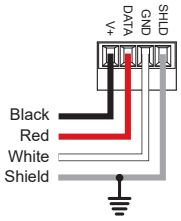
Mfr. Part No.	Code	Description
Calibration		
3-2700.395	**159 001 605**	Calibration kit: includes 3 polyproplyene cups, box used as cup stand, 1 pint pH 4.01, 1 pint pH 7.00
3822-7115	**159 001 606**	20 gm bottle quinhydrone for ORP calibration (must use pH 4.01 and/or pH 7.00 buffer solutions)
3-2759	**159 000 762**	pH/ORP system tester (adapter cable sold separately)
3-2759.391	**159 000 764**	2759 adapter cable for use with 2751 DryLoc sensor electronics
3-0700.390	**198 864 403**	pH buffer kit (1 each 4, 7, 10 pH buffer in powder form, makes 50 ml of each)
3822-7004	**159 001 581**	pH 4 buffer solution, 1 pint (473 ml) bottle
3822-7007	**159 001 582**	pH 7 buffer solution, 1 pint (473 ml) bottle
3822-7010	**159 001 583**	pH 10 buffer solution, 1 pint (473 ml) bottle
Mounting		
3-8050.390-3	**159 310 116**	Retaining nut replacement kit, Black Polypropylene
3-8050-1	**159 000 753**	Universal mount junction box
3-8050-2	**159 000 754**	Universal mount junction box w/EasyCal (for submersible applications, use with 3-2751-3 and -4 where 4 to 20 mA is required)
3-9000.392-1	**159 000 839**	Liquid tight connector kit, NPT (1 connector)
3-9000.392-2	**159 000 841**	Liquid tight connector kit, PG 13.5 (1 connector)
Other		
3-8050.390-1	**159 001 702**	Retaining Nut Replacement Kit, NPT, Valox
3-8050.390-3	**159 310 116**	Retaining Nut Replacement Kit, NPT, PP
5523-0322	**159 000 761**	Sensor cable (per ft), 3-cond. plus shield, 22 AWG, black/ red/white (for use with 2751)
P31515-0P200	**159 000 630**	Universal Pipe Adapter PVC
P31515-0C200	**159 000 631**	Universal Pipe Adapter CPVC
7310-1024	**159 873 004**	24 VDC power supply, 10W, 0.42 A
7310-2024	**159 873 005**	24 VDC power supply, 24W, 1.0 A
7310-4024	**159 873 006**	24 VDC power supply, 40W, 1.7 A
7310-6024	**159 873 007**	24 VDC power supply, 60W, 2.5 A
7310-7024	**159 873 008**	24 VDC power supply, 96W, 4.0 A
3-2700.398	**159 001 886**	O-ring Lubricant Kit (5 packs of Super Lube®, 1cc each)

Wiring information

2751 Digital (S³L) Wiring with no junction box

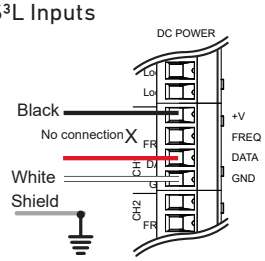


9900 S³L Inputs

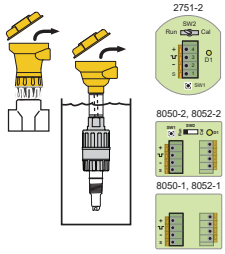


Optional Earth ground

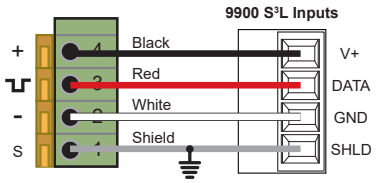
9950 S³L Inputs



2751 Digital (S³L) Wiring with junction box

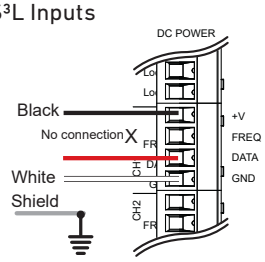


9900 S³L Inputs

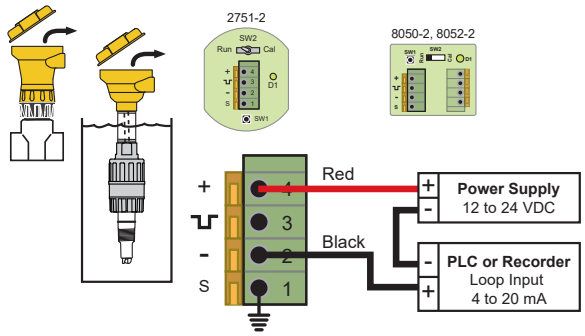


Optional Earth ground

9950 S³L Inputs



2751 4 to 20 mA Loop Wiring - Current loop, junction box with Easy Cal



Optional Earth ground

Planning Fundamentals

of Measurement and Control

Conductivity / Resistivity

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Type 2839-1V(D) to 2842-1V(D) PVDF Conductivity Electrodes 165
Type 2818-2823 Conductivity/Resistivity Electrodes 171
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Introduction

Conductivity/Resistivity Electrodes Specification Matrix

Type		2881	2882	2883	2884
					
Cell Constant		0.01	0.1	1.0	10.0
Operating Range		0.055 µS/cm to 100 µS/cm	1 µS/cm to 1000 µS/cm	10 µS/cm to 10,000 µS/cm	100 µS/cm to 200,000 µS/cm
Compatible Sensor Electronics		2850			
Temperature Element		Pt1000			
Operating Temperature/Pressure		CPVC 6,9 bar at 80 °C (100 psi at 140 °F) PP 6,4 bar at 95 °C (92 psi at 203 °F) PEEK 2,8 bar at 131 °C (40 psi at 268 °F)			6,9 bar at 80 °C (100 psi at 140 °F)
Process Connection		3/4“ Dual NPT oder ISO 7/1-R3/4			
Wetted Materials	Body	CPVC, PP, PEEK			CPVC
	O-rings	EPDM			
	Process Connection	CPVC, PP, PEEK			CPVC
Compatible GF Instruments		9900 direct using conductivity module or 2850, Profibus Concentrator, 9950 single or dual channel conductivity module, or 2850 single or dual (9950-10/11) (S3L)			
Applications Usage		R.O., ultrapure water, resistivity measure-ments	R.O., deionized and distilled water	R.O., distilled water, condensate, drinking water, cooling tower water	R.O., cooling tower water, waste water, salinity, brackish water, sea water
Standards and Approvals		CE, UKCA, RoHS, China RoHS compliant			

Type		2870	2872	2873	2874
					
Cell Constant		0.01	0.1	1.0	10.0
Operating Range		0.055 µS/cm to 100 µS/cm	1 µS/cm to 1000 µS/cm	10 µS/cm to 10,000 µS/cm	100 µS/cm to 200,000 µS/cm
Compatible Sensor Electronics		2850			
Temperature Element		Pt1000			
Operating Temperature/Pressure		Standard Polypro fitting 6.4 bar at 95 °C (93 psi at 203 °F) Optional ¾": NPT 316 SS fitting, 13.8 bar at 120 °C (200 psi at 248 °F)			6.9 bar (100 psi) @ 95 °C (203 °F)
Process Connection		¾ in. NPT			
Wetted Materials	Body	CPVC, PP, PEEK			CPVC
	O-rings	EPDM			
	Process Connection	Polypro (standard), Stainless Steel (optional)			316L SS
Compatible GF Instruments		9900 direct using conductivity module or 2850, Profibus Concentrator, 9950 single or dual channel conductivity module, or 2850 single or dual (9950-10/11) (S3L)			
Applications Usage		R.O., ultrapure water, resistivity measurements	R.O., deionized and distilled water	R.O., distilled water, condensate, drinking water, cooling tower water	R.O., cooling tower water, waste water, salinity, brackish water, sea water
Standards and Approvals		CE, UKCA, RoHS, China RoHS compliant			

Type		2839-1V	2840-1V	2841-1V	2842-1V
					
Cell Constant		0.01	0.1	1.0	10.0
Operating Range		0.055 µS to 100 µS (18.2 MW to 10 KW)	1 µS to 1000 µS (1 MW to 1 KW)	10 µS to 10,000 µS	100 µS to 200,000 µS
Compatible Sensor Electronics		2850			
Temperature Element		Pt1000			
Operating Temperature/Pressure		-10 °C to 85 °C @ 6.9 bar (14 °F to 185 °F @ 100 psi)			
Process Connection		-1V versions: ¾ in. NPT or -1VD versions: ISO 7/1-R 3/4			
Wetted Materials	Body	PVDF			
	O-rings	FKM			
	Process Connection	PVDF			
Compatible GF Instruments		9900 direct using conductivity module or 2850, 0486 Profibus Concentrator, 9950 single or dual channel conductivity module, or 2850 single or dual (9950-10/11) (S³L)			
Applications Usage		R.O., ultrapure water, resistivity measure-ments	R.O., deionized and distilled water	R.O., distilled water, condensate, drinking water, cooling tower water	R.O., cooling tower water, wastewater, salinity, brackish water, sea water
Standards and Approvals		CE, UKCA, RoHS, China RoHS compliant			

Type		2818	2819	2820	2821	2822	2823
							
Cell Constant		0.01		0.1	1.0	10.0	20.0
Operating Range		0.055 µS to 100 µS (18.2 MΩ to 10 KΩ)		1 µS to 1000 µS (1 MΩ to 1 KΩ)	10 µS to 10,000 µS	100 µS to 200,000 µS	200 µS to 400,000 µS
Compatible Sensor Electronics		2850					
Temperature Element		Pt1000					
Operating Temperature/Pressure		Optional 1/2: NPT 316 SS fitting, 13.8 bar (200 psi), 120 °C (248 °F) max. Standard Polypro fitting, 6.9 bar (100 psi), 100 °C (212 °F) max.				6.9 bar (100 psi) @ 95 °C (203 °F)	6.9 bar (100 psi) @ 150 °C (302 °F)
Process Connection		¾ in. NPT					
Wetted Materials	Body	316 SS or Titanium*, PTFE				CPVC	316 SS/PEEK®
	O-rings	EPR (EPDM)					
	Process Connection	Poly Pro (standard) , Stainless steel NPT				316 SS	
Compatible GF Instruments		9900 direct using conductivity module or 2850, Profibus Concentrator, 9950 single or dual channel conductivity module, or 2850 single or dual (9950-10/11) (S³L)					
Applications Usage		R.O., ultrapure water, resistivity measurements		R.O., deionized and distilled water	R.O., distilled & drinking water, cooling tower water	R.O., cooling tower water, waste water, salinity, brackish water, sea water	R.O., salinity, brackish water, sea water, acids/bases, cleaners other concentrated chemicals
Standards and Approvals		CE, UKCA, RoHS, China RoHS compliant					

Conductivity/Resistivity Sanitary Specification Matrix

Type		2819	2820	2821
				
Cell Constant		0.01	0.1	1.0
Operating Range		0.055 µS to 100 µS (18.2 MΩ to 10 KΩ)	1 µS to 1000 µS	10 µS to 10,000 µS
Compatible Sensor Electronics		2850		
Temperature Element		Pt1000		
Operating Temperature/Pressure		5.2 bar (75 psig) max., 130 °C (266 °F) max.		
Process Connection		Sanitary Tri-Clamp		
Wetted Materials	Body	316 SS or Titanium. Material and surface finish > RA 25 for all sensors		
	O-rings	EPR (EPDM)		
	Process Connection	1-1½ in. or 2 in. Sanitary Tri-Clamp		
Compatible GF Instruments		9900 direct using conductivity module or 2850, Profibus Concentrator, 9950 single or dual channel conductivity module, or 2850 single or dual (9950-10/11) (S³L)		
Applications Usage		R.O., ultrapure water, resistivity measurements	R.O., deionized and distilled water	R.O., distilled & drinking water, cooling tower water
Standards and Approvals		CE, UKCA, RoHS, China RoHS compliant, NIST cert available		

Conductivity/Resistivity System Compatibility

The chart below outlines the compatibility between GF conductivity/resistivity electrodes, instruments and sensor fittings. Refer to individual product pages and fittings section of the catalog for more information.

	Electrodes		
	2818-2821	2870-2874 2822-2823	2881-2884 2839-2842
2850 Conductivity Sensor Electronics	✓	✓	✓
9900 Transmitter with Sensor Electronics	✓	✓	✓
9950 Multichannel Transmitter with Sensor Electronics or Module(s)	✓	✓	✓
Fittings - Customer Supplied			
¾ in. process connections	✓	✓	✓
ISO 7/1-R3/4 process connections			✓
Tri-clamp fittings	✓		

Technical Reference Section: Conductivity/Resistivity

Information in this section addresses frequently asked questions regarding Conductivity (Resistivity) and is provided as **reference only** to supplement procedures and recommendations specifically outlined in individual product instruction manuals.

All manuals, data sheets, and additional helpful information are available at www.gfps.com

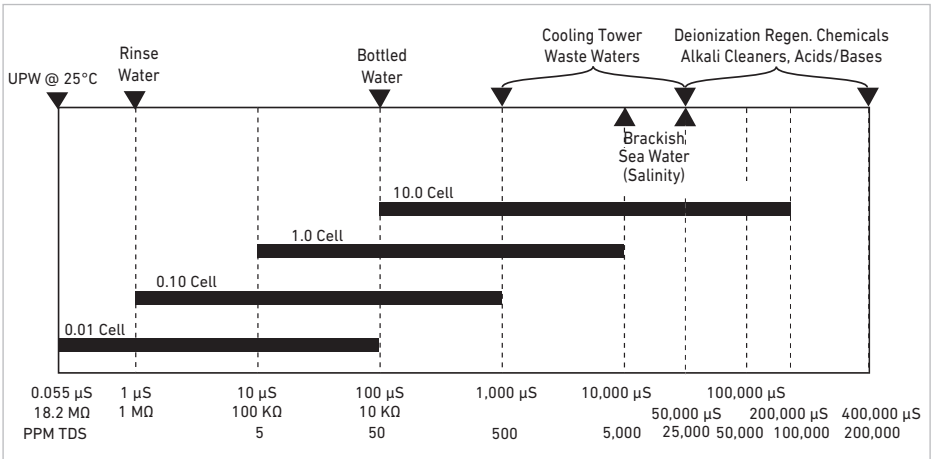
Definition of Conductivity and Resistivity

Conductivity is a measure of the ability of a material to convey an electric current. The proper term for this ability of a solution is electrolytic conductivity, since only ions conduct electric current in solution. When dissolved in solution, many substances such as salts, acids and bases dissociate into ions. Electrolytic conductivity (or simply conductivity) is therefore an indirect measure of the ionic concentration of a solution. Generally, conductivity increases and decreases with the concentration of ions. Unlike pH, which is a specific measure of Hydrogen ion concentration, conductivity is a non-selective measurement of all the dissolved ionic species in a solution. As such, it is a highly utilized parameter in water, wastewater and industrial process analyses. For example, conductivity is used to monitor the salt load of waters entering treatment facilities, to monitor and control the quality of drinking water and ultra-pure water, and to otherwise detect contaminants in industrial processes.

According to the International Standards Organization (ISO) the unit of conductance is the Siemens (S), after Werner von Siemens (1816-1892). However, the following three separate units of measure are commonly used to express conductivity: Siemens/cm (S/cm), mhos/cm, and µS/cm. For any given measurement Siemens/cm and mhos/ cm are exactly equal; they are merely different labels for the same value. The denominator in these units (cm) is sometimes truncated but is always assumed to be present.

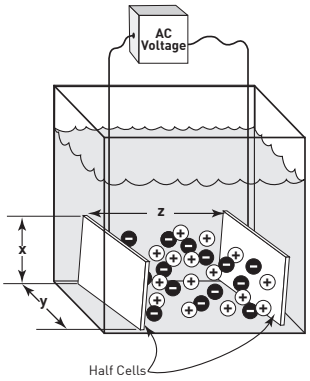
Ohm•cm is a unit of resistivity (the inverse of conductivity) and is frequently replaced by "Ω" the symbol for electrical resistance. Units of resistivity are most commonly associated with ultra-pure water measurements in the millions of ohm•cm, or MΩ (megohms). Some users will also find it desirable to express conductivity in terms of parts per million (PPM) or parts per billion (PPB) of total dissolved solids (TDS). GF instruments accommodate this by allowing the entry of a TDS factor to convert from standard units of conductivity. (See the instruction manual of any current GF conductivity instrument for details.)

Conductivity is a measurement parameter with a very wide range. For example, ultra-pure water has a theoretical maximum resistivity of approximately 18.2 MΩ, approximately 0.055 µS (microsiemens), whereas concentrated acids and bases can exceed 400,000 µS. Despite the wide-ranging possibilities most applications for conductivity measurement are much narrower. Tap water, for instance, typically measures between 50 and 1,000 µS.



Principle of Operation

Most conductivity electrodes consist of two measuring half-cells. The geometry of the half-cells can be tailored to provide highly accurate measurements over a specific conductivity range. Cell constants help to describe electrode geometry for the purpose of selecting the appropriate electrode for a given application. A cell constant is defined as the length between the two halfcells divided by the area of the cells.



$$\text{Conductivity Cell Constant} = \frac{\text{Length}}{\text{CSA*}} = \frac{z}{xy}$$

* CSA is cross sectional area

As an example, When x = y = z = 1cm the cell constant becomes

$$\frac{1\,\text{cm}}{1\,\text{cm}^2} = 1\,\text{cm}^{-1}$$

Solutions of very low conductivity (high resistivity) such as ultra-pure water are best measured with half-cells that are very close together (i.e., cell constant = 0.01 cm-1). Highly conductive solutions should be measured with half-cells that are farther apart and have relatively little cross sectional area between them (i.e., cell constant = 20.0 cm-1).

Temperature Compensation

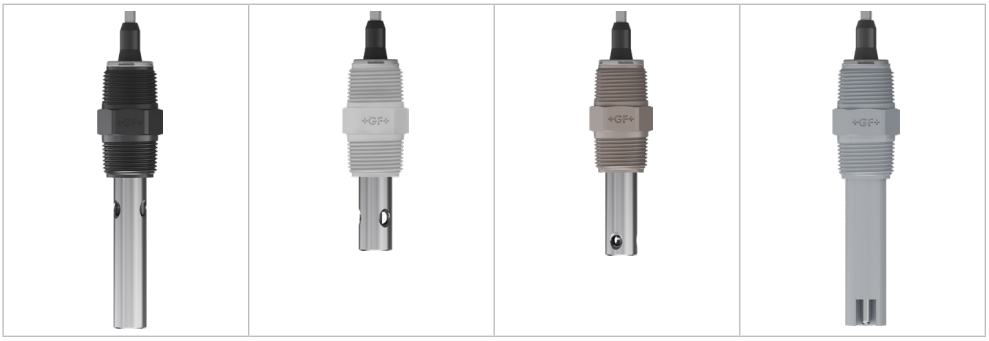
The conductivity of a solution is highly dependent upon temperature. Therefore, conductivity measurements are almost always converted to an equivalent conductivity at the common reference temperature of 25 °C (77 °F). This is accomplished by means of temperature compensation algorithms in the instruments, which require temperature as well as conductivity measurement input. To simplify and facilitate this requirement all GF conductivity electrodes contain high-quality temperature sensing elements intelligently positioned for quick and accurate response. Temperature effects on conductivity are more or less linear for normal water-based solutions, hovering around 2% per °C. However, the actual linear relationship varies considerably with the ionic composition of the solution and can range from less than 1% to more than 3% per °C.

This is true of regional ground water sources as well as for other solutions such as brackish water, acids and bases. GF instruments allow the entry of custom linear compensation coefficients for these applications. See the instruction manual of any GF conductivity instrument for details. The conductivity or resistivity of pure water is not a linear function with respect to temperature. In fact, the latest GF conductivity instruments utilize a sophisticated polynomial to compensate for the peculiar effects. For seamless measurement accuracy all current GF conductivity instruments switch automatically between linear and pure-water compensation as certain measurement thresholds are crossed.

Temperature Compensation Exception

One exception to the requirement for temperature compensation has been established by USP (United States Pharmacopeia), which prescribes limits of acceptability for ultra-pure water quality based upon non-compensated measurements. This methodology is used to eliminate measurement variances that may result from differences in the pure-water temperature compensation algorithms used by different manufacturers of conductivity measurement equipment. A more thorough treatment of the USP standard and instrument functionality can be found in the instruction manuals of the following GF conductivity instruments: Types 9900 and 9950 Transmitters.

Type 2881-2884 Conductivity/Resistivity Electrodes



2881	2882	2883	2884
Cell constant 0.01	Cell constant 0.1	Cell constant 1.0	Cell constant 10.0

Product description

The Type 2881-2884 conductivity/resistivity electrodes are available in four cell constants from 0.01 to 10 cm^{-1} and are suitable for a wide range of applications, from high purity water quality monitoring to chemical process solutions.
The electrodes themselves are made of 316L stainless steel and offer excellent measurement accuracy of ± 2% as standard, with the certified version meeting ± 1% cell constant accuracy.
The Type 2881-2883 conductivity electrodes consist of two coaxial 316L stainless steel electrodes with a flow cell construction, a PEEK insulator, and a 316L thermowell. Dual-threaded process connections in Polypropylene, CPVC, PVDF or PEEK materials are available to meet various process requirements.
Type 2884 conductivity electrodes consist of a flow cell with two parallel 316L stainless steel electrodes, PTFE insulators, and a 316L stainless steel thermowell. The housing and process connection are made of CPVC.
All Type 2881-2884 conductivity/resistivity electrodes have an integral platinum resistance thermometer (Pt1000) in the electrode, which provides optimum temperature sensing. Dual threaded process connections in ¾ NPT or ISO 7/1-R ¾ allow for quick and easy installation in immersion or inline configurations, as well as integrated mounting options for integration into sensor electronics or transmitters.

Features

- CPVC process connections:
  - ¾“ Dual NPT or ISO for all types
- PP, PVDF and PEEK process connections:
  - ¾“ Dual NPT or ISO for 0.01, 0.1 and 1.0 cell constant types
- 316L stainless steel electrodes material
- Triple flow-through vent holes reduce clogging and bubble entrapment
- In-line or submersible mounting
- Option for NIST traceable certified cell constant ±1%

Applications

- Pure Water Treatment
  - Microfiltration
  - Ultrafiltration
  - Reverse Osmosis
  - Ion Exchange
  - Deionization
  - Distillation
- Boiler Condensate
- Semiconductor Water Production
- USP Purified Water
- Rinse Water
  - Coating
  - Cooling towers
  - Fertilization
  - Desalination
  - WFI Water production

08/2026-A 3-2880.099 Rev C
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Tel. (626) 571-2770 • www.gfps.com • E-Mail: info.ps@georgfischer.com

Specifications

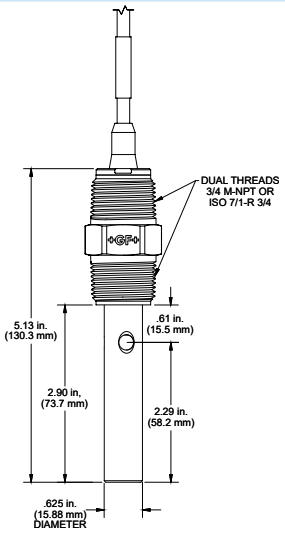
Nominal Cell Constant				
Type	Cell cm $^{-1}$	Operating Range (at 25°C / 77°F)		
2881	0.01	Conductivity	0.055...100 µS/cm	
		Resistivity	0.01...18.2 MΩ	
		TDS	0.02...50 ppm	
2882	0.1	Conductivity	1...1000 µS/cm	
		Resistivity	0.001...1 MΩ	
		TDS	0.5...500 ppm	
2883	1.0	Conductivity	10...10,000 µS/cm	
		TDS	5...5,000 ppm	
2884	10.0	Conductivity	100...200,000 µS/cm	
		Salinity	0.25...50 PPT	
		TDS	50...100,000 ppm	
Accuracy				
Cell Constant Accuracy			± 2% (standard)	± 1% certified (optional)
Temperature				
Temperature Compensation			Pt1000	
Temperature range			-20 ... 95 °C (- 4 ... 203 °F)	
Storage temperature			-20 ... 131 °C (-4 ... 268 °F)	
Temperature Accuracy			0.3 °C	
Temperature Response Time, τ for 90% of change			2881	<40 s
			2882	<47 s
			2883	<89 s
			2884	<15 s
Cable length				
Standard			7.6 m (25 ft)	
Maximum			30 m (100 ft.) with 3-9900 and 3-9950 direct conductivity resistivity modules.* 4.6 m (15 ft.) probe to 3-2850 conductivity electronics.	
Do not splice cable. If longer cable is needed, contact factory.				
For 0.01 cell constant, measurements > 10 MΩ·cm and/or < 20 °C, the max. cable length should not exceed 15 ft. (4.6 m).				
* Calibrate the temperature to offset the resistance of the cable.				
Materials				
2881, 2882, 2883		Electrodes	316L Stainless Steel (1.4408, DIN 17440)	
		Process Connection	Polypropylene, CPVC, PVDF, PEEK	
		Insulator Material	PEEK	
		O-Rings	EPR (EPDM)	
2884		Electrodes	316L Stainless Steel (1.4404, DIN 17440)	
		Body	CPVC	
		Process Connection	CPVC	
		Insulator Material	PEEK	
		O-Rings	EPR (EPDM)	
Maximum Temperature/Pressure Rating				
2881-2884 Fittings				
CPVC			6.9 bar at 80 °C (100 psi at 140 °F)	
Polypropylene*			6.4 bar at 95 °C (93 psi at 203 °F)	
PVDF			2.8 bar at 131 °C (40 psi at 268 °F)	
PEEK			2.8 bar at 131 °C (40 psi at 268 °F)	
*Proof Pressure in accordance with DIN 16962-5 standard and PED (Pressure Equipment Directive, 2014/68/EG Art. 3, Sec. 3)				
Shipping Weight				
2881			0.23 kg (0.50 lb.)	
2882, 2883, 2884			0.20 kg (0.45 lb.)	
Standards and Approvals				
CE, UKCA, RoHS compliant				

China RoHS (Go to www.gfps.com for details)

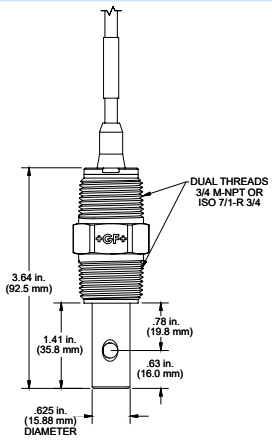
Manufactured under ISO 9001, ISO 14001 and ISO 45001

Dimensions

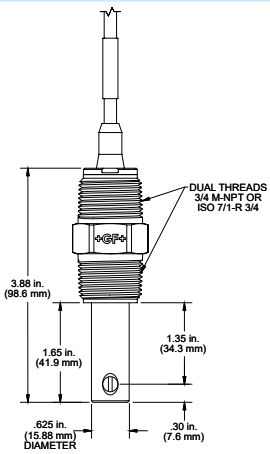
2881



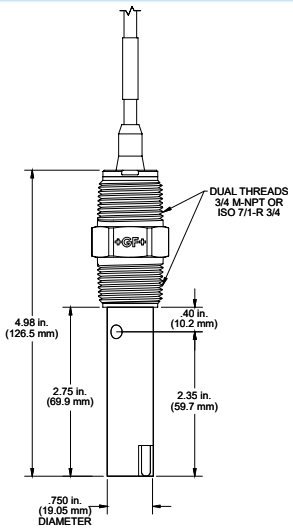
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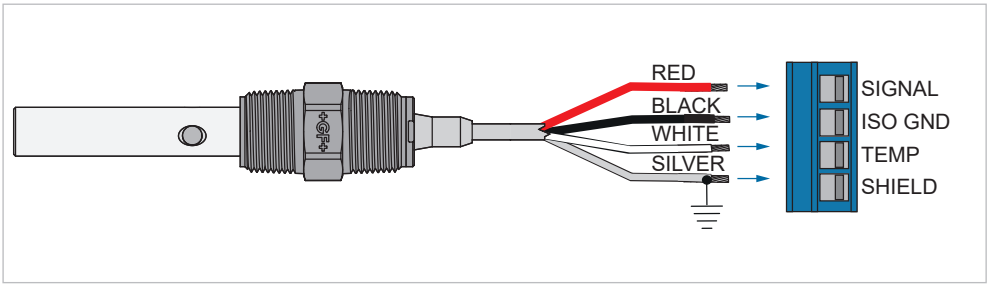
2883



2884



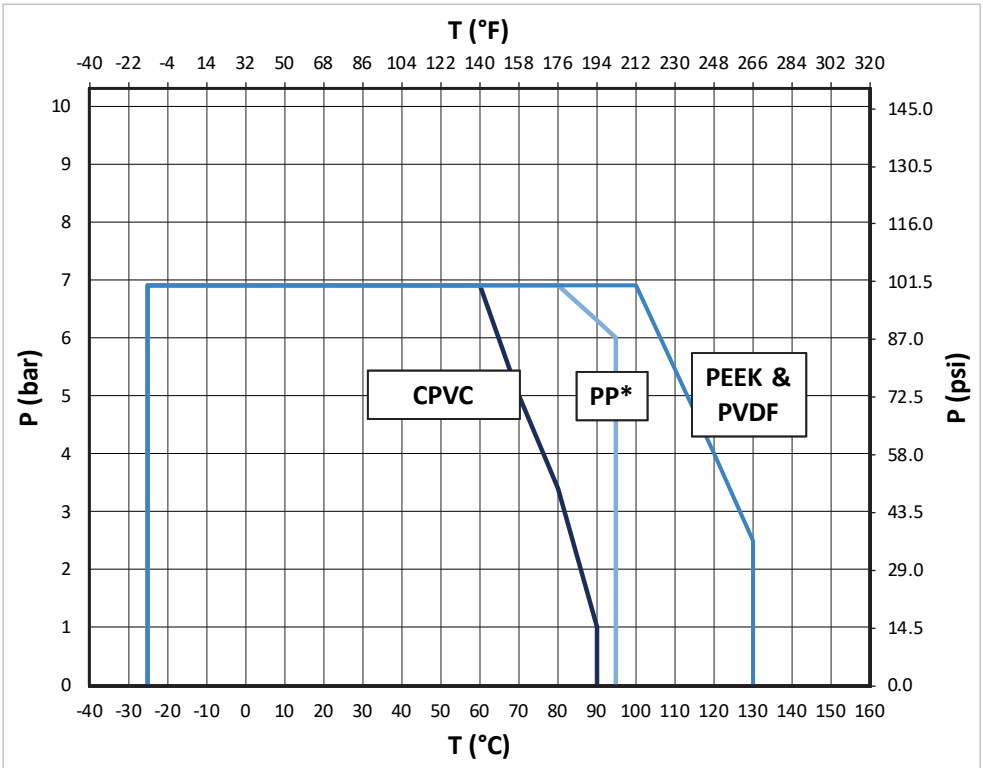
Connection diagram



Pressure-temperature diagram

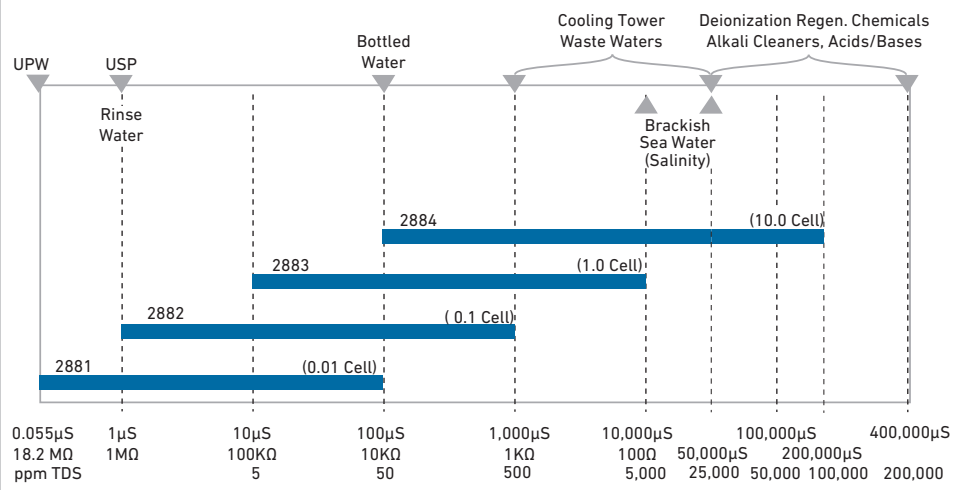
Note

The pressure-temperature diagrams are specifically for the GF sensor. During system design the specifications of all components must be considered. In the case of a metal piping system, a plastic sensor will reduce the system specification.



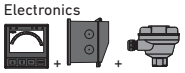
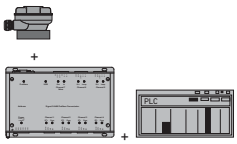
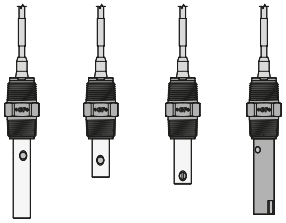
*Maximum pressure rating above 80 °C is in accordance with DIN 16962-5 standard and PED (Pressure Equipment Directive, 2014/68/EG Art.3, Sec.3).

Operating Range Chart



System Overview

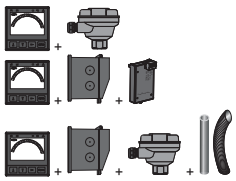
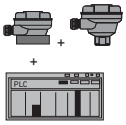
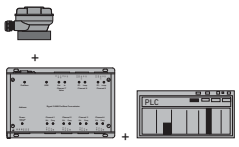
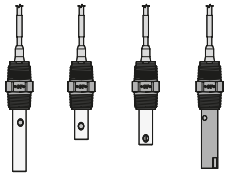
In-Line Installation

Panel Mount	Pipe, Tank, Wall Mount	4 to 20 mA Output	Automation System	Field (Integral) Mount
GF Instruments with 2850 Sensor Electronics  Type 9900 Transmitter with 3-9900.394 Direct Conductivity/ Resistivity Module  Type 9950 Transmitter with 3-9900.394 Direct Conductivity/ Resistivity Module  Type 9950 Transmitter with 3-9950.394-2 Dual Channel Conductivity/Resistivity Module 	GF Instruments with 2850 Sensor Electronics  9900 and Rear Enclosure or with 3-9900.394 Direct Conductivity/ Resistivity Module and Rear Enclosure 	Type 2850 Sensor Electronics with - Customer Supplied Programmable Logic Controller or - Programmable Automation Controller 	Type 2850 Sensor Electronics with - 0486 Profibus Concentrator and - Customer Supplied Programmable Logic Controller or - Programmable Automation Controller 	GF Instrument - 9900 with 3-9900.394 Direct Conductivity/Resistivity Module and Angle Adapter 
Type 288X Conductivity Electrodes				

Fittings- Customer Supplied

All Sold Separately

Submersible Installation

Panel Mount	Pipe, Tank, Wall Mount	4 to 20 mA Output	Automation System
GF Instruments with 2850 Sensor Electronics  Type 9900 Transmitter with 3-9900.394 Direct Conductivity/Resistivity Module  Type 9950 Transmitter with 3-9900.394 Direct Conductivity/Resistivity Module  Type 9950 Transmitter with 3-9950.394-2 Dual Channel Conductivity/Resistivity Module 	GF Instruments with 2850 Sensor Electronics - 9900 and Rear Enclosure or with 3-9900.394 Direct Conductivity/ Resistivity Module, Rear Enclosure and customer supplied pipe extension or conduit with 3/4 in. FNPT threads 	Type 2850 Sensor Electronics with - Customer Supplied Programmable Logic Controller or - Programmable Automation Controller 	Type 2850 Sensor Electronics with - 0486 Profibus Concentrator and Customer Supplied Programmable Logic Controller or - Programmable Automation Controller 
Type 288X Conductivity Electrodes			

All Sold Separately

If the required distance between the measurement point and the display is greater than 100 ft, use 3-2850-51 (S^3L).

Application Tips

- GF advises all conductivity sensors be installed in a piping system in a mounting position that minimizes air bubbles and where the solution will flow through the tube.
- When used in a tank application the liquid levels must be high enough to cover vent hole on sensor body.
- Install sensors in an area that will remain free of air bubbles and sediment build-up.
- Conductivity measurement is affected if the metal electrodes become coated by the process media.

Ordering Information

Ordering Notes

Cable lengths

- When using the 3-2850 conductivity electronics, the maximum cable length probe to electronics should not exceed 15 ft. (4.6 m).
- When used with the 9900 and 9950 direct conductivity modules, the cable length is limited to 30 m (100 ft) maximum.

**Sensors with cable lengths of up to 30 m (100 ft) are available - consult factory.

Test Certificates

- All Type 2881–2884 Conductivity/Resistivity Electrodes are factory-tested and supplied with a test certificate confirming an accuracy within ±2% of the measured value.
- For applications with higher measurement accuracy requirements, GF offers variants with a NIST-certified test certificate that guarantees an accuracy of ±1% by complying with a NIST-traceable measurement uncertainty of less than 0.5%.

Example information on NIST Traceability Certificate:

Test Certificate

Georg Fischer Signet LLC
288X Conductivity Sensor

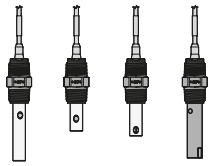
Code:	159 002 XXX
Part number:	3-288X-XX-C
Serial number:	6xxxxxxxxxx
Description:	288X Certified Probe Family
Temperature element:	RTD PT1000
Date of certification:	05/01/2025
Reference ID:	RS-XX
Reference cal Date:	05/01/2025
Verified by:	Georg Fischer

Test	Test Condition	Certified cell constant	Uncertainty
Cell constant calibration	XXX.XX uS/cm	X.XXXX	<0.5%

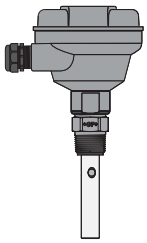
Test	Test Condition	Certified temperature offset
Temperature calibration	XX.XX °C	+X.XX °C

Conductivity Electrodes and Integral Systems with CPVC Process Connection

Mfr. Part No.	Code	Description
3-2881-1	159002017	Cell 0.01, 7.6 m (25 ft) cable, CPVC NPT
3-2881-1-C	159002018	Cell 0.01, 7.6 m (25 ft) cable, CPVC NPT, NIST Certified
3-2882-1	159002019	Cell 0.1, 7.6 m (25 ft) cable, CPVC NPT
3-2882-1-C	159002020	Cell 0.1, 7.6 m (25 ft) cable, CPVC NPT, NIST Certified
3-2883-1	159002021	Cell 1.0, 7.6 m (25 ft) cable, CPVC NPT
3-2883-1-C	159002022	Cell 1.0, 7.6 m (25 ft) cable, CPVC NPT, NIST Certified
3-2884-1	159002023	Cell 10.0, 7.6 m (25 ft) cable, CPVC NPT
3-2881-1D	159002024	Cell 0.01, 7.6 m (25 ft) cable, CPVC ISO
3-2881-1D-C	159002025	Cell 0.01, 7.6 m (25 ft) cable, CPVC ISO, NIST Certified
3-2882-1D	159002026	Cell 0.1, 7.6 m (25 ft) cable, CPVC ISO
3-2882-1D-C	159002027	Cell 0.1, 7.6 m (25 ft) cable, CPVC ISO, NIST Certified
3-2883-1D	159002028	Cell 1.0, 7.6 m (25 ft) cable, CPVC ISO
3-2883-1D-C	159002029	Cell 1.0, 7.6 m (25 ft) cable, CPVC ISO, NIST Certified
3-2884-1D	159002030	Cell 10.0, 7.6 m (25 ft) cable, CPVC ISO

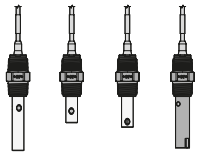


Mfr. Part No.	Code	Description
Digital (S^3L) output		
3-2850-51-81	159002156	Integral 2850 system, Digital (S^3L) output, 0.01 cell, CPVC NPT
3-2850-51-82	159002157	Integral 2850 system, Digital (S^3L) output, 0.1 cell, CPVC NPT
3-2850-51-83	159002158	Integral 2850 system, Digital (S^3L) output, 1.0 cell, CPVC NPT
3-2850-51-84	159002159	Integral 2850 system, Digital (S^3L) output, 10.0 cell, CPVC NPT
3-2850-51-81D	159002160	Integral 2850 system, Digital (S^3L) output, 0.01 cell, CPVC ISO
3-2850-51-82D	159002161	Integral 2850 system, Digital (S^3L) output, 0.1 cell, CPVC ISO
3-2850-51-83D	159002162	Integral 2850 system, Digital (S^3L) output, 1.0 cell, CPVC ISO
3-2850-51-84D	159002163	Integral 2850 system, Digital (S^3L) output, 10.0 cell, CPVC ISO
4 to 20 mA output		
3-2850-52-81	159002164	Integral 2850 system, 4 to 20 mA output, 0.01 cell, CPVC NPT
3-2850-52-82	159002165	Integral 2850 system, 4 to 20 mA output, 0.1 cell, CPVC NPT
3-2850-52-83	159002166	Integral 2850 system, 4 to 20 mA output, 1.0 cell, CPVC NPT
3-2850-52-84	159002167	Integral 2850 system, 4 to 20 mA output, 10.0 cell, CPVC NPT
3-2850-52-81D	159002168	Integral 2850 system, 4 to 20 mA output, 0.01 cell, CPVC ISO
3-2850-52-82D	159002169	Integral 2850 system, 4 to 20 mA output, 0.1 cell, CPVC ISO
3-2850-52-83D	159002170	Integral 2850 system, 4 to 20 mA output, 1.0 cell, CPVC ISO
3-2850-52-84D	159002171	Integral 2850 system, 4 to 20 mA output, 10.0 cell, CPVC ISO

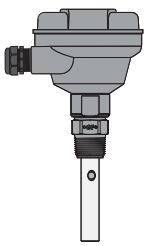


Conductivity Electrodes and Integral Systems with Polypropylene Process Connection

Mfr. Part No.	Code	Description
3-2881-1P	159002031	Cell 0.01, 7.6 m (25 ft) cable, Polypropylene NPT
3-2881-1P-C	159002032	Cell 0.01, 7.6 m (25 ft) cable, Polypropylene NPT, NIST Certified
3-2882-1P	159002033	Cell 0.1, 7.6 m (25 ft) cable, Polypropylene NPT
3-2882-1P-C	159002034	Cell 0.1, 7.6 m (25 ft) cable, Polypropylene NPT, NIST Certified
3-2883-1P	159002035	Cell 1.0, 7.6 m (25 ft) cable, Polypropylene NPT
3-2883-1P-C	159002036	Cell 1.0, 7.6 m (25 ft) cable, Polypropylene NPT, NIST Certified
3-2881-1PD	159002037	Cell 0.01, 7.6 m (25 ft) cable, Polypropylene ISO
3-2881-1PD-C	159002038	Cell 0.01, 7.6 m (25 ft) cable, Polypropylene ISO, NIST Certified
3-2882-1PD	159002039	Cell 0.1, 7.6 m (25 ft) cable, Polypropylene ISO
3-2882-1PD-C	159002040	Cell 0.1, 7.6 m (25 ft) cable, Polypropylene ISO, NIST Certified
3-2883-1PD	159002041	Cell 1.0, 7.6 m (25 ft) cable, Polypropylene ISO
3-2883-1PD-C	159002042	Cell 1.0, 7.6 m (25 ft) cable, Polypropylene ISO, NIST Certified

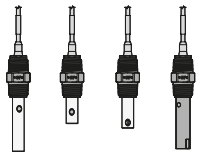


Mfr. Part No.	Code	Description
Digital (S^3L) output		
3-2850-51-81P	159002172	Integral 2850 system, Digital (S^3L) output, 0.01 cell, Polypropylene NPT
3-2850-51-82P	159002173	Integral 2850 system, Digital (S^3L) output, 0.1 cell, Polypropylene NPT
3-2850-51-83P	159002174	Integral 2850 system, Digital (S^3L) output, 1.0 cell, Polypropylene NPT
3-2850-51-81PD	159002175	Integral 2850 system, Digital (S^3L) output, 0.01 cell, Polypropylene ISO
3-2850-51-82PD	159002176	Integral 2850 system, Digital (S^3L) output, 0.1 cell, Polypropylene ISO
3-2850-51-83PD	159002177	Integral 2850 system, Digital (S^3L) output, 1.0 cell, Polypropylene ISO
4 to 20 mA output		
3-2850-52-81P	159002178	Integral 2850 system, 4 to 20 mA output, 0.01 cell, Polypropylene NPT
3-2850-52-82P	159002179	Integral 2850 system, 4 to 20 mA output, 0.1 cell, Polypropylene NPT
3-2850-52-83P	159002180	Integral 2850 system, 4 to 20 mA output, 1.0 cell, Polypropylene NPT
3-2850-52-81PD	159002181	Integral 2850 system, 4 to 20 mA output, 0.01 cell, Polypropylene ISO
3-2850-52-82PD	159002182	Integral 2850 system, 4 to 20 mA output, 0.1 cell, Polypropylene ISO
3-2850-52-83PD	159002183	Integral 2850 system, 4 to 20 mA output, 1.0 cell, Polypropylene ISO

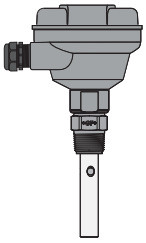


Conductivity Electrodes and Integral Systems with PVDF Process Connection

Mfr. Part No.	Code	Description
3-2881-1V	159002043	Cell 0.01, 7.6 m (25 ft) cable, PVDF NPT
3-2881-1V-C	159002044	Cell 0.01, 7.6 m (25 ft) cable, PVDF NPT, NIST Certified
3-2882-1V	159002045	Cell 0.1, 7.6 m (25 ft) cable, PVDF NPT
3-2882-1V-C	159002046	Cell 0.1, 7.6 m (25 ft) cable, PVDF NPT, NIST Certified
3-2883-1V	159002047	Cell 1.0, 7.6 m (25 ft) cable, PVDF NPT
3-2883-1V-C	159002048	Cell 1.0, 7.6 m (25 ft) cable, PVDF NPT, NIST Certified
3-2881-1VD	159002049	Cell 0.01, 7.6 m (25 ft) cable, PVDF ISO
3-2881-1VD-C	159002050	Cell 0.01, 7.6 m (25 ft) cable, PVDF ISO, NIST Certified
3-2882-1VD	159002051	Cell 0.1, 7.6 m (25 ft) cable, PVDF ISO
3-2882-1VD-C	159002052	Cell 0.1, 7.6 m (25 ft) cable, PVDF ISO, NIST Certified
3-2883-1VD	159002053	Cell 1.0, 7.6 m (25 ft) cable, PVDF ISO
3-2883-1VD-C	159002054	Cell 1.0, 7.6 m (25 ft) cable, PVDF ISO, NIST Certified

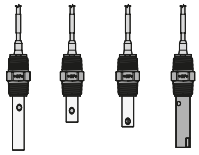


Mfr. Part No.	Code	Description
Digital (S^3L) output		
3-2850-51-81V	159002184	Integral 2850 system, Digital (S^3L) output, 0.01 cell, PVDF NPT
3-2850-51-82V	159002185	Integral 2850 system, Digital (S^3L) output, 0.1 cell, PVDF NPT
3-2850-51-83V	159002186	Integral 2850 system, Digital (S^3L) output, 1.0 cell, PVDF NPT
3-2850-51-81VD	159002187	Integral 2850 system, Digital (S^3L) output, 0.01 cell, PVDF ISO
3-2850-51-82VD	159002188	Integral 2850 system, Digital (S^3L) output, 0.1 cell, PVDF ISO
3-2850-51-83VD	159002189	Integral 2850 system, Digital (S^3L) output, 1.0 cell, PVDF ISO
4 to 20 mA output		
3-2850-52-81V	159002190	Integral 2850 system, 4 to 20 mA output, 0.01 cell, PVDF NPT
3-2850-52-82V	159002191	Integral 2850 system, 4 to 20 mA output, 0.1 cell, PVDF NPT
3-2850-52-83V	159002192	Integral 2850 system, 4 to 20 mA output, 1.0 cell, PVDF NPT
3-2850-52-81VD	159002193	Integral 2850 system, 4 to 20 mA output, 0.01 cell, PVDF ISO
3-2850-52-82VD	159002194	Integral 2850 system, 4 to 20 mA output, 0.1 cell, PVDF ISO
3-2850-52-83VD	159002195	Integral 2850 system, 4 to 20 mA output, 1.0 cell, PVDF ISO

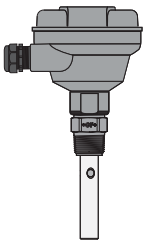


Conductivity Electrodes and Integral Systems with PEEK Process Connection

Mfr. Part No.	Code	Description
3-2881-1K	159002144	Cell 0.01, 7.6 m (25 ft) cable, PEEK NPT
3-2881-1K-C	159002145	Cell 0.01, 7.6 m (25 ft) cable, PEEK NPT, NIST Certified
3-2882-1K	159002146	Cell 0.1, 7.6 m (25 ft) cable, PEEK NPT
3-2882-1K-C	159002147	Cell 0.1, 7.6 m (25 ft) cable, PEEK NPT, NIST Certified
3-2883-1K	159002148	Cell 1.0, 7.6 m (25 ft) cable, PEEK NPT
3-2883-1K-C	159002149	Cell 1.0, 7.6 m (25 ft) cable, PEEK NPT, NIST Certified
3-2881-1KD	159002150	Cell 0.01, 7.6 m (25 ft) cable, PEEK ISO
3-2881-1KD-C	159002151	Cell 0.01, 7.6 m (25 ft) cable, PEEK ISO, NIST Certified
3-2882-1KD	159002152	Cell 0.1, 7.6 m (25 ft) cable, PEEK ISO
3-2882-1KD-C	159002153	Cell 0.1, 7.6 m (25 ft) cable, PEEK ISO, NIST Certified
3-2883-1KD	159002154	Cell 1.0, 7.6 m (25 ft) cable, PEEK ISO
3-2883-1KD-C	159002155	Cell 1.0, 7.6 m (25 ft) cable, PEEK ISO, NIST Certified



Mfr. Part No.	Code	Description
Digital (S^3L) output		
3-2850-51-81K	159002196	Integral 2850 system, Digital (S^3L) output, 0.01 cell, PEEK NPT
3-2850-51-82K	159002197	Integral 2850 system, Digital (S^3L) output, 0.1 cell, PEEK NPT
3-2850-51-83K	159002198	Integral 2850 system, Digital (S^3L) output, 1.0 cell, PEEK NPT
3-2850-51-81KD	159002199	Integral 2850 system, Digital (S^3L) output, 0.01 cell, PEEK ISO
3-2850-51-82KD	159002200	Integral 2850 system, Digital (S^3L) output, 0.1 cell, PEEK ISO
3-2850-51-83KD	159002201	Integral 2850 system, Digital (S^3L) output, 1.0 cell, PEEK ISO
4 to 20 mA output		
3-2850-52-81K	159002202	Integral 2850 system, 4 to 20 mA output, 0.01 cell, PEEK NPT
3-2850-52-82K	159002203	Integral 2850 system, 4 to 20 mA output, 0.1 cell, PEEK NPT
3-2850-52-83K	159002204	Integral 2850 system, 4 to 20 mA output, 1.0 cell, PEEK NPT
3-2850-52-81KD	159002205	Integral 2850 system, 4 to 20 mA output, 0.01 cell, PEEK ISO
3-2850-52-82KD	159002206	Integral 2850 system, 4 to 20 mA output, 0.1 cell, PEEK ISO
3-2850-52-83KD	159002207	Integral 2850 system, 4 to 20 mA output, 1.0 cell, PEEK ISO



Accessories and Replacement Parts

Mfr. Part	Code	Description
3-2850.101-1	159 001 392	Plug-in NIST traceable recertification tool, 1.0 µS simulated, for use with 9900, 9950, 2850 and the 2850 4-20 mA output
3-2850.101-2	159 001 393	Plug-in NIST traceable recertification tool, 2.5 µS simulated, for use with 9900, 9950, 2850 and the 2850 4-20 mA output
3-2850.101-3	159 001 394	Plug-in NIST traceable recertification tool, 10.0 µS simulated, for use with 9900, 9950, 2850 and the 2850 4-20 mA output
3-2850.101-4	159 001 395	Plug-in NIST traceable recertification tool, 18.2 MΩ simulated, for use with 9900, 9950, 2850 and the 2850 4-20 mA output
3-2850.101-5	159 001 396	Plug-in NIST traceable recertification tool, 10.0 MΩ simulated, for use with 9900, 9950, 2850 and the 2850 4-20 mA output
3-2850-61	159 001 400	Universal junction box, conductivity electronics, digital (S^3L) output
3-2850-62	159 001 401	Universal junction box, conductivity electronics, 4 to 20 output
3-2850-63	159 001 402	Universal junction box, conductivity electronics, dual digital (S^3L) outputs

Note: GF recommended sensors that require extended cable lengths can be ordered from the factory.

Type 2870-2874 Conductivity/Resistivity Electrodes



3-2870 | 3-2872 | 3-2873 | 3-2874

Product description

The type 2870-2874 contact conductivity electrodes are ideally suited for measuring resistivity/conductivity of liquids ranging from pure and ultrapure water to seawater, rinse water and chemical solutions.

The 2870-2873 conductivity probes are two-electrode flow-through cell design coaxially arranged made of 316L stainless steel material, PTFE insulator and Polypropylene process connection. A platinum RTD (Pt1000) located within the electrode allows for optimal temperature sensing. With a reversible process connection, these electrodes are designed to provide installation versatility in submersible and in-line configurations.

The 2874 conductivity probes have a two-electrode parallel path flow through cell design made of CPVC body, 316L stainless steel electrodes, PTFE insulator and 316L stainless steel thermowell to allow for optimal temperature sensing. Constructed of high-precision, extremely accurate stainless tubing, the GF 287X electrodes deliver outstanding measurement accuracy and repeatability.

Units with and without certificate of calibration are available. The calibrated electrodes meet a ±1% cell constant accuracy.

Features

- Process connection
  - ¾" NPT Polypropylene (standard for 0.01, 0.1 and 1.0 cell)
  - ¾" NPT 316L SS (standard for 10.0 cell)
  - ¾" NPT 316L SS (optional for 0.01, 0.1 and 1.0 cell)
- New three-hole flow-through design for facilitated installation
- Passivated 316L SS electrodes material
- In-line or submersible mounting for all cell constants
- Option for NIST traceable certified cell constant ±1%

Applications

- Pure Water Treatment
  - Microfiltration
  - Ultrafiltration
  - Reverse Osmosis
  - Ion Exchange
  - Deionization
  - Distillation
- Boiler Condensate
- Semiconductor Water Production
- USP Purified Water
- Rinse Water
- TDS (Total Dissolved Solids)
- Salinity
- WFI Water Production

Specifications

Types 3-2870 (0.01 cm^{-1} cell), 3-2872 (0.1 cm^{-1} cell), 3-2873 (1.0 cm^{-1} cell), 3-2874 (10.0 cm^{-1} cell)

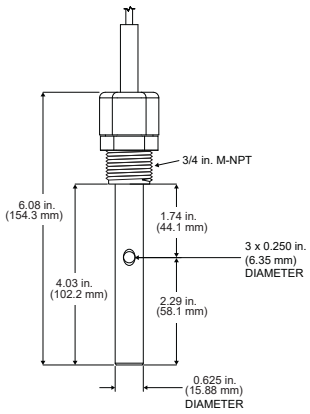
General			
Operating Range			
3-2870	Conductivity	0.055 µS/cm to 100 µS/cm at 25 °C (77 °F)	
	Resistivity	10 kΩ·cm to 18.2 MΩ·cm at 25 °C (77 °F)	
	TDS	0.02 to 50 ppm	
3-2872	Conductivity	1 µS/cm to 1000 µS/cm	
	Resistivity	1 MΩ·cm to 1 KΩ·cm	
	TDS	0.5 to 500 ppm	
3-2873	Conductivity	10 µS/cm to 10,000 µS/cm at 25 °C (77 °F)	
	TDS	5 to 5,000 ppm	
3-2874	Conductivity	100 µS/cm to 200,000 µS/cm at 25 °C (77 °F)	
	TDS	50 to 100,000 ppm	
Nominal Cell Constant			
Cell Constant Accuracy		± 2%	
Certified Cell Constant		± 1%	
Conductivity Repsonse Time			
3-287X	< 5 s for 90% of change at 25 °C (77 °F)		
Temperature			
Temperature Compensation		Pt1000	
Temperature range	2870, 2872, 2873	-20 to 80 °C (- 4 to 176 °F)	
	2874	-20 to 95 °C (- 4 to 203 °F)	
Temperature Accuracy		0.3 °C	
Temperature Response, τ		0.01 cm^{-1} cell	< 40 s for 90% of change
		0.1 cm^{-1} cell	< 47 s for 90% of change
		1.0 cm^{-1} cell	< 89 s for 90% of change
		10.0 cm^{-1} cell	< 15 s for 90% of change
Cable length			
Standard		4.6 m (15 ft) and 7.6 m (25 ft)	
Maximum		30 m (100 ft.) with 3-9900 and 3-9950 direct conductivity resistivity modules. 4.6 m (15 ft.) with 3-2850 conductivity electronics.	
Do not splice cable. If longer cable is needed, contact GF Industry & Infrastructure Flow Solutions.			

Wetted Materials		
2870, 2872, 2873	Electrodes	316L Stainless Steel (1.4408, DIN 17440)
	Body	¾" NPT Polypropylene
	Process Connection	¾" NPT Polypropylene
	Insulator Material	PTFE
	O-Rings	EPR (EPDM)
2874	Electrodes	316L Stainless Steel (1.4404, DIN 17440)
	Body	CPVC
	Process Connection	¾" NPT 316L Stainless Steel
	Insulator Material	PTFE
	O-Rings	EPR (EPDM)
Maximum Temperature/Pressure Rating		
2870, 2872, 2873 Fittings		
Standard Polypropylene		6.4 bar at 95 °C (93 psi at 203 °F)
(3-2870.391) ¾" NPT 316SS		13.8 bar at 120 °C (200 psi at 248 °F)
Proof Pressure in accordance with DIN 16962-5 standard and PED (Pressure Equipment Directive, 2014/68/EG)		
2874 Fitting		
¾" NPT 316L SS		6.9 bar at 95 °C (100 psi at 203 °F)

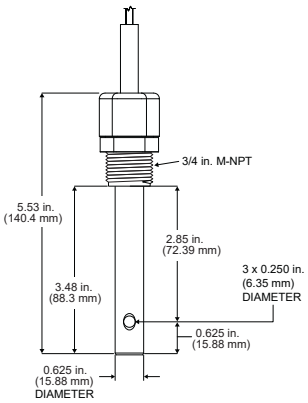
Shipping Weight	
2870-A115	0.25 kg (0.54 lb.)
2870-A125	0.32 kg (0.69 lb.)
2872-A115	0.18 kg (0.40 lb.)
2872-A125	0.25 kg (0.56 lb.)
2873-A115	0.21 kg (0.47 lb.)
2873-A125	0.28 kg (0.62 lb.)
2874-A515	0.27 kg (0.60 lb.)
2874-A525	0.34 kg (0.75 lb.)
Standards and Approvals	
CE, UKCA, RoHS compliant	
China RoHS (Go to www.gfps.com for details)	
Manufactured under ISO 9001, ISO 14001 and ISO 45001	

Dimensions

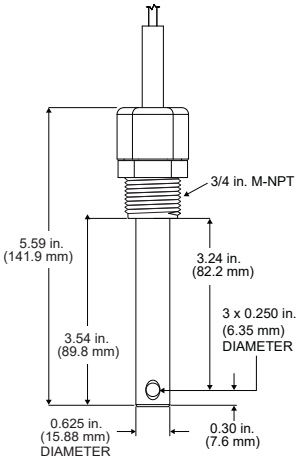
3-2870



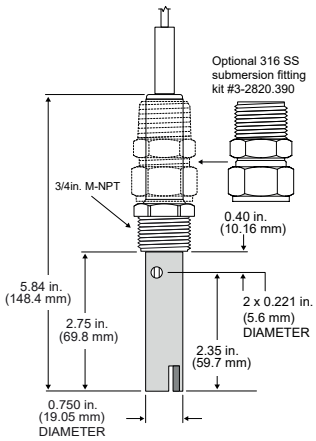
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3-2873

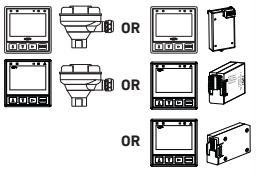
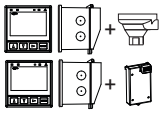
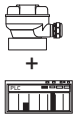
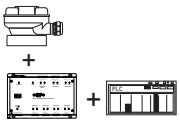
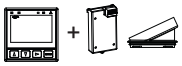


3-2874



System Overview

In-Line Installation

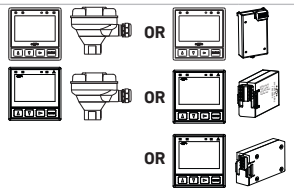
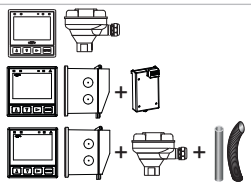
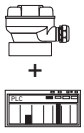
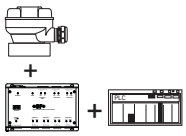
Panel Mount	Pipe, Tank, Wall Mount	4 to 20 mA Output*	Automation System	Field (Integral) Mount*
GF Instruments with 2850 Sensor Electronics - 9900 or with 3-9900.394 Direct Conductivity/Resistivity Module - 9950 with 9950.394 Direct Conductivity/Resistivity Module or with 3-9950.394-2 Dual Channel Conductivity Module	GF Instruments with 2850 Sensor Electronics - 9900 and Rear Enclosure or with 3-9900.394 Direct Conductivity/Resistivity Module and Rear Enclosure	Type 2850 Sensor Electronics with - Customer Supplied Programmable Logic Controller or - Programmable Automation Controller	Type 2850 Sensor Electronics with - 0486 Profibus Concentrator and - Customer Supplied Programmable Logic Controller or - Programmable Automation Controller	GF Instrument - 9900 with 3-9900.394 Direct Conductivity/Resistivity Module and Angle Adapter
				

Type 287X Conductivity Electrodes



All Sold Separately

Submersible Installation

Panel Mount	Pipe, Tank, Wall Mount	4 to 20 mA Output*	Automation System
GF Instruments with 2850 Sensor Electronics - 9900 or with 3-9900.394 Direct Conductivity/Resistivity Module - 9950 with 9950.394 Direct Conductivity/Resistivity Module or with 3-9950.394-2 Dual Channel Conductivity Module	GF Instruments with 2850 Sensor Electronics - 9900 and Rear Enclosure or with 3-9900.394 Direct Conductivity/Resistivity Module, Rear Enclosure and customer supplied pipe extension or conduit with 3/4 in. FNPT threads	Type 2850 Sensor Electronics with - Customer Supplied Programmable Logic Controller or - Programmable Automation Controller	Type 2850 Sensor Electronics with - 0486 Profibus Concentrator and Customer Supplied Programmable Logic Controller or - Programmable Automation Controller
			

Type 287X Conductivity Electrodes



All Sold Separately

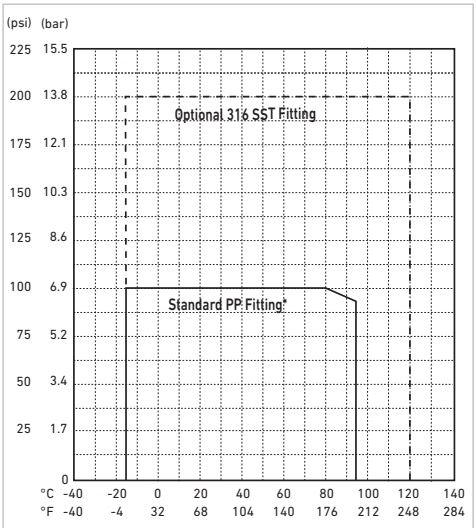
If the required distance between the measurement point and the display is greater than 100 ft, use 3-2850-61 (S^3L).

Measurements above 10 MΩ·cm and/or below 20 °C, the maximum cable length should not exceed 15 ft. (4.6 m).

Pressure-temperature diagram

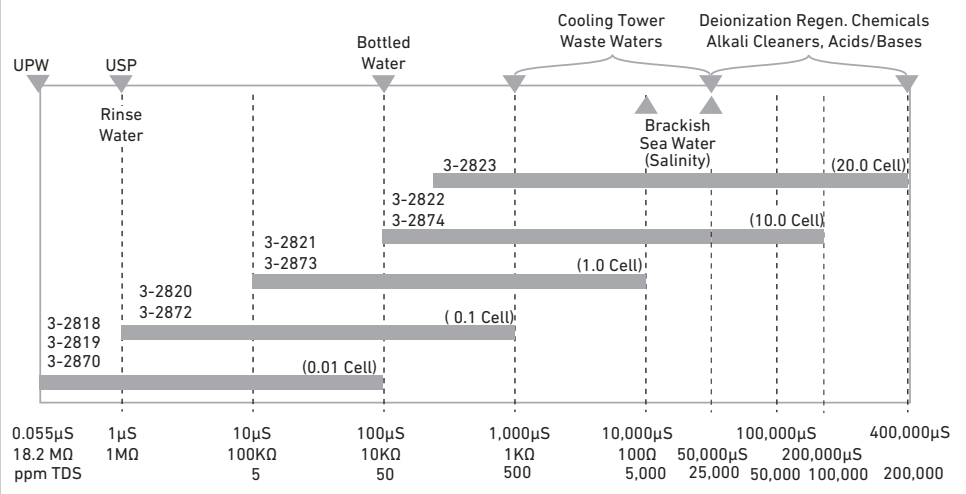
Note

The pressure-temperature diagrams are specifically for the GF sensor. During system design the specifications of all components must be considered. In the case of a metal piping system, a plastic sensor will reduce the system specification.



Maximum pressure rating above 80 °C is in accordance with DIN 16962-5 standard and PED (Pressure Equipment Directive, 2014/68/EG Art.3, Sec.3).

Operating Range Chart



Application Tips

- GF advises all conductivity sensors be installed in a piping system in a mounting position that minimizes air bubbles and where the solution will circulate inside and out of the outer tube.
- When used in a tank application the liquid levels must be high enough to cover vent hole on sensor body.
- Threads can be reversed in the field.
- Install sensors in an area that will remain free of air bubbles and sediment build-up.
- Conductivity measurement is affected if the metal electrodes become coated by the process media.

Ordering Information

Ordering Notes

1. When using the type 3-2850 conductivity electronics, the maximum cable length probe to electronics should not exceed 15 ft. (4.6 m)
2. When used with the 9900 and 9950 conductivity modules, sensors are limited to 30 m (100 ft) maximum.*
3. Sensors with cable lengths of up to 30 m (100 ft) are available - consult factory.
4. Use PN 3-2870.390 for a replacement submersible threaded connection.

* Calibrate the temperature to offset the resistance of the cable.

TEST CERTIFICATE

Code:	159 002 000
Sensor Part Number:	3-2870-A115C
Serial Number:	62201220270
Cell Constant:	0.01005
Temp. Element:	RTD Pt1000
Test Date:	01/23/2022

Example of cell constant certificate of calibration.

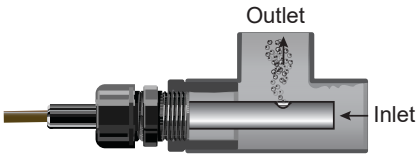
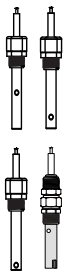


Figure 1

Please refer to Wiring, Installation, and Accessories sections for more information.

Mfr. Part No.	Code	Cell Constant	Description
3-2870-A115	159 001 999	0.01 cm^{-1}	k=0.01 cm^{-1}, ¾ in. NPT fitting, polypro, 15-ft cable, no certificate
3-2870-A115C	159 002 000	0.01 cm^{-1}	k=0.01 cm^{-1}, ¾ in. NPT fitting, polypro, 15-ft cable, with certificate
3-2870-A125	159 002 001	0.01 cm^{-1}	k=0.01 cm^{-1}, ¾ in. NPT fitting, polypro, 25-ft cable, no certificate
3-2870-A125C	159 002 002	0.01 cm^{-1}	k=0.01 cm^{-1}, ¾ in. NPT fitting, polypro, 25-ft cable, with certificate
3-2872-A115	159 002 003	0.1 cm^{-1}	k=0.1 cm^{-1}, ¾ in. NPT fitting, polypro, 15-ft cable, no certificate
3-2872-A115C	159 002 004	0.1 cm^{-1}	k=0.1 cm^{-1}, ¾ in. NPT fitting, polypro, 15-ft cable, with certificate
3-2872-A125	159 002 005	0.1 cm^{-1}	k=0.1 cm^{-1}, ¾ in. NPT fitting, polypro, 25-ft cable, no certificate
3-2872-A125C	159 002 006	0.1 cm^{-1}	k=0.1 cm^{-1}, ¾ in. NPT fitting, polypro, 25-ft cable, with certificate
3-2873-A115	159 002 009	1.0 cm^{-1}	k=1.0 cm^{-1}, ¾ in. NPT fitting, polypro, 15-ft cable, no certificate
3-2873-A115C	159 002 010	1.0 cm^{-1}	k=1.0 cm^{-1}, ¾ in. NPT fitting, polypro, 15-ft cable, with certificate
3-2873-A125	159 002 011	1.0 cm^{-1}	k=1.0 cm^{-1}, ¾ in. NPT fitting, polypro, 25-ft cable, no certificate
3-2873-A125C	159 002 012	1.0 cm^{-1}	k=1.0 cm^{-1}, ¾ in. NPT fitting, polypro, 25-ft cable, with certificate
3-2874-A515	159 002 014	10.0 cm^{-1}	k=10.0 cm^{-1}, ¾ in. NPT fitting 316L SS, 15 ft. cable, no certificate
3-2874-A525	159 002 015	10.0 cm^{-1}	k=10.0 cm^{-1}, ¾ in. NPT fitting 316L SS, 25 ft. cable, no certificate



Accessories and Replacement Parts

Mfr. Part	Code	Description
3-2850.101-1	159 001 392	Plug-in NIST traceable recertification tool, 1.0 µS simulated, for use with 9900, 9950, 2850 and the 2850 4-20 mA output
3-2850.101-2	159 001 393	Plug-in NIST traceable recertification tool, 2.5 µS simulated, for use with 9900, 9950, 2850 and the 2850 4-20 mA output
3-2850.101-3	159 001 394	Plug-in NIST traceable recertification tool, 10.0 µS simulated, for use with 9900, 9950, 2850 and the 2850 4-20 mA output
3-2850.101-4	159 001 395	Plug-in NIST traceable recertification tool, 18.2 MΩ simulated, for use with 9900, 9950, 2850 and the 2850 4-20 mA output
3-2850.101-5	159 001 396	Plug-in NIST traceable recertification tool, 10.0 MΩ simulated, for use with 9900, 9950, 2850 and the 2850 4-20 mA output
3-2850-61	159 001 400	Universal junction box, conductivity electronics, digital (S^3L) output
3-2850-62	159 001 401	Universal junction box, conductivity electronics, 4 to 20 output
3-2850-63	159 001 402	Universal junction box, conductivity electronics, dual digital (S3L) outputs
3-2820.390	198 840 223	¾ in. NPT fitting, 316 SS for use with 2874 for submersible mounting
3-2870.390	159 002 007	¾ in. NPT fitting, polypropylene replacement for use with 2870, 2872 and 2873
3-2870.391	159 002 008	¾ in. NPT fitting, 316 SS for use with 2870, 2872 and 2873
3-2870.392	159 002 016	¾ in. NPT Extended fitting polypropylene

Note: GF recommended sensors that require extended cable lengths can be ordered from the factory.

Type 2839-1V(D) to 2842-1V(D) PVDF Conductivity Electrodes



2839-1V | 2840-1V | 2841-1V 2842-1V

Product description

The type 2839-1V(D) to 2842-1V(D) Conductivity/Resistivity Electrodes are available in four cell constants from 0.01 to 10.0 cm-1, and are suitable for a wide variety of applications from high purity water quality monitoring to weak acids and bases. 316 SS electrode surface finishes are controlled in a precision bead blasting operation to ensure measurement accuracy and repeatability.

The PVDF insulator and process connections are injection over-molded to minimize variance between electrodes. Double threaded connections in either ¾ in. NPT or ISO 7/1-R 3/4 enable quick and easy installation in submersible or in-line configurations.

Transmitter integral mounting kit and junction boxes are available as accessories.

A Certificate of Calibration is included with all 2839-1V(D) to 2842-1V(D) conductivity/Resistivity Electrodes. The electrodes are calibrated to meet

± 2% accuracy.

The certificate includes calculated cell constant and temperature offset which when entered into the „custom cell“ menu of any GF meter would provide a 2% accuracy of the sensors reading. Electrodes can be shipped back to the GF factory for recertification.

Features

- ± 2% accuracy - Custom calibration certificate provided
- Dual-threaded for in-line, submersible, or integral mount for 2850 sensor electronics
- Compact electrode length for easy in-line installation in small pipe sizes
- Triple orifice flow-through design reduces clogging and bubble entrapment
- 316 SS electrodes with injection molded PVDF process connections and insulators
- Meets USP requirements

Applications

- Water Treatment & Water Quality Monitoring
- Reverse Osmosis
- Deionization
- Cooling Tower and Boiler Protection
- Distillation
- Desalination
- Demineralizer
- Semiconductor
- Aquatic Animal Life Support Systems

Technical Details

General				
Operating Range				
	2839	0.055 to 100 µS	0.02 to 50 ppm	18.2 MΩ to 10 KΩ
	2840	1 to 1'000 µS	0.5 to 500 ppm	1 MΩ to 1 KΩ
	2841	10 to 10'000 µS	5 to 5'000 ppm	
	2842	100 to 200'000 µS	50 to 100'000 ppm	
Cell Constant Accuracy		±2% when the custom cell constant is entered into the transmitter/meter or when wet calibrated with a traceable standard.		
Dual-Threaded Process Connection		-1V versions: ¾ in. NPT -1VD versions: ISO 7/1-R 3/4		
Cable Length (use for the 2839, 2040, 2041 and 2042)	standard	4.6 m (15 ft)		
	maximum	30 m (100 ft) all sensors when used with the 9900, 9950 and direct conductivity/resistivity modules		
	Maximum 2850 input cable length 4.6 m (15 ft) for all cells			
Temperature Element		PT1000		
Temp. Response, t				
	0.01 cell	5 sec.		
	0.10 cell	10 sec.		
	1.0 cell	20 sec.		
	10.0 cell	30 sec.		
Temperature Accuracy		±0.5 °C	±0.9 °F	

Wetted Materials	
Electrode Material	316 SS
Threaded Process Connection	PVDF
Internal O-ring (2841 and 2842)	FKM
Insulator Material	PVDF

Max. Temperature/Pressure Rating		
	131 °C @ 2.76 bar	268 °F @ 40 psi
Storage Temperature	-20 °C to 131 °C	-4 °F to 268 °F

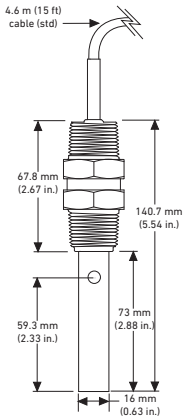
Shipping Weight		
2839	0.34 kg	0.74 lb
2840, 2841, 2842	0.30 kg	0.66 lb

Standards and Approvals
RoHS compliant, China RoHS
Manufactured under ISO 9001, ISO 14001 and ISO 45001

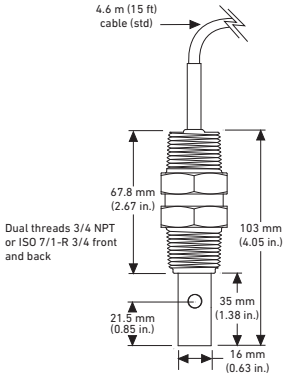
Dimensions

Dual-Threaded Electrodes

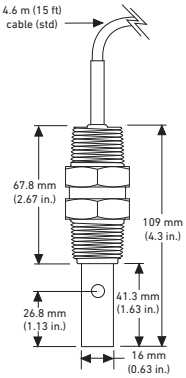
3-2839-1V(D) (0.01 cell)



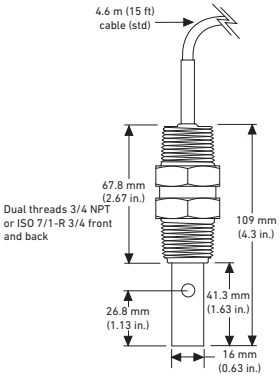
3-2840-1V(D) (0.1 cell)



3-2841-1V(D) (1.0 cell)*



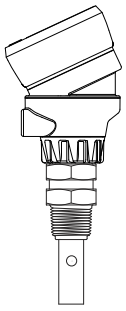
3-2842-1V(D) (10.0 cell)*



* Although these electrodes look similar in design, there is an inherent difference. From the bottom view, the 2841 electrode features a simple plastic insert. However, the 2842 electrode features a complex plastic insert with four holes through which liquid flows.

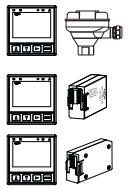
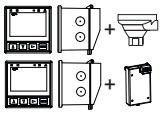
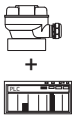
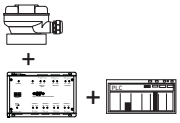
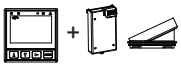
Integral Mount Sensor

The 2839-2842 Dual Threaded Conductivity Electrodes can form an Integral Mount System with the 3-9900-1 GF Transmitter when using the 3-9900.396 Direct Conductivity Module, angle adapter and the 8052 Integral Mount Kit. Complete Integral Mount System with 9900 transmitter are available through our Specials program.

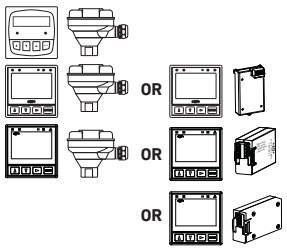
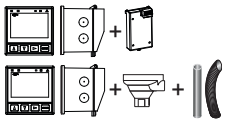
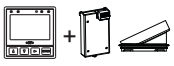
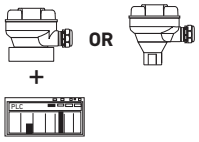
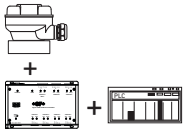


System Overview

In-Line Installation

Panel Mount	Pipe, Tank, Wall Mount	4 to 20 mA Output*	Automation System	Field (Integral) Mount*
GF Instruments - 9900 with 2850 Sensor Electronics - 9900 or with 3-9900.394 Direct Conductivity/Resistivity Module - 9950 with 9950.394 Direct Conductivity/Resistivity Module or with 3-9950.394-2 Dual Channel Conductivity Module	GF Instruments - 9900 with 2850 Sensor Electronics - 9900 and Rear Enclosure or with 3-9900.394 Direct Conductivity/Resistivity Module and Rear Enclosure	Type 2850 Sensor Electronics with - Customer Supplied Programmable Logic Controller or - Programmable Automation Controller	Type 2850 Sensor Electronics with - 0486 Profibus Concentrator and - Customer Supplied Programmable Logic Controller or - Programmable Automation Controller	GF Instrument - 9900 with 3-9900.394 Direct Conductivity/Resistivity Module, 3-9900.396 angle adapter and 3-8052 Integral Mount Kit
				
Type 2839-2842 Conductivity Electrodes 				
Customer Supplied Fittings, 3/4 in. NPT or ISO threaded				All Sold Separately

Submersible Installation

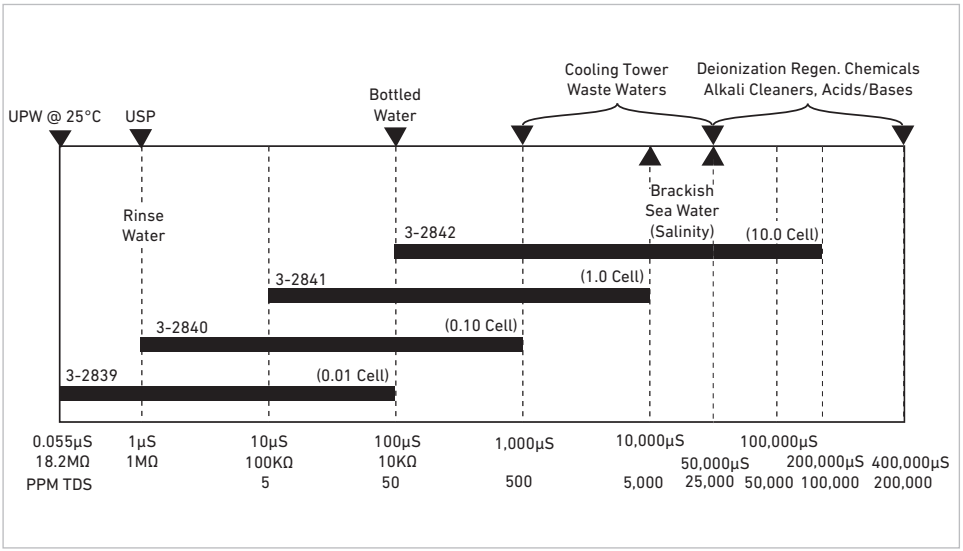
Panel Mount	Pipe, Tank, Wall Mount	Field (Integral) Mount	4 to 20 mA Output*	Automation System
GF Instrumentswith 2850 Sensor Electronics - 9900 or with 3-9900.394 Direct Conductivity/Resistivity Module - 9950 with 9950.394-1 Direct Conductivity/Resistivity Module or with 3-9950.394-2 Dual Channel Conductivity Module	GF Instruments with 2850 Sensor Electronics - 9900 and Rear Enclosure or with 3-9900.394 Direct Conductivity/Resistivity Module, Rear Enclosure and customer supplied pipe extension or conduit with 3/4 in. FNPT threads*	GF Instrument - 9900 with 3-9900.394 Direct Conductivity/Resistivity Module, 3-9900.396 angle adapter and 3-8052 Integral Mount Kit	Type 2850 Sensor Electronics with - Customer Supplied Programmable Logic Controller or - Programmable Automation Controller	Type 2850 Sensor Electronics with - 0486 Profibus Concentrator and Customer Supplied Programmable Logic Controller or - Programmable Automation Controller
				
Type 2839-2842 Conductivity Electrodes 				All Sold Separately

*Refer to the GF Submersion Kit brochure (3-0000.707) located on our website for installation suggestions and options.

Application Tips

- To optimize 9950-10 /-11 I/O module selection, you can utilize 2850-63 for two conductivity sensors at a time.
- Liquid levels must be high enough to cover vent hole on sensor body.
- Install sensors in an area that will remain free of air bubbles and sediment build-up.
- Conductivity measurements are affected if electrodes are coated by process substances.

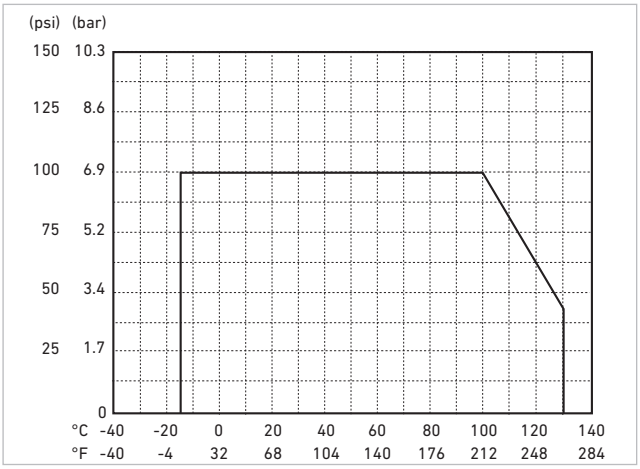
Operating Range Chart



Pressure-temperature diagram

Note

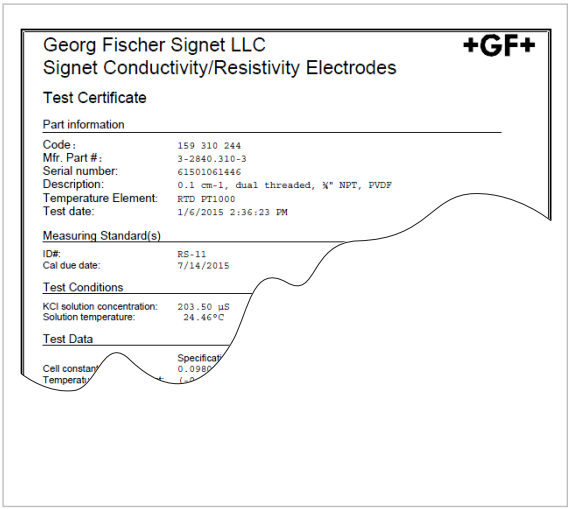
The pressure-temperature diagrams are specifically for the GF sensor. During system design the specifications of all components must be considered. In the case of a metal piping system, a plastic sensor will reduce the system specification.



Ordering Information

Ordering Notes

1. The Conductivity Certification tools are compatible with the following GF Instruments: 9900 and 9950.
2. The sensor cable can be extended up to 30 m (100 ft). See restrictions under General specifications.


Georg Fischer Signet LLC
Signet Conductivity/Resistivity Electrodes
+GF+
Test Certificate
Part information
Code: 159 310 244
Mfr. Part #: 3-2840.310-3
Serial number: 61501061446
Description: 0.1 cm-1, dual threaded, ¾" NPT, PVDF
Temperature Element: RTD PT1000
Test date: 1/6/2015 2:36:23 PM
Measuring Standard(s)
ID#: RS-11
Cal due date: 7/14/2015
Test Conditions
KCl solution concentration: 203.50 µS
Solution temperature: 24.46°C
Test Data

Mfr. Part No.	Code	Cell Constant	Connection	Thread Size(s)	Cable Length
3-2839-1V	159 001 810	0.01 cm-1	Dual threaded	¾ inch NPT	4.6 m (15 ft)
3-2839-1VD	159 001 811	0.01 cm-1	Dual threaded	ISO 7/1-R ¾	4.6 m (15 ft)
3-2840-1V	159 001 812	0.1 cm-1	Dual threaded	¾ inch NPT	4.6 m (15 ft)
3-2840-1VD	159 001 813	0.1 cm-1	Dual threaded	ISO 7/1-R ¾	4.6 m (15 ft)
3-2841-1V	159 001 814	1.0 cm-1	Dual threaded	¾ inch NPT	4.6 m (15 ft)
3-2841-1VD	159 001 815	1.0 cm-1	Dual threaded	ISO 7/1-R ¾	4.6 m (15 ft)
3-2842-1V	159 001 816	10 cm-1	Dual threaded	¾ inch NPT	4.6 m (15 ft)
3-2842-1VD	159 001 817	10 cm-1	Dual threaded	ISO 7/1-R ¾	4.6 m (15 ft)

Special Order Options - Please consult the factory

- Cable length extensions of up to 30 m (100 ft) are available.
- For resistivity measurements above 10 MΩ when used with the 8850-3 or the 8860 cable lengths of the sensor should not exceed 4.6 m (15 ft)

Accessories

Mfr. Part	Code	Description
3-2850.101-1	159 001 392	Plug-in NIST traceable recertification tool, 1.0 µS simulated, for use with 2850 and 9900
3-2850.101-2	159 001 393	Plug-in NIST traceable recertification tool, 2.5 µS simulated, for use with 2850 and 9900
3-2850.101-3	159 001 394	Plug-in NIST traceable recertification tool, 10.0 µS simulated, for use with 2850 and 9900
3-2850.101-4	159 001 395	Plug-in NIST traceable recertification tool, 18.2 MΩ simulated, for use with 2850 and 9900
3-2850.101-5	159 001 396	Plug-in NIST traceable recertification tool, 10.0 MΩ simulated, for use with 2850 and 9900
3-2820.390	198 840 223	¾ in. NPT Fitting, 316 SS replacement for 2823-1, and use for submersible mounting of 2822-1
3-2820.391	198 840 221	¾ in. NPT Fitting, Polypro replacement for 2819-1, 2820-1 or 2821-1
3-2820.392	198 840 222	½ in. NPT Fitting, 316 SS for higher temperature/pressure use with 2819-1, 2820-1 or 2821
3-2850-61	159 001 400	Universal junction box, conductivity electronics, digital (S^3L) output
3-2850-62	159 001 401	Universal junction box, conductivity electronics, 4 to 20 output
3-2850-63	159 001 402	Dual digital (S3L) outputs (for 9950-10/-11)
5523-0322	159 000 761	*Sensor Cable (per ft), 3 cond. plus shield, 22 AWG (for cable extension through a junction box for the following sensors: 3-2820, 3-2821, 3-2822, 3-2823
3-8050-1	159 000 753	Universal mount junction box

* Note: GF recommended sensors that require extended cable lengths be ordered from the factory.

Type 2818-2823 Conductivity/Resistivity Electrodes



2818	2819	2820	2821	2822	2823	Sanitary
	in-line only			Reversible threads for in-line or submersible installation		Tri-clamp flange version

Product description

Type 2818-2823 Conductivity/Resistivity Electrodes are designed to provide versatile installation and accurate sensing across a very broad dynamic range. These electrodes are built with a controlled surface finish to ensure accuracy and repeatability. The standard electrode is constructed 316 SS, but there are other materials available for maximum chemical compatibility.

Reversible threads or sanitary flanges allow for maximum installation versatility.

Sanitary flange versions are available in stainless steel and Titanium with surface quality finish of less than RA 25 and with an optional NIST Traceability Certificate to meet USP requirements.

Coupled with GF patented measuring circuitry, a three decade measurement range is achieved without the need for troublesome electrode platinization. A platinum RTD (Pt1000) located within the electrode allows optimal temperature sensing.

Features

- Standard process connections
  - ¾ in. NPT Polypro
  - ¾ in. NPT SS on 10 and 20 cell
  - Tri-clamp 1 -1½ in., 2 in.
  - Opt. ½ in. NPT 316 SS
- 316 SS or Titanium (indicated tri-clamp only) standard electrode
- Alternative electrode materials available
  - Hastelloy-C
  - Monel
  - Titanium
- In-line or submersible mounting
- NIST traceable certified cells ±1%
- Meet USP requirements

Applications

- Pure Water Treatment
  - Reverse Osmosis
  - Deionization
  - Distillation
- Boiler Condensate
- Semiconductor Water Production
- Rinse Water Monitoring and Control
- TDS (Total Dissolved Solids)
- Salinity
- USP Purified Water
- Ultra Pure Water

Specifications

Types 3-2818-1 (0.01 cm^{-1} Cell), 3-2819-1* (0.01 cm^{-1} Cell), 3-2820-1* (0.1 cm^{-1} Cell), types 3-2821-1* (1.0 cm^{-1} Cell)

* Certified versions available (add "C" suffix to part no.)

General				
Operating Range	3-2818, 3-2819	0.055 to 100 µS	18.2 MΩ to 10 KΩ	0.02 to 50 ppm
	3-2820	1 to 1'000 µS	1 MΩ to 1 KΩ	0.5 to 500 ppm
	3-2821	10 to 10'000 µS	5 to 5'000 ppm	
Cell Constant Accuracy		±2% of reading (certified cells ±1%)		
Temperature Compensation Device		Pt1'000		
Cable Length (use for the 2818, 2819, 2820, 2821, 2822 and 2823)	standard	4.6 m (15 ft)		
	maximum	30 m (100 ft) all sensors when used with 9900 or 9950 and Direct Conductivity/Resistivity Module. 2819, 2819 maximum 4.6 m (15 ft) when used with 2850		

Wetted Materials		
O-rings	EPR (EPDM)	
Insulator Material	Carbon fiber reinforced PTFE	
Electrodes	316L stainless steel (1.4408, DIN 17440) or Titanium	

Max. Temperature/Pressure Rating		
Standard Polypro Fitting	6.9 bar @ 100 °C	100 psi @ 212 °F
Optional 1/2: NPT 316 SS fitting (3-2820.392)	13.8 bar @ 120 °C	200 psi @ 248 °F
Sanitary Connection	6.9 bar @ 120 °C	100 psi @ 248 °F
Temperature Response, τ		
0.01 cell	7 sec.	
0.1 cell	53 sec.	
1.0 cell	21 sec.	
Temperature Accuracy	0.3 °C	

Shipping Weight		
	0.4 kg	0.8 lb

Standards and Approvals
RoHS compliant, China RoHS

Type 3-2822-1 (10.0 cm^{-1} Cell)

General			
Operating Range		100 to 200'000 µS	50 to 100'000 ppm
Cell Constant Accuracy		±2% of reading (certified cells ±1%)	
Temperature Compensation Device		Pt1'000	
Cable length	Standard	4.6 m	15 ft
	Maximum	30 m	100 ft
Wetted Materials			
O-rings		EPR (EPDM)	
Body		CPVC	
Electrodes		316 stainless steel (1.4408, DIN 17440)	
Process Connection		Standard 316 SS fitting	¾ in. NPT threads
		Optional 316 SS submersion adapter fitting (3-2820.390)	¾ in. NPT threads
Max. Temperature/Pressure Rating			
		6.9 bar @ 95 °C	100 psi @ 203 °F
Temp. Response		5 seconds	
Temp. Accuracy		0.3 °C	
Shipping Weight			
		0.4 kg	0.8 lb
Standards and Approvals			
		RoHS compliant, China RoHS	

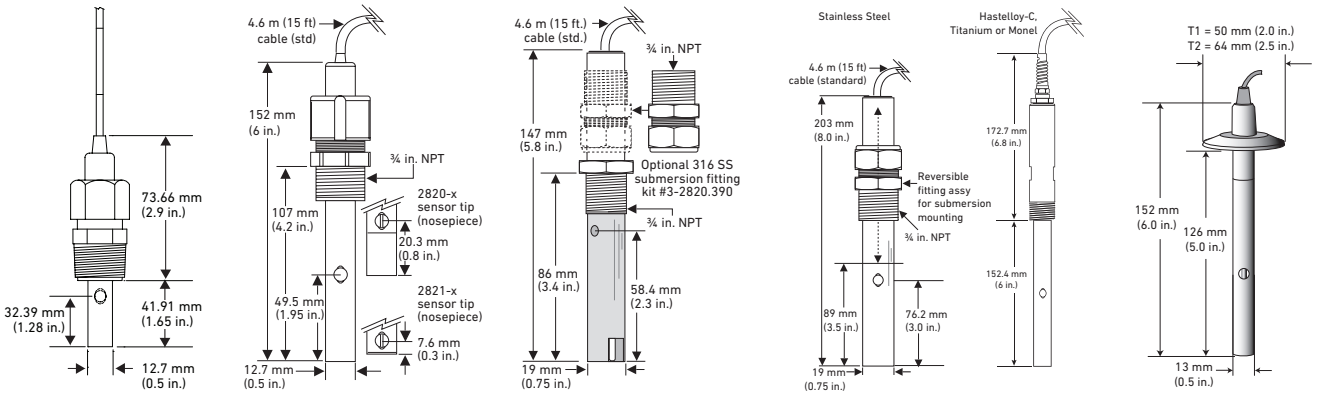
Type 3-2823-1 (20.0 cm^{-1} Cell)

General			
Operating Range		200 to 400'000 µS	100 to 200'000 ppm
Cell Constant Accuracy		±2% of reading	
Temperature Compensation Device		Pt1'000	
Cable Length		Standard	4.6 m (15 ft)
		Maximum	30 m (100 ft)
Wetted Materials			
O-rings		EPR (EPDM)	
Insulator Material		PEEK®	
Process Connection		Electrodes	316 stainless steel (1.4408, DIN 17440)
		Standard 316 SS fitting	¾ in. NPT threads
Max. Temperature/Pressure Rating			
		6.9 bar @ 150 °C	100 psi @ 302 °F
Temp. Response		120 seconds	
Temp. Accuracy		±0.3 °C	
Shipping Weight			
		0.3 kg	0.6 lb
Standards and Approvals			
RoHS compliant, China RoHS			

See pressure-temperature diagrams for more information.

Dimensions

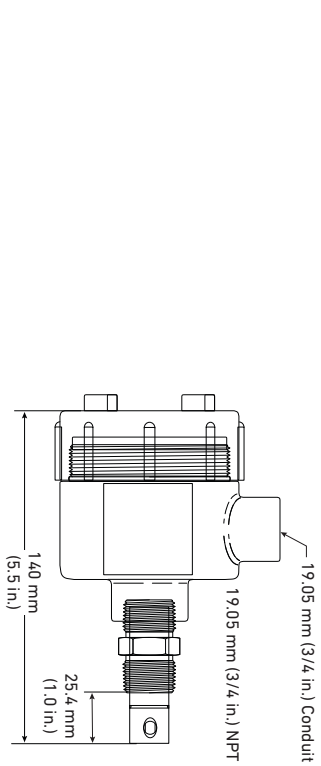
2818	2819, 2820, 2821	2822	2823	Sanitary Tri-clamp

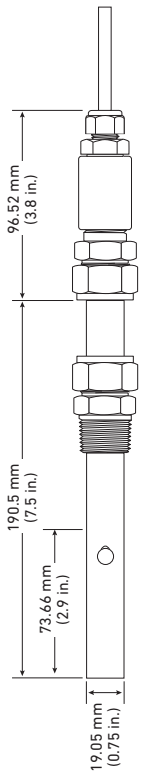


Note

Tri-clamp is available for 2819, 2820, 2821 only. T1 or S1 is for 1 to 1½ in. tees or flanges. T2 or S2 is for 2 in. tees or flanges.

2819, 2820, 2821 -HTHP	2822, 2823 -HP

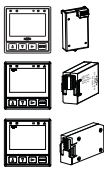
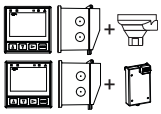
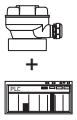
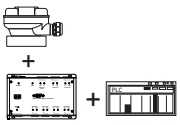
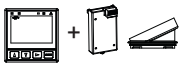




System Overview

In-Line Installation

Panel Mount	Pipe, Tank, Wall Mount	4 to 20 mA Output*	Automation System	Field (Integral) Mount*
GF Instruments - 9900 with 2850 Sensor Electronics - 9900 or with 3-9900.394 Direct Conductivity/Resistivity Module - 9950 with 9950.394 Direct Conductivity/Resistivity Module or with 3-9950.394-2 Dual Channel Conductivity Module	GF Instruments - 9900 with 2850 Sensor Electronics - 9900 and Rear Enclosure or with 3-9900.394 Direct Conductivity/ Resistivity Module and Rear Enclosure	Type 2850 (4-20 mA) Sensor Electronics with - Customer Supplied Programmable Logic Controller or - Programmable Automation Controller	Type 2850 Sensor Electronics with 0486 Profibus Concentrator and - Customer Supplied Programmable Logic Controller or - Programmable Automation Controller	GF Instrument - 9900 with 3-9900.394 Direct Conductivity/Resistivity Module and Angle Adapter

Type 2818-2823 Conductivity Electrodes



Type 2819-2823 Conductivity Electrodes



Note: Conductivity electrodes need to go through 2850 sensor (S^3L or 4 to 20mA) or go through a 9900/9950 (4 to 20mA) via direct conductivity module

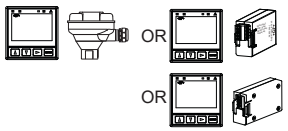
Special order for0.01, 0.1 and1.0 cells**

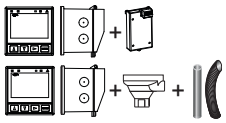
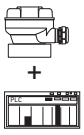
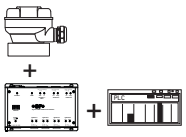
Fittings- Customer Supplied

All Sold Separately

Submersible Installation

Panel Mount	Pipe, Tank, Wall Mount	4 to 20 mA Output*	Automation System
GF Instruments with 2850 Sensor Electronics - 9900 or with 3-9900.394 Direct Conductivity/Resistivity Module - 9950 with 9950.394 Direct Conductivity/ Resistivity Module or with 3-9950.394-2 Dual Channel Conductivity Module	GF Instruments with 2850 Sensor Electronics - 9900 and Rear Enclosure or with 3-9900.394 Direct Conductivity/Resistivity Module, Rear Enclosure and customer supplied pipe extension or conduit with 3/4 in. FNPT threads	Type 2850 Sensor Electronics with - Customer Supplied Programmable Logic Controller or - Programmable Automation Controller	Type 2850 Sensor Electronics with - 0486 Profibus Concentrator and Customer Supplied Programmable Logic Controller or - Programmable Automation Controller



Type 2818-2823 Conductivity Electrodes



^ - Reverse threaded fitting for submersible assembly
** Use 3-2820.390 (sold separately) for submersible assembly

All Sold Separately

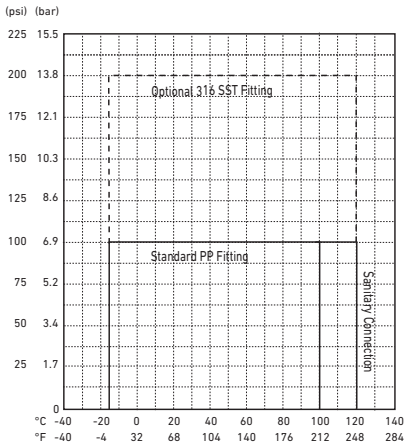
*If required distance between the measurement point and the display is greater than 100 ft, use 3-2850-51 (S3L) or 3-2850-52 4 to 20 mA sensor electronics.

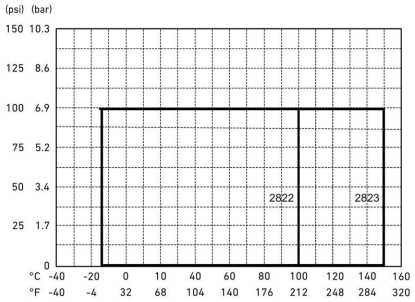
Pressure-temperature diagram

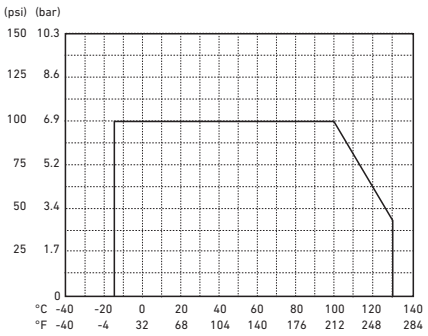
Note

The pressure-temperature diagrams are specifically for the GF sensor. During system design the specifications of all components must be considered. In the case of a metal piping system, a plastic sensor will reduce the system specification.

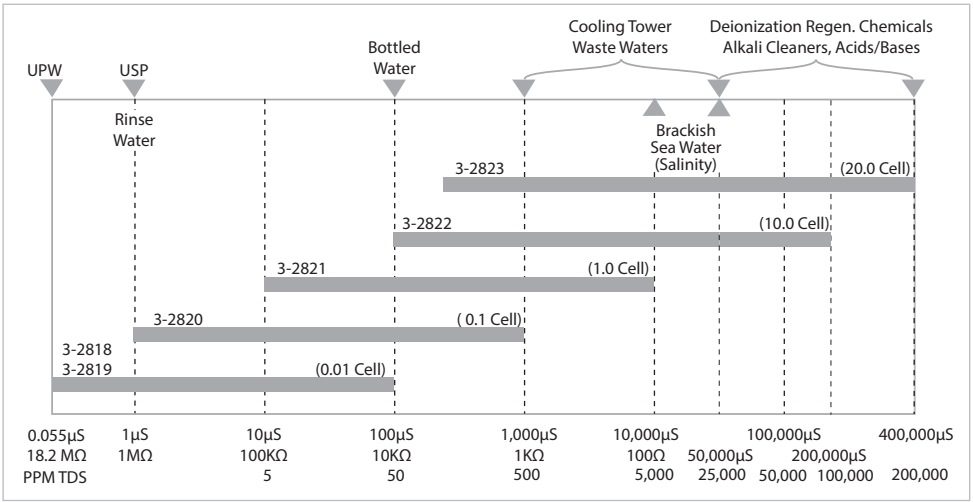
2819, 2820, 2821 | 2822, 2823 | 2823







Operating Range Chart



Application Tips

- GF advises all conductivity sensors be installed in a piping system as shown in Fig 1.
- Liquid levels must be high enough to cover vent hole on sensor body.
- Threads on types 2823 can be reversed in the field.
- Install sensors in an area that will remain free of air bubbles and sediment build-up.
- Conductivity measurements are affected if electrodes are coated by process substances.
- To optimize 9950-10/-11 I/O module selection, you can utilize 2850-63 for two conductivity sensors at a time.

Ordering Information

Ordering Notes

1. Additional wetted materials and sensor lengths are available through special order.
2. The 2818 and 2819 maximum cable length is 4.6M (15 ft) when used with a 2850 sensor electronics.
3. When used with the 9900 and 9950 direct conductivity module, cable length are limited to 30 m (100 ft) maximum .
4. Sensors with cable lengths of up to 30 m (100 ft) are available - consult factory.
5. Use PN 3-2820.390 (2822) for a submersible threaded connection.

CERTIFICATE

Date: November 10, 2017

Sensor Part Number:	3-2819-T1C
Sensor Serial Number:	980159-04
Sensor Cell Constant:	0.0102
Temp. Element Offset:	0.1 °C
Measured at:	24.8 °C

NIST Certified

Example information on NIST Traceability Certificate

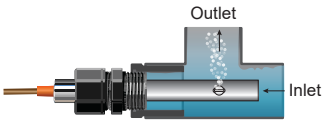
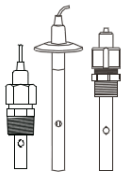
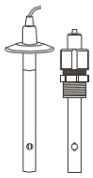


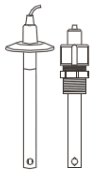
Fig. 1

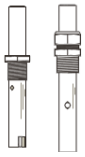
Please refer to Wiring, Installation, and Accessories sections for more information.

Mfr. Part No.	Code	Cell Constant	Sensor Material and Mounting	Insertion into Tee size
3-2818-1**	159 000 718	0.01 cm^{-1}	316 SS electrode, ¾ in. threads	in-line only
3-2819-1	198 844 010	0.01 cm^{-1}	316 SS electrode, ¾ in. threads	in-line only
3-2819-1C	159 000 651	0.01 cm^{-1}	316 SS electrode, ¾ in. threads (certified)	in-line only
3-2819-S1	159 000 085	0.01 cm^{-1}	316 SS electrode, Sanitary Tri-clamp flange	1 to 1½ in.
3-2819-S1C†*	159 000 087	0.01 cm^{-1}	316 SS electrode, Sanitary Tri-clamp flange	1 to 1½ in.
3-2819-S2†	159 000 086	0.01 cm^{-1}	316 SS electrode, Sanitary Tri-clamp flange	2 in.
3-2819-S2C†*	159 000 088	0.01 cm^{-1}	316 SS electrode, Sanitary Tri-clamp flange	2 in.
3-2819-T1†	159 000 081	0.01 cm^{-1}	Titanium electrode, Sanitary Tri-clamp flange	1 to 1½ in.
3-2819-T1C†*	159 000 083	0.01 cm^{-1}	Titanium electrode, Sanitary Tri-clamp flange	1 to 1½ in.
3-2819-T2†	159 000 082	0.01 cm^{-1}	Titanium electrode, Sanitary Tri-clamp flange	2 in.
3-2819-T2C†*	159 000 084	0.01 cm^{-1}	Titanium electrode, Sanitary Tri-clamp flange	2 in.
3-2820-1	198 844 000	0.1 cm^{-1}	316 SS electrode, ¾ in. threads	in-line only
3-2820-1C	159 000 654	0.1 cm^{-1}	316 SS electrode, ¾ in. threads (certified)	in-line only
3-2820-S1	159 000 089	0.1 cm^{-1}	316 SS electrode, Sanitary Tri-clamp flange	1 to 1½ in.
3-2820-S1C†*	159 000 091	0.1 cm^{-1}	316 SS electrode, Sanitary Tri-clamp flange	1 to 1½ in.
3-2820-S2†	159 000 090	0.1 cm^{-1}	316 SS electrode, Sanitary Tri-clamp flange	2 in.
3-2820-S2C†*	159 000 092	0.1 cm^{-1}	316 SS electrode, Sanitary Tri-clamp flange	2 in.
3-2820-T1†	159 000 624	0.1 cm^{-1}	Titanium electrode, Sanitary Tri-clamp flange	1 to 1½ in.
3-2820-T2†	159 000 625	0.1 cm^{-1}	Titanium electrode, Sanitary Tri-clamp flange	2 in.
3-2821-1	198 844 001	1.0 cm^{-1}	316 SS electrode, ¾ in. threads	in-line only
3-2821-1C	159 000 650	1.0 cm^{-1}	316 SS electrode, ¾ in. threads (certified)	in-line only
3-2821-S1†	159 000 093	1.0 cm^{-1}	316 SS electrode, Sanitary Tri-clamp flange	1 to 1½ in.
3-2821-S1C†*	159 000 095	1.0 cm^{-1}	316 SS electrode, Sanitary Tri-clamp flange	1 to 1½ in.
3-2821-S2†	159 000 094	1.0 cm^{-1}	316 SS electrode, Sanitary Tri-clamp flange	2 in.
3-2821-S2C†*	159 000 096	1.0 cm^{-1}	316 SS electrode, Sanitary Tri-clamp flange	2 in.
3-2821-T1†	159 000 626	1.0 cm^{-1}	Titanium electrode, Sanitary Tri-clamp flange	1 to 1½ in.
3-2821-T2†	159 000 627	1.0 cm^{-1}	Titanium electrode, Sanitary Tri-clamp flange	2 in.
3-2822-1	198 844 002	10 cm^{-1}	316 SS electrode, ¾ in. threads	in-line or submersible mounting only
3-2823-1	198 844 003	20 cm-1	316 SS electrode, ¾ in. reversible threads	in-line or submersible mounting only









† Available for 0.01 cm^{-1}, 0.1 cm^{-1}, and 1.0 cm^{-1} cells only
* NIST Certified
** NIST certificate available. Contact the factory.

Additional ordering information

Additional possible configurations are listed below. For variants, combinations, and orders, please contact the local GF sales company.

Example Part Number **3-2820-2K-050**	Cell Constant		Sensor Body Material	Process Connection	O-ring Material		Cable Length
3-28		**-**				**-**	
Cell Constant							
K = 0.01	**19**						
K = 0.1	**20**						
K = 1.0	**21**						
K = 10.0	**22**						
K = 20.0	**23**						
Sensor Body Material							
316 Stainless Steel			**1**				
Hastelloy-C 276			**2**				
Titanium			**3**				
Monel			**4**				
316L Stainless Steel, High Temperature, High Pressure (17 bar @ 205°C/250 psi @ 401°F)**			**HTHP**				
316L Stainless Steel, High Pressure (34 bar @ 25°C/500 psi @ 77°F)***			**HP**				
Process Connection							
½ in. NPT PVDF (2819-2821) / ¾ in. NPT PVDF (2822-2823)				**K**			
½ in. NPT Stainless Steel (2819-2821) / ¾ in. NPT Stainless Steel (2822-2823)				**S**			
¾ in. NPT Polypropylene (2819-2821 only)				**P**			
PVC Submersible (2822-2823 only)				**C**			
¾ in. Dual Stainless Steel (to install into 2850 electronics) (2819-2821 only)				**DS**			
¾ in. Dual Titanium (to install into 2850 electronics) (2819-2821 only)				**DT**			
1 -1½ in. Tri-clamp Stainless Steel* (2819-2821 only)				**S1**			
2 in. Tri-clamp Stainless Steel* (2819-2821 only)				**S2**			
1 -1½ in. Tri-clamp Titanium* (2819-2821 only)				**T1**			
2 in. Tri-clamp Titanium* (2819-2821 only)				**T2**			
O-ring Material							
EPR (EPDM) - standard material					**-**		
FPM (FKM)					**1**		
Cable Length							
7.6 m (25 ft)							**025**
15.2 m (50 ft)							**050**
22.8 m (75 ft)							**075**
30.5 m (100 ft)							**100**

*See 3-2819.606-X dual NPT adapter
**Special High Temperature, High Pressure, Cell Constant 0.01 - 1.0. Ordering: 3-28XX-HTHP
***Special High Pressure, Cell Constant 10.0 - 20.0. Ordering: 3-282X-HP

Accessories and Replacement Parts

Mfr. Part	Code	Description
3-2850.101-1	159 001 392	Plug-in NIST traceable recertification tool, 1.0 µS simulated, for use with 9900, 9950, 2850 and the 2850 4-20 mA output
3-2850.101-2	159 001 393	Plug-in NIST traceable recertification tool, 2.5 µS simulated, for use with 9900, 9950, 2850 and the 2850 4-20 mA output
3-2850.101-3	159 001 394	Plug-in NIST traceable recertification tool, 10.0 µS simulated, for use with 9900, 9950, 2850 and the 2850 4-20 mA output
3-2850.101-4	159 001 395	Plug-in NIST traceable recertification tool, 18.2 MΩ simulated, for use with 9900, 9950, 2850 and the 2850 4-20 mA output
3-2850.101-5	159 001 396	Plug-in NIST traceable recertification tool, 10.0 MΩ simulated, for use with 9900, 9950, 2850 and the 2850 4-20 mA output
3-2820.390	198 840 223	¾ in. NPT fitting, 316 SS for use with 2822-1 and 2823-1 for submersible mounting
3-2820.391	198 840 221	¾ in. NPT fitting, Polypro replacement for 2819-1, 2820-1 or 2821-1
3-2820.392	198 840 222	½ in. NPT fitting, 316 SS for use with 2819-1, 2820-1 or 2821
3-2850-61	159 001 400	Universal junction box, conductivity electronics, digital (S^3L) output
3-2850-62	159 001 401	Universal junction box, conductivity electronics, 4 to 20 output
3-2850-63	159 001 402	Dual digital (S^3L) outputs (for 9950-10/-11)
5523-0322	159 000 761	*Sensor cable (per ft), 3 cond. plus shield, 22 AWG (for cable extension through a junction box for the following sensors: 3-2820, 3-2821, 3-2822, 3-2823)
3-8050-1	159 000 753	Universal mount junction box

***Note:** GF recommended sensors that require extended cable lengths can be ordered from the factory.

Type 2850 Cond./Res. Sensor Electronics and Integral Systems with Sensor



Universal Mount Sensor electronics



3/4" FNPT Mount Sensor electronics



2850 Integral Conductivity System for in-line installations

Product description

The type 2850 Conductivity/Resistivity Sensor Electronics are available in various configurations for maximum installation flexibility. The universal mount version is for pipe, wall, or tank mounting and enables single or dual (digital versions only) inputs using any standard GF conductivity/resistivity sensor. The threaded j-box version can be used with these same GF sensors for submersible sensor mounting. It is also available as a combined integral system configuration for in-line mounting and includes a conductivity electrode in a choice of 0.01, 0.1, 1.0, 10.0 or 20.0 cm-1 cell constants.

The 2850 is ideal for applications with a conductivity range of 0.055 to 400,000 µS or a resistivity range of 18.2 MΩ to 10 kΩ.

The 2850 is available with a digital (S^3L) output, or a single 4 to 20 mA. The digital (S^3L) output version can be paired with the 9900 or the 9950 Transmitter to extend the distance between the measuring points to 120 m (400 ft).

The 9950-10/-11 Six-Channel Transmitter allows for up to six 2850 (S^3L) output conductivity sensors to be used. To optimize 9950-10/-11 I/O module selection, you can utilize 2850-63 for two conductivity sensors at a time.

The two-wire 4 to 20 mA output version is available with eight 4 to 20 mA output ranges for each electrode cell constant. Each range can be inverted and is field selectable.

EasyCal is a standard feature that automatically recognizes conductivity test solution values for simple field calibration. A certification tool is available for validation of the sensor electronics according to USP requirements.

Features

- Test certificate supplied with all 2881-2884 sensors
- Custom cell constant programmed into all integral conductivity systems at the factory
- All 2850 Sensor electronics are built with NEMA 4X / IP65 enclosures
- Integral mount systems for quick and easy installation
- Compact design for maximum installation flexibility
- Extends the distance between the measuring point and the 9900/9950's to 120 m (400 ft)
- Digital (S^3L) interface or two-wire 4 to 20 mA output
- EasyCal with automatic test solution recognition
- For use with ALL GF conductivity electrodes

Applications

- Water Treatment & Water Quality Monitoring
- Reverse Osmosis
- Deionization
- Demineralizer, Regeneration & Rinse
- Scrubber, Cooling Tower and Boiler Protection
- Aquatic Animal Life Support Systems

U.S. Patent No.: 7,550,979 B2

Technical Details

General		
Compatible Electrodes	All GF Conductivity Sensors	
Materials		
NPT Mount Junction Box for Integral Mount	PBT	
Universal/Remote Mount	PBT, PVC-C	
EasyCal - Automatic Recognition of the Following Conductivity Values		
	146.93 µS, 1408.8 µS, 12856 µS (@25 °C) (Test solutions Per ASTM D1125-95)	
	10 µS, 100 µS, 200 µS, 500 µS, 1000 µS, 5000 µS, 10,000 µS, 50,000 µS, 100,000 µS (@ 25 °C) (Standard test solutions)	
Electrical		
Power	12 to 24 VDC ±10%, regulated for 4 to 20 mA output (typically called "Loop Powered")	
	5 to 6.5 VDC ±5% regulated recommended (provided by the GF 9900, 9950, 0486), 3.0 mA max for Digital (S^3L) output (Reverse polarity and short circuit protected)	
Digital (S^3L) Output: Serial ASCII, TTL level 9600 bps		
Accuracy	Conductivity	± 2% of reading
	Temperature	< 0.2 °C
Resolution	Conductivity	0.1% of reading
	Temperature	< 0.2 °C
Update Rate	Conductivity and Temperature	< 600 ms
Available Data via Digital (S^3L) Output		
	Raw conductivity	
	Calibrated conductivity	
	Calibrated temperature-compensated conductivity	
	Temperature	
Max. Temperature/Pressure Rating		
Operating Temperature	-10 °C to 85 ° C	14 °F to 185 °F
Storage Temperature	-20 °C to 85 ° C	-4 °F to 185 °F
Relative Humidity	0 to 95%, non-condensing	
Enclosure	NEMA 4X/IP65	
Current Output		
Field-selectable ranges		
Factory Set Span (Integral mount only)	0.01 cell (2881)*	4 to 20 mA = 0 to 100 µS/cm
	0.10 cell (2882)*	4 to 20 mA = 0 to 1000 µS/cm
	1.0 cell (2883)*	4 to 20 mA = 0 to 10'000 µS/cm
	10.0 cell (2884)*	4 to 20 mA = 0 to 200'000 µS/cm
	20.0 cell (2823)**	4 to 20 mA = 0 to 400'000 µS/cm
Max. Loop Resistance	50 Ω @ 12 VDC	
	325 Ω@ 18 VDC	
	600 Ω @ 24 VDC	
Accuracy	± 2% of output span	
Resolution	7 µA	
Update Rate	< 600 ms	
Error Indication	22 mA	
Pure Water Compensation	When using 0.01-cm cell and raw conductivity value < 0.5 µS, the 2850 auto-switches to compensate for non-linear temperature effects found in this low conductivity (high resistivity) range.	

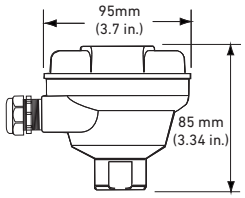
* Test certificate supplied with all sensors. Custom cell constant programmed into the electronics.
** Special Order

Shipping Weight			
3-2850-5X	NPT Mount Junction Box System	0.75 kg	1.75 lb
3-2850-6X	Universal Mount System	0.75 kg	1.75 lb
3-2850-5X-81	Field (Integral) Mount Systems	0.26 kg	0.57 lb
3-2850-5X-82	Field (Integral) Mount Systems	0.24 kg	0.52 lb
3-2850-5X-83	Field (Integral) Mount Systems	0.24 kg	0.53 lb
3-2850-5X-84	Field (Integral) Mount Systems	0.24 kg	0.52 lb

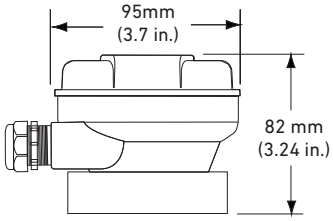
Standards and Approvals
CE, UKCA, FCC
RoHS compliant, China RoHS
Manufactured under ISO 9001, ISO 14001 and ISO 45001

Dimensions

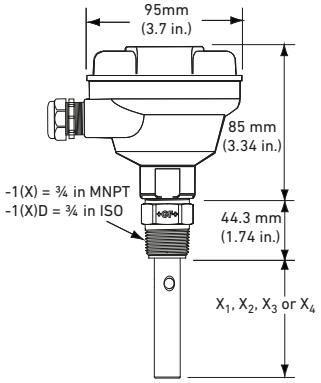
2850-5X NPT
Mount Junction Box Systems



2850-6X
Universal Mount Systems

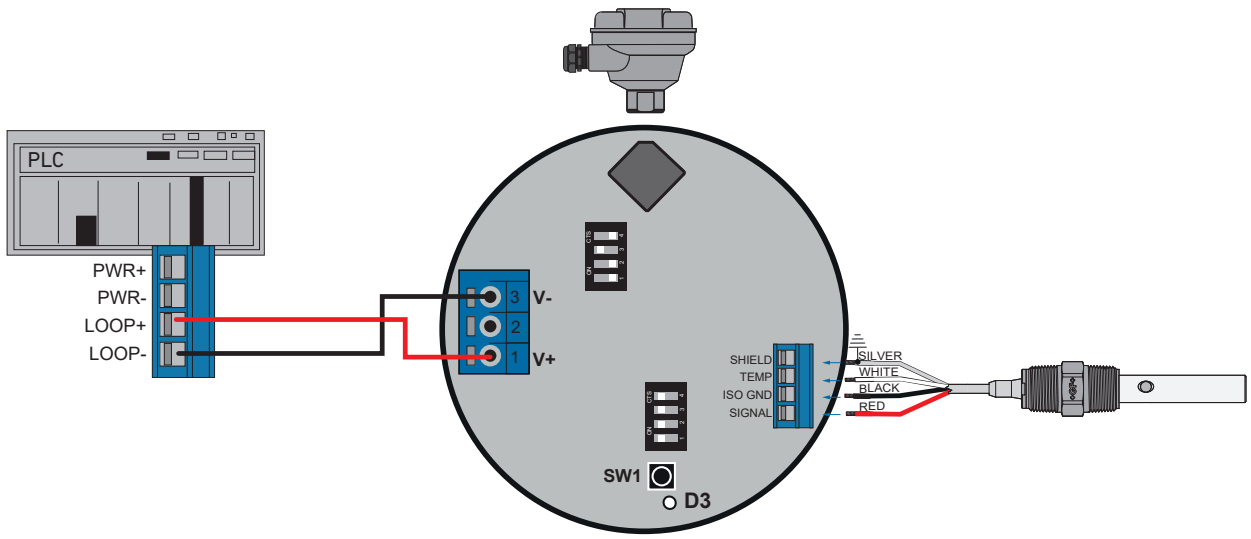


2850-5X-8X-1(X)(D)
NEW Field (Integral) Mount Systems

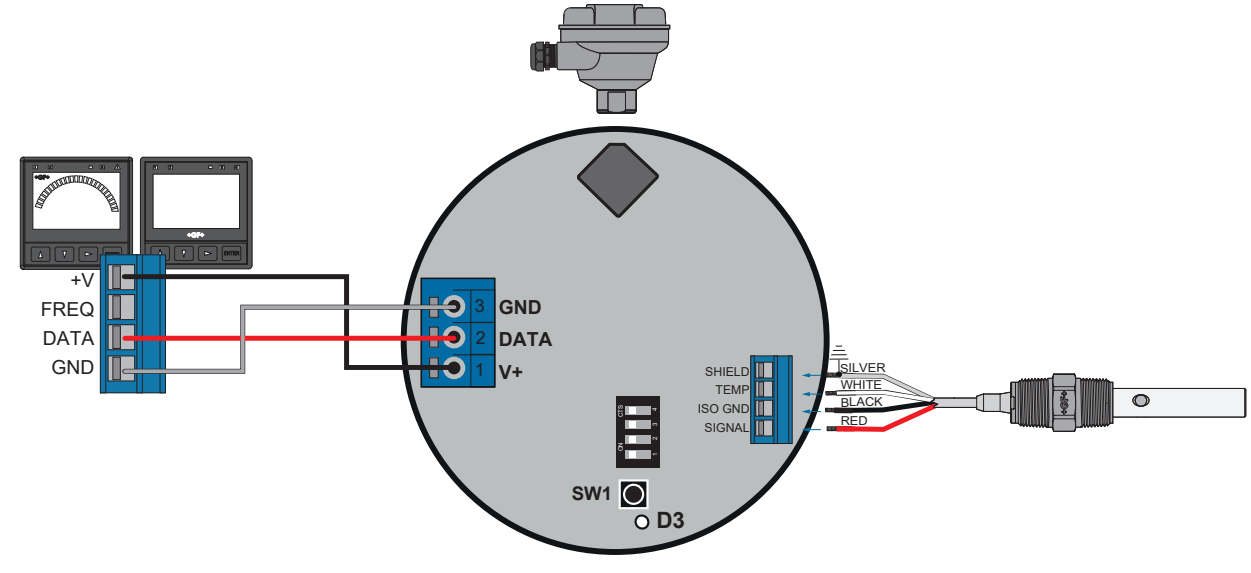


Sensor	Insertion Depth
X1 (2881)	73.7 mm (2.90 in.)
X2 (2882)	35.8 mm (1.41 in).
X3 (2883)	41.9 mm (1.65 in.)
X4 (2884)	69.9 mm (2.75 in.)

Wiring to 4 to 20 mA Loop Output



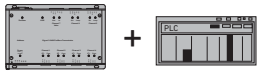
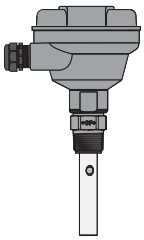
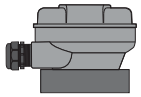
Wiring to 9900/9950 Transmitter (S³L)



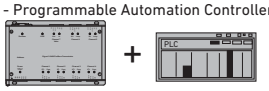
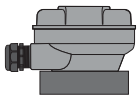
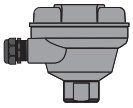
*Note: Under normal operation, the shield wire does not need to be connected. However, in noisy environments, the shield should be connected to improve noise immunity.

System Overview

In-Line Installation

Panel, Wall Mount	4 to 20 mA Output	Automation System
GF Instruments - 9900 - 9950 	- Customer Supplied Programmable Logic Controller, or - Programmable Automation Controller 	- 0486 Profibus Concentrator and Customer Supplied Programmable Logic Controller or - Programmable Automation Controller 
Type 2850 Conductivity Integral System (2881-2883), or 2850 Universal Mount with any GF conductivity probe 		
Fittings - Customer Supplied 3/4 in. NPT or ISO threads		All sold separately

Submersible Installation

Panel, Wall Mount	4 to 20 mA Output	Automation System
GF Instruments - 9900 - 9950 	- Customer Supplied Programmable Logic Controller, or - Programmable Automation Controller 	- 0486 Profibus Concentrator and Customer Supplied Programmable Logic Controller or - Programmable Automation Controller 
Type 2850 Universal Mount or NPT Mount Sensor Electronics with any GF conductivity probe 		
Submersible Fittings - Customer Supplied 3/4 in. NPT or ISO threads		All sold separately

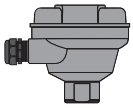
* The 2850 (S³L) signal can be used for distances over 30 m (100 ft). The 2850 has a limited sensor cable input length of 4.6 m (15 ft).

Note:

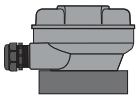
The 9900/9950 (with Direct Conductivity/Resistivity module) can run all conductivity sensors with 30 m (100 ft) of cable.

Application Tips

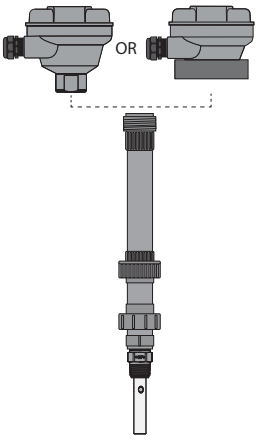
- Maximum distance between sensor and 2850 electronics is 4.6 m (15 ft).

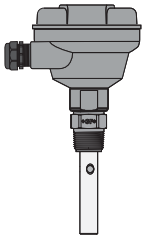


-5X 3/4" FNPT Mount Sensor Electronics

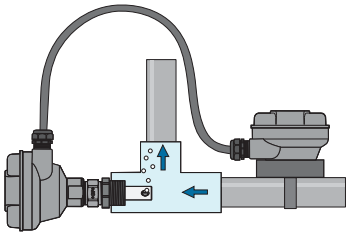


-6X Universal Mount Sensor Electronics





Integral System includes the 2850 sensor electronics and a choice of Conductivity/ Resistivity electrode.



Universal Sensor Electronics assembly allows sensors without the 3/4" rear thread to be used.

Field Selectable Ranges for 4 to 20 mA Operation

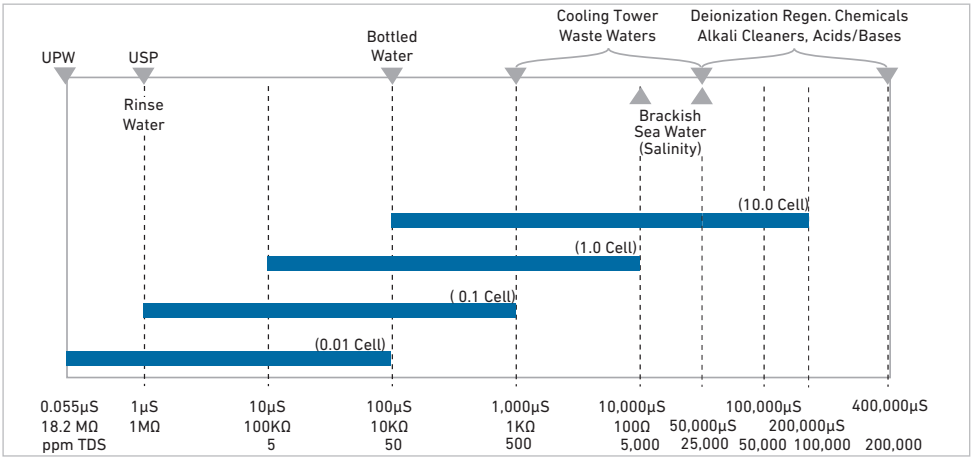
The chart below indicates the field selectable ranges in which the 2850 sensor electronics can be set via internal switches. All ranges can be inverted if required. Types listed below are compatible Conductivity/Resistivity electrodes.

0.01 Cell	0.10 Cell	1.0 Cell	10.0 Cell	20.0 Cell
Type 2881	Type 2882	Type 2882	Type 2884	Type 2823 (Special Order)
10 to 20 MΩ	0 to 2 µS	0 to 20 µS	0 to 200 µS	0 to 400 µS
2 to 10 MΩ	0 to 5 µS	0 to 50 µS	0 to 500 µS	0 to 1'000 µS
0 to 2 MΩ	0 to 10 µS	0 to 100 µS	0 to 1'000 µS	0 to 2'000 µS
0 to 1 MΩ	0 to 50 µS	0 to 500 µS	0 to 5'000 µS	0 to 10'000 µS
0 to 5 MΩ	0 to 100 µS	0 to 1'000 µS	0 to 10'000 µS	0 to 200'000 µS
0 to 10 MΩ	0 to 200 µS	0 to 2'000 µS	0 to 50'000 µS	0 to 100'000 µS
N/A	0 to 500 µS	0 to 5'000 µS	0 to 100'000 µS	0 to 200'000 µS
N/A	0 to 1'000 µS	0 to 10'000 µS	0 to 200'000 µS	0 to 400'000 µS

The 4 to 20 mA output ranges shown in this chart can be inverted using the internal switch Resistivity. Ranges are in BOLD
Note: The 2819-2823 series Integral Systems must be ordered through special order products.

Operating Range Chart

The 2850 is capable of measuring conductivity and resistivity values over a wide range. Below is a chart of GF Conductivity/ Resistivity electrodes (listed in each range box) that is recommended for the specified measurement range.



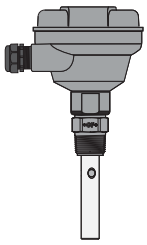
Ordering Information

Ordering Notes

1. All 2850 units can be used with any GF Conductivity/Resistivity electrode
2. Integral systems are only offered with type 2881-2884 electrodes. 2818-2823 and 2870-2874 require a special order sensor.
3. Dual channel units are only available in the 3-2850- 63 universal mount junction box/remote mount configuration and with digital (S³L) output for use with the 9950-10/-11.

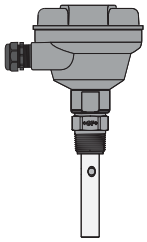
Conductivity Integral Systems with CPVC Process Connection

Mfr. Part No.	Code	Description
Digital (S³L) output		
3-2850-51-81	159002156	Integral 2850 system, Digital (S³L) output, 0.01 cell, CPVC NPT
3-2850-51-82	159002157	Integral 2850 system, Digital (S³L) output, 0.1 cell, CPVC NPT
3-2850-51-83	159002158	Integral 2850 system, Digital (S³L) output, 1.0 cell, CPVC NPT
3-2850-51-84	159002159	Integral 2850 system, Digital (S³L) output, 10.0 cell, CPVC NPT
3-2850-51-81D	159002160	Integral 2850 system, Digital (S³L) output, 0.01 cell, CPVC ISO
3-2850-51-82D	159002161	Integral 2850 system, Digital (S³L) output, 0.1 cell, CPVC ISO
3-2850-51-83D	159002162	Integral 2850 system, Digital (S³L) output, 1.0 cell, CPVC ISO
3-2850-51-84D	159002163	Integral 2850 system, Digital (S³L) output, 10.0 cell, CPVC ISO
4 to 20 mA output		
3-2850-52-81	159002164	Integral 2850 system, 4 to 20 mA output, 0.01 cell, CPVC NPT
3-2850-52-82	159002165	Integral 2850 system, 4 to 20 mA output, 0.1 cell, CPVC NPT
3-2850-52-83	159002166	Integral 2850 system, 4 to 20 mA output, 1.0 cell, CPVC NPT
3-2850-52-84	159002167	Integral 2850 system, 4 to 20 mA output, 10.0 cell, CPVC NPT
3-2850-52-81D	159002168	Integral 2850 system, 4 to 20 mA output, 0.01 cell, CPVC ISO
3-2850-52-82D	159002169	Integral 2850 system, 4 to 20 mA output, 0.1 cell, CPVC ISO
3-2850-52-83D	159002170	Integral 2850 system, 4 to 20 mA output, 1.0 cell, CPVC ISO
3-2850-52-84D	159002171	Integral 2850 system, 4 to 20 mA output, 10.0 cell, CPVC ISO



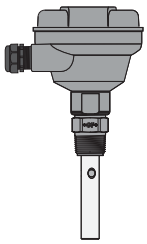
Conductivity Integral Systems with Polypropylene Process Connection

Mfr. Part No.	Code	Description
Digital (S^3L) output		
3-2850-51-81P	159002172	Integral 2850 system, Digital (S^3L) output, 0.01 cell, Polypropylene NPT
3-2850-51-82P	159002173	Integral 2850 system, Digital (S^3L) output, 0.1 cell, Polypropylene NPT
3-2850-51-83P	159002174	Integral 2850 system, Digital (S^3L) output, 1.0 cell, Polypropylene NPT
3-2850-51-81PD	159002175	Integral 2850 system, Digital (S^3L) output, 0.01 cell, Polypropylene ISO
3-2850-51-82PD	159002176	Integral 2850 system, Digital (S^3L) output, 0.1 cell, Polypropylene ISO
3-2850-51-83PD	159002177	Integral 2850 system, Digital (S^3L) output, 1.0 cell, Polypropylene ISO
4 to 20 mA output		
3-2850-52-81P	159002178	Integral 2850 system, 4 to 20 mA output, 0.01 cell, Polypropylene NPT
3-2850-52-82P	159002179	Integral 2850 system, 4 to 20 mA output, 0.1 cell, Polypropylene NPT
3-2850-52-83P	159002180	Integral 2850 system, 4 to 20 mA output, 1.0 cell, Polypropylene NPT
3-2850-52-81PD	159002181	Integral 2850 system, 4 to 20 mA output, 0.01 cell, Polypropylene ISO
3-2850-52-82PD	159002182	Integral 2850 system, 4 to 20 mA output, 0.1 cell, Polypropylene ISO
3-2850-52-83PD	159002183	Integral 2850 system, 4 to 20 mA output, 1.0 cell, Polypropylene ISO



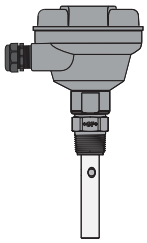
Conductivity Integral Systems with PVDF Process Connection

Mfr. Part No.	Code	Description
Digital (S^3L) output		
3-2850-51-81V	159002184	Integral 2850 system, Digital (S^3L) output, 0.01 cell, PVDF NPT
3-2850-51-82V	159002185	Integral 2850 system, Digital (S^3L) output, 0.1 cell, PVDF NPT
3-2850-51-83V	159002186	Integral 2850 system, Digital (S^3L) output, 1.0 cell, PVDF NPT
3-2850-51-81VD	159002187	Integral 2850 system, Digital (S^3L) output, 0.01 cell, PVDF ISO
3-2850-51-82VD	159002188	Integral 2850 system, Digital (S^3L) output, 0.1 cell, PVDF ISO
3-2850-51-83VD	159002189	Integral 2850 system, Digital (S^3L) output, 1.0 cell, PVDF ISO
4 to 20 mA output		
3-2850-52-81V	159002190	Integral 2850 system, 4 to 20 mA output, 0.01 cell, PVDF NPT
3-2850-52-82V	159002191	Integral 2850 system, 4 to 20 mA output, 0.1 cell, PVDF NPT
3-2850-52-83V	159002192	Integral 2850 system, 4 to 20 mA output, 1.0 cell, PVDF NPT
3-2850-52-81VD	159002193	Integral 2850 system, 4 to 20 mA output, 0.01 cell, PVDF ISO
3-2850-52-82VD	159002194	Integral 2850 system, 4 to 20 mA output, 0.1 cell, PVDF ISO
3-2850-52-83VD	159002195	Integral 2850 system, 4 to 20 mA output, 1.0 cell, PVDF ISO



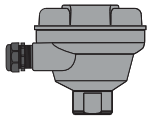
Conductivity Integral Systems with PEEK Process Connection

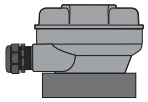
Mfr. Part No.	Code	Description
Digital (S^3L) output		
3-2850-51-81K	159002196	Integral 2850 system, Digital (S^3L) output, 0.01 cell, PEEK NPT
3-2850-51-82K	159002197	Integral 2850 system, Digital (S^3L) output, 0.1 cell, PEEK NPT
3-2850-51-83K	159002198	Integral 2850 system, Digital (S^3L) output, 1.0 cell, PEEK NPT
3-2850-51-81KD	159002199	Integral 2850 system, Digital (S^3L) output, 0.01 cell, PEEK ISO
3-2850-51-82KD	159002200	Integral 2850 system, Digital (S^3L) output, 0.1 cell, PEEK ISO
3-2850-51-83KD	159002201	Integral 2850 system, Digital (S^3L) output, 1.0 cell, PEEK ISO
4 to 20 mA output		
3-2850-52-81K	159002202	Integral 2850 system, 4 to 20 mA output, 0.01 cell, PEEK NPT
3-2850-52-82K	159002203	Integral 2850 system, 4 to 20 mA output, 0.1 cell, PEEK NPT
3-2850-52-83K	159002204	Integral 2850 system, 4 to 20 mA output, 1.0 cell, PEEK NPT
3-2850-52-81KD	159002205	Integral 2850 system, 4 to 20 mA output, 0.01 cell, PEEK ISO
3-2850-52-82KD	159002206	Integral 2850 system, 4 to 20 mA output, 0.1 cell, PEEK ISO
3-2850-52-83KD	159002207	Integral 2850 system, 4 to 20 mA output, 1.0 cell, PEEK ISO



Note: Integral systems are shipped with a sensor and 2850 combined. Other 2850 systems are available with type 288X electrodes upon request. See individual electrode product pages for more information.

Mfr. Part No.	Code	Output
2850 Sensor Electronics with EasyCal		
NPT mount junction box (¾ inch threaded) for standpipe or integral mounting, single input only		
3-2850-51	159 001 398	One input/one digital (S^3L) output
3-2850-52	159 001 399	One input/one 4 to 20 mA output
Universal mount junction box for remote mount, single or dual input*		
3-2850-61	159 001 400	One input/one digital (S^3L) output for use with 9900 or
3-2850-62	159 001 401	9950
3-2850-63	159 001 402	One input/one 4 to 20 mA output
		Dual digital (S^3L) outputs





*For use when remote sensor mounting is desired. Compatible with ALL GF conductivity electrodes. See individual electrode product pages for more information.

Additional ordering information

Additional possible configurations are listed below. For variants, combinations, and orders, please contact the local GF sales company.

Example Part Number
3-2850-51-21-T

	Output		Cell Constant		Sensor Material
3-2850-		**-**		**-**	
Output					
Digital (S^3L)	**51**				
4 to 20 mA	**52**				
Cell Constant					
K= 0.01 - Long sensor length			**19**		
K= 0.1 - Long sensor length			**20**		
K= 1.0 - Long sensor length			**21**		
Sensor Body and Process Connection Material					
3/4" 316 L Stainless Steel					**S**
3/4" Titanium					**T**

Accessories and Replacement Parts

Mfr. Part	Code	Description
3-2850.101-1	159 001 392	Plug-in NIST traceable recertification tool, 1.0 µS simulated, for use with 9900, 9950, 2850 and the 2850 4-20 mA output
3-2850.101-2	159 001 393	Plug-in NIST traceable recertification tool, 2.5 µS simulated, for use with 9900, 9950, 2850 and the 2850 4-20 mA output
3-2850.101-3	159 001 394	Plug-in NIST traceable recertification tool, 10.0 µS simulated, for use with 9900, 9950, 2850 and the 2850 4-20 mA output
3-2850.101-4	159 001 395	Plug-in NIST traceable recertification tool, 18.2 MΩ simulated, for use with 9900, 9950, 2850 and the 2850 4-20 mA output
3-2850.101-5	159 001 396	Plug-in NIST traceable recertification tool, 10.0 MΩ simulated, for use with 9900, 9950, 2850 and the 2850 4-20 mA output
5523-0322V	159 001 807	**Sensor cable (per ft), 3 cond. plus shield, 22 AWG

** Although a customer can extend the cable of a conductivity sensor, GF does not recommend this, and offers extended cable lengths from the factory.

Conductivity/Resistivity Integral Systems with type 9900 Transmitters

Member of the SmartPro® Family of Instruments



Product description

GF has combined the type 9900 SmartPro® Transmitter with conductivity and resistivity sensors to create integral systems that are easy to order and simple to install. Also available in fl ow, level, temperature and pressure configurations, each integral system features a 9900 Transmitter which provides a local and easy to read LCD display. The push button keypad makes it easy to navigate through the transmitter's menu. The DC-powered 9900 features a scalable 4 to 20 mA output and open collector for process control.

The integral system is also offered with a choice of GF conductivity and resistivity sensors, types 2839, 2840, 2841, and 2842 in 0.01, 0.1, 1.0, or 10.0 cm-1 cell constants, respectively. These sensors are field proven and reliably perform in ranges from 18.2 MΩ (0.055 µS) to 200,000 µS. They are ideal for installation into standard pipes via the ¾ inch sensor threaded (NPT or ISO) process connection. The sensors are available with 316 stainless steel and PVDF wetted materials.

Features

- Local Display for sensor mounted instruments
- Provides 4 to 20 mA output
- „At a glance" visibility
- „Dial-type" digital bar graph
- NEMA 4X/IP65 enclosures

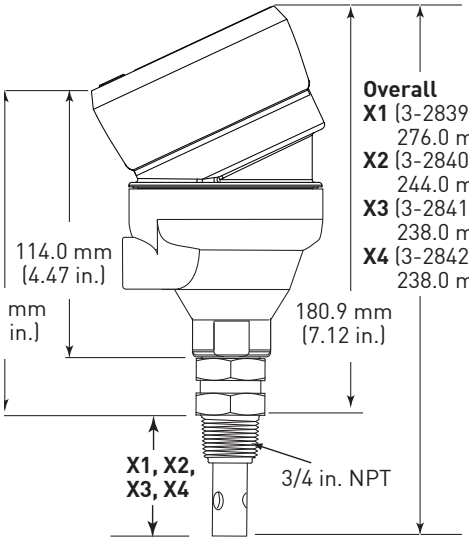
Applications

- RO/DI System Control
- Cooling Tower Control
- Water Quality Monitoring
- Filtration Systems
- Scrubber Systems
- Boiler Condensate
- Semiconductor Water Production
- Leak Detection

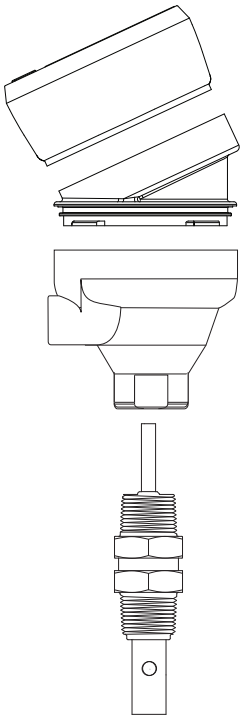
Technical Details

See individual instrument and sensor/electrode catalogue pages for more information. Refer to types 2839, 2840, 2841, 2842, and 9900 technical specifications for more details on these products.

Dimensions



Electrode
X1 (3-2839-1, -1D): 73mm (2.88 in.)
X2 (3-2840-1, -1D): 35mm (1.38 in.)
X3 (3-2841-1, -1D): 41.3mm (1.63 in.)
X4 (3-2842-1, -1D): 41.3mm (1.63 in.)



3-9900 + 3-9900.394
Instrument + Direct
Conductivity/Resistivity Module

3-9900-396
Angle Adjustment Adapter Kit

3-8052
Integral
Mount Kit

3-28XX-XX
Conductivity
Electrode

Ordering Notes

Integral Mounts are available with all parts conveniently assembled (transmitter, conductivity module, angle adapter, integral mount kits and electrode). Alternatively, all five parts can be purchased separately. See individual instrument and sensor pages for more information. All other global regions contact GF Special Order products for pricing and availability.

System Overview

Integral Installation

Type 9900 Transmitter
3-9900.394 Direct Conductivity/Resistivity Module, 3-8052 Integral Mount Kit and
3-9900.396 Angle Adapter



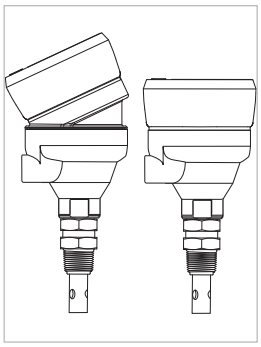
GF Dual Threaded Conductivity Electrodes
- 2839
- 2841
- 2840
- 2842



Ordering Information

Mfr. Part No./ Code	Instrument + Sensor	Angle adapter	Description
159 002 230	3-9900-1 + 3-2839-1V	yes	Cell constant: 0.01 cm-1, ¾ in. NPT
159 002 231	3-9900-1 + 3-2840-1V	yes	Cell constant: 0.1 cm-1, ¾ in. NPT
159 002 232	3-9900-1 + 3-2841-1V	yes	Cell constant: 1.0 cm-1, ¾ in. NPT
159 002 233	3-9900-1 + 3-2842-1V	yes	Cell constant: 10.0 cm-1, ¾ in. NPT
159 001 728*	3-9900-1 + 3-2839-1V	no	Cell constant: 0.01 cm-1, ¾ in. NPT
159 001 729*	3-9900-1 + 3-2840-1V	no	Cell constant: 0.1 cm-1, ¾ in. NPT
159 001 730*	3-9900-1 + 3-2841-1V	no	Cell constant: 1.0 cm-1, ¾ in. NPT
159 001 731*	3-9900-1 + 3-2842-1V	no	Cell constant: 10.0 cm-1, ¾ in. NPT
159 001 757*	3-9900-1 + 3-2839-1VD	no	Cell constant: 0.01 cm-1, ISO 7/1-R ¾
159 001 758*	3-9900-1 + 3-2840-1VD	no	Cell constant: 0.1 cm-1, ISO 7/1-R ¾
159 001 759*	3-9900-1 + 3-2841-1VD	no	Cell constant: 1.0 cm-1, ISO 7/1-R ¾
159 001 732*	3-9900-1 + 3-2842-1VD	no	Cell constant: 10.0 cm-1, ISO 7/1-R ¾

*Only available in Europe.



Accessories

Mfr. Part	Code	Description
3-9900.396	159 001 701	Angle adjustment adapter kit

Planning Fundamentals

of Measurement and Control

Chlorine Analyzer Systems

Content

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Type 4630 Free Chlorine Analyzer System 204
Type 4632 Chlorine Dioxide Analyzer System 209
Type 2630 Amperometric Free Chlorine Electrode 213
Type 2632 Amperometric Chlorine Dioxide Electrode 217
Type 2650 DryLoc® Amperometric Electronics 221
Type 2751-7 pH Electronics 224

Introduction

Chlorine Analysis Systems Specification Matrix

Type	4630	4632
		
Description	Free Chlorine Analyzer System	Chlorine Dioxide Analyzer System
Materials	Panel - Black Acrylic, Flow Cell - Acrylic, Wiring Enclosure - Polycarbonate	
Flow Cell, Spacer Rings	Acrylic	
Flow Regulator Housing	Polycarbonate	
Strainer, E-clip, Regulator Spring, Float	Stainless Steel	
Valves, Vent	Polypropylene	
Flow Cell O-rings, Diaphragm	EPR (EPDM), FKM	
Chlorine Electrode	PVC, PTFE, FKM, Nylon, Silicone	
pH Electrode	PPS, Glass, UHMW PE, FKM	
Sealing Tape on Valves, Plug and Vent	PTFE	
Plug	Polyethylene	
Languages	English	
Power Requirements	DC input: 24 VDC nominal (12 to 32 VDC, ± 10% regulated), UL 60950-1 or UL 61010-1 AC input: 100 to 240 VAC. 50 to 60 Hz. 24 VA Current Loop: 12 to 32 VDC, ±10% regulated, 4 to 20 mA (30 mA max.)	
Enclosure	NEMA 4X (with output wire glands sealed)	
Standards and Approvals	CE, UKCA, FCC, UL, CUL, WEEE, China RoHS, Free Chlorine - EPA 334.0	

Chlorine Analysis Electrodes Specification Matrix

Type	2630	2632	2724
			
Description	Amperometric Free Chlorine Electrode	Amperometric Chlorine Dioxide Electrode	Flat pH Electrode
Materials	CPVC		PPS
Wetted Materials	PTFE		PPS
	FKM		Porous UHMW PE
	Nylon, Silicone		Glass, FKM
Operation Range	0.02 to 2 ppm (mg/l) 0.05 to 5 ppm (mg/l) 0.1 to 20 ppm (mg/l) 5.5 to 8.2 pH	0.02 to 2 ppm (mg/l)	-1 to 15 pH
Connector Style	DryLoc®		
Output Specs	Digital (S^3L)		
Operating Temperature (°C) (°F)	5 °C to 45 °C (41 °F to 113 °F)		-10 °C to 85 °C (14 °F to 185 °F)
Standards and Approvals	CE, FCC, RoHS compliant, China RoHS		RoHS compliant, China RoHS

Chlorine Analysis Specification Matrix

Amperometric electronics, pH electronics and chlorine controller

Type	2650	2751-7	9950-3-4
			
Description	Amperometric Electronics	pH Electronics	Chlorine Controller
Materials	PC+PBT	PC+PBT	PBT, Neoprene, PP, Silicone Rubber
Operation Range	±450 mV	-1.0 to 15.0 pH	Free chlorine 0-20 ppm Chlorine dioxide 0 to 2 ppm pH: -1.00 to 15.00 pH
Connector Style	DryLoc®	DryLoc®	
Display			LCD
Output Specs	Digital (S³L)	Digital (S³L)	Current Loop (4) 4 to 20 mA Optional Modbus Module
Max. Relays			4 binary input and 2 dry contact relay (standard)
Languages			English, Spanish, French, German
Operating Temperature (°C) (°F)	0 °C to 85 °C (32 °F to 185 °F)	0 °C to 85 °C (32 °F to 185 °F)	-10 °C to 70 °C (14 °F to 158 °F)
Standards and Approvals	CE, FCC, RoHS compliant, China RoHS	CE, FCC, RoHS compliant, China RoHS	CE, UKCA, FCC, UL, CUL, RoHS compliant, China RoHS, NEMA TYPE 4X/ IP65 (front face only)

Free Chlorine 2630 Sensor Capabilities

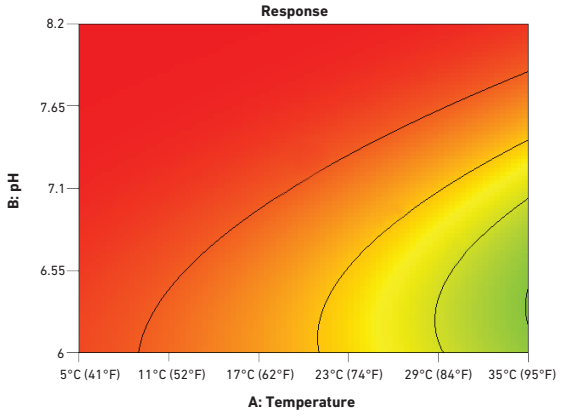
Quick Guide

1. Select the chart that represents the normal free chlorine level.
2. Find the nominal pH of the water (left side of the chart).
3. Find the lowest possible temperature of the water (chart bottom).
4. Where the two lines in the table intersect, the color legend can be used to determine whether the 3-2630-X sensor is suitable for the respective application.

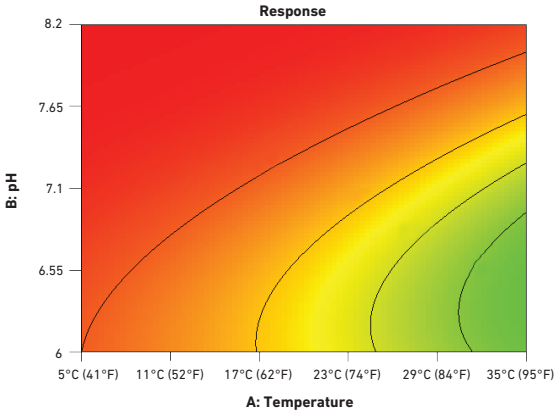
Color	Signal quality	Signal compensation	Application recommendation
Blue	High signal	Low signal compensation	Highly Recommended
Green	Good signal	Low compensation	Recommended
Yellow	Medium signal	Medium compensation	Recommended
Orange	Low signal	High signal compensation	Recommended with Caution*
Red	Bad signal	Mostly compensated signal	Not Recommended

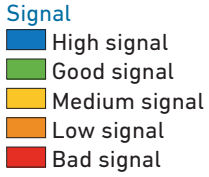
*The sensor is working at its operating limit and must be serviced more frequently to ensure that it functions properly at all times.

Chlorine Concentration 0.1 ppm

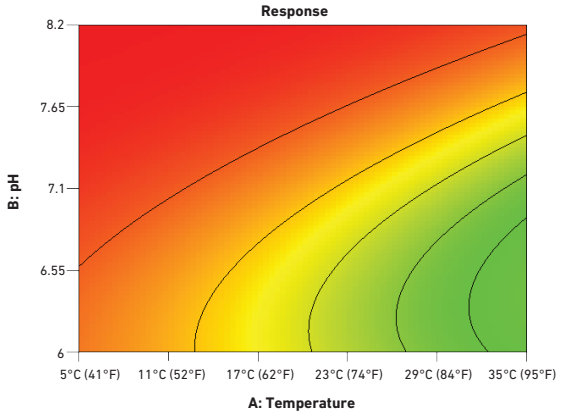


Chlorine Concentration 0.2 ppm

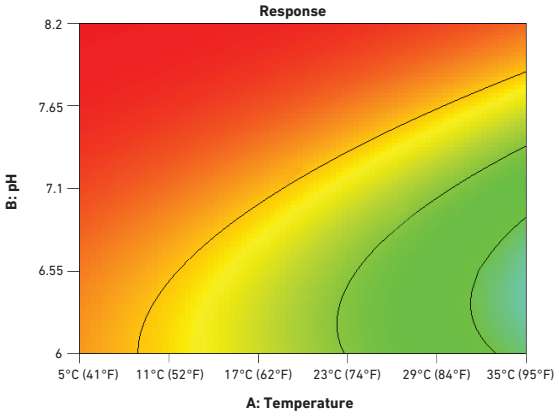


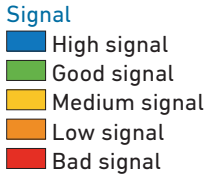


Chlorine Concentration 0.3 ppm

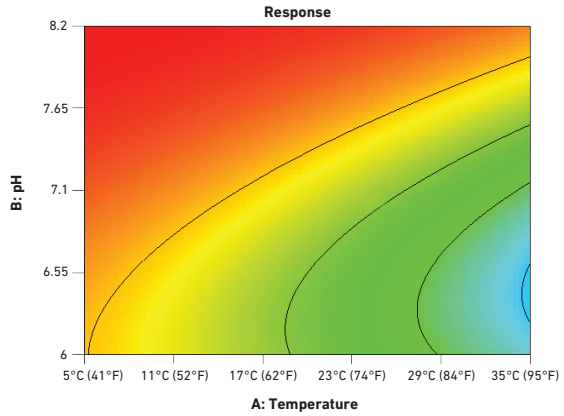


Chlorine Concentration 0.4 ppm

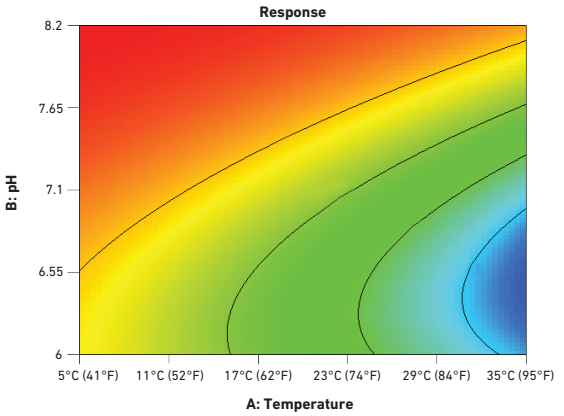


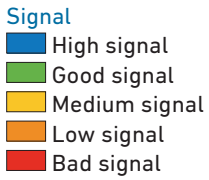


Chlorine Concentration 0.5 ppm

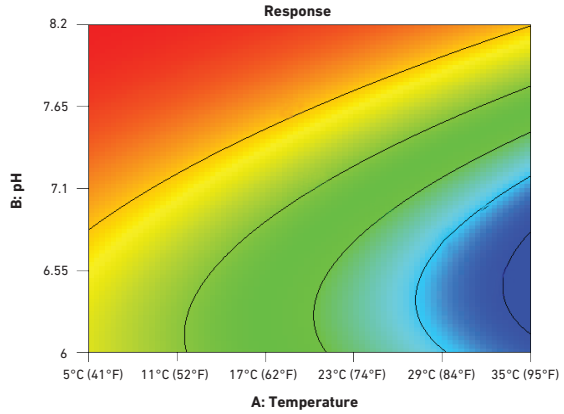


Chlorine Concentration 0.6 ppm

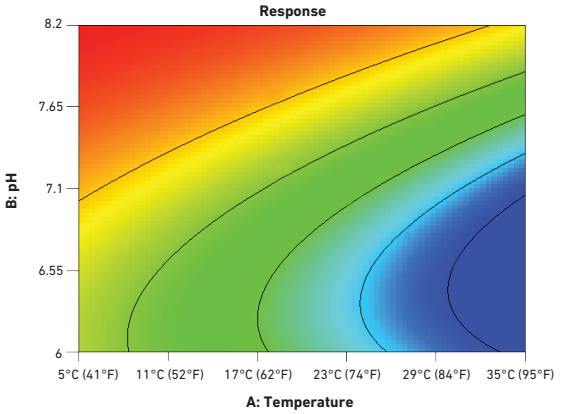


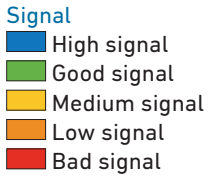


Chlorine Concentration 0.7 ppm

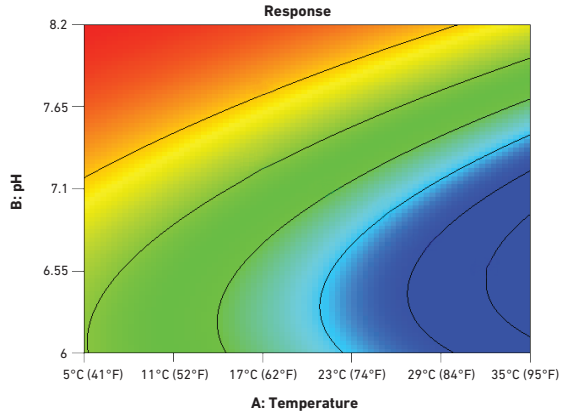


Chlorine Concentration 0.8 ppm

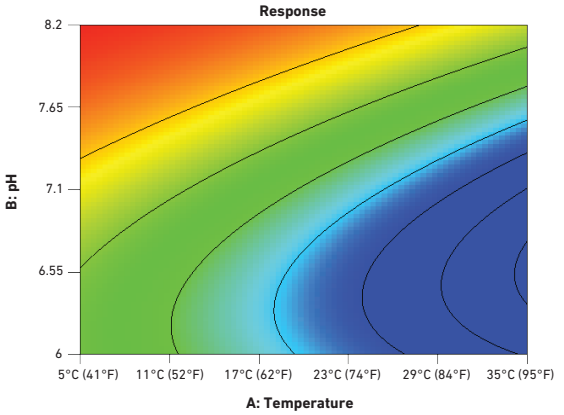


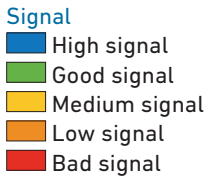


Chlorine Concentration 0.9 ppm

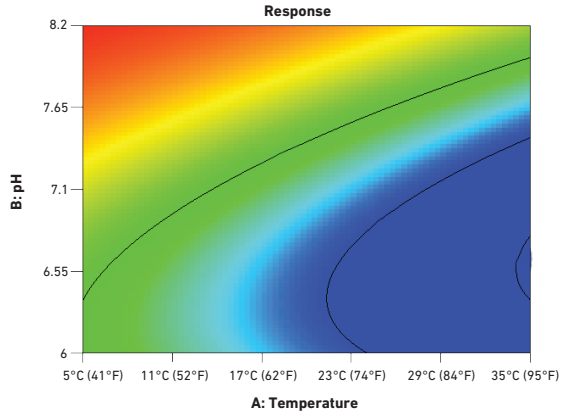


Chlorine Concentration 1.0 ppm

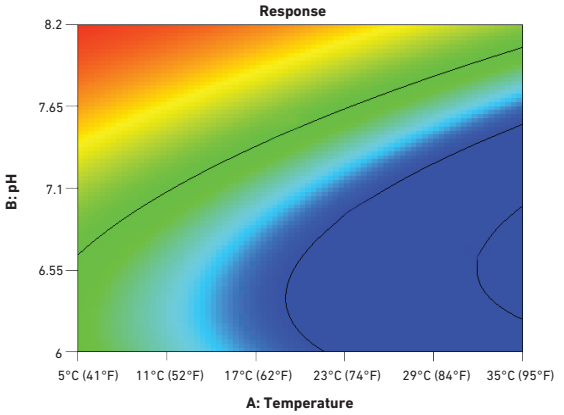


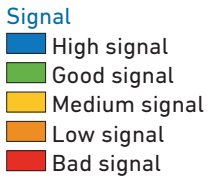


Chlorine Concentration 1.1 ppm

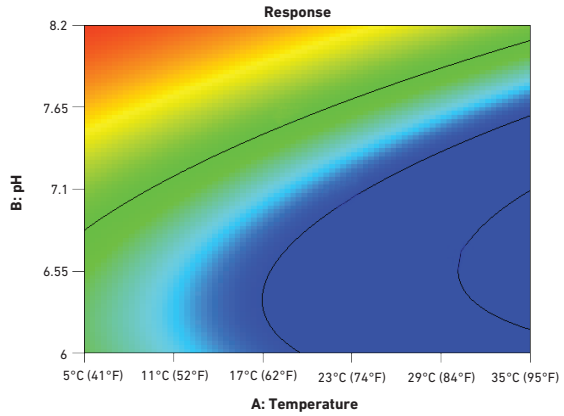


Chlorine Concentration 1.2 ppm

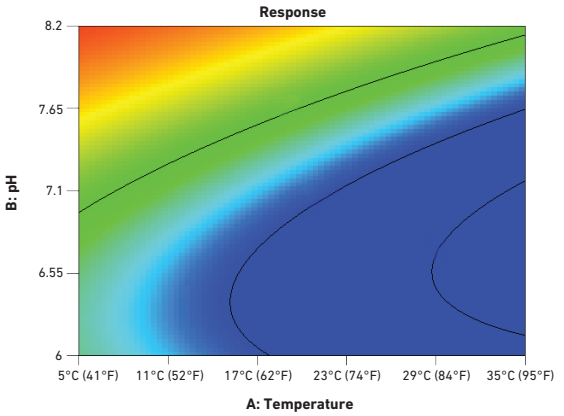




Chlorine Concentration 1.3 ppm

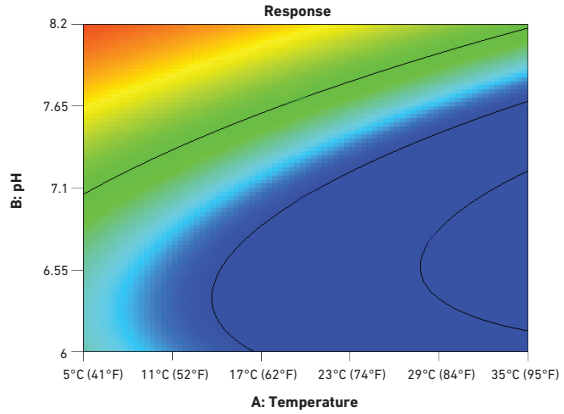


Chlorine Concentration 1.4 ppm

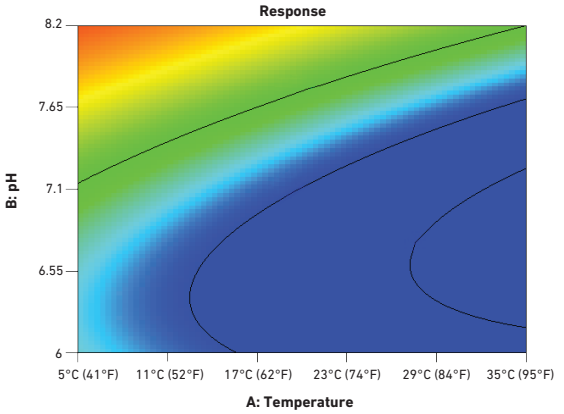


Signal
- High signal
- Good signal
- Medium signal
- Low signal
- Bad signal

Chlorine Concentration 1.5 ppm

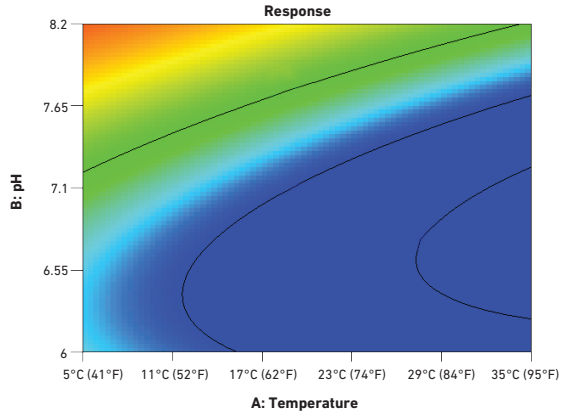


Chlorine Concentration 1.6 ppm

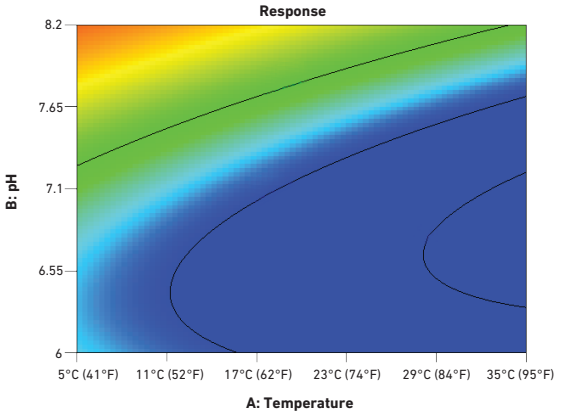


Signal
- High signal
- Good signal
- Medium signal
- Low signal
- Bad signal

Chlorine Concentration 1.7 ppm

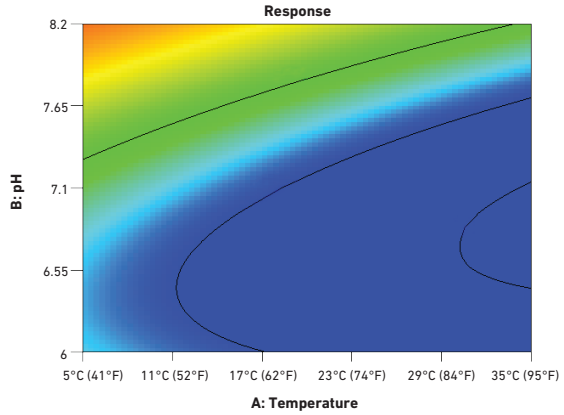


Chlorine Concentration 1.8 ppm

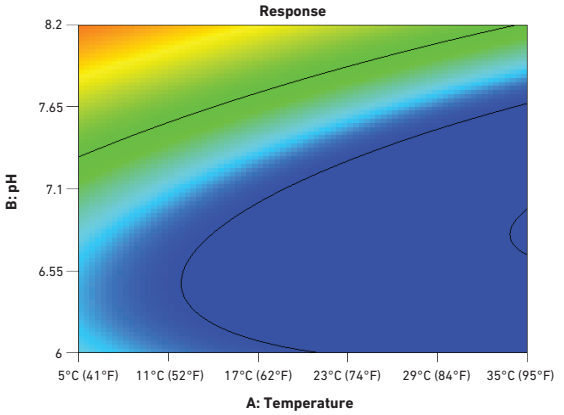


Signal
- High signal
- Good signal
- Medium signal
- Low signal
- Bad signal

Chlorine Concentration 1.9 ppm



Chlorine Concentration 2.0 ppm



Signal
- High signal
- Good signal
- Medium signal
- Low signal
- Bad signal

Chlorine Technical Basics

General Theory of Operation

The process of disinfecting drinking water to remove water-borne viruses and bacteria is essential to protecting public health. Chlorination of water prior to distribution is important, however other factors must also be taken into consideration to prevent outbreaks of water-borne diseases. Examples include protection of the water source itself, filtration of surface water supplies to remove pathogens and particles (turbidity), the integrity of the distribution piping system and ensuring there is enough Chlorine residual in the water to maintain a safe disinfectant level at the end of the distribution network.

Chlorine is very effective in killing a wide variety of common water-borne viruses such as e-coli, salmonella and leptospira. Chlorine is also very effective in the removal of foul taste and odor from water and reduces bio-slime in tanks, heat exchangers and distribution piping systems.

Chlorine is available in three forms that are used in water treatment, Chlorine gas and sodium or calcium hypochlorite.

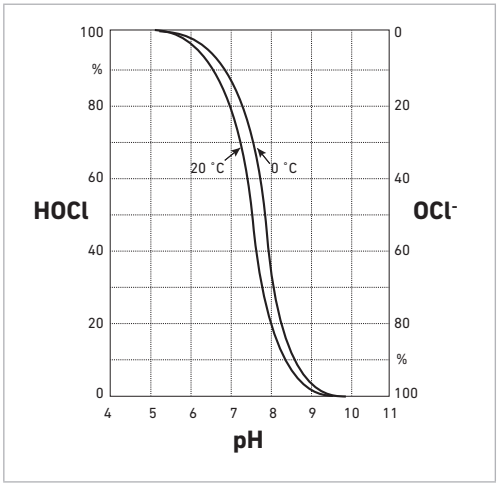
Chlorine gas is the most cost effective method of disinfecting water and is the predominant form of chlorine used in the USA and Asia. The main concerns for the use of Chlorine gas is the need for specialized training and a response program in case of a storage tank rupture or leaks.

Hypochlorite (sodium hypochlorite or calcium hypochlorite) is the second choice of chlorination. Sodium hypochlorite is more expensive to generate on-site, but is favored in remote locations where there is electrical power available. Hypochlorites are usually

selected if there is no availability of chlorine gas or if a good safety program can not be put into place.

Chloride dissociates in water to form two chemicals, Hypochlorous acid (HOCl) and hypochlorite ion (OCl-). Both are considered “free” chlorine, however, the HOCl provides the strongest disinfectant and oxidizing characteristics. The ratio between these chemicals is pH dependent.

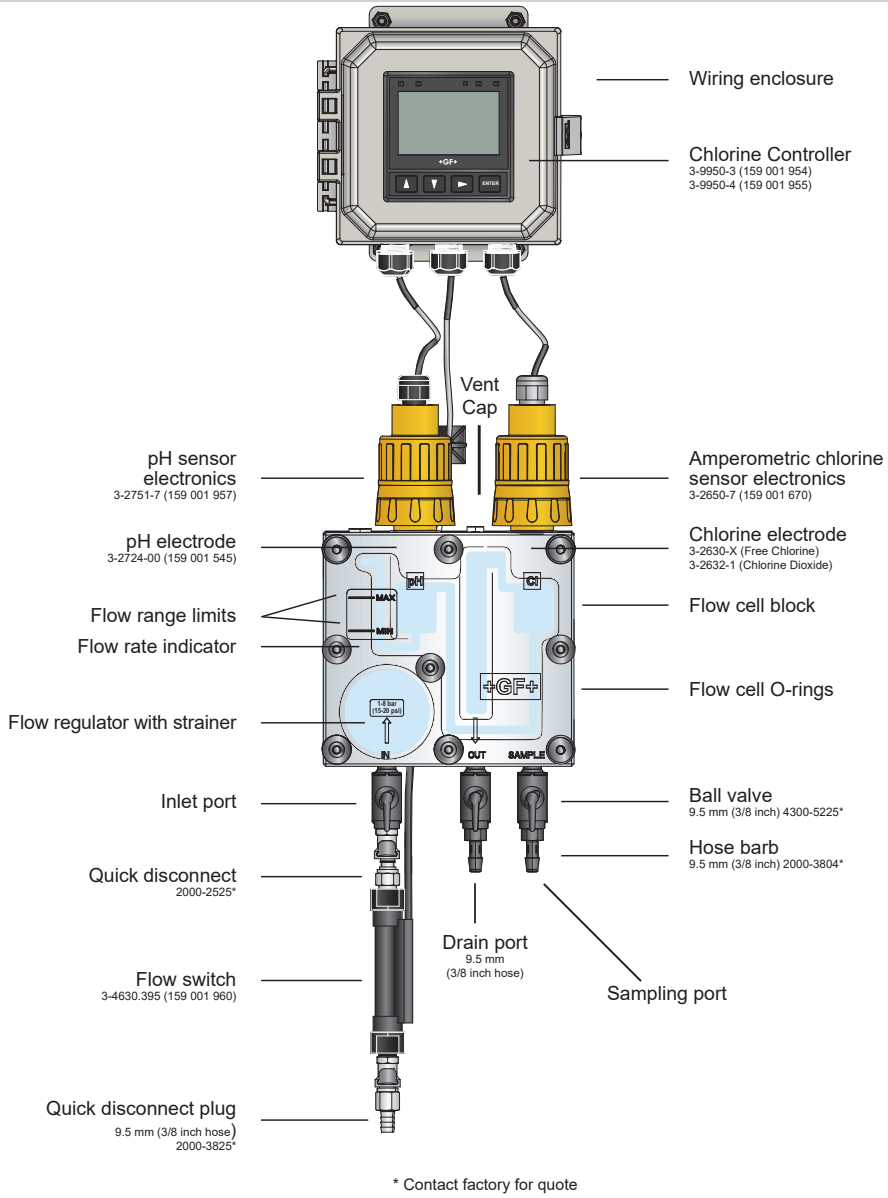
At pH 4 to 5.5, HOCl is Exclusively present. At this pH, the HOCl is very aggressive and causes corrosion. When pH levels exceed 9.0, OClis exclusively present. Although OCl- is still considered a disinfectant, the contact time at these pH levels need to be extended to properly disinfect. At pH 7.5, there is an even amount of HOCl and OCl-. Processes that maintain a pH level of 7.2 create a strong presence of HOCl, which is a faster disinfectant than the OCl-. Free chlorine is measured in parts per million (ppm) or milligrams per liter (mg/l). Chlorine gas and sodium or calcium hypochlorite reactions produce the desired HOCl, however, the end products of the reaction are very different. The reaction of chlorine gas and water produces an end product of hydrochloric acid (HCl) which tends to lower the pH, while the Hypochlorite reaction tends to raise the pH of the water due to the creation of the hydroxyl ions.



Chlorine Gas:	Chlorine		Water		Hypochlorous Acid	Hydrochloric Acid
	Cl_2	+	H_2O	⟶	HOCl	+ HCl
Sodium Hypochlorite:	Sodium Hypochlorite		Water		Hypochlorous Acid	Sodium Hydroxide
	NaOCl	+	H_2O	⟶	HOCl	+ Na(OH)
Calcium Hypochlorite	Calcium Hypochlorite		Water		Hypochlorous Acid	Calcium Hydroxide
	$Ca(OCl)_2$	+	H_2O	⟶	2 HOCl	+ $Ca(OH)_2$

There are six factors that influence the effectiveness of chlorine.

1. pH - Chlorine is most effective between 7.2 and 7.5 when the predominate chemical is HOCl.
2. Temperature - Higher temperatures allows fast reaction.
3. Turbidity - Suspended particals act as a food source and shelter for organisms.
4. Contact time - Must be calculated using the pH level and temperature of the water.
5. Adequate mixing - Mixing of chlorine is very important.
6. Measurement control system - A system that can accurately measure the chlorine levels and control the dosing of chlorine to maintain the proper chlorine levels.



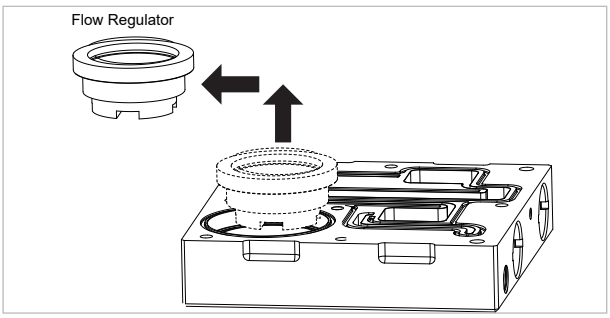
4630 Flow Cell Design

The 4630 Free Chlorine Analyzer System's flow cell is designed with unique features:

1. Built in flow regulator - Allows the system to be installed into any service line with pressures ranging from 15 to 120 psi (1 to 8 bar).
2. Built in VAFM - To provide at a quick glance that the water flow across the sensor membrane is good.
3. Flow cell design and sensor placement – Reduces the build up of bubbles on the sensor.
4. Sensors press fit into the flow cell - For easy removal during service and calibration.
5. Inlet port connector with check valve - The internal check valve allows the technician to interrupt flow by simply removing the connector from the flow cell.
6. Cut off valves - Provided to isolate the drain and influent flow stream
7. A sample port - Provided for DPD test verification

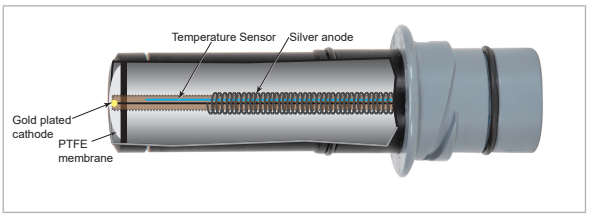
For gravity feed applications or systems that have an influent pressure below 15 psi will need to have the internal flow regulator removed. As long as there is a constant steady flow stream across the sensor and the VAFM indicator is above the "MIN" line accurate chlorine levels can be obtained.

- Open the flow cell by removing the six bolts
- Remove the regulator assembly
- Reinstall flow cell bolts and torque bolts per instructions on the back of the flow cell or in the manual. (see cleaning)



2630 Amperometric Free Chlorine Electrode Theory of Operation

The type 2630 Amperometric Free Chlorine Electrode is an electrochemical sensor which generates an internal current that is proportional to the concentration of the chlorine in the sample.



The electrochemical sensors' construction includes a hydrophobic membrane that allows the diffusion of hypochlorous acid (HOCl), which causes a reaction with the gold cathode (working electrode) and destroys the HOCL. This electrochemical reaction consumes two electrons.

Cathode (working electrode): $HOCl + H^+ + 2e \rightarrow Cl^- + H_2O$ (reduction of hypochlorous acid)

A silver/silver chloride Anode (counter electrode) provides the source of electrons for the cathode reaction and also acts as a reference electrode.

Anode (reference electrode): $2Cl^- + 2Ag^0 \rightarrow 2\ AgCl + 2e$ (oxidation of the silver)

The two metal electrodes are separated by an electrolyte solution that allows the transfer of ions to pass from cathode to anode, generating a small nA signal; typically 20 to 60 nA per 1 ppm of chlorine.

A Pt1000 temperature element ensures accurate chlorine measurements over a wide range of temperatures. The 2630 electrode is connected to the 2650 electronics which provides the polarizing voltage between the cathode and anode and provides chlorine information to be displayed on the 9950-3/-4 Chlorine Transmitter.

2630 Sensor Maintenance

Servicing of the sensor is necessary. Sensor maintenance consists of changing the membrane when it is torn or becomes dirty (membrane can not be cleaned) and changing the internal electrolyte solution when the system can not maintain calibration or the chlorine level drifts.



Membrane Change

1. Remove the membrane cap (do not use tools) by holding the sensor in one hand and twist off the membrane cap with the other hand.
2. Inspect the sensor cathode for any defects and verify the 8 openings in the tip of the sensor are clear and unobstructed.
3. The membrane can not be cleaned. if the membrane is dirty or fouled, it must be replaced.

Electrolyte Replacement

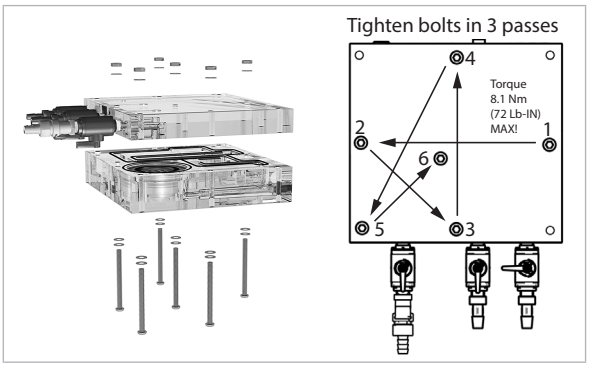
1. Remove the membrane cap (do not use tools) by holding the sensor in one hand and twist off the membrane cap with the other hand.
2. Inspect the sensor cathode for any defects and verify the 8 openings in the tip of the sensor are clear and unobstructed.
3. Turn the sensor upside down and shake the internal electrolyte out of the sensor.
4. Using the syringe provided with the sensor inject 14 ml of the new electrolyte into one of the eight holes in the sensor tip until the electrolyte bubbles out.
5. Install new membrane cap slowly.

Easy Cleaning of the Flow Cell

The design of the 4630 flow cell allows for easy cleaning:

1. Remove the electrodes from the flow cell
2. Remove the three knurl nuts and remove the cell from the panel
3. Remove the 6 bolts that hold the two halves of the cell together
4. Remove the O-ring string and inspect and replace if necessary

Do not use an abrasive cleaner or brush that could damage the O-ring groove. Assembly of the flow cell requires the six bolts to be torqued in the proper sequence. The torqued information is provided on the back of the flow cell for easy reference.



Common Terms*

Free available residual chlorine

That portion of the total available residual chlorine composed of dissolved chlorine gas (Cl_2), hypochlorous acid (HOCl), and/or hypochlorite ion (OCl-) remaining in water after chlorination. This does not include chlorine that has combined with ammonia, nitrogen, or other compounds.

Total residual chlorine

The amount of available chlorine remaining after a given contact time. The sum of the combined available residual chlorine and the free available residual chlorine.

Combined available residual chlorine

The concentration of residual chlorine which is combined with ammonia (NH_3) and/or organic nitrogen in water as a chloramine (or other chloro derivative) yet is still available to oxidize organic matter and utilize its bactericidal properties.

Chlorine demand

Chlorine demand is the difference between the amount of chlorine added to water and the amount of residual chlorine remaining after a given contact time. Chlorine demand may change with dosage, time, temperature, pH, and nature and amount of the impurities in the water.

Breakpoint chlorination

Addition of chlorine to water until the chlorine demand has been satisfied. At this point, further additions of chlorine will result in a free residual chlorine that is directly proportional to the amount of chlorine added beyond the breakpoint.

Hypochlorite (Hi-poe-KLOR-ite)

Chemical compounds containing available chlorine; used for disinfection. They are available as liquids (bleach) or solids (powder, granules and pellets). Salts of hypochlorous acid.

Milligrams per liter (mg/L)

A measure of concentration of a dissolved substance. A concentration of one mg/L means that one milligram of a substance is dissolved in each liter of water. For practical purposes, this unit is equal to parts per million (ppm) since one liter of water is equal in weight to one million milligrams. Thus a liter of water containing 10 milligrams of calcium has 10 parts of calcium per one million parts of water, or 10 parts per million (10 ppm).

Dechlorination (dee-KLOR-uh-NAY-shun)

The deliberate removal of chlorine from water. The partial or complete reduction of residual chlorine by any chemical or physical process.

Turbidity (ter-BID-it-tee)

The cloudy appearance of water caused by the presence of suspended and colloidal matter. In the waterworks field, a turbidity measurement is used to indicate the clarity of water. Technically, turbidity is an optical property of the water based on the amount of light reflected by suspended particles. Turbidity cannot be directly equated to suspended solids because white particles reflect more light than dark-colored particles and many small particles will reflect more light than an equivalent large particle.

*Referenced from: http://water.epa.gov/drink/resources/glossary.cfm

Type 4630 Free Chlorine Analyzer System



Product Description

The type 4630 Free Chlorine Analyzer System is an integrated all-in-one system designed to measure free chlorine. The 3-4630 Free Chlorine Analyzer with pH sensor is used to accurately calculate free chlorine in applications that have varying pH values (±0.20 pH units).

The advanced 9950-3/-4 Chlorine Controller includes a new feature called the "Chemical Guard" relay control.

Because free chlorine concentration is pH dependent, the Chemical Guard feature interrupts/disables the relay that is assigned to the oxidant chemical (such as sodium hypochlorite) until the pH of the application is corrected. The 4630 series also comes complete with a flow switch that will disable the mechanical relays to the dosing pumps when the system is off or flow is interrupted to the flow cell.

The unique integrated clear flow cell accommodates the free chlorine and pH electrode, flow regulator, filter and variable area flow indicator in one compact unit. An integrated flow regulator with removable filter accepts inlet pressures of 1 to 8 bar (15 to 120 psi), while maintaining constant flow and minimal pressure to the sensors.

Water flows vertically into sensor tip eliminating bubble entrapment. The flow cell is designed to maintain a minimum amount of water to ensure sensors stay submerged, even when the system and flow is turned off.

The 4630 Free Chlorine Analyzer System comes complete with everything needed to support chlorine monitoring for 1 full year of operation. Panel design allows quick and easy installation and comes complete with four 4 to 20 mA outputs, flow switch with relay interrupt, four binary inputs and two mechanical relays. The 9950-3/-4 can also be used with the optional 3-9950.395-M (159 001 905) Modbus Module.

Features

- EPA 334.0 Compliant
- Reagent free measuring
- Chemical Guard prevents over dosing of oxidants chemicals
- Built in flow switch
- Chlorine and pH electrode performance data
- Automatic time stamp after successful calibration
- Customer enabled alarm feature for recalibration
- Complete panel system allows for quick and easy installation
- Built-in flow regulator maintains constant flow and pressure to the sensors regardless of inlet pressure
- Automatic pH compensation

Applications

Residual Chlorine Monitoring:

- Water Distribution
- Ground Water
- Surface Water
- HVAC Applications (cooling water)
- Food and Beverage
- Swimming Pools
- Water Parks

EPA Compliant According to Method 334.0

The 3-4630 Free Chlorine Analyzer System can be used for reporting chlorine residuals in accordance with EPA Method 334.0

Technical Details

General	
Compatibility	3-2630-1 Free Chlorine Electrode, 0.02 to 2 ppm /
	3-2630-2 Free Chlorine Electrode, 0.05 to 5 ppm /
	3-2630-3 Free Chlorine Electrode, 0.1 to 20 ppm / 3-2650-7 Amperometric Electronics
	3-2724-00 Flat pH Electrode, 0 to 14 pH/ 3-2751-7 pH Sensor Electronics

Materials	
Panel	Black Acrylic
Flow Cell	Acrylic
Wiring Enclosure	Polycarbonate

Wetted Materials	
Flow Cell, Spacer Rings	Acrylic
Flow Regulator Housing	Polycarbonate
Strainer, E-clip, Regulator Spring, Float	Stainless Steel
Valves, Vent	Polypropylene
Flow Cell O-rings, Diaphragm	EPR (EPDM), FKM
Chlorine Electrode	PVC, PTFE, FKM, Nylon, Silicone
pH electrode	PPS, Glass, UHMW PE, FKM
Flow Switch	Polypropylene
Sealing Tape on Valves, Plug and Vent	PTFE
Plug	Polyethylene

Max. Temperature/Pressure Rating		
System Inlet Pressure Rating	1 to 8 bar	15 to 120 psi
Pressure Regulator	< 0.69 bar (10 psi) variation over all ranges of flow and pressure	
Flow Tolerance	± 15% or rated specification above	
Flow Rate Limits	30.24 to 45.36 LPH	8 to 12 US gal/h
Storage Temperature	0 °C to 65 °C	32 °F to 149 °F
Operating Temperature	0 °C to 45 °C	32 °F to 113 °F
pH Range	5.5 to 8.2 pH	

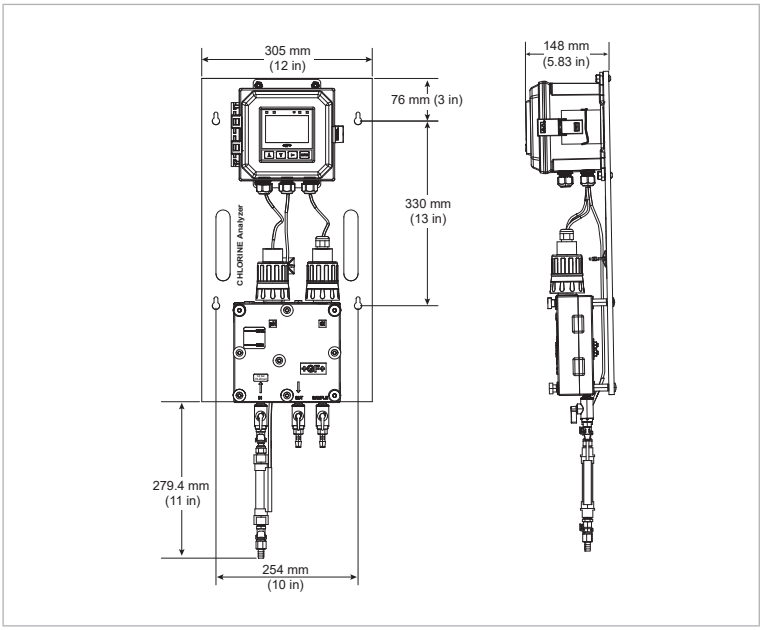
Power Requirements	
DC Input (3-9950-3, standard)	24 VDC nominal (12 to 32 VDC, ± 10% regulated), UL 60950-1 or UL 61010-1
AC input (9950-4)	100 to 240 VAC. 50 to 60 Hz. 24 VA
3-9950-3/-4 Relay Mode	Current draw up to 500 mA
Current Loop	12 to 32 VDC, ±10% regulated, 4 to 20 mA (30 mA max.)
Overvoltage Protection	Protection 48 Volt Transient Protection Device. Current limiting for circuit protection. Reverse-voltage protection.

Environmental	
Relative Humidity	0 to 95%
Maximum Altitude	4'000 m (13'123 ft)
Enclosure	NEMA 4X (with output wire glands sealed)

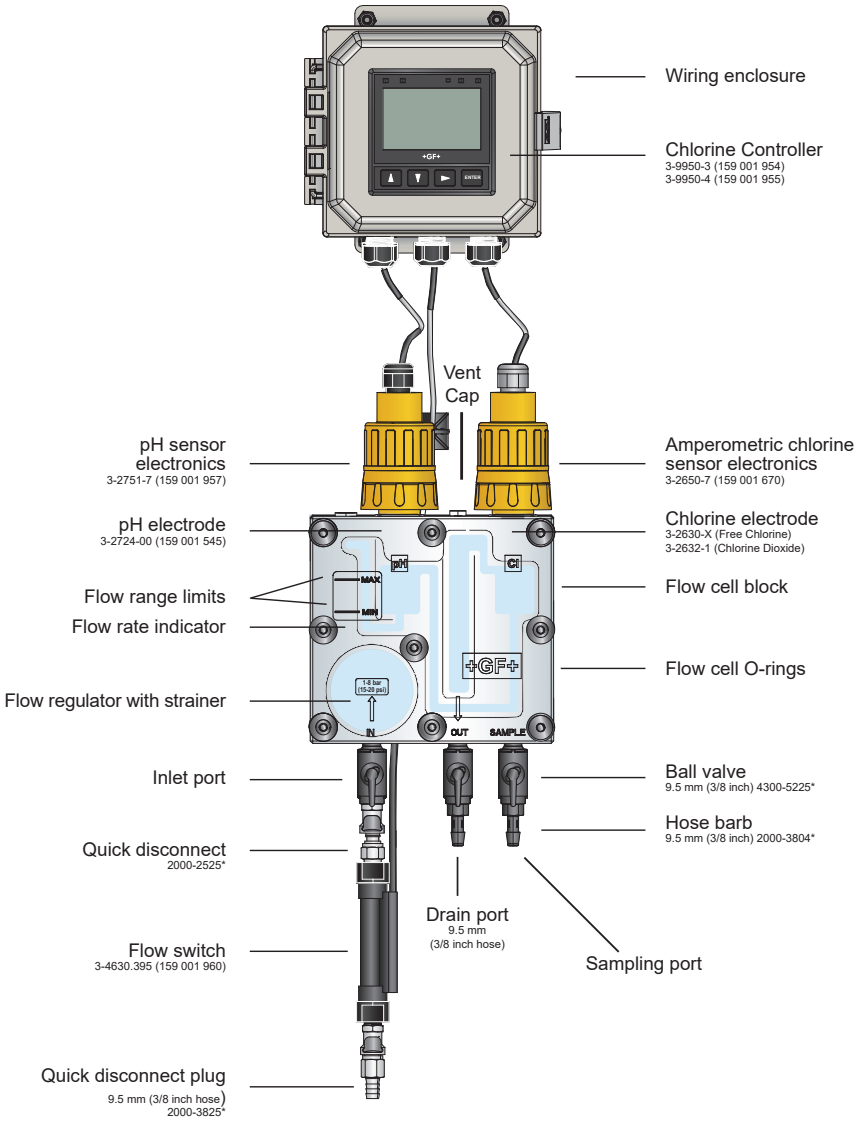
Shipping Weight		
	10 kg	22 lb

Standards and Approvals
UKCA, CE, FCC, UL, CUL, WEEE
China RoHS
Manufactured under ISO 9001, ISO 14001, and ISO 45001

Dimensions



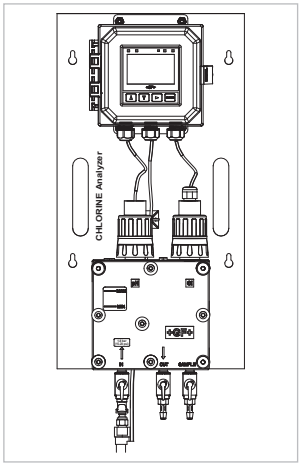
System overview



* Contact factory for quote

Ordering Information

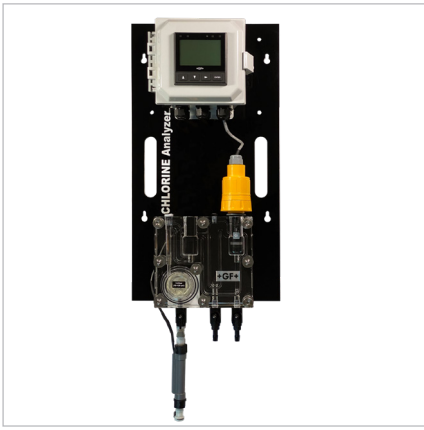
Mfr. Part No.	Code	Description
Chlorine System: Chlorine controller, Free chlorine electrode with electronics, pH electrode with electronics, flow cell, flow switch all mounted on one single panel.		
3-4630-13	159 001 949	Chlorine panel, free chlorine sensor (0.02 to 2 ppm) w/ pH sensor, 12/24 VDC
3-4630-14	159 001 996	Chlorine panel, free chlorine sensor (0.02 to 2 ppm) w/ pH sensor, 100 - 240 VAC
3-4630-23	159 001 950	Chlorine panel, free chlorine sensor (0.05 to 5 ppm) w/ pH sensor, 12/24 VDC
3-4630-24	159 001 997	Chlorine panel, free chlorine sensor (0.05 to 5 ppm) w/ pH sensor, 100 - 240 VAC
3-4630-33	159 001 951	Chlorine panel, free chlorine sensor (0.1 to 20 ppm) w/ pH sensor, 12/24 VDC
3-4630-34	159 001 998	Chlorine panel, free chlorine sensor (0.1 to 20 ppm) w/ pH sensor, 100 - 240 VAC



Accessories and Replacement Parts

Mfr. Part No.	Code	Description
3-9950-3	159 001 954	Chlorine Controller, with four 4 to 20 mA output and binary/Relay Module, 12/24 VDC
3-9950-4	159 001 955	Chlorine Controller, with four 4 to 20 mA output and binary/Relay Module, 12/24 VDC or 100 - 240 VAC
3-9950-5	159 001 956	Chlorine Monitor, no relays or output modules, 12/24 VDC
3-9950-6	159 002 013	Chlorine Monitor, no relays or output modules, 12/24 VDC or 100 - 240 VAC
3-9950.393-1	159 310 268	Relay Module with 4 Mechanical Relays
3-9950.393-2	159 310 269	Relay Module with 2 Mechanical and 2 Solid State Relays
3-9950.393-3	159 310 270	Relay Module with 2 Mechanical Relays and 4 Binary Inputs
3-9950.395-M	159 001 905	Modbus Module
3-9950.398-2	159 001 848	Dual Channel 4 to 20 mA Current Loop Output Module
3-2630-1	159 001 746	Free Chlorine sensor, 0.02 to 2 ppm (mg/l)
3-2630-2	159 001 662	Free Chlorine sensor, 0.05 to 5 ppm (mg/l)
3-2630-3	159 001 747	Free Chlorine sensor, 0.1 to 20 ppm (mg/l)
3-2724-00	159 001 545	pH Electrode, Flat Glass, Pt1000 Temp Element, ¾ in. MNPT
3-2650-7	159 001 670	Chlorine - In-line Amperometric Electronics, Digital (S3L), 4.6 m (15 ft) cable
3-2751-7	159 001 957	pH - Inline Electronics, Digital (S3L), 4.6 m (15 ft) cable
3-4630.390	159 001 688	Rebuild kit: O-rings, boots, screws, 1 filter screen
3-4630.391	159 001 689	Pressure Regulator with 1 spare filter screen
3-4630.392	159 001 690	Acrylic Flow Cell complete with all components and connections
3-2630.391	159 001 674	Electrolyte kit, 30 ml bottle with syringe and needle
3-2630.394	159 310 164	Free Chlorine Replacement PTFE membrane (1 pcs.)
3-2630.398	159 310 166	Free Chlorine Sensor maintenance kit - 2 pcs. 30 ml bottles electrolyte, 2 pcs. PTFE membranes and 2 pcs. silicone bands
3-0700.390	198 864 403	pH Buffer Kit: 1 each 4, 7, 10 pH buffer in powder form, makes 50 ml of each
3822-7004	159 001 581	pH 4.01 buffer solution, 1 pint (473 ml) bottle
3822-7007	159 001 582	pH 7.00 buffer solution, 1 pint (473 ml) bottle
3822-7010	159 001 583	pH 10.00 buffer solution, 1 pint (473 ml) bottle
3-2700.395	159 001 605	Calibration kit: 3 polypropylene cups, box used as cup stand,1 pint pH 4.01, 1 pint pH 7.00
3800-5000	159 838 107	3.0M KCl Storage Solution for pH and ORP, 1 pint (473 ml) bottle
3-2700.397	159 001 870	Protective Cap for pH/ORP electrodes, 5 pieces
3-2700.398	159 001 886	Lubricant Kit
7300-0024	159 001 693	VDC Power Supply
3-2759	159 000 762	pH/ORP System Tester (adapter cable sold separately
3-2759.391	159 000 764	2759 DryLoc Adapter Cable (for use with 2751)

Type 4632 Chlorine Dioxide Analyzer System



Product Description

The type 4632 Chlorine Dioxide Analyzer System is an integrated all-in-one system designed to measure Chlorine Dioxide residual up to 2 ppm/mg/l.

The unique integrated clear flow cell accommodates the Chlorine Dioxide and optional pH electrode, flow regulator, filter and variable area flow indicator in one compact unit. An integrated flow regulator with removable filter accepts inlet pressures of 1 to 8 bar (15 to 120 psi), while maintaining constant flow and minimal pressure to the sensors. Water flows vertically into sensor tip eliminating bubble entrapment. The flow cell is designed to maintain a minimum amount of water to ensure sensors stay submerged, even when the system and flow is turned off. The 4632 Chlorine Dioxide Analyzer System comes complete with everything needed to support chlorine monitoring for 1 full year of operation. Panel design allows quick and easy installation and comes complete with four 4 to 20 mA outputs, flow switch with relay interrupt, four binary inputs and two mechanical relays. The 9950-X can also be used with the optional 3-9950.395-M (159 001 905) Modbus Module.

Features

- Reagent free measuring
- Chemical Guard, prevents over dosing of oxidants chemicals
- Built-in flow switch
- Chlorine Dioxide and pH electrode performance data (optional pH)
- Automatic time stamp after successful calibration
- Customer enabled alarm feature for re-calibrate
- Complete panel system allows for quick and easy installation
- Built-in flow regulator maintains constant flow and pressure to the sensors regardless of inlet pressure

Applications

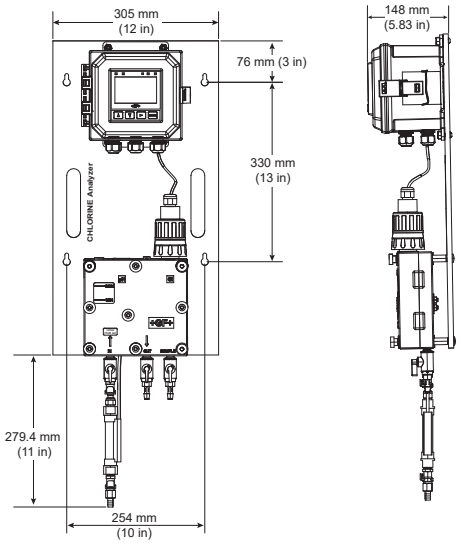
Residual Chlorine Monitoring:

- Cooling Towers
- Fruit and Vegetable Washing
- Water Distribution
- Wastewater Odor Control
- Poultry and Meat Processing
- UPW Treatment
- Hospital and Healthcare Facilities

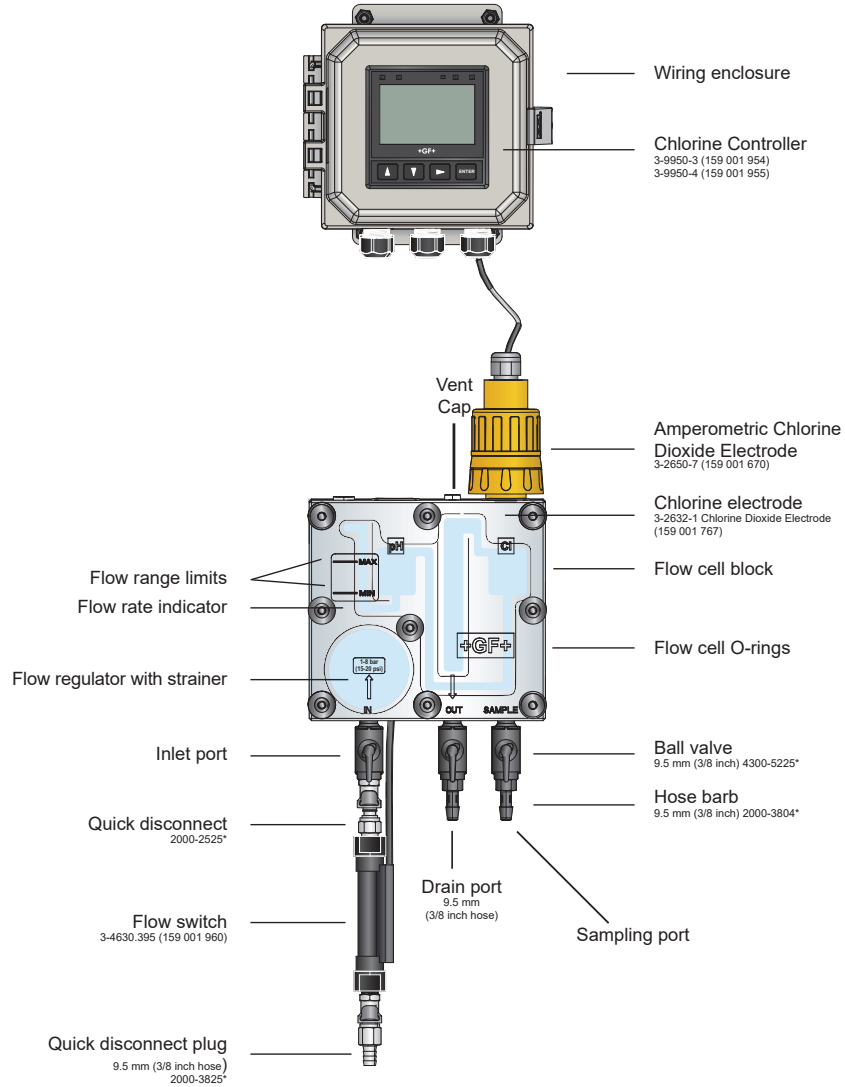
Technical Details

General		
Compatibility	3-2632-1 Chlorine Dioxide Electrode, 0.02 to 2 ppm	
	3-2650-7 Amperometric Electronics	
	3-2724-00 Flat pH Electrode, 0 to 14 pH (4632-13 only)	
	3-2751-7 pH Sensor Electronics	
Materials		
Panel	Black Acrylic	
Flow Cell	Acrylic	
Wiring Enclosure	Polycarbonate	
Wetted Materials		
Flow Cell, Spacer Rings	Acrylic	
Flow Regulator Housing	Polycarbonate	
Strainer, E-clip, Regulator Spring, Float	Stainless Steel	
Valves, Vent	Polypropylene	
Flow Cell O-rings, Diaphragm	EPR (EPDM), FKM	
Chlorine Electrode	PVC, PTFE, FKM, Nylon, Silicone	
pH electrode	PPS, Glass, UHMWPE, FKM	
Flow Switch	Polypropylene	
Sealing Tape on Valves, Plug and Vent	PTFE	
Plug	Polyethylene	
Max. Temperature/Pressure Rating		
System Inlet Pressure Rating	1 to 8 bar	15 to 120 psi
Pressure Regulator	< 0.69 bar (10 psi) variation over all ranges of flow and pressure	
Flow Tolerance	± 15% or rated specification above	
Flow Rate Limits	30.24 to 45.36 LPH	8 to 12 US gal/h
Storage Temperature	0 °C to 65 °C	32 °F to 149 °F
Operating Temperature	0 °C to 45 °C	32 °F to 113 °F
Electrical		
DC Input (3-9950-3, standard) - Optional Configuration	24 VDC nominal (12 to 32 VDC ±10% regulated)	
Environmental		
Relative Humidity	0 to 95%	
Maximum Altitude	4'000 m (13'123 ft)	
Enclosure	NEMA 4X (with output wire glands sealed)	
Shipping Weight		
	10 kg	22 lb
Standards and Approvals		
UKCA, CE, UL, CUL, FCC, WEEE		
China RoHS		
Manufactured under ISO 9001, ISO 14001, and ISO 45001		

Dimensions



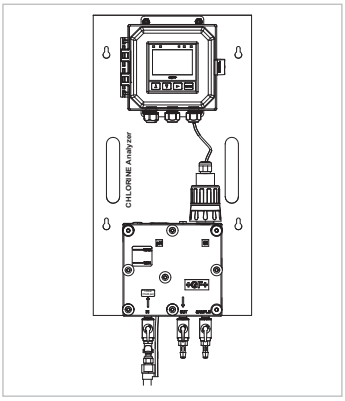
System overview



* Contact factory for quote

Ordering Information

Mfr. Part No.	Code	Description
3-4632-12	159 001 952	Chlorine Dioxide Panel, free chlorine sensor (0.02 to 2 ppm), 12/24 VDC, no pH sensor
3-4632-13	159 001 958	Chlorine Dioxide Panel, free chlorine sensor (0.02 to 2 ppm), 12/24 VDC, with pH sensor



Accessories and Replacement Parts

Mfr. Part No.	Code	Description
3-9950-3	159 001 954	Chlorine Controller, with four 4 to 20 mA output and binary/Relay Module, 12/24 VDC
3-9950-4	159 001 955	Chlorine Controller, with four 4 to 20 mA output and binary/Relay Module, 12/24 VDC or 100 - 240 VAC
3-9950-5	159 001 956	Chlorine Monitor, no relays or output modules, 12/24 VDC
3-9950-6	159 002 013	Chlorine Monitor, no relays or output modules, 12/24 VDC or 100 - 240 VAC
3-2632-1	159 001 767	Chlorine Dioxide Electrode, 0 to 2 ppm (mg/L)
3-2650-7	159 001 670	Chlorine – In-line Amperometric Electronics, Digital (S3L), 4.6 m (15 ft) cable
3-2724-00	159 001 545	pH Sensor, Flat Glass , Pt1000 Temp Element, 3/4" MNPT
3-2751-7	159 001 957	pH – In-line Electronics, Digital (S3L) , 4.6 m (15 ft) cable
3-4630.390	159 001 688	Rebuild Kit: O-rings, boots, screws, 1 filter screen
3-4630.391	159 001 689	Pressure Regulator with 1 spare filter screen
3-4630.392	159 001 690	Acrylic Flow Cell complete with all components and connections
3-2632.391	159 310 160	Chlorine Dioxide Electrolyte, 30 mL (2) bottles
3-2632.398	159 310 165	Chlorine Dioxide Maintenance Kit - 2 pcs. 30 ml bottles electrolyte, 2 pcs. PTFE membranes, 2 pcs. silicone bands, and polishing paper
3-2630.394	159 310 164	Free Chlorine and Chlorine Dioxide Replacement PTFE membrane (1)

Type 2630 Amperometric Free Chlorine Electrode



Product Description

The type 2630 Amperometric Chlorine electrode is designed to measure free chlorine in fresh water treatment applications. The electrode is available with a measurement range of 0.02 to 2 ppm, 0.05 to 5 ppm or 0.1 to 20 ppm. This electrode requires the 2650 Amperometric Electronics to output a digital (S³L) signal to the 9950-3/-4 Chlorine Controller.

Utilizing smart-sensor technology, this electrode has a unique embedded memory chip and can communicate a wide variety of information to the 9950-3/-4 Chlorine Controller. The 9950-3/-4 can display the electrodes stored information which includes the serial number, electrode type, service time in hours, chlorine range, high and low temperatures, and the maximum and minimum pH detected over time.

The patented DryLoc® connector with its Gold plated contacts and O-ring seal ensure a waterproof and reliable interconnect to the 2650 electronics and allows quick assembly during system start up, while providing a easy way to service or replace the Amperometric electrode.

NOTE: This electrode is required to be in chlorined water at ALL times.

Features

- Embedded memory chip accessible via the 9950-3/-4 Chlorine Controller
- Quick assembly with GF 's patented DryLoc® connector
- Integrated temperature element for automatic temperature compensation
- Separate drive electronics (2650 Electronics), for easy servicing and electrode replacement

Applications

Residual Chlorine Monitoring:

- Water Distribution
- Ground Water
- Surface Water
- HVAC Applications (cooling water)
- Food and Beverage
- Swimming Pools
- Water Parks

*NOTE: The 9950-3/-4 Chlorine Controller is not compatible with the 3-9950-1 / -2 /-10 /-11 controller

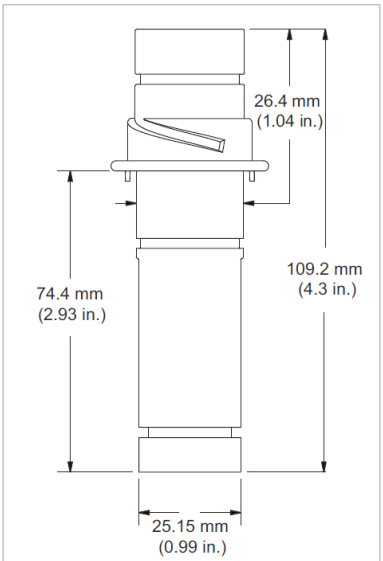
U.S. Patent No.: 6,666,701

Technical Details

General			
Polarization Source	2650 Amperometric Electronics		
Compatibility	3-4630.392 (159 001 690)		
	3-3610-1 (159 001 683)		
	3-3610-2 (159 001 684)		
Mounting	DryLoc connection		
Materials	CPVC		
Free Chlorine			
Membrane Material	PTFE		
O-ring Material	FKM		
Working Electrode	Gold		
Counter Reference Electrode	Silver halide		
Wetted Material			
	PVC, PTFE, FKM, Nylon, Silicone		
Performance			
Electrode			
Repeatability	±0.08 ppm (mg/l) or 3% of selected range whichever is less		
Slope	15 to 60 nA/ppm (mg/l) @ 25 °C		
Response Time, T90	< 2 minutes		
System (including electronics and instrument)			
Accuracy	< ±3% of electrode signal after calibration		
Resolution	±0.5% of electrode range		
Sensor Conditioning			
New, first start-up	4 hours maximum before calibration		
Subsequent start-ups	2 hours maximum		
Temperature Element	Pt1000		
Operational Ranges and Limits			
Free Chlorine Range	0.02 to 2 ppm (mg/l)	0.05 to 5 ppm (mg/l)	0.1 to 20 ppm (mg/l)
Free Chlorine pH Operating	5.5 to 8.2 pH		
Operational Temperature	5 °C to 45 °C	41 °F to 113 °F	
Maximum Operating Pressure			
Membrane	0.48 bar @ 25 °C (7 psi @ 77 °F)		
Flow Velocity Across Membrane Surface			
Minimum	15 cm/s (0.49 ft/s)		
Maximum	30 cm/s (0.98 ft/s)		
Interferences	ClO_2, ozone, bromine		
Chemical Compatibility	< 50% ethanol/water, < 50% glycerol/water		
Environmental			
System Temperature	-10 °C to 60 °C	-4 °F to 140 °F	
Storage Temperature	-10 °C to 60 °C	-4 °F to 140 °F	
Relative Humidity	0 to 95% indoor/outdoor non-condensing to rated ambient		
Shipping Weight			
	0.14 kg	0.30 lb	
Standards and Approvals			
UKCA, CE, FCC			
RoHS compliant, China RoHS			
Manufactured under ISO 9001 for Quality			

Dimensions

3-2630-X



System Overview

Panel Mount

GF Instrument 9950-3/-4
Chlorine Controller



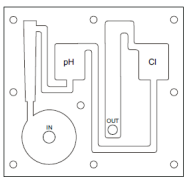
GF Amperometric
Electronics
2650-7



Type 2630-X
Chlorine Electrode



GF Flow Cell
GF Fitting
3610



All sold separately

Application Tips

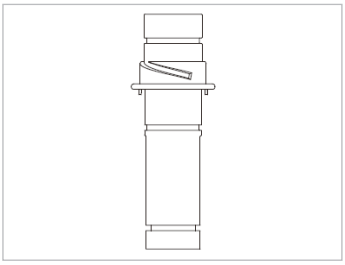
Amperometric sensors require the water to be chlorinated at ALL times.
The sensors should not be used in water containing surfactants, oils, organic chlorine or stabilizers such as cyanuric acid.

Ordering Information

Ordering Notes

The sensor must have a stable and constant flow of water past its membrane for accurate free chlorine measurement. Typical flow rate should be 30.24 - 45.36 lph (8 - 12 gph).

Mfr. Part	Code	Description
3-2630-1	159 001 746	Free Chlorine electrode, 0.02 to 2 ppm (mg/l)
3-2630-2	159 001 662	Free Chlorine electrode, 0.05 to 5 ppm (mg/l)
3-2630-3	159 001 747	Free Chlorine electrode, 0.1 to 20 ppm (mg/l)



Accessories

Mfr. Part	Code	Description
3-2630.398	159 310 166	Free Chlorine Sensor Maintenance Kit - (2) electrolyte and (2) PTFE membranes, (2) silicone bands, polishing papers
3-2630.391	159 001 674	Free Chlorine Electrolyte Kit, 30 ml (2) bottles with syringe and needle
3-2630.394	159 310 164	Free Chlorine and Chlorine Dioxide replacement PTFE membrane (1)
3-2600.510	159 500 422	Silicone Band, Chlorine Sensor
3-3610-1	159 001 683	Flow Cell, Clear PVC 1/2" Tee
3-3610-2	159 001 684	Flow Cell, Clear PVC 1/2" Tee, Barb Conn

Type 2632 Amperometric Chlorine Dioxide Electrode



Product description

The type 2632 Amperometric Chlorine Dioxide electrode is designed to measure chlorine dioxide residual in water treatment applications. The electrode is available with a measurement range of 0.02 to 2 ppm. This electrode requires the 2650 Amperometric Electronics to output a digital (S³L) signal to the 9950-3/-4 Chlorine Controller.

Utilizing smart-sensor technology, this electrode has a unique embedded memory chip and can communicate a wide variety of information to the 9950-3/-4 Chlorine Controller. The 9950-3/-4 can display the electrodes stored information which includes the serial number, electrode type, service time in hours, chlorine range, high and low temperatures.

The patented DryLoc® connector with its Gold plated contacts and O-ring seal ensure a waterproof and reliable interconnect to the 2650 electronics and allows quick assembly during system start up, while providing a easy way to service or replace the Amperometric electrode.

Features

- Embedded memory chip accessible via the type 9950-3/-4 Chlorine Controller
- Quick assembly with the patented DryLoc® connector
- Integrated temperature element for automatic temperature compensation
- Separate drive electronics (2650 Electronics), for easy servicing and electrode replacement

Applications

Residual Chlorine Monitoring:

- Water Distribution
- Ground Water
- Surface Water
- HVAC Applications (cooling water)
- Food and Beverage

*NOTE: The 9950-3/-4 Chlorine Controller is not compatible with the 3-9950-1 / -2 /-10 /-11 controller

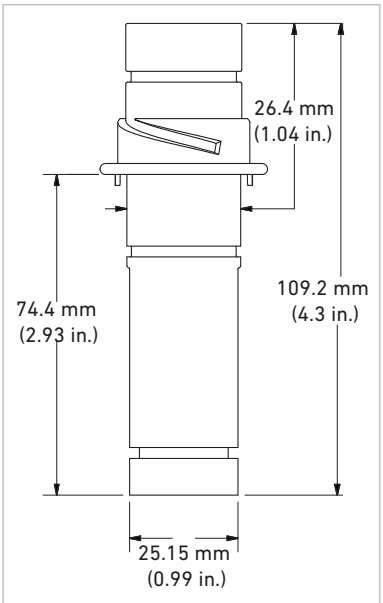
U.S. Patent No.: 6,666,701

Technical Data

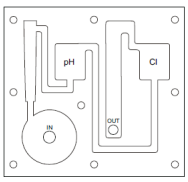
General		
Polarization Source	2650 Amperometric Electronics	
Compatibility	3-4630.392 (159 001 690)	
	3-3610-1 (159 001 683)	
	3-3610-2 (159 001 684)	
Mounting	DryLoc® connection	
Materials	CPVC	
Chlorine Dioxide		
Membrane Material	PTFE	
O-ring Material	FKM	
Working Electrode	Gold	
Counter Reference Electrode	Silver halide	
Wetted Material		
	PVC, PTFE, FKM, Nylon, Silicone	
Performance		
Electrode		
Repeatability	±0.08 ppm (mg/l) or 3% of selected range, whichever is less	
Slope	40 to 200 nA/ppm (mg/l) @ 17 °C	
Response Time, T90	< 2 minutes	
System (including electronics and instrument)		
Accuracy	< ±3% of electrode signal after calibration	
Resolution	±0.5% of electrode range	
Sensor Conditioning		
New, first start-up	4 hours maximum before calibration	
Subsequent start-ups	2 hours maximum	
Temperature Element	Pt1000	
Operational Ranges and Limits		
Free Chlorine Range	0.02 to 2 ppm (mg/l)	
Free Chlorine pH Operating	4.0 to 11.0 pH	
Maximum Media Temperature	5 °C to 45 °C	41 °F to 113 °F
Maximum Operating Pressure		
Membrane	0.48 bar @ 25 °C (7 psi @ 77 °F)	
Flow Velocity Across Membrane Surface		
Minimum	15 cm/s (0.49 ft/s)	
Maximum	30 cm/s (0.98 ft/s)	
Sensitivity	Free Chlorine, ozone	
Chemical Compatibility	< 50% ethanol/water, < 50% glycerol/water	
Environmental		
System Temperature	-10 °C to 60 °C	14 °F to 140 °F
Storage Temperature	-10 °C to 60 °C	14 °F to 140 °F
Relative Humidity	0 to 95% indoor/outdoor non-condensing to rated ambient	
Shipping Weight		
	0.14 kg	0.30 lb
Standards and Approvals		
UKCA, CE, FCC		
RoHS compliant, China RoHS		
Manufactured under ISO 9001 for Quality		

Dimensions

3-2632-1



System Overview

Panel Mount		
GF Instrument 9950-3/-4 Chlorine Controller		
GF Amperometric Electronics 2650-7		
Type 2632-1 Chlorine Dioxide Electrode		
GF Flow Cell		All sold separately

Application Tips

Amperometric sensors require the water to be chlorinated at ALL times.

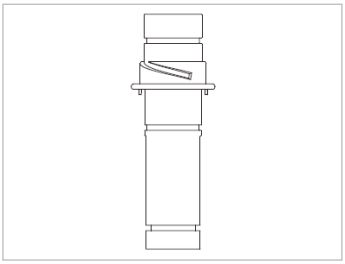
The sensors should not be used in water containing surfactants, oils, organic chlorine or stabilizers such as cyanuric acid.

Ordering Information

Ordering Notes

The sensor must have a stable and constant flow of water past its membrane for accurate free chlorine measurement. Typical flow rate should be 30.24 - 45.36 lph (8 - 12 gph).

Mfr. Part	Code	Description
3-2632-1	159 001 767	Chlorine Dioxide Electrode, 0 to 2 ppm (mg/l)



Accessories

Mfr. Part	Code	Description
3-2632.398	159 310 165	Chlorine Dioxide Sensor Maintenance Kit - (2) electrolyte and (2) PTFE membranes, (2) silicone bands, polishing papers
3-2632.391	159 310 160	Chlorine Dioxide Electrolyte Solution, 30 ml (2) bottles with syringe and needle
3-2630.394	159 310 164	Free Chlorine and Chlorine Dioxide replacement PTFE membrane (1)
3-2600.510	159 500 422	Silicone Band, Chlorine Electrode

Type 2650 DryLoc® Amperometric Electronics



Product description

The type 2650 Amperometric Electronics provide the polarization voltage and signal conditioning required by all GF Amperometric Sensors. The 2650 Amperometric Electronics also relays important sensor information that is stored on a memory chip inside the sensor to be displayed on the 3-9950-3/-4 Chlorine Controller. Information includes factory calibration data, service life, calibration information and more.

The patented DryLoc® connector provides a quick and secure connection to the sensor. Gold-plated contacts and an O-ring seal ensure a waterproof and reliable interconnect to the sensor.

Sensor maintenance, replacement and troubleshooting has never been easier. The DryLoc® electronics can be separated from the sensor, which allows the user to detect a faulty sensor, electronics or cable assembly.

Features

- Provides polarization voltage and conditions the signal from the 2630 and 2632 electrodes
- Provides access to the Amperometric electrode's stored data for display on the 9950-3/-4 Chlorine Controller
- Patented DryLoc® connector provides a quick and secure connection to the sensor
- Waterproof and reliable interconnect to the sensor
- Easy sensor replacement without running new cable
- Easy sensor removal for servicing

Applications

Residual Chlorine Monitoring:

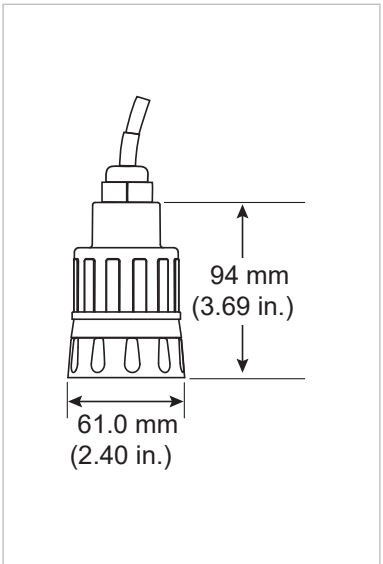
- Water Distribution
- Ground Water
- Surface Water
- HVAC Applications (cooling water)
- Food and Beverage
- Water Park

* NOTE: The 9950-X Chlorine Controller is not compatible with the standard 9950-3/-4 controller.
U.S. Patent No.: 6,666,701

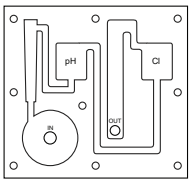
Technical Details

General		
Compatibility	All GF Amperometric DryLoc Sensors	
	9950-3 DC Chlorine Controller	
	9950-4 AC Chlorine Controller	
	All 463X Chlorine panel assemblies	
Mounting	DryLoc connection	
Materials	PC+PBT	
Cable	4.6 m (15 ft) 3 conductor shielded, 22 AWG	
Performance		
Electronics Accuracy	< 5 nA or 1% of reading, whichever is greater @ 25 °C over full input range	
Temperature	±1.0 °C (Pt1000) over full operation range (when calibrated at ambient temperature)	
Update Rate	500 ms	
Operational Range	±450 nA	
Resolution	0.1 nA	
Electrical		
Input Specifications		
Sensor	Raw Signal	
Temperature	Pt1000 RTD	
Output Specifications		
Digital (S^3L)	Serial ASCII, TTL level 9600 bps	
Max. Cable Length	30 m (100 ft)	
Power Supply Input	Digital (S^3L) mode	5 to 6.5 V ± 10%, 3 mA max.
Environmental		
Operating Temperature	0 °C to 85 °C	32 °F to 185 °F
Storage Temperature	-20 °C to 85 °C	-4°F to 185 °F
Relative Humidity	0 to 95%, non-condensing (no electrode connected)	
Enclosure	NEMA 4X/IP65 with electrode connected	
Shipping Weight		
	0.64 kg	1.41 lb
Standards and Approvals		
UKCA, CE, FCC		
RoHS compliant, China RoHS		
Manufactured under ISO 9001, ISO 14001 and ISO 45001		

Dimensions



System Overview

Panel Mount	
Type 9950-3/4	
GF Amperometric Electronics 2650-7	
GF Electrode 2630-1 2630-2 2630-3 2632-1	
GF Flow Cell	

All sold separately

Ordering Information

Mfr. Part	No. Code	Description
3-2650-7	159 001 670	Amperometric Sensor

Type 2751-7 pH Electronics



Product description

When used with the type 9950-3/-4 Chlorine Controller, the type 2751-7 pH/ORP Smart Sensor Electronics featuring the DryLoc® connector is the solution for field-free calibration, broken glass and high impedance detection, alerting the operator to probe failure or maintenance needs.

The pH/ORP Smart Sensor Electronics will allow for calibration of electrodes in a laboratory setting and installation of pre-calibrated probes in the field, reducing system downtime. The data stream also includes important information regarding the performance and life span of the pH electrode. The 9950-3/-4 Chlorine Controller provides the operator with a calculated slope of the electrode (electrode health) and can detect when the electrode requires cleaning.

Sensor maintenance, replacement and troubleshooting has never been easier. The DryLoc® electronics can be separated from the sensor, which allows the user to detect a faulty sensor, electronics or cable assembly.

Features

- Amplifies the output from the pH electrode and converts it to a reliable (S^3L) signal
- Patented DryLoc connector provides a quick and secure connection to the sensor
- Waterproof and reliable interconnect to the sensor
- Easy sensor replacement without running new cable
- Easy sensor removal for servicing

Applications

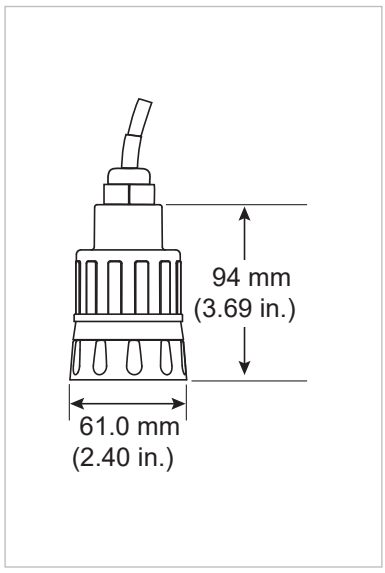
- Water Distribution
- Ground Water
- Surface Water
- HVAC Application (cooling water)
- Food and Beverage
- Swimming Pools
- Water Parks

* NOTE: The 9950-3/-4 Chlorine Controller is not compatible with the standard 9950 controller.

Technical Details

General		
Compatibility	DryLoc pH and ORP Electrodes, 2724 and 2724	
Mounting	DryLoc connection	
Materials	PC+PBT	
Cable	4.6 m (15 ft) 3 conductor shielded, 22 AWG	
Performance		
Electronics Accurracy	±0.02 pH @ 25 °C	
Operational Range	-1.0 to 15.0 pH	
Response Time	< 6 s for 95% of change (includes electrode response)	
Electrical		
Input Specifications		
Input Impedance	> 10^{11} Ω	
Temperature Drift	±0.002 pH per °C	
Input Resolution	0.02 pH, 0.3 °C	
Output Specifications		
Digital (S^3L)	Serial ASCII, TTL level 9'600 bps	
Max. Cable Length	30 m (100 ft)	
Environmental		
Operating Temperature	0 °C to 85 °C	32 °F to 185 °F
Storage Temperature	-20 °C to 85 °C	-4 °F to 185 °F
Relative Humidity	0 to 95%, non-condensing	
Enclosure	NEMA 4XI/IP65 with electrode connected	
Shipping Weight		
	0.64 kg	1.41 lb
Standards and Approvals		
UKCA, CE, FCC		
RoHS compliant, China RoHS		
Manufactured under ISO 9001, ISO 14001 and ISO 45001		

Dimensions



System Overview

Panel Mount

GF Instrument
9950-3/-4



Type 2751-7
pH Electronics

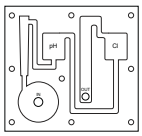


GF Electrodes
2724



All sold separately

GF Flow Cell 4630



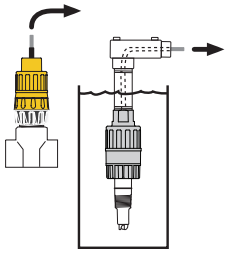
All sold separately

Ordering Information

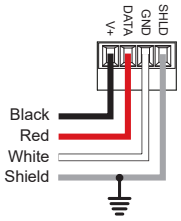
Mfr. Part No.	Code	Description
3-2751-7	159 001 957	pH Electronics

Wiring information

2751 Digital (S³L) Wiring with no junction box

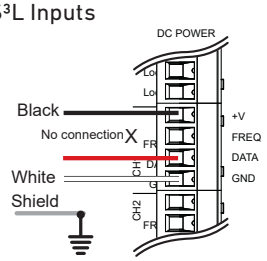


9900 S³L Inputs

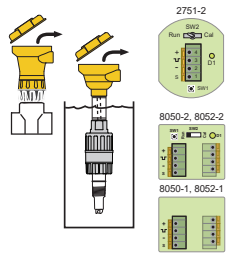


Optional Earth ground

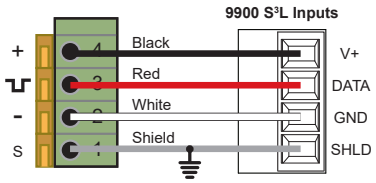
9950 S³L Inputs



2751 Digital (S³L) Wiring with junction box

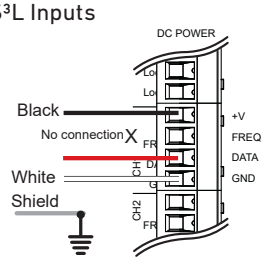


9900 S³L Inputs

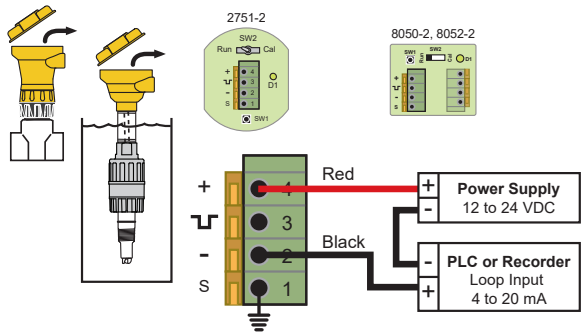


Optional Earth ground

9950 S³L Inputs



2751 4 to 20 mA Loop Wiring - Current loop, junction box with Easy Cal



Optional Earth ground

Planning Fundamentals

of Measurement and Control

Turbidity

Content

Introduction 229
Type 4170 Turbidity Sensor 232
Type 8640 Turbidity Transmitter 238

Introduction

Turbidity Specification Matrix

Type		4170
		
Description		Turbidity Sensor
Measuring principle		90° Scattered light measurement according to ISO 7027/EN27027
Operation Range		0 ... 4'000 FNU
Output Specs	Analog	1 x current output 0/4 .. 20 mA, maximum load 600 Ohm – Minus pole to ground on service voltage (connector version M12 only)
	Digital	- 2 x digital outputs; 24V, high side, max. 25mA (connector version only) - Modbus RTU (all versions)
Materials	Housing body	Stainless steel 316Ti (1.4571)
	Optical windows	Sapphire
	Light absorber	PPSU
Connection	Connector version	M12x1, 8-pin, 10 m
	Cable version	Fixed cable, 10 m
Operating Temperature		0 °C to 60 °C 32 °F to 140 °F
Dimensions		Ø 40 mm x 197 mm (length with connector 300 mm)
Standards and Approvals		CE, China RoHS, certificates from SVGW; ACS, DWI, DVGW safe for use for drinking water applications

Technical Basics

Function

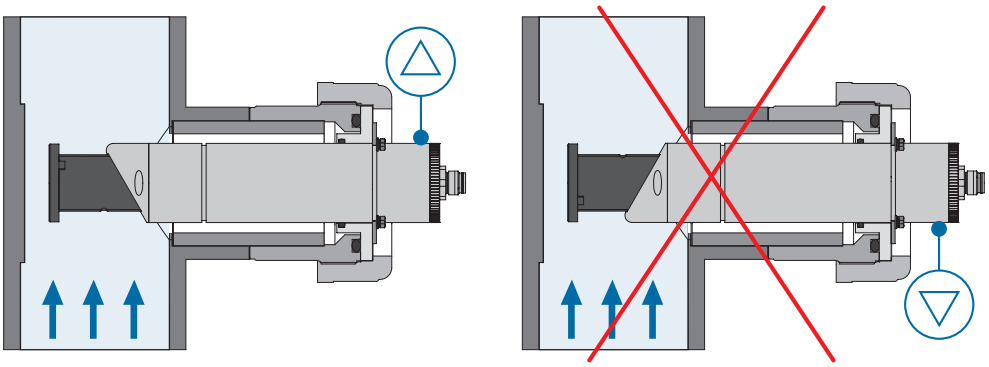
Turbidity sensors are essential instruments for continuously monitoring the concentration of suspended particles in liquids, widely used in water treatment, environmental monitoring, and various industrial processes. Turbidity refers to the scattering of light caused by undissolved solids, microorganisms, or air bubbles present in the fluid.
A common and internationally standardized method is the 90° scattered light measurement according to ISO 7027 / EN 27027. In this method, an infrared light source emits a beam through the liquid. A detector positioned at a 90° angle to the light source measures the amount of light scattered by particles in the medium. The intensity of this scattered light is directly proportional to the turbidity level.
Using stable near-infrared LED light, this measurement technique is insensitive to the color of the liquid, ensuring reliable results even under varying process conditions. The 90° scattered light method enables precise, repeatable, and standard-compliant turbidity measurements across a wide range of applications.

General mounting information

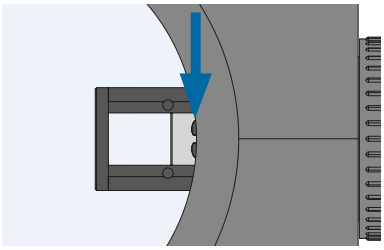
Turbidity Sensors should be mounted in positions where there is a uniform flow. This is usually the case in the standpipe. To ensure that measurements are performed properly, it is important to avoid any interference of the measuring signal.

Flow direction

The slanted sensor head must always face against the flow direction. Refer to the flow direction marking on the sensor body.



For optimum passive sensor self-cleaning, the optical part must be located within the flow.



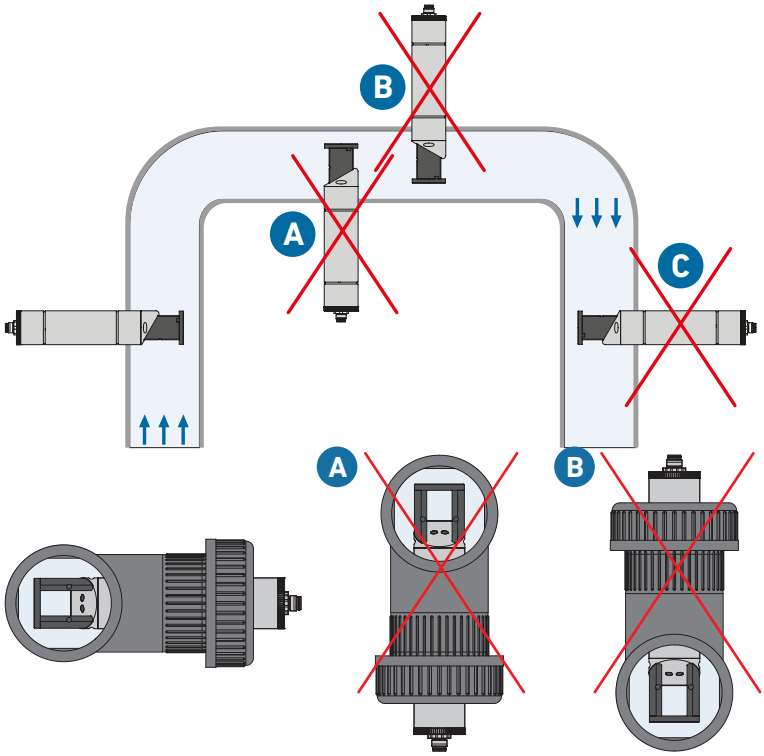
Mounting orientation and location

Turbidity sensors can be installed in horizontal pipelines when mounted sideways.

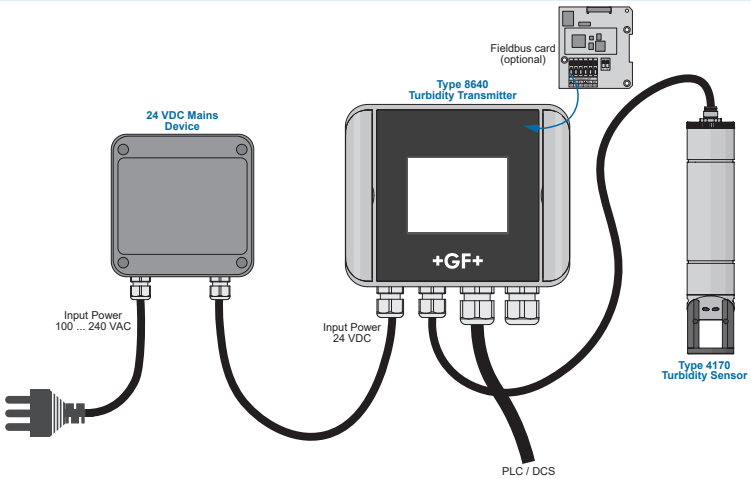
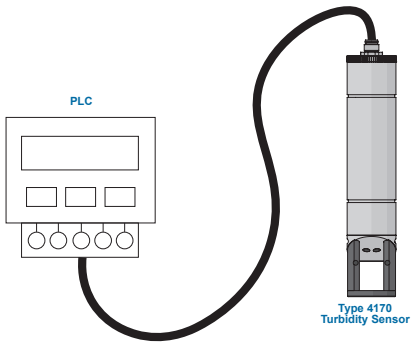
A) Do not install the sensor in areas where dirt or particles may settle or accumulate.

B) Do not install the sensor in areas where bubbles can accumulate.

C) Do not mount in a downpipe.



System overview

Type 4170 Turbidity Sensor to Type 8640 Turbidity Transmitter	Type 4170 Turbidity Sensor to PLC
	
Wiring to the Type 8640 Turbidity Transmitter enables convenient display, graphical analysis, extended functions, fieldbus communication, and simplified calibration and settings.	The Type 4170 Turbidity Sensor integrates with a PLC via 4...20mA or Modbus RTU (connector version only). Fixed cable version support Modubs RTU only. Configuration via PC.

Type 4170 Turbidity Sensor



Type 4170 Turbidity Sensor
M12-Connector version



Type 4170 Turbidity Sensor
Fixed cable version
for submersible applications

Product description

The Type 4170 Turbidity Sensor is a high-performance optical sensor, designed for inline turbidity measurement in drinking water, desalination, and industrial water applications. Based on the 90° scattered light principle (ISO 7027 / EN 27027), it provides precise measurements from 0.001 to 4000 FNU with minimal maintenance.
Made from durable materials like SS316Ti, sapphire glass, and PPSU, the sensor features a slanted optical head. This allows continuous flushing by the flowing medium, reducing fouling and minimizing maintenance. An integrated light absorber increases measurement stability, supports self-flushinand enables reliable operation. This ensures reliable measurement even in challenging pipe conditions, such as tight bends, reducers, or reflective surfaces (e.g., stainless steel) down to DN50 (2"). The sensor enables precise measurement, calibration, and verification even under standard laboratory lighting, without interference from external light sources.
The Type 4170 turbidity sensor can be directly integrated into PLC or SCADA systems via Modbus RTU; the M12-Connector version also includes an analog 4 ... 20 mA output. In combination with the compatible Type 8640 turbidity transmitter, it forms a complete monitoring system with display, configuration options, and graphical analysis.

Features

- Inline turbidity measurement according to ISO 7027 (90° light scattering), measuring range 0.001–4000 FNU, accuracy ±0.1–0.2%
- Integrated light absorber and slanted, self-flushing sensor head for minimal maintenance
- Durable materials: SS316Ti, sapphire window, PPSU, and O-ring-free sapphire-to-metal seal
- Compact design: 40 mm diameter, suitable for DN50 (2"), with integrated temperature sensor
- Protection ratings: IP67 (M12) or IP68 (fixed cable) for harsh or submersible environments
- Recalibration possible with solid-state reference – no formazin required
- Modbus RTU; compatible with Type 8640 turbidity transmitter for display, calibration, and data analysis

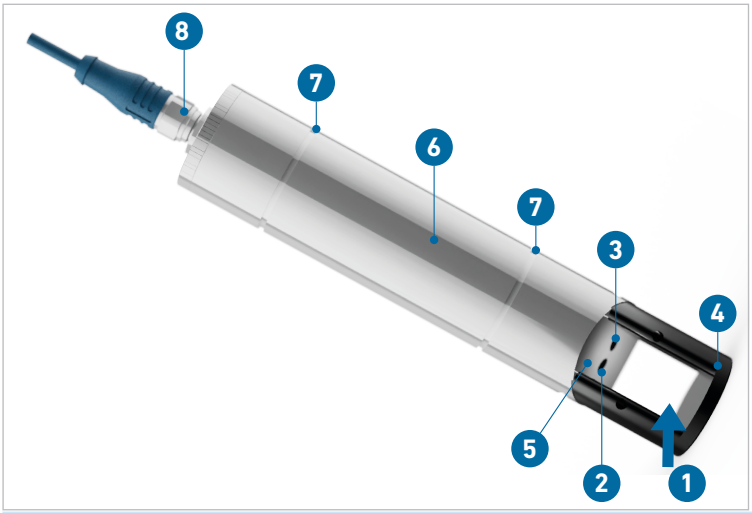
Advantages

- Color-independent, precise inline measurement without air bubble interference
- Reliable performance in reflective pipes and tight installations (from DN50 / 2")
- Self-flushing, O-ring-free sapphire window for long-term stability and minimal maintenance
- Integrated temperature sensor for real-time process monitoring
- Direct PLC/SCADA connectivity via Modbus RTU and 4 ... 20 mA (Connector version).
- Fast, chemical-free verification using solid-state reference kit
- Type 8640 transmitter enables local display, diagnostics, and calibration even under ambient light

Applications

- **Surface and Intake Water** – Clarification, flocculation, and pre-filtration monitoring
- **Drinking Water Distribution** – Compliance and final turbidity quality control
- **Desalination Systems** – Pretreatment monitoring before UF and RO membranes
- **Industrial Wastewater** – Clarifier efficiency, sludge overflow, and effluent turbidity
- **Mining & Mineral Processing** – Sedimentation and discharge turbidity monitoring
- **Cooling & Process Water** – Turbidity control in closed-loop and recirculating systems

Technical data

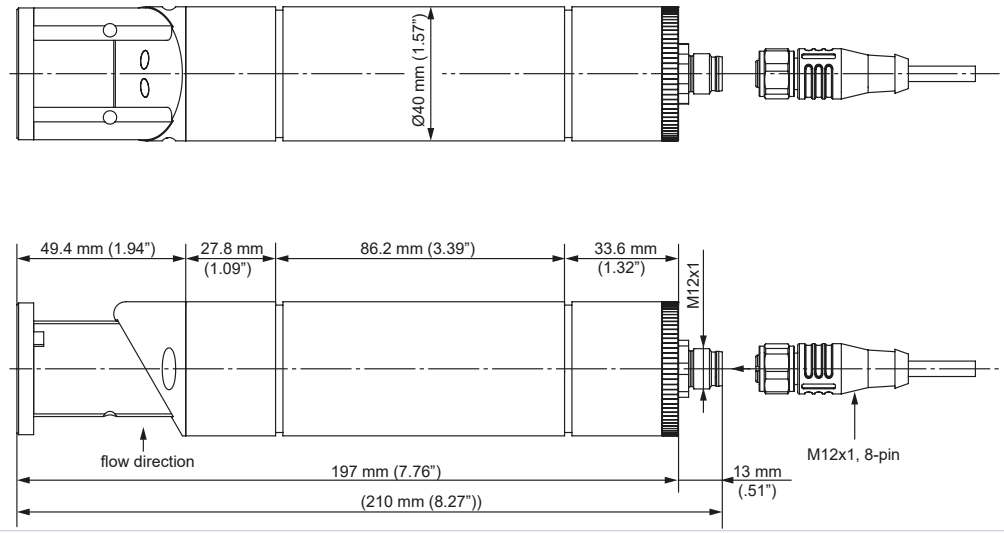


1 Flow direction
2 Near-Infrared LED
3 Photo detector
4 Light absorber
5 Slanted sensor head
6 Stainless steel sensor body
7 Mounting grooves
8 Scope of delivery: Cable with M-12 plug, 8-pin, 10 m, or fixed cable with a length of 10 m

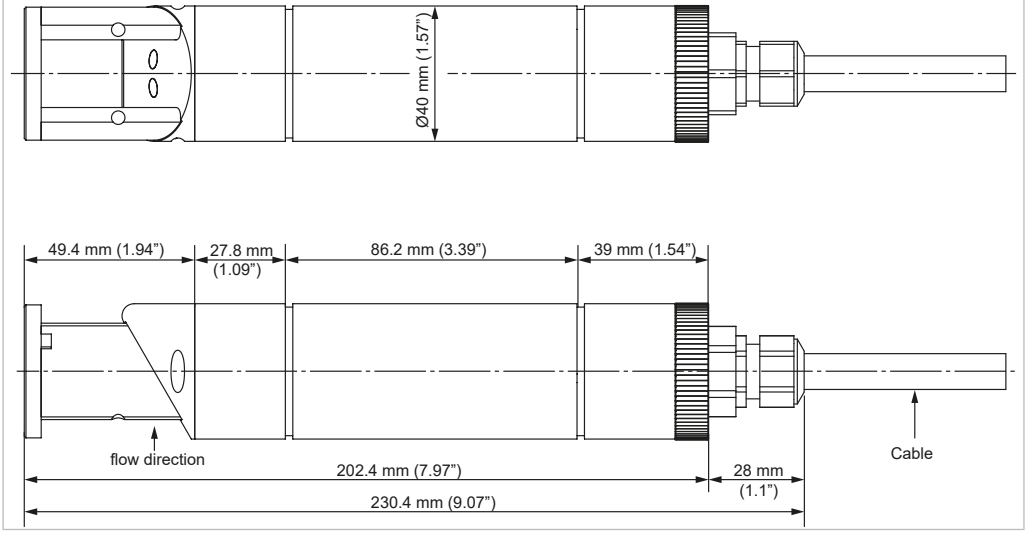
Technical Data		
General	Measuring principle	90° Scattered light measurement according to ISO 7027/EN27027
	Light source	Long life low drift 860nm near-infrared LED
	Measurement span	0 ... 4000 FNU (or NTU), unit changeable
	Sample medium	Water
	Wavelength	860 nm near-infrared, compliant with ISO 7027 / EN 27027
Accuracy	Measurement accuracy	± 0.2 % of measurement value (range 0 ... 0.5 FNU) ± 0.1 % of measurement value (range >0.5 FNU)
	Resolution	0.001 FNU
	Reproducibility	0 ... 10 FNU: ± 0.002 FNU, or ± 1 %
		10 ... 4000 FNU: ± 2 %
	Repeatability	0.001 FNU, or ± 0.1%
	Resolution temp. measurement	0.1 °C
Outputs	Analog	1 x current output 0/4 .. 20 mA, maximum load 600 Ohm – Minus pole to ground on service voltage (connector version M12 only)
	Digital	- 2 x digital outputs; 24V, high side, max. 25mA (connector version only) - Modbus RTU (all versions)
Application	Pressure max.	1 MPa (10 bar) @ 20 °C
	Flow speed max.	3 m/sec.
	Sample temperature	0 ... +60 °C / 32 ... 140 °F
	Ambient temperature	0 ... +60 °C / 32 ... 140 °F
	Temperature measure-ment	0 ... +60 °C / 32 ... 140 °F (immersion vers.)
	Ambient humidity	0 ... 100 % rel.
	Protection class	IP67: M12-Connector version IP68: Fixed cable version
Power	Voltage supply	24 VDC ± 10 % isolated from sensor housing
	Power consumption max.	2 W
Materials	Housing body	Stainless steel 316Ti (1.4571)
	Optical windows	Sapphire
	Light absorber	PPSU
Connection	Connector version	M12x1, 8-pin, 10 m
	Cable version	Fixed cable, 10 m
Dimensions	Weight	0.5 kg
	Dimensions	Ø 40 mm x 197 mm (length with connector 300 mm)
Approvals and Standards	CE, China RoHS, certificates from SVGW; ACS, DWI, DVGW safe for use for drinking water applications	

Dimensions

M12-Connector version

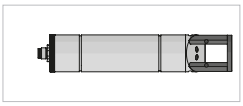
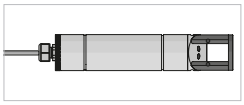


Fixed cable version

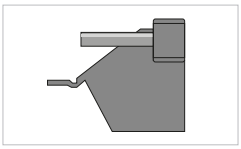
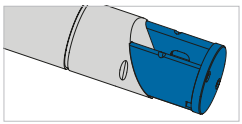
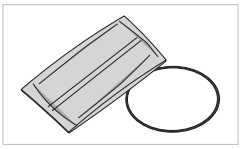


Ordering Information

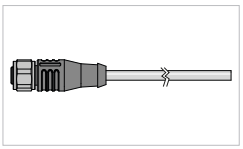
Type 4170 Turbidity Sensor

Mfr. Part No.	Code	Description	
3-4170-1	159 002 290	Type 4170 Turbidity Sensor, M12-Connector Version 10 m device cable provided	
3-4170-2	159 002 291	Type 4170 Turbidity Sensor, 10 m Fixed cable version	
3-4170-20	159 002 292	Mobile Unit, contains Type 4170 Turbidity Sensor (5m fixed cable), Type 8640 Turbidity Transmitter, power bank and wall socket for charging	

Consumable and maintenance parts

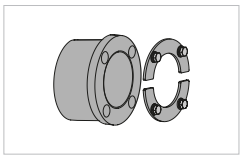
Mfr. Part No.	Code	Description	
3-4170.390	159 002 298	**Checking unit for Type 4170 Turbidity Sensor** Makes precise recalibration possible without Formazin	
3-4170.398	159 002 301	**Sensor Light-Absorber** PPSU-cover-Absorber - 4 screws included	
3-4170.399	159 002 302	**Type 4170 Turbidity Sensor Service Set** Includes: 1x Desiccant bag, and 1x EPDM O-ring	

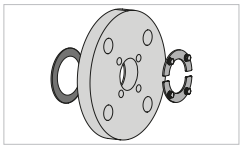
Cables

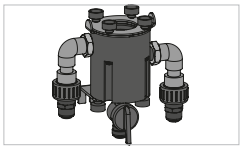
Mfr. Part No.	Code	Description	
4170.260-10	159 002 308	Device cable, 8-pins, M12, 10 m	
4170.260-20	159 002 309	Device cable, 8-pins, M12, 20 m	
4170.260-30	159 002 310	Device cable, 8-pins, M12, 30 m	

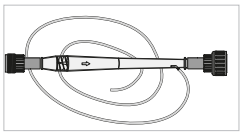
Installation and Fittings

Mfr. Part No.	Code	Description
3-4170.391-1	159 002 303	Stainless steel union end DN50 / 2"
3-4170.392-15E	159 002 305	Pipe Flange DN40 PN10-40, 1.4404 / 316L
3-4170.392-2E	159 002 304	Pipe Flange DN50 PN16, 1.4404/316L
3-4170.392-2A	159 002 306	Pipe Flange ASME ASME B16, 2" Class 150, 1.4404 / 316L
3-4170.396	159 002 299	Flowcell for bypass installation
3-4170.397	159 002 300	Deaeration kit (for bypass installation)



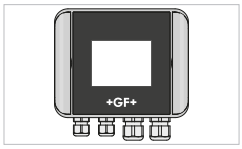


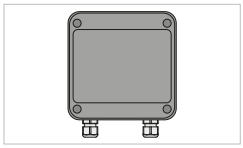


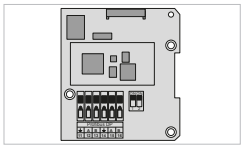


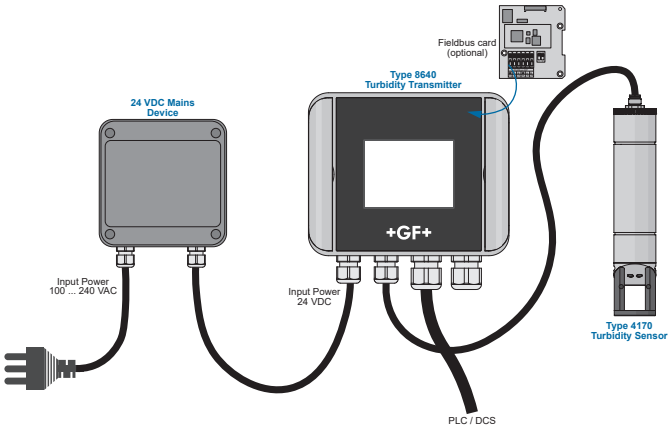
Transmitters

Mfr. Part No.	Code	Description
3-8640-1	159 002 293	Type 8640 Turbidity Transmitter
3-4170-21	159 002 294	Power supply 230V AC 24V DC 24 VDC mains device 20 W, input 100 ... 240 VAC, 47 to 63 Hz, IP66, Polycarbonate, 130 x 155 x 55 mm
3-8640-10.401	159 002 295	Type 8640 Turbidity Transmitter Profibus DP interface printed circuit board
3-8640-10.402	159 002 296	Type 8640 Turbidity Transmitter Profinet IO interface printed circuit board
3-8640-10.403	159 002 297	Type 8640 Turbidity Transmitter Modbus RTU interface printed circuit board



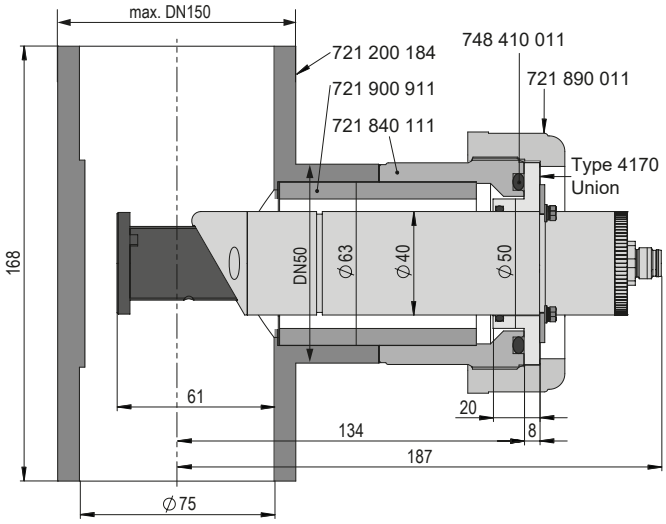




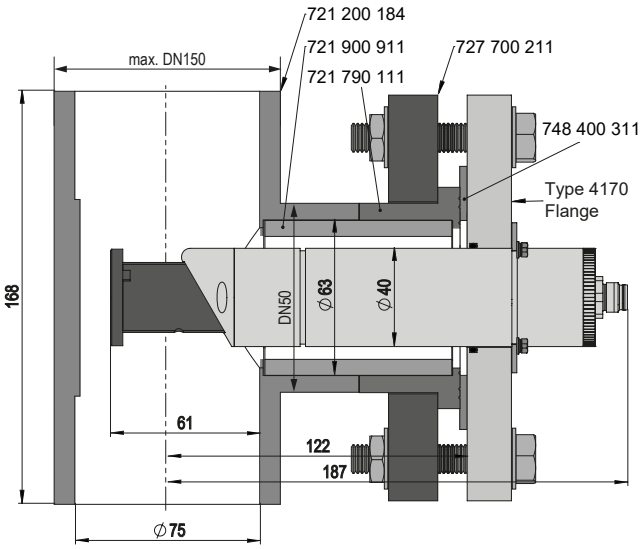


Installation variants

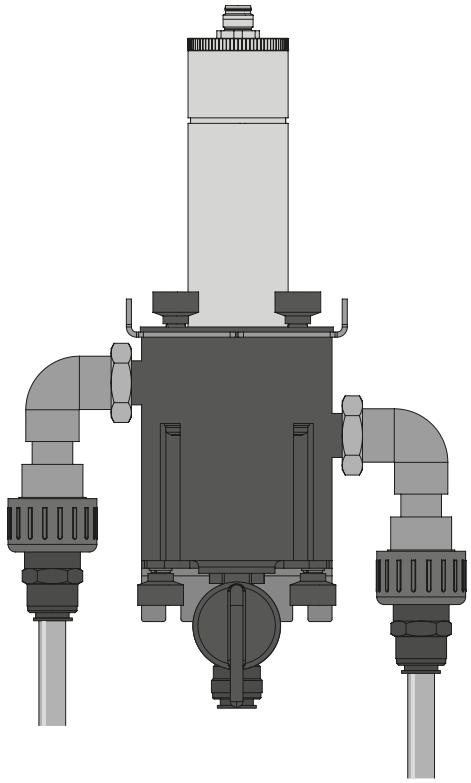
Union installation



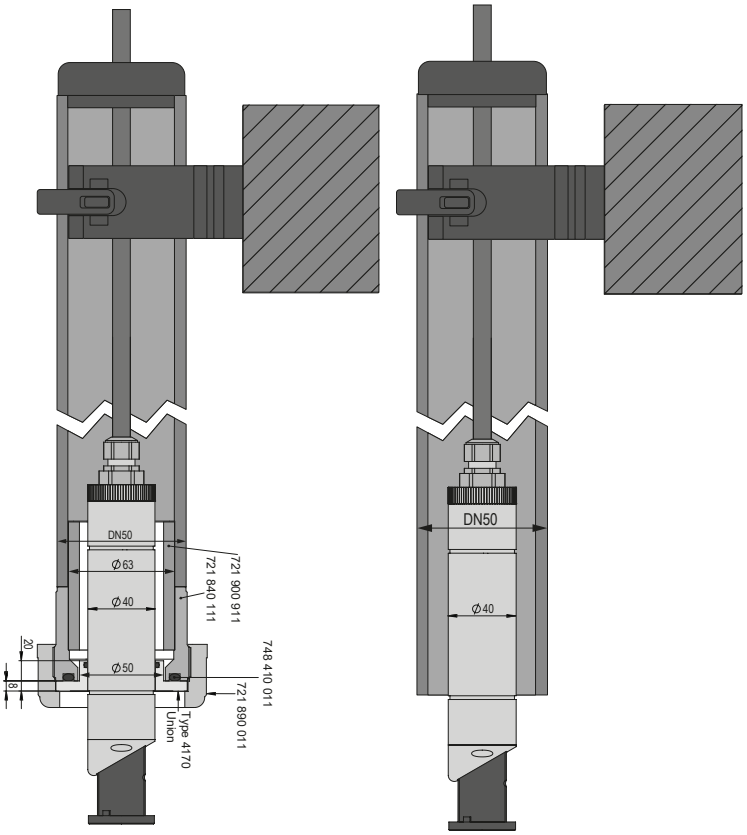
Flange installation



In-Line Installation (Bypass)



Submersible installation



Type 8640 Turbidity Transmitter



Product description

The Type 8640 Turbidity Transmitter is a compact, single-channel transmitter designed specifically for the Type 4170 Turbidity Sensor, delivering precise turbidity measurement in water treatment and industrial process applications. Its high-resolution VGA color touchscreen, rugged IP66 housing, and versatile communication interfaces ensure reliable performance, intuitive operation, and seamless integration into control systems.

Features

- Dedicated interface for seamless integration with the Type 4170 Turbidity Sensor
- ¼ VGA color touchscreen for intuitive navigation and real-time display
- Four 4–20 mA outputs, expandable with Modbus RTU, Profibus DP, or Profinet IO via optional interface card
- Onboard microSD for data logging, firmware updates, and diagnostics
- Flexible display modes: numeric, trend graphs, and historical data
- Multi-level password protection for secure access
- Visual alerts and status indicators for process reliability
- Rugged IP66 wall-mount housing for harsh or wet environments

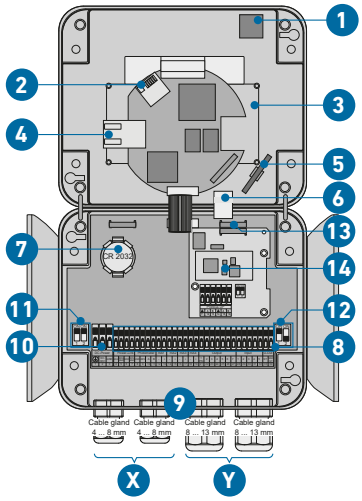
Advantages

- Seamless Sensor Integration – Purpose-built for the Type 4170 Turbidity Sensor with plug-and-measure functionality
- Intuitive Touchscreen Operation – Simplifies use, reduces errors, and shortens training time
- Reliable Process Monitoring – Real-time values, alarms, and trends for quick decisions and stable control
- Secure and Traceable – Multi-level access, event logging, and calibration history for compliance and audits
- Flexible Connectivity – Field-upgradeable Modbus, Profibus, or Profinet for easy system integration
- Rugged, Space-Saving Design – IP66 housing for harsh environments without extra enclosures
- Long-Term Data Management – microSD card for extended logging, diagnostics, and easy firmware updates

Applications

- **Surface & Intake Water –** Clarification, flocculation, and pre-filtration monitoring
- **Drinking Water Distribution –** Turbidity compliance and final water quality assurance
- **Desalination & RO Systems –** Pretreatment monitoring before UF and RO membranes
- **Industrial Wastewater –** Clarifier performance, sludge overflow, and effluent control
- **Mining & Mineral Processing –** Tailing water, sedimentation, and discharge monitoring
- **Cooling & Process Water –** Turbidity control in closed-loop and recirculating systems

Technical data

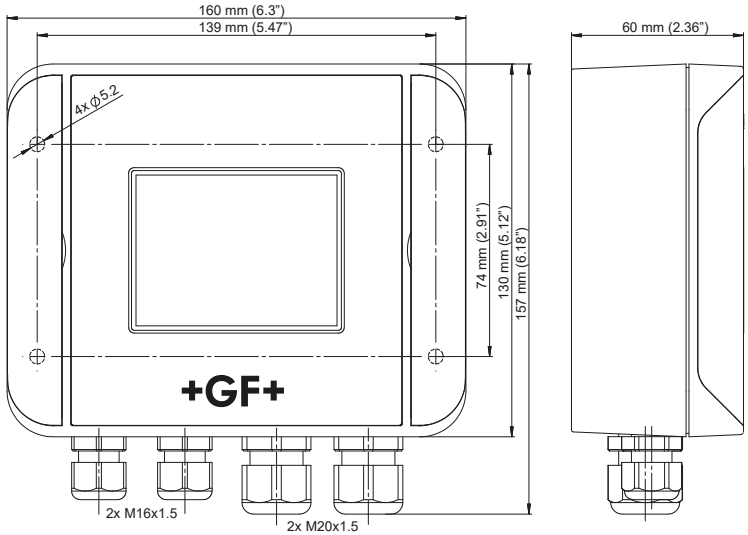


1 Park position for cover clamp
2 microSD card (card for log data)
3 USB connection
4 Ethernet connection
5 SD card adapter with holder
6 Cover clamp in holding position
7 Battery (type CR2032)
8 External connections
9 Cable gland
X: 4 to 8 mm
Y: 8 to 13 mm
10 Service voltage input (DC Only)
11 Dip Switches 1
12 Dip Switches 2
13 Fieldbus interface card slot
14 Fieldbus interaface card (optional)

Technical Data		
Electrical	Power supply	9 ... 30 VDC
	Power consumption	5 W
Resolution		0.001 FNU
Display	Characteristics	¼ VGA with touchscreen
	Resolution	320 x 240 pixels, 3.5" diagonal
Outputs	Analog	4 x 0/4 ... 20 mA outputs, galvanically isolated up to max. 50 V to earth and max. 500 Ω load
	Digital	7 x digital outputs up to max. 30 VDC, freely configurable, of which 1 output as relay normally closed
Inputs	Analog	1x Type 4170 Turbidity Sensor
	Digital	5 x digital inputs up to max. 30 VDC, freely configurable
Fieldbus	Standard	Modbus TCP / Ethernet
	Optional	Modbus RTU, Profibus DP, Profinet IO
Materials	Housing	ABS
Protection class	IP66	
Dimensions	160 x 157 x 60 mm	
Weight	Approx. 0.6 kg	
Approvals and Standards	CE, RoHS	

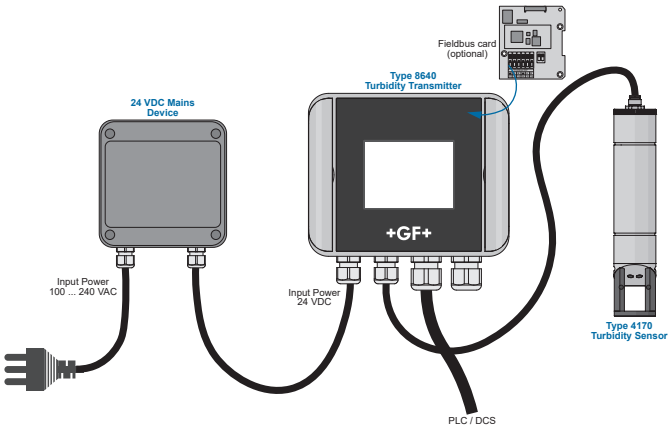
Dimensions

Type 8640 Turbidity Transmitter



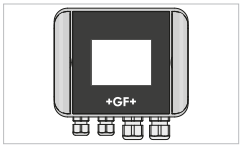
Ordering Information

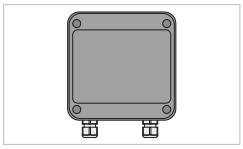
System overview

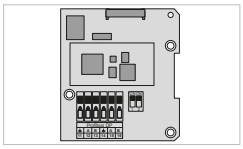


Transmitters

Mfr. Part No.	Code	Description
3-8640-1	159 002 293	Type 8640 Turbidity Transmitter
3-4170-21	159 002 294	Power supply 230V AC 24V DC 24 VDC mains device 20 W, input 100 ... 240 VAC, 47 to 63 Hz, IP66, Polycarbonate, 130 x 155 x 55 mm
3-8640-10.401	159 002 295	Type 8640 Turbidity Transmitter Profibus DP interface printed circuit board
3-8640-10.402	159 002 296	Type 8640 Turbidity Transmitter Profinet IO interface printed circuit board
3-8640-10.403	159 002 297	Type 8640 Turbidity Transmitter Modbus RTU interface printed circuit board

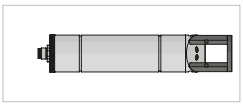


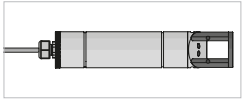




Type 4170 Turbidity Sensor

Mfr. Part No.	Code	Description
3-4170-1	159 002 290	Type 4170 Turbidity Sensor, M12-Connector Version 10 m device cable provided
3-4170-2	159 002 291	Type 4170 Turbidity Sensor, 10 m Fixed cable version
3-4170-20	159 002 292	Mobile Unit, contains Type 4170 Turbidity Sensor (5m fixed cable), Type 8640 Turbidity Transmitter, power bank and wall socket for charging







Planning Fundamentals

of Measurement and Control

Dissolved Oxygen (DO)

Content

Introduction 242
Type 2610 Process Optical Dissolved Oxygen Sensor Gen II 244

Introduction

Dissolved Oxygen Specification Matrix

Type	2610
	
Description	Process Optical Dissolved Oxygen Sensor
Wetted Materials	ABS, Titanium
	FKM
Operation Range	0 to 60 ppm (mg/l), 0 to 200% Saturation Concentration
Connector Style	10 meter cable
Output Specs	S³L, Modbus RS485, 4-20 mA
Operating Temperature (°C) (°F)	0 °C to 50 °C 32 °F to 122 °F
Standards and Approvals	CE, FCC, RoHS compliant, China RoHS

Technical Basics

Introduction

Dissolved oxygen (DO) sensors are used to measure the amount of oxygen present in fluid. Dissolved oxygen readings are important in wastewater treatment, aquaculture, and food and beverage production, for example, because they provide important information about the condition of the water and the effectiveness of water treatment processes.

General Theory of Operation

Optical DO sensors employ a light source in the sensor head, which emits light at various wavelengths. This is reflected back by the water and detected by a photo diode in the sensor head. The intensity of the signal is proportional to the concentration of dissolved oxygen in the water. The signal is processed in the sensor and converted to a digital/analog reading.
Optical DO sensors have high accuracy, stability and reliability as well as long calibration intervals and low maintenance requirements.

Type 2610 Process Optical Dissolved Oxygen Sensor Gen II



Product Description

The type 2610 RDO® Pro is a rugged, reliable sensor designed to deliver accurate dissolved oxygen (DO) data across a wide measuring range while reducing maintenance costs. It features the latest optical technology for DO measurement and eliminates the replacement of membrane and reference solutions.

The type 2610 optical sensor cap is calibrated at the factory and requires no field calibration. The optical measurement technology resists abrasion and bleaching allowing for a long life in many harsh applications. The DO sensor has a built in Modbus RS485 and 4 to 20 mA current loop outputs for ease of interface to existing control systems. The 3-2610-51 version includes the GF (S^3L) digital interface for direct connection with the 9900 SmartPro® Transmitter and 9950 SmartPro® Dual Channel Transmitter.

Additional features include a 10 m (32.8 ft) cable with stripped and tinned ends as well as a titanium temperature sensore for improved compatibility in salt water applications.

Features

- Measurement range: to 60 mg/L (ppm)
- Two year measurement cap life
- Optical measurement, no minimum flow requirements
- Rugged construction
- Calibration built into the measurement cap
- Accuracy ±0.1 mg/L, 0 to 20 mg/L; ±5% of reading, 20 to 60 mg/L
- No membranes or filling solutions
- Digital (S^3L), 4 to 20 mA or Modbus
- Installs in-line or submersible
- 3-2610-51 compatible with 9900 SmartPro Transmitter, 9950 Transmitter series

Applications

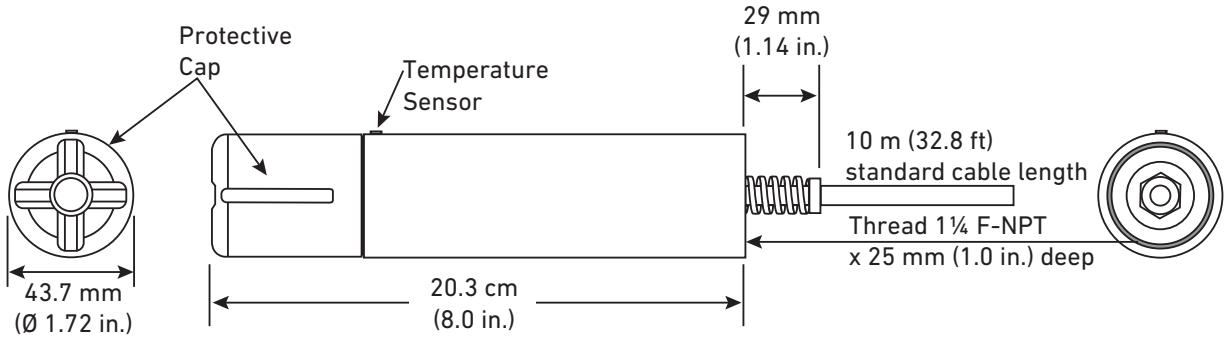
- Municipal and Industrial Wastewater Treatment
- Drinking Water Reservoir Monitoring
- Environmental Water Discharge Monitoring
- Aquatic Life Support
- Aquaculture
- Controlled Environment Agriculture (CEA)
- Mining

RDO is a registered trademark of In-Situ® Inc., Fort Collins, CO USA

Specifications

General		
Sensor type	Optical luminescent dissolved oxygen sensor	
Transmitter/Local Display	Optional, not required. Compatible with SmartPro instruments	
Communications Options	Digital (S^3L), 4-20 mA, Modbus (RS485)	
Maximum Cable Length	Modbus and 4 to 20 mA: up to 1'219 m (4'000 ft) Digital (S^3L): 38 m (125 ft)	
Internal Mounting Thread	1¼ NPT	
Power Requirements	12 to 24 VDC ±10% regulated (Note: external power supply, cannot be powered by GF transmitters directly)	
4 to 20 mA output span	0 to 20 mg/L and 0 to 60 mg/L are factory defaults, either unit can be respanned anywhere in between (contact GF Sales office)	
Performance		
Salinity Range	0 to 42 PSU, fixed or real-time capable	
pH Range	2 to 10 pH	
Barometric Range	507 to 1115 mbar, fixed or real-time capable	
Maximum Pressure	150 psi @25°C	
Range	0 to 60 mg/L concentration	
Units	mg/L, ppm, %SAT	
Accuracy (DO)	±0.1 mg/L, 0 to 20 mg/L,	
	±5% of reading, 20 to 60 mg/L	
Response Time of Cap	T90: 30 sec	
	T95: 37 sec @ 25 °C	
Repeatability	0.05 mg/L	
Resolution	0.01 mg/L	
Environmental		
Wetted Materials	ABS, Titanium and FKM	
Usage Life of Cap	2 years from the first instrument reading	
Shelf Life of Cap	24 months from date of manufacture (install within 12 mo. of manufacture)	
Operating Temperature	0 °C to 50 °C	32 °F to 122 °F
IP Rating	IP-67 with cap off, IP-68 with cap installed	
Compliance	Heavy industrial, IEC 61000-6-2:2005	
Storage Conditions, Cap	1 °C to 60 °C	33 °F to 140 °F, in factory container
Storage Conditions, Sensor	-5 °C to 60 °C	23 °F to 140 °F
Warranty		
Sensor	3 years from date of manufacture	
Standards and Approvals		
CE, FCC		
RoHS Compliant, China RoHS		

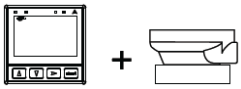
Dimensions



System Overview

Panel Mount (S^3L)	Pipe, Tank, Wall (S^3L)	4 to 20 mA	Automation System (S^3L, 4-20 mA, or Modbus)	In-line Installation
GF Instruments - 9900 - 9950	GF Instruments 9900 with 3-8050 Universal Mount Kit	Customer Supplied Chart Recorder, Programmable Logic Controller, or Programmable Automation Controller	0486 Profibus Concentrator and Customer Supplied Programmable Logic Controller or Programmable Automation Controller	GF Pipe Adapter 3-2610.501







Type 2610-51
Optical luminescent dissolved oxygen sensor

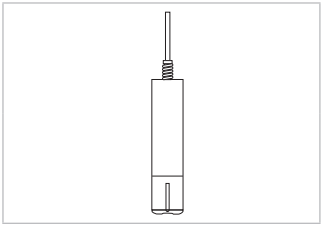


All sold separately

Ordering Information

Dissolved Oxygen Sensors

Mfr. Part No.	Code	Description
3-2610-51	159 001 849	Gen II Optical Dissolved Oxygen Sensor (0.2 to 20 ppm) with Digital (S^3L), 4 to 20 mA, and Modbus output
3-2610-51-60	159 002 227	Gen II Optical Dissolved Oxygen Sensor (0.2 to 60 ppm) with Digital (S^3L), 4 to 20 mA, and Modbus output



Replacement parts and tools

Mfr. Part No.	Code	Description
3-2610.392	159 310 122	Replacement Optical Dissolved Oxygen Sensor cap for 3-2610-31 and 3-2610-41 DO Sensors
3-2610.394	159 310 301	Replacement Optical Dissolved Oxygen Sensor cap for Gen II 3-2610-51 DO Sensor
3-0252	159 001 808	Configuration Tool



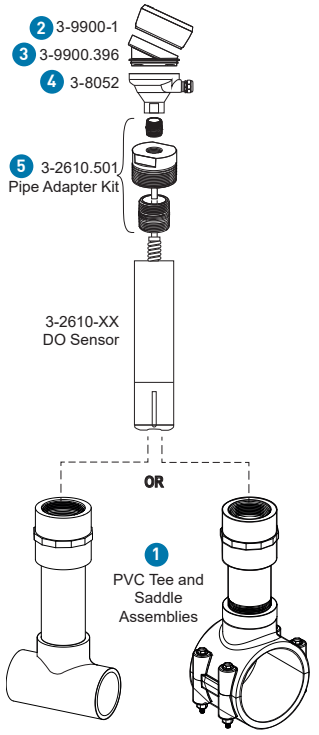
For installation options, see instruction manual and Specials Catalog.

Accessories

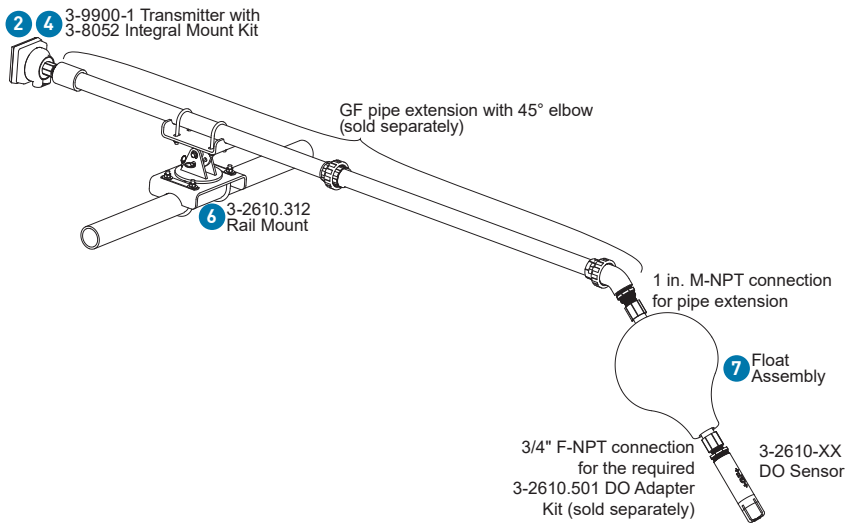
Contact GF Sales office for more information.

Dissolved Oxygen assembly overviews

Dissolved Oxygen Tee / Saddle Assembly

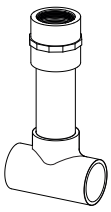


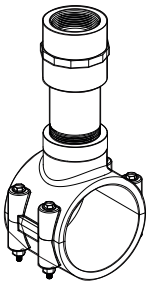
Dissolved Oxygen Float Assembly



Saddles and Tees 1

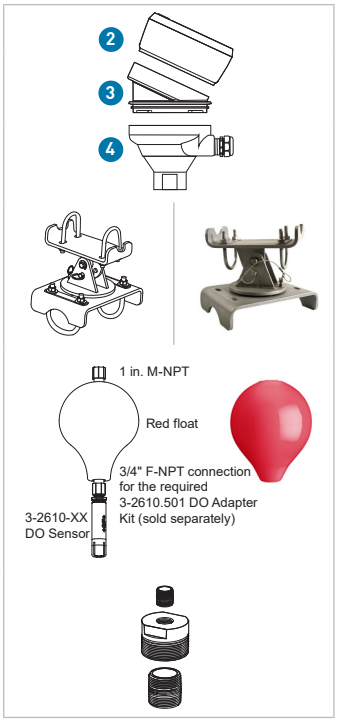
Mfr. Part No	Description
3-2610.100	2 in. Tee Assembly, PVC
3-2610.101-01	3 in. Saddle Assembly, PVC
3-2610.101-02	4 in. Saddle Assembly, PVC
3-2610.101-03	6 in. Saddle Assembly, PVC
3-2610.101-04	8 in. Saddle Assembly, PVC





Dissolved Oxygen Mounting Accessories

No.	Mfr. Part No	Designation	Description
2	3-9900-1	159 001 696	9900 Field Mount Transmitter
3	3-9900.396	159 001 701	Angle Adjustment Adapter Kit
4	3-8052	159 000 188	¾ in. Integral Mount Kit
6	3-2610.312	Rail Mount (Stainless Steel)	Securely mounts the piping assembly onto railing
7	3-2610.FLT	DO Float Assembly	The float assembly includes: • 1 in. M-NPT connection for extension pipe • Red float • ¾ in. F-NPT connection for required 3-2610.501 adapter kit
5	3-2610.501	DO Threaded Pipe Adapter Kit (SCH 80 PVC)	DO Threaded Pipe Adapter kit, includes one each: • ¾ in. close nipple • 2 in. M-NPT machined adapter • 1 ¼ in. close nipple



Dissolved Oxygen sensor accessories

Mfr. Part No	Designation	Description
3-2610-81950	DO Sensor Air-Blast	The compressed air adapter mounts to the DO sensor and connects to a 20 psi air source with a ¼" OD hose and makes it possible to automatically clean the sensor with compressed air.
3-2610-81300	DO Anti Fouling Guard	The copper protection is attached to the front of the sensor, thereby reducing biological contamination, improving measurement accuracy and extending the time between sensor cleanings.



Flow

Content

Paddlewheel Flow Sensors **254**

In-line Rotor Flow Sensors **300**

Variable Area Flowmeters **315**

Magmeters **329**

Ultrasonic Flowmeters **367**

Introduction

Flow Sensors Specification Matrix

Type		2581	2551	2552	2536	515	2537	2540
								
Sensor Style		Full Bore Plastic Magnetic flowmeter	Insertion Magmeter	Insertion Metal Magmeter	Insertion Paddlewheel	Insertion Paddlewheel	Insertion Paddlewheel	Insertion Paddlewheel
Operating Range m/s (ft/s)		0.02 to 10 m/s (0.07 to 33 ft/s)	0.05 to 10 m/s (0.15 to 33 ft/s)		0.1 to 6 m/s (0.3 to 20 ft/s)	0.3 to 6 m/s (1 to 20 ft/s)	0.1 to 6 m/s (0.3 to 20 ft/s)	
Installation Mounting Styles		Union 1" to 2" (DN25 to DN50) Flanged 3" and 4" (DN80 and DN100)	GF fittings offered in various plastic and metal for sizes 1/2 - 12 inches. Above 12 inches special order.	Customer supplied threaded fittings	GF fittings offered in various plastic and metal for sizes 1/2 - 12 inches. Above 12 inches special order.			Customer supplied threaded saddle/ weld-on fittings
Pipe Size Range		DN25 (1 in.), DN40 (1.5 in.) DN 50 (2 in.) DN 80 (3 in.), DN100 (4 in.)	DN15 to DN900 (½ to 36 in.)	DN50 to DN2550 (2 to 102 in.)	DN15 to DN900 (½ to 36 in.)	DN15 to DN900 (½ to 36 in.)	DN15 to DN200 (½ to 8 in.)	DN40 to DN900 (1½ to 36 in.)
Wetted Materials	Sensor Body	PVC	PP or PVDF	316L SS	PP, PVDF or PVC	PP or PVDF		316 SS
	Rotor	N/A			PVDF or ETFE			17-4PH-1 Stainless Steel
	Rotor Pin (choice of)	N/A		Tungsten Carbide GRP 1, 316 SS	Titanium, Tantalum, Stainless Steel, Ceramic, Hastelloy-C, or PVDF			Tungsten Carbide GRP 1, 316 SS
	O-ring	FKM, EPR (EPDM)	FKM or EPR (EPDM) or FFKM	FKM	FKM or EPR (EPDM) or FFKM	FKM or EPR (EPDM) or FFKM	FKM or EPR (EPDM) or FFKM	FKM or EPR (EPDM)
	Other	Titanium (grade 2) or Hastelloy C-276 electrodes	316L SS Hastelloy-C, or Titanium	PVDF insulator	None			Carbon Fiber reinforced PTFE (bearings)
Fluid Temperature (°C) Fluid Temperature (°F)		0 °C to 60 °C (32 °F to 140 °F)	0 °C to 85 °C (32 °F to 185 °F)	-15 °C to 85 °C (5 °F to 185 °F)	-18 °C to 85 °C (0 °F to 185 °F)	-18 °C to 100 °C (0 °F to 212 °F)	-18 °C to 85 °C (0 °F to 185 °F)	-18 °C to 100 °C (0 °F to 212 °F)
Max. Operating Pressure		10 bar (145 psi) @ 23 °C (73 °F)	10.3 bar (150 psi)	20.7 bar (300 psi) @ 25 °C (77 °F)	14 bar (200 psi)		12.5 bar (180 psi)	17 bar (250 psi)
Standards and Approvals		CE, UKCA, FCC, NSF (Titanium only, does not include flange gaskets) UL, CUL Recognized Component RoHS compliant, China RoHS, NEMA-4X	CE, UKCA, FCC, UL (display version only), CUL, RoHS compliant, China RoHS, NSF, NEMA-4X	CE, UKCA, FCC, RoHS compliant, China RoHS	CE, UKCA, FCC, RoHS compliant, China RoHS, NSF	CE, UKCA, RoHS compliant, China RoHS, Lloyd's Register, NSF	CE, UKCA, FCC, UL, RoHS compliant, China RoHS, NSF, NEMA-4X	CE, UKCA, FCC, RoHS compliant, China RoHS
Power Requirements		24 VDC, Max 24W (12 to 24 VDC)	5 to 24, 24 VDC, ±10%, regulated	5 to 24, 24 VDC, ±10%, regulated	5 to 24 VDC, ±10%, regulated	None	5 to 24 VDC, ±10%, regulated	
Output		Frequency or digital, and 4 to 20 mA output	Frequency, digital (S^3L), 4 to 20 mA output or relay	Frequency, digital, or 4 to 20 mA output	Open collector	AC frequency	Open collector, 4 to 20 mA, digital (S^3L), AC Relay, Solid State Relay	Open Collector
Compatible GF Flow Instruments		All except 8150				All	All except 8150	
Comments		Partially filled pipe detection, on-the-fly configuration with bluetooth app	Features empty pipe detection, bi-directional flow, optional multi-language display	Features empty pipe detection, hot-tap version available, bi-directional flow	General Purpose Sensor with installation fittings for many materials		Various output versions available to suit application needs	Steel sensor, low flow capability requires no custom fittings
Moving Parts		No	No	No	Yes			
Suitable for High Purity Applications		No, (>20 µS/cm)	No, (>20 µS/cm)	No	Yes			No

*** Derated by Pressure and Materials**
**** Derated by Temperature and Materials**

Type	525	PF220/330 V2	U1000 V2	U3000 V2	2000	2507	2100
							
Sensor Style	Insertion Paddlewheel	Portable Ultrasonic	Ultrasonic	Ultrasonic	In-line Rotor		In-line Turbine
Operating Range m/s (ft/s)	0.5 to 6 m/s (1.6 to 20 ft/s)	0.1 to 20 m/s (0.32 to 65.62 f/s)	0.1 to 10 m/s (0.33 to 33 f/s)	0.1 to 20 m/s (0.32 to 65.62 f/s)	0.11 to 12.11 lpm (0.03 to 3.2 gpm)	0.1 to 12 lpm (0.026 to 3.170 gpm)	0.38 to 38 lpm (0.10 to 10 gpm)
Installation Mounting Styles	Metalex installation fittings for metal pipe	Clamp-on	Clamp-on	Clamp-on	¼ in. threads		Socket, flare end, or hose barb fittings
Pipe Size Range	DN15 to DN300 (½ to 12 in.)	13 mm to 2000 mm (0.5 in. to 78 in.)	d22 mm to d180 mm (3/4 in. to 6 in.)	13 mm to 2000 mm (0.5 in. to 78 in.)	¼ in. tubing		DN8, DN10, DN15 (1/4 in., 3/8 in., 1/2 in.)
Wetted Materials	316 SS	U1000 V2 WM: d22-d225 (3/4 in. -8.8 in)			PPS	PVDF	
	17-4PH-1 Stainless Steel	N/A			PEEK®	PVDF	
	Tungsten Carbide GRP 1, 316 SS	N/A					
	N/A				FKM		FKM or EPR (EPDM)
	Carbon Fiber reinforced PTFE (bearings), Klinger sil C-4401 (gasket)	Applicable pipe materials: PVDF-SYGEF, PP-PROGEF, PE-ELGEF, PB-INSTAFLEX, ABS, PVC-U/PVC-C, Mild Steel, Ductile Iron, Stainless Steel 316, Copper Applicable pipe linings: Rubber, Glass, Concrete, Epoxy, Steel	Applicable pipe materials: PVDF-SYGEF, PP-PROGEF, PE-ELGEF, PB-INSTAFLEX, ABS, PVC-U/ PVC-C, Mild Steel, Ductile Iron, Stainless Steel 316	Applicable pipe materials: PVDF-SYGEF, PP-PROGEF, PE-ELGEF, PB-INSTAFLEX, ABS, PVC-U/ PVC-C, Mild Steel, Ductile Iron, Stainless Steel 316, Copper Applicable pipe linings: Rubber, Glass, Concrete, Epoxy, Steel	N/A	PTFE	Ceramic
Fluid Temperature (°C) Fluid Temperature (°F)	-18 °C to 149 °C (0 °F to 300 °F)	-20 °C to 135 °C (-4 °F to 275 °F)	0 °C to 85 °C (32 °F to 185 °F)	-20 °C to 135 °C (-4 °F to 275 °F)	0 °C to 80 °C (32 °F to 176 °F)	-30 °C to 120 °C (-22 °F to 248 °F)	-20 °C to 70 °C (-4 °F to 158 °F)
Max. Operating Pressure	103 bar (1500 psi @ safety factor 1.5)	N/A			5.5 bar (80 psi)		9.3 bar (130 psi)
Standards and Approvals	CE, UKCA, RoHS compliant, China RoHS	CE, UKCA, RoHS compliant Safety: BS EN 61010 EMC: BS EN 61326 - 1:2006, BS EN 61326-2-3:2006 Power supply: EN61204 - 3 UL, CUL, TUV, CB, CE	CE, UKCA, RoHS compliant Safety: BS EN 61010-1:2001 EMC: BS EN 61326 - 1:2006, BS EN 61326-2-3:2006 Environmental: BS EN 60068-1:1995,BS EN 60068-2-1:2007, BS EN 60068-2-2:2007		N/A	CE, UKCA, FCC, RoHS compliant, China RoHS	
Power Requirements	None	Battery Powered. Input charger voltage is 90-264 VAC	12 to 24 V AC or DC	12 to 24 V AC or DC; 86 to 264 V AC (47Hz to 63Hz)	5 to 24 VDC, ±10%, regulated		
Output	AC frequency	4 to 20 mA, Pulse, Alarm, USB	Modbus, 4 to 20 mA, Pulse, Alarm	Modbus, 4 to 20 mA, Pulse, Alarm, USB	Open collector output		
Compatible GF Flow Instruments	All	N/A	All except 8150				
Comments	For high pressure, high temperature applications	Non-invasive measurement of liquid flow			Lowest flow range: 110 mL/min. PPS body for tough service, good chemical resistance	Excellent chemical resistance, note significant pressure drop	Excellent chemical resistance, replaceable electronics, affordable package
Moving Parts	Yes	No			Yes		
Suitable for High Purity Applications	No	Yes			No	Yes	

*** Derated by Pressure and Materials**

**** Derated by Temperature and Materials**

Flow System Compatibility

The chart below outlines the compatibility between GF Flow sensors, instruments and sensor fittings. Refer to individual product pages for more information.

	Flow Sensors										
Types	515	2536	2537	525	2000	2507	2100	2540	2551	2552	2581
8150 Battery Powered Flow Totalizer	✓			✓							
9900 Transmitter	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
9900-1BC Batch Controller	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
9950 Multichannel Transmitter	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Fittings - Customer Supplied											
¼ inch tubing or rigid pipe					✓	✓					
Wide choice of end connectors - see individual data sheet							✓				
1¼ inch NPT or ISO 7/1-R 1¼								✓		✓	
1½ inch NPT or ISO 7/1-R 1½								✓		✓	
GF Fittings											
Metric PP Wafer EPR (EPDM)	✓	✓	✓						✓		
Metric PP Wafer (FKM)	✓	✓	✓						✓		
Metric PP Union Tee	✓	✓	✓						✓		
Metric PVDF Union Tee	✓	✓	✓						✓		
Metric PVDF Wafer (FKM)	✓	✓	✓						✓		
PVC SCH 80 Tee	✓	✓	✓						✓		
PVC SCH 80 Tee w/pipe	✓	✓	✓						✓		
PVC-C SCH 80 Tee	✓	✓	✓						✓		
PVC-C SCH 80 Tee w/pipe	✓	✓	✓						✓		
PVC Clamp-on Saddle	✓	✓	✓						✓		
Fiberglass Glue-On Tee	✓	✓	✓						✓		
Iron Threaded Tee (NPT)	✓	✓	✓						✓		
Iron Strap-On Saddle	✓	✓	✓						✓		
Copper Sweat-On Tee	✓	✓	✓						✓		
Brass Brazolet	✓	✓	✓						✓		
Carbon Steel Tee (NPT)	✓	✓	✓						✓		
Carbon Steel Weldolet	✓	✓	✓						✓		
316 SS Threaded Tee (NPT)	✓	✓	✓						✓		
316 SS Weldolet	✓	✓	✓						✓		
Metalex Socket Weld				✓							
Metalex Weld-On Mini-Tap				✓							
PVC Glue-On Large Saddle	✓	✓	✓						✓		
Brass Threaded Tee (NPT)	✓	✓	✓						✓		
Metric/BSP PVC Union Tee*	✓	✓	✓						✓		
Metric/BSP PVC Saddle*	✓	✓	✓						✓		
Plastic Weld-On Fittings (PVC)	✓	✓	✓						✓		
Plastic Weld-On Fittings (PP)	✓	✓	✓						✓		
Plastic Weld-On Fittings (PE)	✓	✓	✓						✓		
Steel Weld-On Fittings (SS 1.4435)	✓	✓	✓								
Electrofusion Transition Saddles								✓		✓	
Strap-on Saddles, Threaded								✓		✓	

* Available only through your local Georg Fischer sales office.

Flow Sensors Technical Basics

Velocity-based flow measurement technologies

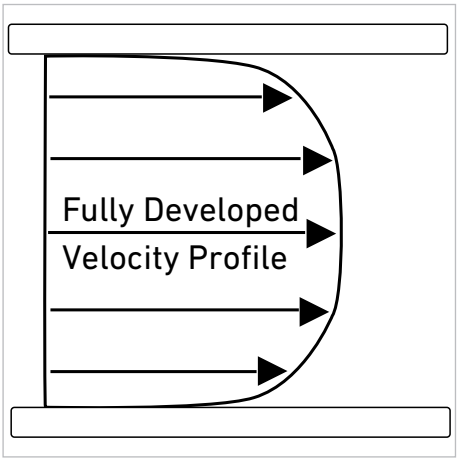
All of the flow sensors belong to the broad category of velocity-based flow measurement devices. This vast offering includes paddlewheel, electromagnetic, in-line rotor, and turbine flow sensors. Principles of operation vary considerably for each type, but some very important installation considerations are common throughout. The following discussion, plus the general selection guidelines should help the user choose the appropriate sensor type to obtain optimal flow measurement results.

All manuals, data sheets, and additional information are available at www.gfps.com

Fully Developed Turbulent Flow

Velocity-based flow sensors depend on fully developed turbulent flow for accurate and repeatable measurements. Fully developed turbulent flow occurs in Newtonian fluids with a Reynolds Number (Re) greater than 4,500. Low flow rates, viscous liquids, and large pipe sizes make fully developed turbulent flow more difficult to achieve. The opposite is also true. That is, for a given set of conditions, simply reducing the pipe size to increase the local flow velocity will produce a higher Reynolds Number.

Re: Reynolds Number



$Re = 3{,}162.76 \cdot Q \cdot Sg/(\mu \times ID)$

Q Flow Rate in GPM
Sg Specific Gravity
μ Dynamic Viscosity in Centipoise (cP)
ID Pipe Inside Diameter in Inches

OR

$Re = DN \cdot V/\nu$

DN Pipe Inside Diameter (m)
V Flow Velocity (m/s)
ν Kinematic Viscosity (m^2/s)
(ν of water = 1 x 10-6 m^2/s)

Planning Fundamentals

of Measurement and Control

Paddlewheel Flow Sensors

Content

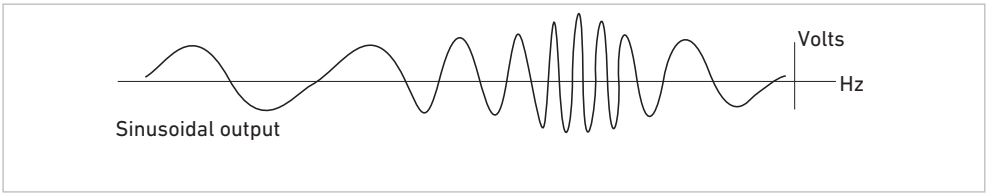
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Introduction

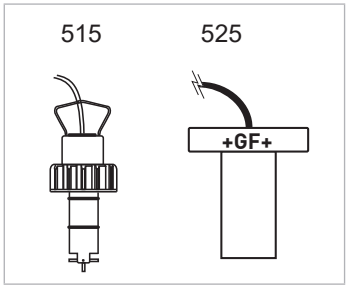
Principles of operation

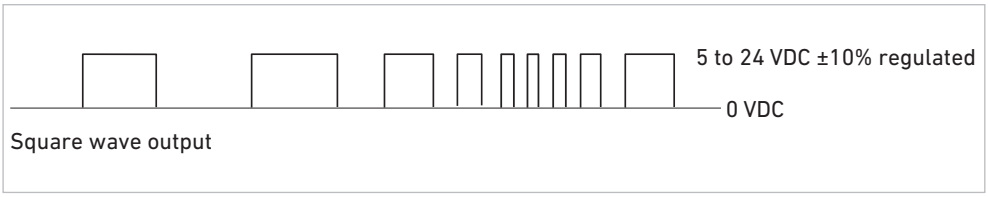
Paddlewheel flow sensors

Paddlewheel flow sensors are insertion devices, mounted perpendicular to the piping system, and rely upon the energy in the flow stream to spin a rotor (paddlewheel) around a stationary shaft. Most paddlewheel fl ow sensors utilize rotors with magnets embedded in each blade. The magnets are typically used either in conjunction with a coil internal to the sensor housing to produce a sinusoidal output (selfgenerating, non-powered sensors), or to trigger an internal electronic switch to produce a square-wave output (transistor-type, powered sensors). Either way, the resulting frequency is directly proportional to the fluid velocity.

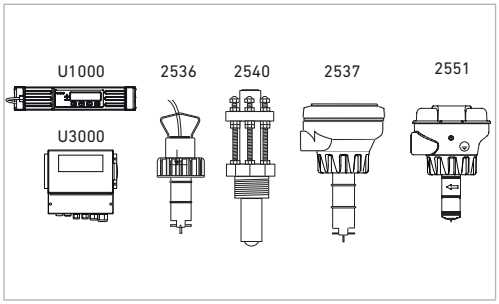


1 Sinusoidal sensors output a signal typical of selfgenerating, non-powered paddlewheel sensors such as the type 515 or 525. The frequency and amplitude (voltage) both vary directly with flow rate.





2 Transistor-type sensors output a signal typical of powered sensors such as the type 2536, 2540, and all other GF powered flow sensors with frequency output.



K-Factors

K-Factors are calibration values (pulses per unit of volume) used to convert flow sensor output frequencies to flow rates. GF publishes K-Factors for water only in gallons (pulses per gallon) and liters (pulses per liter) for all sensors, in all applicable pipe sizes and materials, and/or all applicable installation fitting sizes and materials. K-Factors for fluids other than water must be determined empirically, typically on-site using a secondary standard.

⚠ K-Factors are published for pipe sizes of DN15 to DN300 (½ in. to 12 in.). For other pipe sizes, statistical K-Factors may be available. Contact Technical Support for more information.

Flow Range Charts Paddlewheel Sensors (GPM)

GPM Flow Rates for DN15 to DN450 (½ in. to 18 in.) pipe sizes

Nominal Pipe Size		2536/8512/ 2537/2540		515 and 8510		525	
Inch	Metric DN (mm)	Min	Max	Min	Max	Min	Max
		0.3 ft/s	20 ft/s	1 ft/s	20 ft/s	1.6 ft/s	20 ft/s
0.5	15	0.28	18.94	0.95	18.94	1.52	18.94
0.75	20	0.5	33.24	1.66	33.24	2.66	33.24
1	25	0.81	53.88	2.69	53.88	4.31	53.88
1.25	32	1.4	93.24	4.66	93.24	7.46	93.24
1.5	40	1.9	126.91	6.35	126.91	10.15	126.91
2	50	3.14	209.18	10.46	209.18	16.73	209.18
2.5	65	4.48	298.46	14.92	298.46	23.88	298.46
3	80	6.91	460.84	23.04	460.84	36.87	460.84
4	100	11.9	793.57	39.68	793.57	63.49	793.57
5	125	18.71	1247.12	62.36	1247.12	99.77	1247.12
6	150	27.01	1800.95	90.05	1800.95	144.08	1800.95
8	200	46.78	3118.56	155.93	3118.56	249.49	3118.56
10	250	73.73	4915.59	245.78	4915.59	393.25	4915.59
12	300	105.75	7050.22	352.51	7050.22	564.02	7050.22
14	350	128.93	8595.51	429.78	8595.51		
16	400	170.79	11386.22	569.31	11386.22		
18	450	218.53	14568.61	728.43	14568.61		
20	500	272.14	18142.68	907.13	18142.68		
22	550	331.63	22108.43	1105.42	22108.43		
24	600	396.99	26465.86	1323.29	26465.86		
26	650	468.22	31214.96	1560.75	31214.96		
28	700	545.34	36355.75	1817.79	36355.75		
30	750	628.32	41888.21	2094.41	41888.21		
32	800	717.19	47812.35	2390.62	47812.35		
34	850	811.92	54128.17	2706.41	54128.17		
36	900	912.54	60835.67	3041.78	60835.67		
42	1050	1249.62	83308.24	4165.41	83308.24		
48	1200	1639.59	109305.92	5465.3	109305.92		

All numbers are nominal values based on SCH 40 pipe.

Flow Range Charts Paddlewheel Sensors (LPM)

LPM Flow Rates for DN15 to DN450 (½ in. to 18 in.) pipe sizes

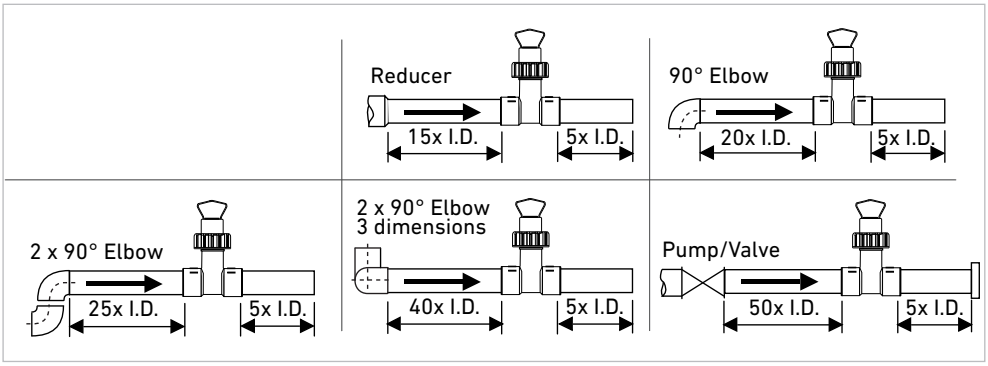
Nominal Pipe Size		2536/8512/ 2537/2540		515 and 8510		525	
Inch	Metric DN (mm)	Min 0.1 m/s	Max 6 m/s	Min 0.3 m/s	Max 6 m/s	Min 0.5 m/s	Max 6 m/s
0.5	15	1.18	70.57	3.53	70.57	5.88	70.57
0.75	20	2.06	123.86	6.19	123.86	10.32	123.86
1	25	3.35	200.73	10.04	200.73	16.73	200.73
1.25	32	5.79	347.39	17.37	347.39	28.95	347.39
1.5	40	7.88	472.84	23.64	472.84	39.4	472.84
2	50	12.99	779.36	38.97	779.36	64.95	779.36
2.5	65	18.53	1111.99	55.6	1111.99	92.67	1111.99
3	80	28.62	1717	85.85	1717	143.08	1717
4	100	49.28	2956.7	147.83	2956.7	246.39	2956.7
5	125	77.44	4646.5	232.33	4646.5	387.21	4646.5
6	150	111.83	6709.98	335.5	6709.98	559.16	6709.98
8	200	193.65	11619.14	580.96	11619.14	968.26	11619.14
10	250	305.24	18314.49	915.72	18314.49	1526.21	18314.49
12	300	437.79	26267.69	1313.38	26267.69	2188.97	26267.69
14	350	533.75	32025.15	1601.26	32025.15		
16	400	707.05	42422.78	2121.14	42422.78		
18	450	904.66	54279.73	2713.99	54279.73		
20	500	1126.6	67595.99	3379.8	67595.99		
22	550	1372.86	82371.56	4118.58	82371.56		
24	600	1643.44	98606.46	4930.32	98606.46		
26	650	1938.34	116300.67	5815.03	116300.67		
28	700	2257.57	135454.2	6772.71	135454.2		
30	750	2601.12	156067.04	7803.35	156067.04		
32	800	2968.99	178139.2	8906.96	178139.2		
34	850	3361.18	201670.67	10083.53	201670.67		
36	900	3777.69	226661.46	11333.07	226661.46		
42	1050	5173.16	310389.74	15519.49	310389.74		
48	1200	6787.53	407251.86	20362.59	407251.86		

All numbers are nominal values based on SCH 40 pipe.

Installation of Paddlewheel Flow Sensors

Piping location

- The correct location of the sensor in the piping system helps to ensure a proper flow profile in the pipe. It is important to have sufficient straight pipe immediately upstream of the sensor to create “fully developed turbulent flow.” Such a flow profile provides the stability required for the paddlewheel to measure accurately.
- The diagrams below illustrate the minimum distances that are recommended to mount plastic and metal paddlewheel sensors.
- In all scenarios, it is recommended to choose a location with as much straight, uninterrupted pipe length upstream of the sensor as possible. Always use synthetic grease on O-rings.

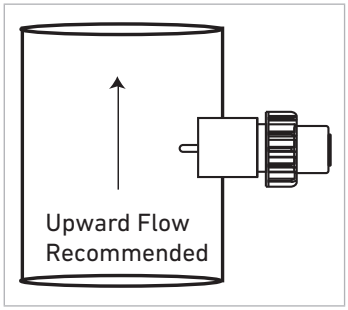


Mounting angle

Paddlewheel sensors are affected by the mounting angle due to the effect of gravity increasing the friction between rotor and bearing surfaces. Air entrapment and sediments within the pipe may also adversely affect sensing accuracy and/or impede operation.

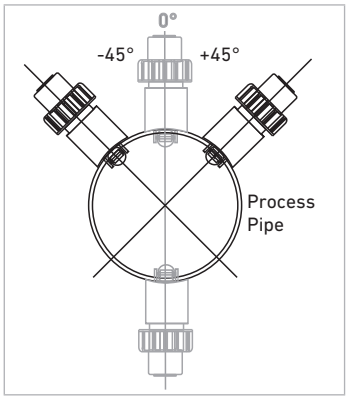
Paddlewheels in Vertical Pipes

- Mount the sensor in a pipe with an upward flow. This position is recommended for all scenarios, as it ensures a full pipe.
- Vertical installations with downward flow are not recommended.



Paddlewheels in Horizontal Pipes

- Recommended sensor mounting angle is ±45° from vertical to avoid air bubbles (pipe must be full). With the sensor at greater angles, the drag created by the rotor resting against the sensor body may compromise performance at the lower end of the operating range.
- Straight up installations may experience interference from entrained air at the top of the pipe.
- Inverted installations are often subject to blockage due to sediments in the pipe. Mounting sensors in the bottom of the pipe is NOT recommended if sediments are likely to be in the pipe.



Type 515 Rotor-X Paddlewheel Flow Sensor



Standard Sensor (with red cap)



Integral Sensor



Wet-Tap Sensor

Product description

Simple to install with time-honored reliable performance, type 515 Rotor-X Paddlewheel Flow Sensors are highly repeatable, rugged sensors that offer exceptional value with little or no maintenance. The wide dynamic flow range of 0.3 to 6 m/s (1 to 20 ft/s) allows the sensor to measure liquid flow rates in full pipes and can be used in low pressure systems.

The type 515 sensors are offered in a variety of materials for a wide range of pipe sizes and insertion configurations. The many material choices including PP and PVDF make this type highly versatile and chemically compatible to many liquid process solutions. Sensors can be installed in up to DN900 (36 in.) pipes using GF 's comprehensive line of custom fittings. These custom fittings, which include tees, saddles, and weldolets, seat the sensor to the proper insertion depth into the process flow. The sensors are also offered in configurations for wet-tap installation requirements.

Features

- Operating range 0.3 to 6 m/s (1 to 20 ft/s)
- Wide turndown ratio of 20:1
- Highly repeatable output
- Simple, economical design
- Installs into pipe sizes DN15 to DN900 (½ to 36 in.)
- Self-powered/no external power required
- Test certificate included for -X0, -X1
- Chemically resistant materials

(P51530-PX version only)

Applications

- Pure Water Production
- Filtration Systems
- Chemical Production
- Liquid Delivery Systems
- Pump Protection
- Scrubber Systems
- Water Monitoring
- Not suitable for gases

Technical Data

General		
Operating Range	0.3 to 6 m/s	1 to 20 ft/s
Pipe Size Range	DN15 to DN900	½ to 36 in.
Linearity	±1% of max. range @ 25 °C (77 °F)	
Repeatability	±0.5% of max. range @ 25 °C (77 °F)	
Min. Reynolds Number Required	4'500	

Wetted Materials	
Sensor Body	Glass-filled PP (black) or PVDF (natural)
O-rings	FKM (std), optional EPR (EPDM) or FFKM
Rotor Shaft	Titanium, Hastelloy-C or PVDF; optional Ceramic, Tantalum, or Stainless Steel
Rotor	Black PVDF or Natural PVDF; optional ETFE, with or without carbon fiber reinforced PTFE sleeve

Electrical		
Frequency	19.7 Hz per m/s nominal	6 Hz per ft/s sinusoidal
Amplitude	3.3 V p/p per m/s nominal	1 V p/p per ft/s
Source Impedance	8 KΩ	
Cable type	2-conductor twisted pair with shield, 22 AWG	
Cable Length	7.6 m (25 ft) can be extended up to 60 m (200 ft) maximum	

Max. Temperature/Pressure Rating - Standard and Integral Sensor		
PP	12.5 bar @ 20 °C	181 psi @ 68 °F
	1.7 bar @ 90 °C	25 psi @ 194 °F
PVDF	14 bar @ 20 °C	203 psi @ 68 °F
	1.4 bar @ 100 °C	20 psi @ 212 °F
Operating Temperature		
PP	-18 °C to 90 °C	0 °F to 194 °F
PVDF	-18 °C to 100 °C	0 °F to 212 °F

Max. Temperature/Pressure Rating - Wet-Tap Sensor		
PP	7 bar @ 20 °C	102 psi @ 68 °F
	1.4 bar @ 66 °C	20 psi @ 150 °F
Operating Temperature		
	-18 °C to 66 °C	0 °F to 150 °F
Max. Wet-Tap Sensor Removal Rating		
	1.7 bar @ 22 °C	25 psi @ 72 °F

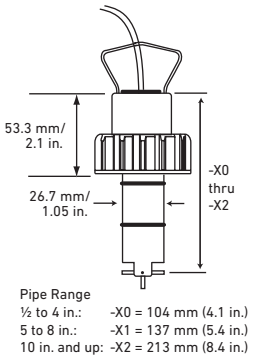
Shipping Weight		
P51530-X0	0.454 kg	1.00 lb
P51530-X1	0.476 kg	1.05 lb
P51530-X2	0.680 kg	1.50 lb
P51530-X3	0.780 kg	1.72 lb
P51530-X4	0.800 kg	1.76 lb
P51530-X5	0.880 kg	1.94 lb
3-8510-X0	0.23 kg	0.50 lb
3-8510-X1	0.23 kg	0.50 lb

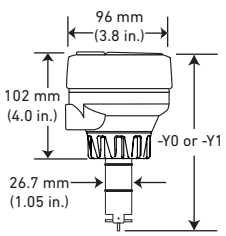
Standards and Approvals
RoHS compliant, China RoHS
Lloyd's Register type Approval , NSF (P51530-PX version only)
Manufactured under ISO 9001 for Quality and ISO 14001 for Environmental Management and OHSAS 18001 for Occupational Health and Safety

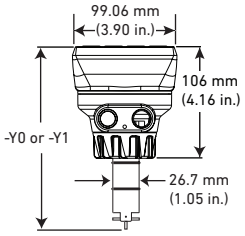
See pressure-temperature diagrams for more information

Dimensions

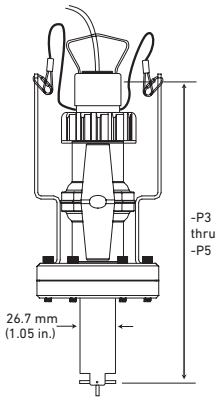
Standard Mount	Field (Integral) Mount	Wet-Tap Mount Sensor with 3519 Wet-Tap Valve







(shown with Transmitter, sold separately)



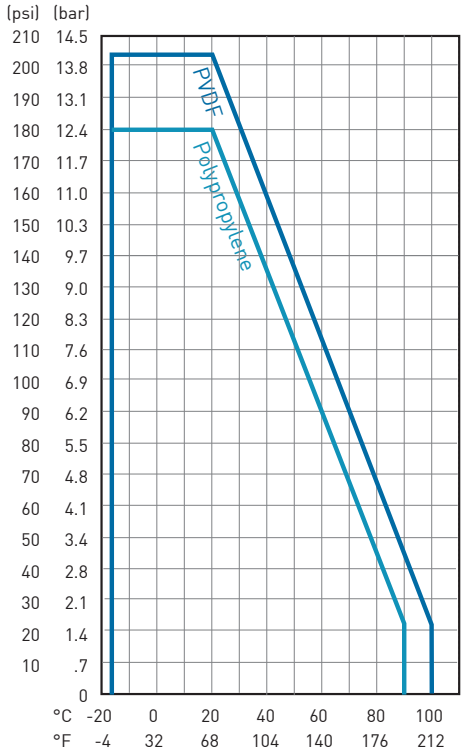
(See 3519 product page for more information).

Pipe range		Pipe range		Pipe range	
0.5 to 4 in.	-X0 = 104 mm (4.1 in.)	0.5 to 4 in.	-Y0 = 152 mm (6.0 in.)	0.5 to 4 in.	-P3 = 297 mm (11.7 in.)
5 to 8 in.	-X1 = 137 mm (5.4 in.)	5 to 8 in.	-Y1 = 185 mm (7.3 in.)	5 to 8 in.	-P4 = 333 mm (13.1 in.)
10 in. and up	-X2 = 213 mm (8.4 in.)			10 in. and up	-P5 = 409 mm (16.1 in.)

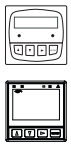
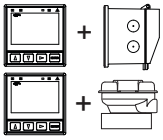
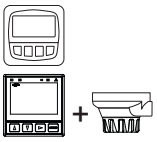
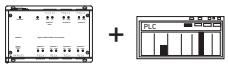
Pressure-temperature diagrams

Note

The pressure-temperature diagrams are specifically for the GF sensor. During system design the specifications of all components must be considered. In the case of a metal piping system, a plastic sensor will reduce the system specification. When using a PVDF sensor in a PVC piping system, the fitting will reduce the system specification.



System Overview

Panel Mount	Pipe, Tank, Wall Mount		Field (Integral) Mount	Automation System
GF Instruments - 8150 - 9900 - 9900-1BC - 9950 	GF Instruments - 9900-1P with Rear Enclosure - 9900-1BC with Rear Enclosure - 9900 with 3-8050-1 Universal Mount Kit or 3-8052-1 Integral Mount Kit		GF Instruments - 8150 - 9900-1 with 3-8051-X Integral Mount Kit 	- 0486 Profibus Concentrator and Customer Supplied Programmable Logic Controller or - Programmable Automation Controller 
Type 515 Standard, Wet-Tap or 8510 Integral Mount Flow Sensors				
GF Fittings				All sold separately

For overview of Wet-Tap System, see 3519 product page

Application Tips

- Use the Conduit Adapter Kit to protect the cable-to-sensor connection when used in outdoor environments. See Accessories section for more information.
- Use a sleeved rotor in abrasive liquids to reduce wear.
- Sensor plug can be used to plug installation fitting after extraction of sensor from pipe.
- For liquids containing ferrous particles, use GF Magmeters.
- For systems with components of more than one material, the maximum temperature/pressure specification must always be referenced to the component with the lowest rating.

Ordering Information

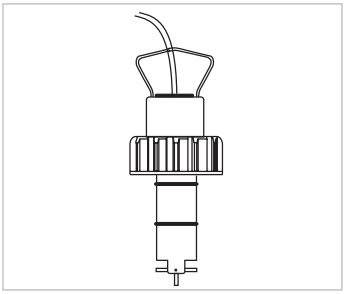
Ordering notes

1. Most common part number combinations shown. For all other combinations contact factory.
2. Other rotor and shaft materials are available for purchase from the factory and can be easily replaced in the field. See Accessories section.

Type 515 Standard Mount Paddlewheel

When choosing this style of sensor, the instrument is mounted directly onto the sensor for a local display. See guideline below for instructions.

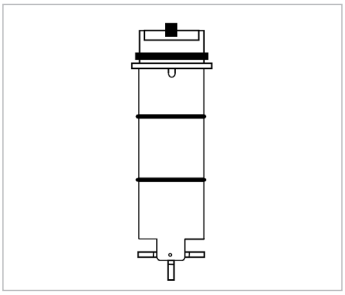
Mfr. Part No.	Code	Body	Rotor	Shaft Material
Paddlewheel Flow Sensor for use with remote mount instrument				
DN15 to DN100 - ½ to 4 in.				
P51530-H0	198 801 659	Polypropylene	Black PVDF	Hastelloy-C
P51530-P0	198 801 620	Polypropylene	Black PVDF	Titanium
P51530-S0	198 801 661	Polypropylene	Black PVDF	Natural PVDF
P51530-T0	198 801 663	Natural PVDF	Natural PVDF	Natural PVDF
P51530-V0	198 801 623	Natural PVDF	Natural PVDF	Hastelloy-C
Pipe size DN125 to DN200 - 5 to 8 in.				
P51530-P1	198 801 621	Polypropylene	Black PVDF	Titanium
P51530-T1	198 801 664	Natural PVDF	Natural PVDF	Natural PVDF
P51530-V1	198 801 624	Natural PVDF	Natural PVDF	Hastelloy-C
Pipe size DN250 - DN900 - 10 to 36 in.				
P51530-P2	198 801 622	Polypropylene	Black PVDF	Titanium
P51530-V2	198 801 625	Natural PVDF	Natural PVDF	Hastelloy-C



Type 515 Integral Mount Paddlewheel

When choosing this style of sensor, the instrument is mounted directly onto the sensor for a local display. See guideline below for instructions.

Mfr. Part No.	Code	Body	Rotor	Shaft Material
Flow sensor for integral mounting on the 8150, 8850 or 9900 instrument using the 3-8051-X flow sensor integral mounting kit (sold separately)				
DN15 to DN100 - ½ to 4 in.				
3-8510-P0	198 864 504	Polypropylene	Black PVDF	Titanium
3-8510-T0	159 000 622	Natural PVDF**	Natural PVDF	Natural PVDF**
3-8510-V0	198 864 506	Natural PVDF**	Natural PVDF**	Hastelloy-C**
DN125 to DN200 - 5 to 8 in.				
3-8510-P1	198 864 505	Polypropylene	Black PVDF	Titanium



** PVDF available ½ in. to 4 in. only

Combining a 515 Integral mount flow sensor with an integrally mounted instrument

Option 1

Once an integral mount sensor is chosen, it can be mounted directly to a field mount transmitter by following these guidelines:

1. Order the 3-8051-X flow sensor integral mounting kit (sold separately) to connect the sensor to an instrument.
2. Order a field mount transmitter (sold separately). The following part numbers are compatible: 3-8150-1, 3-9900-1.
3. Assembling the sensor with the integral adapter and instrument is quick and simple.

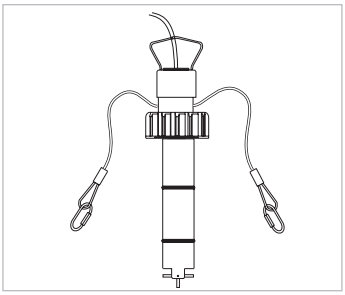
Option 2

These parts can also be ordered as an assembled part. See “Integral Mount”.

Type 515 Wet-Tap Mount Paddlewheel Flow Sensor

When choosing this style of sensor, the instrument can be mounted nearby on a pipe or wall or in a remote location up to 61 m (200 ft) by connecting the sensor through a standard 3-8050-1 universal junction box. Standard cable length is 7.6 m (25 ft). This style of sensor uses the 3519 Wet-Tap valve only (see individual product page for more information).

Mfr. Part No.	Code	Body	Rotor	Shaft Material
Flow Sensor for wet-tap mounting with the 3519 Wet-Tap Valve (sold separately)				
DN15 to DN100 - ½ to 4 in.				
P51530-P3	198 840 310	Polypropylene	Black PVDF	Titanium
DN125 to DN200 - 5 to 8 in.				
P51530-P4	198 840 311	Polypropylene	Black PVDF	Titanium
DN250 to DN900 - 10 to 36 in.				
P51530-P5	198 840 312	Polypropylene	Black PVDF	Titanium



Combining a 515 Wet-Tap Sensor with a 3519 Wet-Tap Valve:

1. Sensor can be mounted in a 3519 Wet-Tap Valve (sold separately)
2. Assembling a sensor with a 3519 Wet-Tap valve is quick and simple. These parts can also be ordered as complete assemblies. See 3519 product page.

Please refer to Wiring, Installation, Accessories and Fitting section for more information.

Additional ordering information

Additional possible configurations are listed below. For variants, combinations, and orders, please contact the local GF sales company.

Example Part Number **P51530-2231-025-1**	Sensor Body Material	Rotor Material	Pin Material	O-ring Material		Cable Length		Sensor Length
P51530-					-		-	
Sensor Body Material								
Black Polypropylene	1							
PVDF	2							
Rotor Material								
PVDF, black		1						
PVDF, natural		2						
ETFE		3						
Sleeved Black PVDF		4						
Sleeved Natural PVDF		5						
Sleeved ETFE		6						
Pin Material								
Titanium			1					
Hastelloy-C			2					
Stainless Steel			3					
Tantalum			4					
Ceramic			5					
PVDF, natural*			6					
O-ring Material								
FPM (FKM)				1				
EPR (EPDM)				2				
FFKM				3				
Cable Length								
7.6 m (25 ft)						025		
15.2 m (50 ft)						050		
22.8 m (75 ft)						075		
30.5 m (100 ft)						100		
Sensor Length								
DN15 to DN100 (0.5 to 4 in.)								0
DN125 to DN200 (5 to 8 in.)								1
DN250 to DN900 (10 to 36 in.)								2

* Only available with Natural PVDF Rotors

Accessories and Replacement Parts

Mfr. Part No.	Code	Description
Rotors		
M1538-2	198 801 181	Rotor, PVDF Black
M1538-4	198 820 018	Rotor, ETFE
3-0515.322-1	198 820 059	Sleeved rotor, PVDF Black
3-0515.322-2	198 820 060	Sleeved rotor, PVDF Natural
3-0515.322-3	198 820 017	Sleeved rotor, ETFE
Rotor Shafts		
M1546-1	198 801 182	Shaft, Titanium
M1546-2	198 801 183	Shaft, Hastelloy-C
M1546-3	198 820 014	Shaft, Tantalum
M1546-4	198 820 015	Shaft, Stainless Steel
P51545	198 820 016	Shaft, Ceramic
O-Rings		
1220-0021	198 801 000	O-ring, FKM (2 required per sensor)
1224-0021	198 820 006	O-ring, EPR (EPDM) (2 required per sensor)
1228-0021	198 820 007	O-ring, FFKM (2 required per sensor)
Miscellaneous		
P31536	198 840 201	Sensor plug, Polypropylene
P31542	198 801 630	Sensor cap, Red
P31934	159 000 466	Conduit cap
P51589	159 000 476	Conduit adapter kit
P51550-3	198 820 043	Rotor kit, PVDF natural, (rotor and shaft)
5523-0222	159 000 392	Cable (per foot), 2 cond. w/shield, 22 AWG
3-8050	159 000 184	Universal mounting kit
3-8050-1	159 001 753	Universal mount junction box
3-8050.390-1	159 001 702	Retaining nut replacement kit, NPT, Valox (for use with 8510 and 8512)
3-8050.390-3	159 310 116	Retaining nut replacement kit, NPT, PP (for use with 8510 and 8512)
3-8050.390-4	159 310 117	Retaining nut replacement kit, NPT, PVDF (for use with 8510 and 8512)
3-8051	159 000 187	Transmitter integral adapter (for use with 8510 and 8512)
3-8051-1	159 001 755	Transmitter integral mount kit, NPT, PP (for use with 8510 and 8512)
3-8051-2	159 001 756	Transmitter integral mount kit, NPT, PVDF (for use with 8510 and 8512)

Type 2536 Rotor-X Paddlewheel Flow Sensor



PVC Sensor
(gray body and cap)



Standard Sensor
(blue cap)



Integral
Sensor



Wet-Tap Sensor

Product description

Simple to install with time-honored reliable performance, type 2536 Rotor-X Paddlewheel Flow Sensors are highly repeatable, rugged sensors that offer exceptional value with little or no maintenance. The type 2536 has a process-ready open collector signal with a wide dynamic flow range of 0.1 to 6 m/s (0.3 to 20 ft/s). The sensor measures liquid flow rates in full pipes and can be used in low pressure systems.

The type 2536 sensors are offered in a variety of materials for a wide range of pipe sizes and insertion configurations. The many material choices including PP and PVDF make this type highly versatile and chemically compatible to many liquid process solutions.

Sensors can be installed in DN15 to DN900 (½ to 36 in.) pipes (except the 2536 PVC versions, which can be installed in DN15 to DN100 (½ to 4 in.) pipes), using GF 's comprehensive line of custom fittings. These custom fittings, which include tees, saddles, and weldolets, seat the sensor to the proper insertion depth into the process flow. The sensors are also offered in configurations for wet-tap installation requirements.

Features

- Operating range 0.1 to 6 m/s (0.3 to 20 ft/s)
- Wide turndown ratio of 66:1
- Open-collector output
- Highly repeatable output
- Simple, economical design
- Installs into pipe sizes DN15 to DN900 (½ to 36 in.)
- PVC 2536 version DN15 to DN100 (½ to 4 in.) for concentrated Sodium Hypochlorite 12.5% applications
- High resolution and noise immunity
- Test certificate included for -X0, -X1
- Chemically resistant materials

NSF Certified to NSF/ANSI 61 & 372

(3-2536-PX
version only)

Applications

- Pure Water Production
- Filtration Systems
- Chemical Production
- Liquid Delivery Systems
- Pump Protection
- Scrubber/Gas Stacks
- Gravity Feed Lines
- Not suitable for gas
- Sodium Hypochlorite transfer/injection/batching (3-2536-G0)

Specifications

General		
Operating Range	0.1 to 6 m/s	0.3 to 20 ft/s
Pipe Size Range	DN15 to DN900	½ to 36 in.
PVC Sensor Body	DN15 to DN100	½ to 4 in.
Linearity	±1% of max. range @ 25 °C (77 °F)	
Repeatability	±0.5% of max. range @ 25 °C (77 °F)	
Min. Reynolds Number Required	4500	
Wetted Materials		
Sensor Body	Glass-filled PP (black), PVDF (natural) or PVC (gray)	
O-rings	FKM (std) optional EPR (EPDM) or FFKM	
Rotor Pin	Titanium, Hastelloy-C or PVDF; optional Ceramic, Tantalum or Stainless Steel	
Rotor	Black PVDF or Natural PVDF; optional ETFE, with or w/o carbon fiber reinforced PTFE sleeve for rotor pin	
Electrical		
Frequency	49 Hz per m/s nominal	15 Hz per ft/s nominal
Supply Voltage	5 to 24 VDC ±10%, regulated	
Supply Current	<1.5 mA @ 3.3 to 6 VDC	<20 mA @ 6 to 24 VDC
Output type	Open collector, sinking 10 mA max.	
Cable type	2-conductor twisted pair with shield, 22 AWG	
Cable Length	7.6 m (25 ft) can be extended up to 305 m (1'000 ft) maximum	
Max. Temperature/Pressure Rating - Standard and Integral Sensor		
PP	12.5 bar @ 20 °C	180 psi @ 68 °F
	1.7 bar @ 85 °C	25 psi @185°F
PVDF	14 bar @ 20 °C	200 psi @ 68 °F
	1.7 bar @ 85 °C	25 psi @ 185 °F
PVC	12.5 bar @ 20 °C	180 psi @ 68 °F
	6.9 bar @ 60 °C	100 psi @ 140 °F
Operating Temperature		
PP	-18 °C to 85 °C	0 °F to 185 °F
PVDF	-18 °C to 85 °C	0 °F to 185 °F
PVC	0 °C to 50 °C	32 °F to 122 °F
Max. Temperature/Pressure Rating - Wet-Tap Sensor		
PP	7 bar @ 20 °C	100 psi @ 68 °F
	1.4 bar @ 60 °C	20 psi @ 140 °F
Operating Temperature	-18 °C to 60 °C	0 °F to 140 °F
Max. Wet-Tap Sensor Removal Rating	1.7 bar @ 22 °C	25 psi @ 72 °F

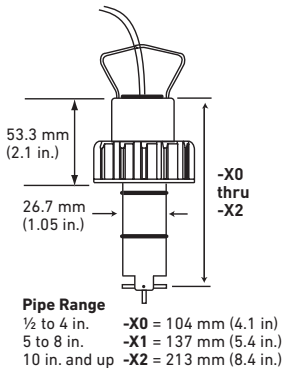
Shipping Weight		
3-2536-X0	0.454 kg	1.00 lb
3-2536-X1	0.476 kg	1.05 lb
3-2536-X2	0.680 kg	1.50 lb
3-2536-X3	0.780 kg	1.72 lb
3-2536-X4	0.800 kg	1.76 lb
3-2536-X5	0.880 kg	1.94 lb
3-8512-X0	0.35 kg	0.77 lb
3-8512-X1	0.37 kg	0.81 lb

Standards and Approvals
CE, UKCA, FCC, NSF (3-2536-PX only)
RoHS compliant, China RoHS
Manufactured under ISO 9001, ISO 14001 and ISO 45001

See pressure-temperature diagrams for more information.

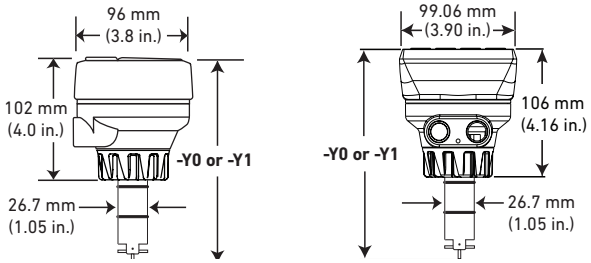
Dimensions

Standard Mount



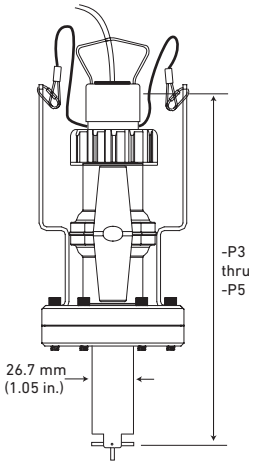
PVC Mount
(0.5 to 4 in. pipe range only)

Integral Mount



(shown with Transmitter sold separately)

Wet-Tap Mount Sensor with 3519 Wet-Tap Valve



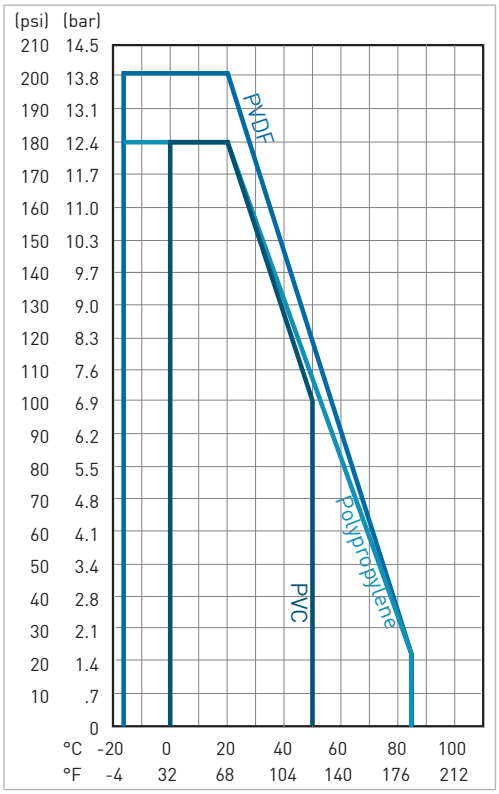
(See 3519 product page for more information)

Pipe range		Pipe range		Pipe range	
0.5 to 4 in.	-X0 = 104 mm (4.1 in.)	0.5 to 4 in.	-Y0 = 152 mm (6.0 in.)	0.5 to 4 in.	-P3 = 297 mm (11.7 in.)
5 to 8 in.	-X1 = 137 mm (5.4 in.)	5 to 8 in.	-Y1 = 185 mm (7.3 in.)	5 to 8 in.	-P4 = 333 mm (13.1 in.)
10 in. and up	-X2 = 213 mm (8.4 in.)			10 in. and up	-P5 = 409 mm (16.1 in.)

Pressure-temperature diagrams

Note

The pressure-temperature diagrams are specifically for the GF sensor. During system design the specifications of all components must be considered. In the case of a metal piping system, a plastic sensor will reduce the system specification. When using a PVDF sensor in a PVC piping system, the fitting will reduce the system specification.



System Overview

Panel Mount	Pipe, Tank, Wall Mount		Field (Integral) Mount	Automation System
GF Instruments - 9900 - 9900-1BC - 9950	GF Instruments - 9900-1P with Rear Enclosure - 9900-1BC with Rear Enclosure - 9900 with 3-8050-1 Universal Mount Kit - 9950 with 3-8050-1 Universal Mount Kit		GF Instruments - 9900-1 with 3-8051-X Integral Mount Kit	- 0486 Profibus Concentrator and Customer Supplied Programmable Logic Controller or - Programmable Automation Controller
Type 2536 PVC, Standard, Wet-Tap or 8512 Integral Mount Flow Sensors				
GF Fittings				All sold separately

Application Tips

- Use the Conduit Adapter Kit to protect the cable-to-sensor connection when used in outdoor environments. See Accessories section for more information.
- Use a sleeved rotor in abrasive liquids to reduce wear.
- Sensor plug can be used to plug installation fitting after extraction of sensor from pipe.
- For liquids containing ferrous particles, use GF Magmeters.
- For systems with components of more than one material, the maximum temperature/pressure specification must always be referenced to the component with the lowest rating.

Ordering Information

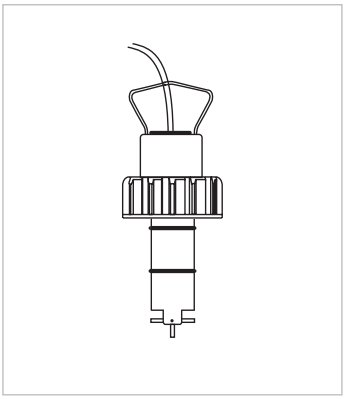
Ordering Notes

1. Most common part number combinations are shown. For all other combinations contact factory.
2. Other rotor and pin materials are available for purchase from the factory and can be easily replaced in the field. See Accessories section.

Type 2536 Standard Mount Paddlewheel

When choosing this style of sensor, the instrument can be mounted nearby on a pipe or wall or in a remote location up to 305 m (1000 ft) by connecting the sensor through a standard 3-8050-1 universal junction box. Standard cable length is 7.6 m (25 ft). Use GF fittings for proper seating of the sensor into the process flow.

Mfr. Part No.	Code	Body	Rotor	Pin Material
Flow Sensor for use with remote mount instrument				
DN15 to DN100 - ½ to 4 in.				
3-2536-P0	198 840 143	Polypropylene	Black PVDF	Titanium
3-2536-T0	198 840 149	Natural PVDF	Natural PVDF	Natural PVDF
3-2536-G0	159 001 959	PVC	Black PVDF	Titanium
3-2536-V0	198 840 146	Natural PVDF	Natural PVDF	Hastelloy-C
DN125 to DN 200 - 5 to 8 in				
3-2536-P1	198 840 144	Polypropylene	Black PVDF	Titanium
3-2536-V1	198 840 147	Natural PVDF	Natural PVDF	Hastelloy-C
DN250 - DN900 - 10 to 36 in.				
3-2536-P2	198 840 145	Polypropylene	Black PVDF	Titanium

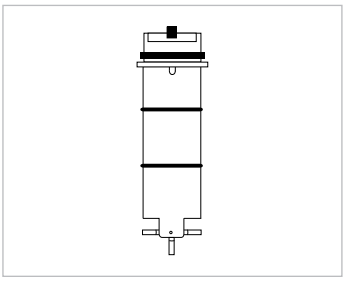


Type 2536 Integral Mount Paddlewheel

When choosing this style of sensor, the instrument is mounted directly onto the sensor for a local display.

See guidelines below for instructions.

Mfr. Part No.	Code	Body	Rotor	Pin Material
Flow sensor for integral mounting on the 8150 instrument using the 3-8051-X Flow Sensor Integral Mount Kit (sold separately)				
DN15 to DN100 - ½ to 4 in.				
3-8512-P0	198 864 513	Polypropylene	Black PVDF	Titanium
3-8512-T0	198 864 518	Natural PVDF**	Natural PVDF	Natural PVDF
3-8512-V0	198 864 516	Natural PVDF**	Natural PVDF	Hastelloy-C
DN125 to DN200 - 5 to 8 in. (PP only)				
3-8512-P1	198 864 514	Polypropylene	Black PVDF	Titanium



**Natural PVDF available ½ in. to 4 in. only

Guidelines: Combining a 2536 integral mount flow sensor with an integrally mounted instrument

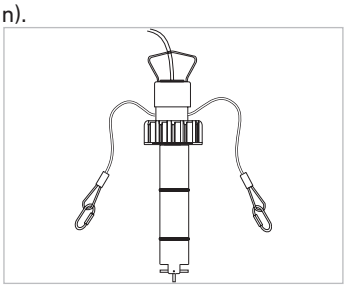
Option 1

Once an integral mount sensor is chosen, it can be mounted directly to a field mount transmitter by following these guidelines:

a) Order the 3-8051-X flow sensor integral mounting kit (sold separately) to connect the sensor to an instrument.
b) Order a field mount transmitter (sold separately). The following part numbers are compatible: 3-9900-1.
c) Assembling the sensor with the integral adapter and instrument is quick and simple.

Type 2536 Wet-Tap Mount Paddlewheel Flow Sensor

When choosing this style of sensor, the instrument can be mounted nearby on a pipe or wall or in a remote location up to 305 m (1000 ft) by connecting the sensor through a standard 3-8050-1 universal junction box. Standard cable length is 7.6 m (25 ft). This style of sensor uses the 3519 Wet-Tap valve only (see individual product page for more information).



Mfr. Part No.	Code	Body	Rotor	Pin Material
Flow Sensor for wet-tap mounting with the 3519 Wet-Tap Valve (sold separately)				
DN15 to DN100 - ½ to 4 in.				
3-2536-P3	159 000 758	Polypropylene	Black PVDF	Titanium
DN125 to DN200 - 5 to 8 in.				
3-2536-P4	159 000 759	Polypropylene	Black PVDF	Titanium
DN250 to DN900 - 10 to 36 in.				
3-2536-P5	159 000 760	Polypropylene	Black PVDF	Titanium

Guideline: Combining a 2536 Wet-Tap Sensor with a 3519 Wet-Tap Valve

a) Once a sensor is chosen, it can be mounted in a 3519 Wet-Tap Valve (sold separately)

b) Assembling a sensor with a 3519 Wet-Tap valve is quick and simple. These parts can also be ordered as complete assemblies. See 3519 product page.

Additional ordering information

Additional possible configurations are listed below. For variants, combinations, and orders, please contact the local GF sales company.

Example Part Number **3-2536-2231-025-1**	Sensor Body Material	Rotor Material	Pin Material	O-ring Material		Cable Length		Sensor Length
3-2536-					-		-	
Sensor Body Material								
Black Polypropylene	1							
PVDF	2							
Rotor Material								
PVDF, black		1						
PVDF, natural		2						
ETFE		3						
Sleeved Black PVDF		4						
Sleeved Natural PVDF		5						
Sleeved ETFE		6						
Pin Material								
Titanium			1					
Hastelloy-C			2					
Stainless Steel			3					
Tantalum			4					
Ceramic			5					
PVDF, natural*			6					
O-ring Material								
FPM (FKM)				1				
EPR (EPDM)				2				
FFKM				3				
Cable Length								
7.6 m (25 ft)						025		
15.2 m (50 ft)						050		
22.8 m (75 ft)						075		
30.5 m (100 ft)						100		
Sensor Length**								
DN15 to DN100 (0.5 to 4 in.)								0
DN125 to DN200 (5 to 8 in.)								1
DN250 to DN900 (10 to 36 in.)								2

* Only available with Natural PVDF Rotors
** PVDF only available in sensor lengths X0 and X1

Accessories and Replacement Parts

Mfr. Part No.	Code	Description
Rotors		
3-2536.320-1	198 820 052	Rotor, PVDF Black
3-2536.320-2	159 000 272	Rotor, PVDF Natural
3-2536.320-3	159 000 273	Rotor, ETFE
3-2536.322-1	198 820 056	Sleeved rotor, PVDF Black
3-2536.322-2	198 820 057	Sleeved rotor, PVDF Natural
3-2536.322-3	198 820 058	Sleeved rotor, ETFE
Rotor Pins		
M1546-1	198 801 182	Pin, Titanium
M1546-2	198 801 183	Pin, Hastelloy-C
M1546-3	198 820 014	Pin, Tantalum
M1546-4	198 820 015	Pin, Stainless Steel
P51545	198 820 016	Pin, Ceramic
O-Rings		
1220-0021	198 801 000	O-ring, FKM (2 required per sensor)
1224-0021	198 820 006	O-ring, EPR (EPDM) (2 required per sensor)
1228-0021	198 820 007	O-ring, FFKM (2 required per sensor)
Miscellaneous		
P31536	198 840 201	Sensor plug, Polypropylene
P31542-3	159 000 464	Sensor cap, Blue
3-2536.555	159 500 532	Sensor cap, Gray
P31934	159 000 466	Conduit cap
P51589	159 000 476	Conduit adapter kit
5523-0222	159 000 392	Cable (per foot), 2 cond. w/shield, 22 AWG
3-2536.321	198 820 054	PVDF Natural, Rotor kit (rotor and pin)
3-8050	159 000 184	Universal mount kit
3-8050-1	159 000 753	Universal junction box
3-8050.390-1	159 001 702	Retaining nut replacement kit, NPT, Valox (for use with 8510 and 8512)
3-8050.390-3	159 310 116	Retaining nut replacement kit, NPT, PP (for use with 8510 and 8512)
3-8050.390-4	159 310 117	Retaining nut replacement kit, NPT, PVDF (for use with 8510 and 8512)
3-8051	159 000 187	Transmitter integral adapter (for use with 8510 and 8512)
3-8051-1	159 001 755	Transmitter integral mounting kit, NPT, PP (for use with 8510 and 8512)
3-8051-2	159 001 756	Transmitter integral mounting kit, NPT, PVDF (for use with 8510 and 8512)

Type 2537 Paddlewheel Flowmeter



Product description

The type 2537 Flowmeter is the next generation in fluid measurement technology from the inventor of the original paddlewheel flowmeter. This sensor is an improvement on what's already an industry standard. It has the added functionality of various output options including flow switch, multi-functional pulse, digital (S^3L) or 4 to 20 mA. Additionally, it offers low flow, low power and high resolution and can be configured onsite directly through the built-in user interface.

Installation is simple because the type 2537 utilizes the same fittings as the popular type 515 and 2536 Paddlewheel Sensors and fits into pipe sizes ranging from DN15 to DN200 (½ to 8 inches). Available in Polypropylene and PVDF, it is ideal for a variety of applications including chemical processing, water and wastewater monitoring and scrubber control.

Features

- Digital (S^3L) or 4 to 20 mA outputs or (Multi-function)
- Allows for up to six sensors to type 9950-XX
- Low flow capabilities down to 0.1 m/s (0.3 ft/s)
- Polypropylene or PVDF sensor bodies
- Polypropylene or PVDF retaining nuts standard, Valox optional
- Installs into pipe sizes DN15 to DN200 (½ to 8 in.)
- Test certificate included for -X0, -X1
- Low power and high resolution

Certified to NSF/ANSI 61 & 372

(3-2537-XC-PX version only)

Applications

- Process Flow Monitoring
- Pump Protection
- Pure Water Production
- Filtration Systems
- Chemical Production
- Reverse Osmosis
- Demineralization/Regeneration
- Fume Scrubbers
- Cooling Towers
- Proportional Metering Pump

Technical Details

General			
Operating Range	0.1 to 6 m/s	0.3 to 20 ft/s	
Pipe Size Range	DN15 to DN200	½ to 8 in.	
Linearity	±1% of max. range @ 25 °C (77 °F)		
Repeatability	±0.5% of max. range @ 25 °C (77 °F)		
System Responses	100 ms update rate nominal		

Wetted Materials	
Sensor Body	Glass-filled PP (black) or PVDF (natural)
O-rings	FKM (std) optional EPR (EPDM) or FFKM
Rotor Shaft	Titanium, Hastelloy-C or PVDF; optional Ceramic, Tantalum or Stainless Steel
Rotor	Black PVDF or Natural PVDF; optional ETFE, with or w/o carbon fiber reinforced PTFE sleeve for rotor shaft

Electrical			
Multi	With Dry-Contact Relay	24 VDC nominal, ±10%, regulated, 30 mA max current	
	With Solid State Relay	6 V to 24 VDC, ±10%, regulated, 30 mA max current	
	Digital (S^3L)	5.0 VDC min to 6.5 VDC max., 30 mA max current (1.5 mA nominal)	
	4 to 20 mA	400 mV max ripple voltage, 30 mA max current	
	Maximum Pulse Rate	300 Hz	
	Maximum Pulse Width	50 ms	
	Minimum Pulse Rate	0.5 Hz	
	Compatible with PLC, PC or similar equipment		
	Compatible with customer supplied metering pump		
Digital (S^3L) Version		5 VDC nominal, regulated, 3 mA max current	
	Type	Serial ASCII, TTL lever 9600 bps	
	Compatible with types 9900,9950-1/2, 9950-10/11		
4 to 20 mA Version		12 to 32 VDC nominal, ±10%, regulated, 21 mA max current	
	Loop Accuracy	±32 µA @ 25 °C @ 24 VDC)	
	Loop Resolution	5 µA	
	Temp. Drift	±1µA per °C max.	
	Power Supply Rejection	±1µA per V	
	Max. Cable	305 m	1'000 ft
	Maximum Loop Resistance	600 Ω @ 24 VDC	1 KΩ @ 32 VDC
	Load Impedance	375 Ω	
Reverse Polarity and Short Circuit Protected		Up to 40 V. 1 hour	
Over-voltage Protection		> 40 VDC over 1 hour	

Relay Specifications

	Mechanical SPDT	5 A @ 30 VDC, 5 A @ 250 VAC
	Solid-State Relay	100 mA @ 40 VDC, 70 mA @ 33 VAC
	Relay Modes	Low, High
	Time Delay	0.0 to 6'400.0 seconds
	Hysteresis	Adjustable for exiting alarm condition

Max. Temperature/Pressure Rating			
Storage Temperature		-10 °C to 75 °F	14 °C to 167 °F
Operating Temperature		0 °C to 65 °C	32 °F to 149 °F
Relative Humidity		0 to 90%, non-condensing	
Flow Sensor/ Retaining Nut	PP	12.5 bar @ 20 °C	181 psi @ 68 °F
		1.7 bar @ 85 °C	25 psi @185 °F
	PVDF	14 bar @ 20 °C	203 psi @ 68 °F
		1.7 bar @ 85 °C	25 psi @ 185 °F
Operating Temperature			
	PP	-18 °C to 85 °C	0 °F to 185 °F
	PVDF	-18 °C to 85 °C	0 °F to 185 °F

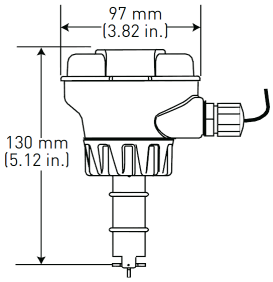
Environmental	
Enclosure	NEMA 4X/IP65

Shipping Weight		
	0.640 kg	1.41 lb

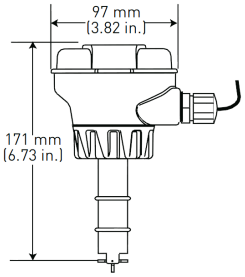
Standards and Approvals
CE, UKCA, FCC, UL, NSF (3-2537-XC-PX version only)
RoHS compliant, China RoHS
Manufactured under ISO 9001, ISO 14001 and ISO 45001

Dimensions

½ in. to 4 in. pipe



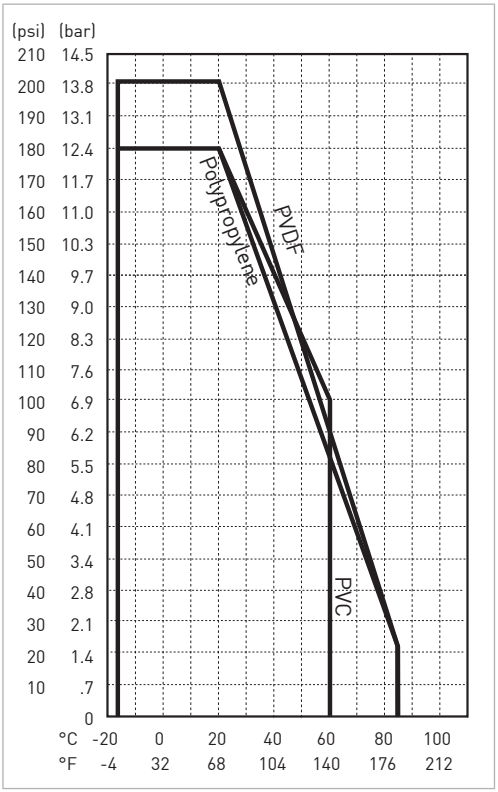
5 to 8 in. pipe



Pressure-temperature diagrams

Note

The pressure-temperature diagrams are specifically for the GF sensor. During system design the specifications of all components must be considered. In the case of a metal piping system, a plastic sensor will reduce the system specification. When using a PVDF sensor in a PVC piping system, the fitting will reduce the system specification.



System Overview

Panel Mount	4 to 20 mA Dry Contact, Solid State	4 to 20 mA Output	Automation System
GF Instruments - 9900 - 9950	- Customer Supplied Metering Pump	- Customer Supplied Chart Recorder - Programmable Logic Controller or Programmable Automation Controller	- 0486 Profibus Concentrator and Customer Supplied Programmable Logic Controller or - Programmable Automation Controller
Type 2537 Paddlewheel Flowmeter			
GF Fittings			All Sold Separately

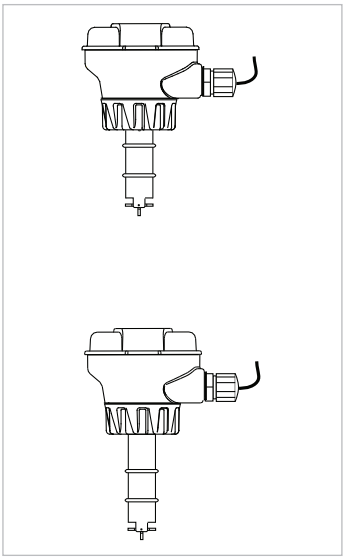
Application Tips

- Select PVDF Rotor Shaft for use in Deionized Water.
- Use a sleeved rotor in abrasive liquids to reduce wear.
- Sensor plug is used to plug installation fitting after extraction of sensor from pipe.
- For liquids containing ferrous particles, use GF Magmeters.
- For systems with components of more than one material, the maximum temperature/pressure Specification must always be referenced to the component with the lowest rating.

Ordering Information

Mfr. Part	Code	Output
Paddlewheel Flowmeter – Integral Mount (8512 sensors)		
DN15 to DN100 - ½ to 4 in.		
Polypropylene body, black Polypropylene retaining nut, black PVDF rotor, Titanium shaft, FKM O-rings		
3-2537-1C-P0	159 001 291	Pulse/Flow Switch Dry Contact Relay (DCR)
3-2537-2C-P0	159 001 292	Pulse/Flow Switch Solid State Relay (SSR)
3-2537-5C-P0	159 001 295	Digital (S^3L)
3-2537-6C-P0	159 001 296	4 to 20 mA
Natural PVDF body, Natural PVDF retaining nut, rotor and shaft, FKM O-rings*		
3-2537-1C-T0	159 001 315	Pulse/Flow Switch Dry Contact Relay (DCR)
3-2537-2C-T0	159 001 316	Pulse/Flow Switch Solid State Relay (SSR)
3-2537-5C-T0	159 001 319	Digital (S^3L)
3-2537-6C-T0	159 001 320	4 to 20 mA
DN125 to DN200 – 5 to 8 in.		
Polypropylene body, black Polypropylene retaining nut, black PVDF rotor, Titanium shaft, FKM O-rings		
3-2537-1C-P1	159 001 303	Pulse/Flow Switch Dry Contact Relay (DCR)
3-2537-2C-P1	159 001 304	Pulse/Flow Switch Solid State Relay (SSR)
3-2537-5C-P1	159 001 307	Digital (S^3L)
3-2537-6C-P1	159 001 308	4 to 20 mA

* PVDF available ½ in. to 4 in. only.



Accessories and Replacement Parts

Mfr. Part	Code	Output
Rotors		
3-2536.320-1	198 820 052	Rotor, PVDF Black
3-2536.320-2	159 000 272	Rotor, PVDF Natural
3-2536.320-3	159 000 273	Rotor ETFE
3-2536.322-3	198 820 056	Sleeved rotor, PVDF Black
3-2536.322-2	198 820 057	Sleeved rotor, PVDF Natural
3-2536.322-3	198 820 058	Sleeved rotor, ETFE
Rotor Shafts		
M1546-1	198 801 182	Shaft, Titanium
M1546-2	198 801 183	Shaft, Hastelloy-C
M1546-3	198 820 014	Shaft, Tantalum
M1546-4	198 820 015	Shaft, Stainless Steel
P51545	198 820 016	Shaft, Ceramic
O-Rings		
1220-0021	198 801 000	O-ring, FKM (2 required per sensor)
1224-0021	198 820 006	O-ring, EPR (EPDM) (2 required per sensor)
1228-0021	198 820 007	O-ring, FFKM (2 required per sensor)
Miscellaneous		
P31536	198 840 201	Sensor plug, Polypropylene
3-2536.321	198 820 054	PVDF Natural, Rotor kit
3-8050.390-1	159 001 702	Retaining Nut Replacement Kit, NPT, Valox
3-8050.390-3	159 310 116	Retaining Nut Replacement Kit, NPT, PP
3-8050.390-4	159 310 117	Retaining Nut replacement Kit, NPT PVDF
3-8050-396	159 000 617	RC Filter kit (for relay use, inductive loads) 2 per kit
3-9000.392-1	159 000 839	Liquid tight connector kit, NPT (1 piece)
3-9000.392-2	159 000 841	Liquid tight connector kit, PG13.5 (1 piece)
7310-1024	159 873 004	24 VDC Power Supply, 10 W, 0.42 A
7310-2024	159 873 005	24 VDC Power Supply, 24 W, 1.0 A
7310-4024	159 873 006	24 VDC Power Supply, 40 W, 1.7 A
7310-6024	159 873 007	24 VDC Power Supply, 60 +, 2.5 A
7310-7024	159 873 008	24 VDC Power Supply, 96 W, 4.0 A

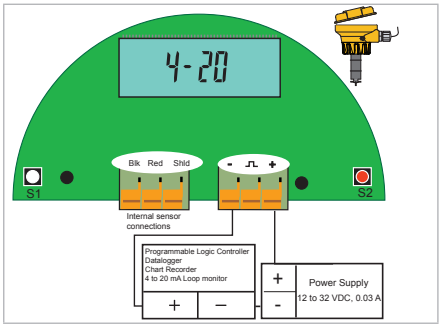
Wiring Information

Digital (S³L) Wiring

The digital (S³L) output is compatible with the type 9900 single-channel transmitters and 9950 multi-channel transmitters.

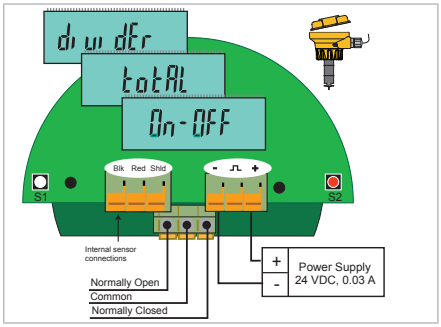
Loop Wiring

The 4 to 20 mA output can be connected to Chart Recorders, PLCs or any device that requires a 4 to 20 mA signal.



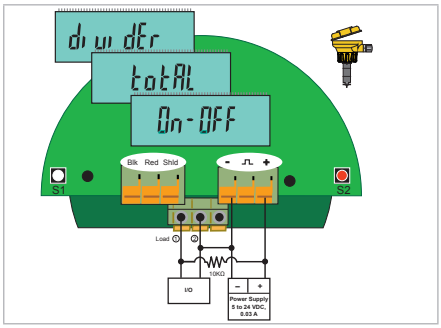
Dry Contact Relay Wiring

The wiring is identical for On-OFF and Pulse modes.



Solid State Relay Wiring

The wiring is identical for On-OFF and Pulse modes.



Type 2540 Stainless Steel High Performance Paddlewheel Flow Sensor



Standard Sensor | Hot-Tap Sensor

Product description

The type 2540 Paddlewheel Flow Sensor offers the strength and corrosion resistance of stainless steel for liquid applications with low velocity measurements. Unique internal circuitry eliminates the need for magnets in the process fluid, enabling flow measurement of 0.1 to 6 m/s (0.3 to 20 ft/s) while maintaining the advantages of insertion sensor design. Ultraflon 500C bearings and Tungsten Carbide shaft provide exceptional wear resistance.

The type 2540 offers field replaceable electronics and transient voltage suppression (TVS) to provide greater immunity to large voltage disturbances (i.e. lightning) sometimes encountered in field wiring. Sensors can be installed in DN40 to DN600 (1½ to 24 inch) pipes using the 1½ inch or ISO 7/1-R 1.5 threaded process connection.

The sensors are also offered in a hot-tap configuration with a bleed valve service without process shutdown in pipes up to DN900 (36 in.). Both styles of sensors must be used in full pipes and can be used in low pressure systems.

Features

- Operating range 0.1 to 6 m/s (0.3 to 20 ft/s)
- Field replaceable electronics
- Non-magnetic RF detection
- Standard NPT or ISO process connections
- Hot-tap versions for installation/service without system shutdown
- For pipe sizes up to DN900 (36 in.)
- Adjustable sensor - one size for entire pipe range
- 7.6 m (25 ft) cable

Applications

- HVAC
- Turf Irrigation
- Cooling Systems
- Filtration Systems
- Water Distribution
- Leak Detection
- Pump Protection
- Clarified Effluent Totalization
- Ground Water Remediation
- Gravity Feed Line

Technical Details

General			
Operating Range	0.1 to 6 m/s	0.3 to 20 ft/s	
Pipe Size Range	Standard Version	DN40 to DN600	1½ to 24 in.
	Hot-Tap Version	DN40 to DN900	1½ to 36 in.
Sensor Fitting Options	1½ in. NPT threads ISO	7/1-R 1.5 threads	
Linearity	±1% of full range		
Repeatability	±0.5% of full range		
Min. Reynolds Number Required	4500		

Wetted Materials	
Body	316 stainless steel (1.4401)
Fitting	318 stainless steel (1.4401)
Fitting O-rings	FKM, optional EPR (EPDM)
Rotor	17-4PH-1 Stainless Steel
Rotor Shaft	Tungsten Carbide GRP 1 (standard) stainless steel (optional)
Retainers (2)	316 stainless steel (1.4401)
Rotor Bearings (2)	Carbon fiber reinforced PTFE

Electrical		
Frequency	15 Hz per ft/s nominal	49 Hz per m/s nominal
Power	5 to 24 VDC ±10%, regulated, 1.5 mA max.	
Output type	Open collector, sinking, max 10.0 mA	
Cable Length	7.6 m (25 ft), can be extended up to 300 m (1,000 ft)	
Cable type	2-conductor twisted-pair with shield, 22 AWG	

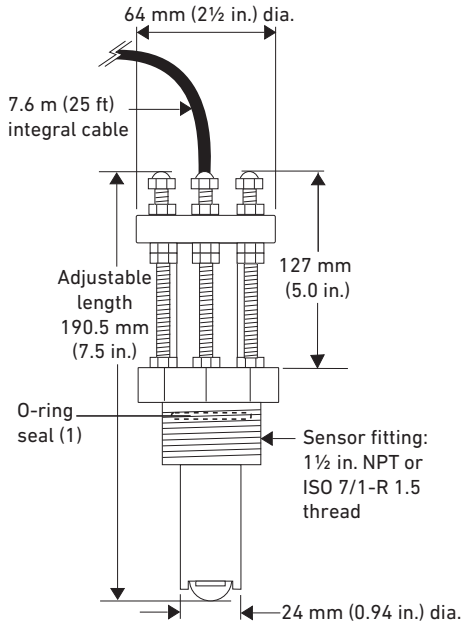
Max. Temperature/Pressure Rating		
Sensor with standard FKM sensor fitting O-rings	17 bar @ 82 °C	250 psi @ 180 °F
Sensor with optional EPR (EPDM) sensor fitting O-rings	17 bar @ 100 °C	250 psi @ 212 °F
Operating Temperature	-18 °C to 100 °C	0 °F to 212 °F

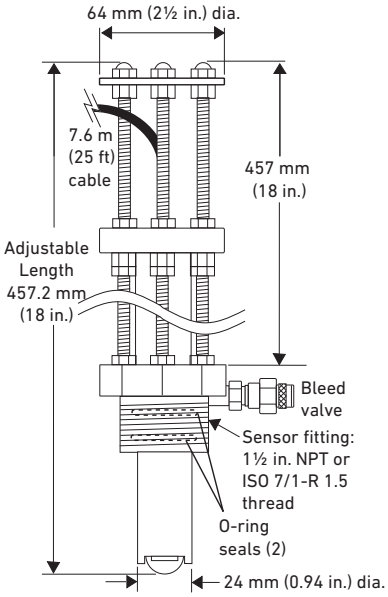
Shipping Weight			
	3-2540-/1/-2/-1S/-2S	1.79 kg	3.9 lb
	3-2540-3/-4/-3S/-4S	2.15 kg	4.7 lb

Standards and Approvals
CE, UKCA, FCC
RoHS compliant, China RoHS
Manufactured under ISO 9001, ISO 14001 and ISO 45001

Dimensions

2540 High Performance Flow Sensor for 1½ to 24 in. pipes	2540 Hot-Tap for 1½ to 36 in. pipes





System Overview

Panel Mount	Pipe, Tank, Wall Mount	Field (Integral) Mount	Automation System
GF Instruments - 9900 - 9900-1BC - 9950	GF Instruments - 9900-1P with Rear Enclosure - 9900-1BC with Rear Enclosure - 9900 with 3-8050-1 Universal Mount Kit	GF Instruments - 9900-1 with 3-8050-1 Universal Mount Kit	- 0486 Profibus Concentrator and Customer Supplied Programmable Logic Controller or - Programmable Automation Controller

Type 2540-XX

ball or gate valve 1¼" or 1½"	closed nipple 1¼" or 1½"	Weld-on weldolet 1¼" or 1½" outlet *	Iron strap-on saddle 1¼" or 1½" outlet*

* Contact GF for ordering information
All sold separately

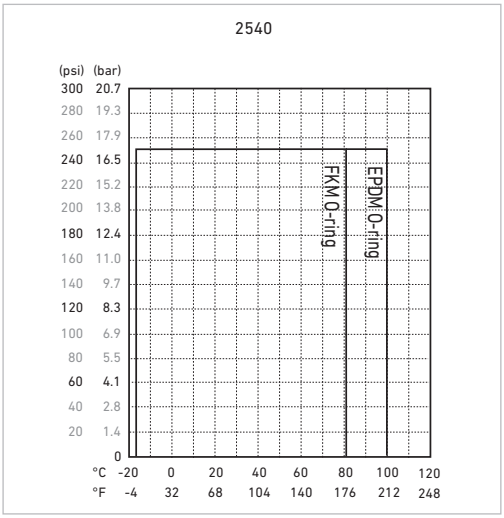
Application Tips

- For systems with components of more than one material, the maximum temperature/pressure specification must always be referenced to the component with the lowest rating.
- Use the Conduit Adapter Kit to protect the cable-to-sensor connection when used in outdoor environments.
- Sensor electronics can be easily replaced by 3-2541.260-1 or 3-2541.260-2.

Pressure-temperature diagram

Note

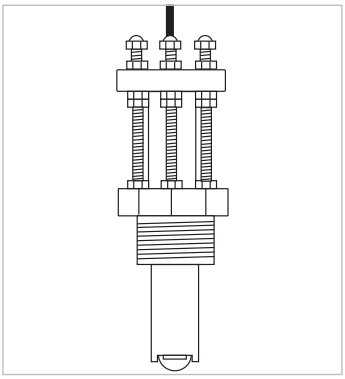
The pressure-temperature diagrams are specifically for the GF sensor. During system design the specifications of all components must be considered. In the case of a metal piping system, a plastic sensor will reduce the system specification. When using a PVDF sensor in a PVC piping system, the fitting will reduce the system specification.



Ordering Information

Mfr. Part	Code	Mounting Option	Rotor Shaft Material
Stainless Steel High Performance flow sensor with removable electronics			
3-2540-1	198 840 035	1½ inch NPT thread	Tungsten Carbide
3-2540-2	198 840 036	1½ inch ISO thread	Tungsten Carbide
3-2540-3	198 840 037	1½ inch NPT thread, Hot-Tap design*	Tungsten Carbide
3-2540-4	198 840 038	1½ inch ISO thread, Hot-Tap design*	Tungsten Carbide
3-2540-1S	159 001 501	1½ inch NPT thread	316 Stainless Steel
3-2540-2S	159 001 502	1½ inch ISO thread	316 Stainless Steel
3-2540-3S	159 001 503	1½ inch NPT thread, Hot-Tap design*	316 Stainless Steel
3-2540-4S	159 001 504	1½ inch ISO thread, Hot-Tap design*	316 Stainless Steel

* Must use 3-1500.663 Hot-Tap installation tool (ordered separately).



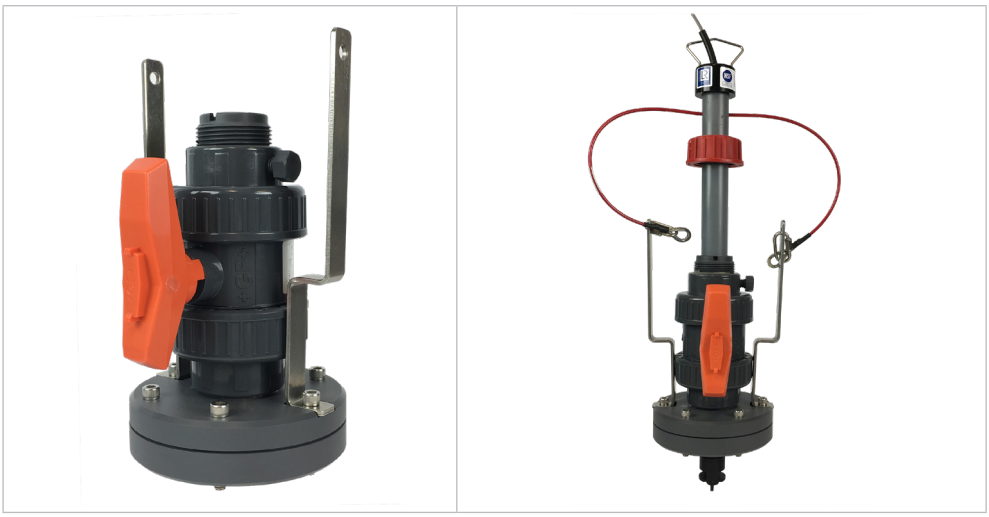
Ordering Notes

Installation fittings and Hot-Tap valves are customer supplied or can be ordered by contacting the Special Order products.

Accessories and Replacement Parts

Mfr. Part No.	Code	Description
3-1500.663	198 820 008	Hot-Tap Installation Tool (see Installation for more info)
1220-0021	198 801 000	O-ring, FKM (2 required per sensor)
1224-0021	198 820 006	O-ring, EPR (EPDM) (2 required per sensor)
1228-0021	198 820 007	O-ring, FFKM (2 required per sensor)
3-2540.320	198 820 040	Rotor kit, 2540 PEEK Bearing (old version)
3-2540.321	159 000 623	Rotor kit, 2540 Tungsten Carbide Shaft (new version since January 1, 2000)
3-2540.322	159 000 864	Rotor kit, stainless steel shaft and rotor
P52504-3	159 000 866	Rotor shaft, Tungsten Carbide
P52504-4	159 000 867	Rotor shaft, 316 SS
P52503	198 820 013	Bearing, carbon reinforced PTFE
P52527	159 000 481	Retainers, SS (1.44019
3-2541.260-1	159 000 849	Standard replacement electronics module
3-2541.260-2	159 000 850	Hot-Tap replacement electronics module
5523-0222	159 000 392	Cable (per foot), 2 cond. w/shield, 22 AWG
P51589	159 000 476	Conduit adapter kit
P31934	159 000 466	Conduit cap

Type 3519 Flow Wet-Tap Valve



Assembly shown with extended length flow sensor installed.

Product description

The type 3519 Flow Wet-Tap Valve serves as a unique interface between the installation fitting and the wet-tap style type 515 or 2536 Rotor-X flow sensor. It provides a fast method of removing the sensor from the pipe under specified operating pressures. The PVC and stainless steel design of the Wet-Tap makes it resistant to corrosion and chemical attack by acids, alkalies, salt, and a number of other harsh chemicals.

The type 3519 Wet-Tap Valve mounts directly onto standard type installation fittings. The 3519 Wet-Tap consists of a flange and support plate that threads onto the pipe fitting insert, and a PVC ball valve through which an extended length sensor is inserted into the pipe.

Features

- Allows sensor removal without process shutdown
- Pressure release valve for safe sensor removal
- Dual safety lanyards
- Rugged corrosion-resistant PVC construction and stainless steel hardware
- Compatible with type 515 or 2536 Rotor-X Wet-Tap Flow Sensors
- Eliminates process downtime

Applications

- Filtration Systems
- Chemical Production
- Pump Protection
- Scrubbers
- Water Distribution
- Effluent Totalization
- Process Cooling Loops

Technical Details

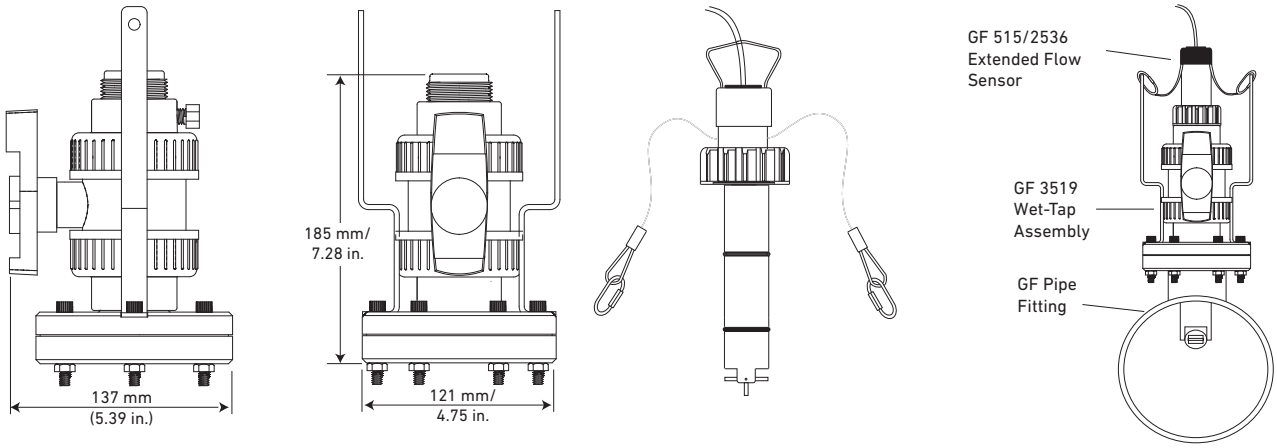
General		
Body	PVC	
Ball Seal	PTFE	
Seats	FKM (std) or EPR (EPDM) also available, contact factory	
Hardware	303 SS (brackets), 18/8 SS (nuts & bolts)	

Max. Temperature/Pressure Rating		
	7 bar max. @ 20 °C	100 psi max. @ 68 °F
	1.4 bar max @ 66 °C	20 psi max. @ 150 °F
Wet-Tap Maximum Installation/Removal Rating		
	1.7 bar @ 22 °C	25 psi @ 72 °F

Shipping Weight		
	1.3 kg	2.86 lb

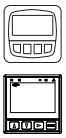
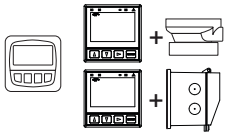
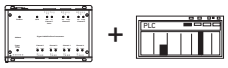
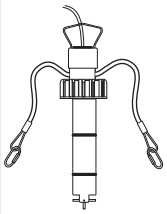
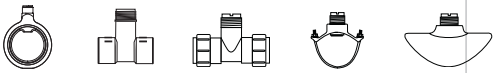
Standards and Approvals
CE, UKCA, FCC
Manufactured under ISO 9001, ISO 14001 and ISO 45001

Dimensions



Type 515 or 2536 Wet-Tap Sensor

System Overview

Panel Mount	Pipe, Tank, Wall Mount	Automation System
GF Instruments - 8150* - 9900-1P - 9900-1BC - 9950	GF Instruments - 8150 - 9900-1 with 3-8050 Universal Mount Kit - 9900-1BC with Rear Enclosure - 9950	- 0486 Profibus Concentrator and Customer Supplied Programmable Logic Controller or - Programmable Automation Controller
		
GF Wet-Tap Flow Sensor - 515 - 2536	**Type 3519 Wet-Tap Valve**	
		
GF Fittings		
		All sold separately

See Fittings section for more information.
* The 8150 will only work with the P51530-XX sensor

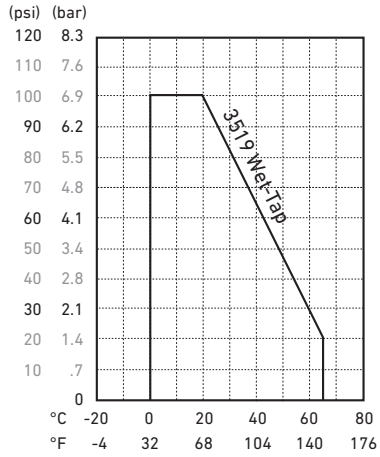
Application Tips

- Once installed, sensor insertion and removal can be performed without process shutdown; see installation/removal pressure specifications page.
- Use the Conduit Adapter Kit when used in outdoor environments.
- For liquids containing ferrous particles, use GF Magmeters.
- Use sensors with sleeved rotors in abrasive liquids to reduce wear.
- For systems with components of more than one material, maximum temperature and pressure specifications must always be referenced to the component with the lowest rating.

Pressure-temperature diagram

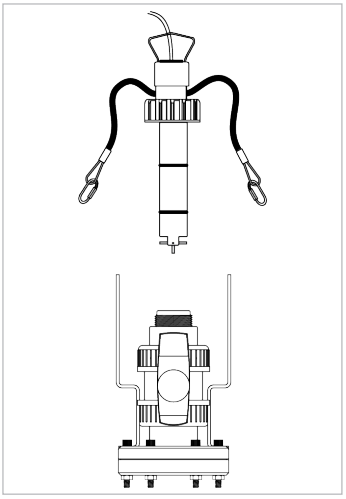
Note

The pressure-temperature diagrams are specifically for the GF sensor. During system design the specifications of all components must be considered. In the case of a metal piping system, a plastic sensor will reduce the system specification. When using a PVDF sensor in a PVC piping system, the fitting will reduce the system specification.



Ordering Information

Mfr. Part No.	Code	Flow Range
3-3519	159 000 757	Wet-Tap Valve only for 515 and 2536 Wet-Tap flow sensors
For ½ to 4 inch pipes		
P51530-P3*	198 840 310	Polypro extended length paddlewheel sensor
3-2536-P3**	159 000 758	Polypro extended length low flow paddlewheel sensor
For 5 to 8 inch pipes		
P51530-P4*	198 840 311	Polypro extended length paddlewheel sensor
3-2536-P4**	159 000 759	Polypro extended length low flow paddlewheel sensor
For 10 to 36 inch pipes		
P51530-P5*	198 840 312	Polypro extended length paddlewheel sensor
3-2536-P5**	159 000 760	Polypro extended length low flow paddlewheel sensor



Ordering Notes

* See type 515 data sheet for sensor specifications.

** See type 2536 data sheet for sensor specifications.

Types 515 and 2536 Wet-Tap sensors can be ordered separately.

Type 525 Metalex Paddlewheel Flow Sensor



Product description

The type 525 Metalex Paddlewheel Flow Sensor combines stainless steel construction with insertion paddlewheel technology. The result is a highly reliable sensor suitable for operation at extreme pressures and temperatures. The Tungsten Carbide shaft and carbon fiber reinforced PTFE bearing provides excellent wear resistance for extended service.

A comprehensive fitting program allows installation in steel lines with the mini-block for small diameters, and either the mini-tap or saddle for pipes up to DN300 (12 in.). The self-generating output signal allows use with the battery operated flow totalizer 8150.

Features

- For up to 103 bar (1500 psi @ safety factor 1.5) pressure
- For up to 149 °C (300 °F) temperature
- DN15 to DN300 (½ to 12 in.) pipe range
- Simple installation
- Self-powered/no external power required
- 316 SS body
- Tungsten Carbide or SS shaft
- 7.6 m (25 ft) cable included
- Operating range 0.5 to 6 m/s (1.6 to 20 ft/s)

Applications

- Boiler Feedwater Monitoring
- HVAC
- Chemical Transport
- Heat Exchangers
- Reverse Osmosis
- Cooling Systems
- Not Suitable for Gases

Technical Details

General		
Operating Range	0.5 to 6 m/s	1.6 to 20 ft/s
Pipe Size Range	DN15 to DN300	½ to 12 in.
Linearity	±1% if max. range @ 25 °C (77 °F)	
Repeatability	±0.5% of max. range @ 25 °C (77 °F)	
Min. Reynolds Number Required	4500	

Wetted Materials	
Sensor Body	316 SS (ACI type CF-8M per ASTM A351), DIN 17440
Rotor Material	17-4PH-1 Stainless Steel
Rotor Shaft	Tungsten Carbide GRP 1 or 316 stainless steel
Retainers (2)	316 stainless steel (1.4401
Rotor Bearings (2)	Carbon fiber reinforced PTFE
Gasket	KLINGER sil C-4401 (supplied with fitting)

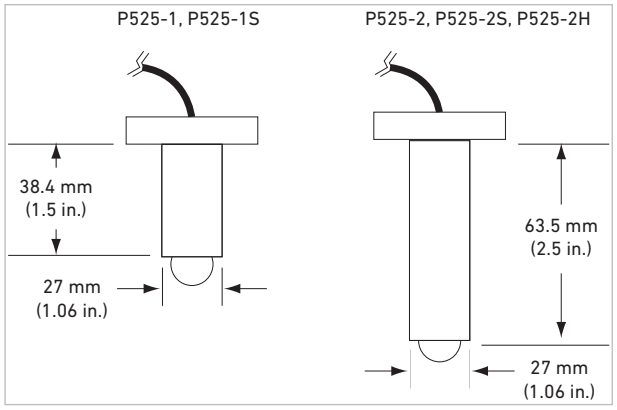
Electrical		
Frequency	39 Hz per m/s nominal	12 Hz per ft/s nominal
Amplitude	5 to 8 mV p-p per Hz	
Source Impedance	11.6 KΩ	
Cable Length	7.6 m (25 ft), can be extended up to 61 m (200 ft)	
Cable type	Cable (per foot) 2 cond. w/shield, 22 AWG	

Max. Temperature/Pressure Rating		
Socket Weld or Weld-On Mini-Tap Fittings	103 bar (1'500 psi @ safety factor 1.5) @ 149 °C (300 °F)	
Strap-on Saddle Fitting	21 bar (305 psi) @ 66 °C (151 °F)	
Operating Temperature	-18 °C to 149 °C	0 °F to 300 °F

Shipping Weight		
P525-1/ -1S	0.723 kg	1.6 lb
P525-2/ -2S	0.774 kg	1.7 lb

Standards and Approvals
RoHS compliant, China RoHS
Manufactured under ISO 9001, ISO 14001 and ISO 45001

Dimensions



System Overview

Panel Mount	Pipe, Tank, Wall Mount	Automation System
GF Instruments - 8150 - 9900 - 9900-1BC - 9950	GF Instruments - 8150 with 3-8050 Universal Mount Kit - 9900-1 - 9900-1BC with Rear Enclosure - 9950	- 0486 Profibus Concentrator and Customer Supplied Programmable Logic Controller or - Programmable Automation Controller

Type 525 Metalex Flow Sensor

GF Fittings

All sold separately

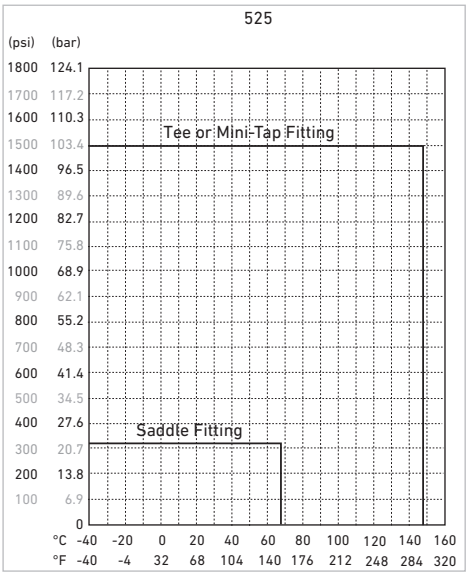
Application Tips

- Use the Conduit Adapter Kit to protect the cable-to-sensor connection when used in outdoor environments. See Accessories section.
- Use the Socket Weld or Weld-on Mini-Tap fittings for sensor installation in pressures up to 1500 psi (103 bar).Sensor plug can be used to plug installation fitting after extraction of sensor from pipe.

Pressure-temperature diagram

Note

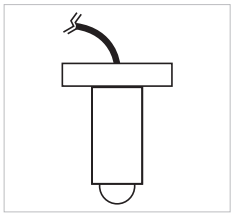
The pressure-temperature diagrams are specifically for the GF sensor. During system design the specifications of all components must be considered. In the case of a metal piping system, a plastic sensor will reduce the system specification. When using a PVDF sensor in a PVC piping system, the fitting will reduce the system specification.



Ordering Information

Mfr. Part	No./Code	Sensor Style	Rotor Shaft Material
Metalex Flow sensor for high pressures and temperatures			
P525-1	198 801 494	Used with ½ to 1 inch socket-weld mini-tap fittings**	Tungsten Carbide
P525-2	198 801 495	Used with 1¼ to 12 inch weld-on mini-tap fittings**	Tungsten Carbide
P525-1S	159 000 963	Used with ½ to1 inch socket-weld mini-tap fittings**	316 Stainless Steel
P525-2S	159 000 964	Used with 1¼ to 12 inch weld-on mini-tap fittings**	316 Stainless Steel

** See Fittings section



Accessories and Replacement Parts

Ordering Notes

1) Each sensor option is used with a different fitting based on pipe size.

2) Fittings must be ordered separately.

3) See fittings section for more information.

Mfr. Part	Code	Description
P52509	198 801 501	Rotor kit (rotors, stainless steel shaft, bearings, retainers)
P52509-2	159 000 480	Rotor kit (rotors, tungsten carbide shaft, bearings, retainers)
P52504-1	198 801 500	Rotor shaft, Stainless Steel (1.4401)
P52504-2	198 820 023	Rotor shaft, Tungsten Carbide
P52618	159 000 493	Gasket
P52503	198 820 013	Bearing, carbon fiber reinforced PTFE
P52527	159 000 481	Retainers, Stainless Steel
P52628	159 000 504	Fitting cap kit (cap and gasket)
P51589	159 000 476	Conduit adapter kit
5523-3222	159 000 393	Cable (per foot) 2 cond. w/shield, 22 AWG

Flow Integral Systems with type 9900 Transmitter

Member of the SmartPro® Family of Instruments



Product description

GF has combined the 9900 SmartPro® Transmitter with the 515/8510 and 2536/8512 Paddlewheel Flow sensors to create integral systems that are easy to order and simple to install. Integral systems are also available in conductivity, level, temperature, and pressure configurations.

Each integral system features a 9900 Transmitter which provides a local and easy to read LCD display. The push button keypad makes it easy to navigate through the transmitter's menu. The DC-powered 9900 features a scalable 4 to 20 mA output and open collector for process control.

Flow Integral Systems with 9900 Transmitters are combined with GF's field-proven Models 515/8510 and 2536/8512. These sensors reliably perform in flow ranges from 0.3 to 6 m/s (1 to 20 ft/s) and 0.1 to 6 m/s (0.3 to 20 ft/s) respectively for pipe sizes from ½ to 8 inches. They are available in a variety of materials including polypropylene and PVDF and are easily mounted in the pipe using GF's comprehensive line of standard fittings.

Features

- Local display for sensor mounted instruments
- Provides 4 to 20 mA output
- "At a glance" visibility
- "Dial-type" digital bar graph
- NEMA 4X/IP65

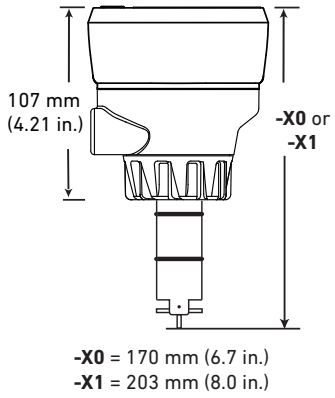
Applications

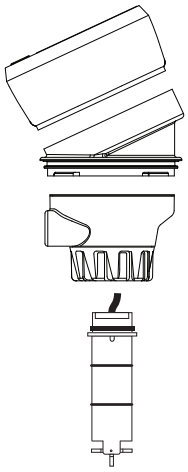
- RO/DI System Control
- Cooling Tower Control
- Water Quality Monitoring
- Filtration Systems
- Chemical Production
- Liquid Delivery Systems
- Pump Protection
- Scrubber Systems
- Semiconductor Water Production

Technical Details

See individual product pages for more information.

Dimensions





3-9900
Instrument

3-9900-396
Angle Adjustment Adapter Kit
(optional accessory)

3-8051-X
Integral Mount Kit

3-8510-X or 3-8512-X
Flow Sensor

System Overview

Integral Installation

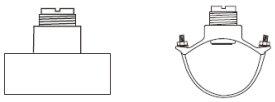
Type 9900 Transmitter
With 3-8051-X Integral Mount Kit and 3-9900.396 Angle Adapter



GF Sensor
3-8510-XX
3-8512-XX



Customer supplied standard ¾ in fittings



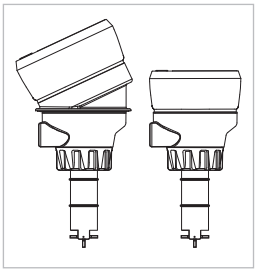
All sold separately

Ordering Information

Ordering Notes

Integral Mounts are available with all parts conveniently assembled (transmitter, sensor, and mounting kit). Alternatively, all three parts can be purchased separately. See individual transmitter and sensor pages for more information.

Mfr. Part No./Code	Instrument + Sensor	Angle adapter	Pipe Size	Sensor Body Material	Sensor Rotor/Pin Material
159 002 234	3-9900-1 w/3-8510-P0	yes	½ to 4 in.	Polypropylene	Black PVDF/Titanium
159 002 235	3-9900-1 w/3-8510-H0	yes	½ to 4 in.	Polypropylene	Black PVDF/Hatelloy-C
159 002 236	3-9900-1 w/3-8510-S0	yes	½ to 4 in.	Polypropylene	Black PVDF/Natural PVDF
159 002 237	3-9900-1 w/3-8510-T0	yes	½ to 4 in.	PVDF Natural	Natural PVDF/Natural PVDF
159 002 238	3-9900-1 w/3-8510-P1	yes	5 to 8 in.	Polypropylene	Black PVDF/Titanium
159 002 239	3-9900-1 w/3-8512-P0	yes	½ to 4 in.	Polypropylene	Black PVDF/Titanium
159 002 240	3-9900-1 w/3-8512-H0	yes	½ to 4 in.	Polypropylene	Black PVDF/Hastelloy-C
159 002 241	3-9900-1 w/3-8512-S0	yes	½ to 4 in.	Polypropylene	Black PVDF/Natural PVDF
159 002 242	3-9900-1 w/3-8512-V0	yes	½ to 4 in.	PVDF Natural	Natural PVDF/Hastelloy-C
159 002 243	3-9900-1 w/3-8512-T0	yes	½ to 4 in.	PVDF Natural	Natural PVDF/Natural PVDF
159 002 244	3-9900-1 w/3-8512-P1	yes	5 to 8 in.	Polypropylene	Black PVDF/Titanium
159 001 733*	3-9900-1 w/3-8510-P0	no	½ to 4 in.	Polypropylene	Black PVDF/Titanium
159 001 734*	3-9900-1 w/3-8510-H0	no	½ to 4 in.	Polypropylene	Black PVDF/Hatelloy-C
159 001 735*	3-9900-1 w/3-8510-S0	no	½ to 4 in.	Polypropylene	Black PVDF/Natural PVDF
159 001 736*	3-9900-1 w/3-8510-T0	no	½ to 4 in.	PVDF Natural	Natural PVDF/Natural PVDF
159 001 737*	3-9900-1 w/3-8510-P1	no	5 to 8 in.	Polypropylene	Black PVDF/Titanium
159 001 738*	3-9900-1 w/3-8512-P0	no	½ to 4 in.	Polypropylene	Black PVDF/Titanium
159 001 739*	3-9900-1 w/3-8512-H0	no	½ to 4 in.	Polypropylene	Black PVDF/Hastelloy-C
159 001 740*	3-9900-1 w/3-8512-S0	no	½ to 4 in.	Polypropylene	Black PVDF/Natural PVDF
159 001 741*	3-9900-1 w/3-8512-V0	no	½ to 4 in.	PVDF Natural	Natural PVDF/Hastelloy-C
159 001 742*	3-9900-1 w/3-8512-T0	no	½ to 4 in.	PVDF Natural	Natural PVDF/Natural PVDF
159 001 743*	3-9900-1 w/3-8512-P1	no	5 to 8 in.	Polypropylene	Black PVDF/Titanium



*Only available in Europe.

Accessoires

Mfr. Part	Code	Description
3-9900.396	159 001 701	Angle adjustment adapter kit
3-0252	159 001 808	Configuration Tool

Type 8150 Battery Powered Flow Totalizer

Member of the ProcessPro® Family of Instruments



Panel Mount



Pipe, Wall and Tank Mount



Integral Mount

Product description

The type 8150 Battery Operated Flow Totalizer is compatible with the type 515 and 525 flow sensors, and will provide years of dependable operation. The large digital display indicates flow rate and totalized flow volume simultaneously. One of the three totalizers is resettable from the front panel or a remote location, while the second resettable totalizer can only be reset by entering a user-selectable security code. The third is a permanent non-resettable totalizer.

Our intuitive software design and four-button keypad provide for simple operation while setting screen displays and programming the system. Calibration can be easily performed by entering the AutoCal feature and entering a value to match an external reference. Screen displays can be modified to suit the user's needs; along with the flow rate, any of the three totalizers can be selected as the displayed totalizer. Customers can quickly scroll through the totalizers simply by pressing any key on the keypad. A display averaging feature is included for applications where the flow in the pipe fluctuates. For applications where flow stops and starts due to production needs, a no-flow indicator will display the hours of non-flow.

Features

- Three totalizers: 2 resettable and 1 permanent, user-selectable
- Long-lasting lithium batteries
- Mounting versatility
- No-flow indicator
- Large digital display with averaging
- Simple push-button operation
- User-selectable access code prevents unwanted changes
- Auto-calibration

Applications

- Wastewater Flow Accumulation
- Water Treatment Systems
- Remote or Mobile Treatment/ Distribution Systems
- Irrigation Systems
- Filtration Systems
- Commercial Pools & Spas
- Groundwater Remediation
- R.O. Concentrate
- Process Flow Monitoring
- UPW Distribution
- Demineralizer Regeneration
- Process Cooling Water

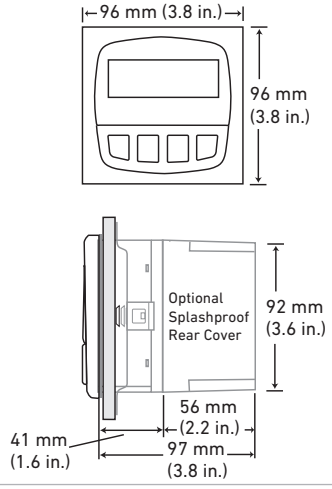
Technical Details

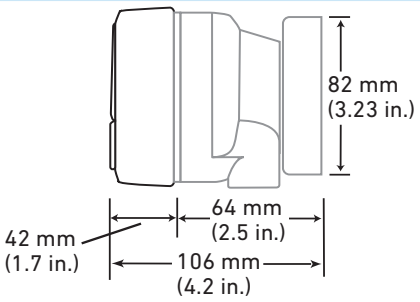
General		
Compatibility	Type 515 and 525 flow sensors	
Input Freq. Range	0 to 400 Hz	
Accuracy	±0.5% of reading	
Display	LCD type	
	4-digit upper line – flow rate	
	8-digit lower line – volume totalizer count, either resettable or permanend	
Averaging	0 to 120 secs.	
Contrast	Automatic	
Low Battery Indication	Battery symbol appears on LCD display	
8-digit Resettable Totalizers	Stored until user resets; continues to be stored even after batteries are removed	
8-digit Permanent	Kept permanently, even when batteries are removed	
Materials		
Enclosure	PBT resin	
Keypad	Sealed 4-key silicon rubber	
Panel and Case Gasket	Neoprene	
Window	Polyurethane coated polycarbonate	
Electrical		
Battery	Two 3.6 V Lithium thionyl chloride, AA-size	
Battery Life	4 years nominal @ 50 °C (122 °F)	
Environmental		
Operating Temperature	-10 °C to 65 °C	14 °F to 149 °F
	-40 °C to 100 °C	-40 °F to 212 °F
Relative Humidity	0 to 95%, non-condensing	
Enclosure	NEMA 4X/IP65 (front face only on panel mount); field mount is 100% NEMA 4X/IP65	
Shipping Weight		
	0.5 kg	1.1 lb
Standard and Approvals		
	CE, UKCA, FCC, UL, CUL	
	RoHS compliant, China RoHS	
	Manufactured under ISO 9001, ISO 14001 and ISO 45001	

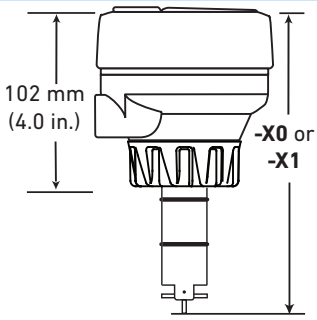
Dimensions

3-8150-1P – Panel Mount	3-8150-1 with Universal Mount	Model 8510-XX Integral Mount Sensors - see 515 data sheet for specifications

Panel Mount





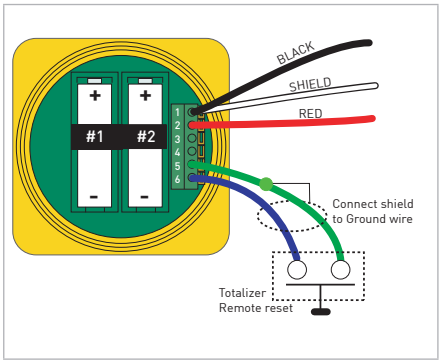


-X0 = 152 mm (6.0 in.)
-X1 = 185 mm (7.3 in.)

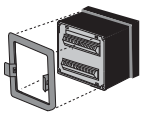
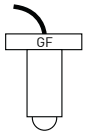
Wiring information

8150 Battery Powered Flow Totalizer

The 8150 Battery Powered Flow Totalizer is compatible only with the AC output sensors, 515 and 525. The wiring is shown here. See Operation Manual for more information.



System Overview

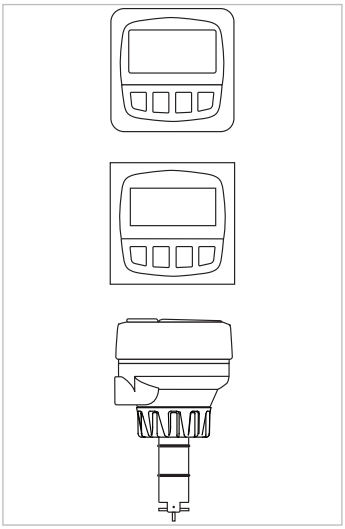
Panel Mount	Pipe, Tank, Wall
8150 Flow Totalizer includes mounting bracket and panel gasket	**8150 Flow Totalizer** with 3-8050 Universal Mount Kit
 	 + 
GF Sensors - 515 - 525 	 + 
GF Fittings 	
All sold separately	

Ordering Information

Ordering Notes

- For panel version, cutout must be 92 x 92 mm (3.62 x 3.62 in.)
- To mount the panel version on a wall, use the heavy duty wall mount bracket.
- Use the Universal mounting kit with the Field mount instrument to mount to a pipe, tank or wall.
- An optional splashproof rear cover van be ordered separately if needed.

Mfr. Part No.	Code	Mounting Notes
Battery Operated Flow Totalizer		
Field Mount (yellow body)		
3-8150-1	159 000 929	Field mount for pipe, tank, and wall mounting
Panel Mount (black body)		
3-8150-1P	159 000 930	Panel mount; includes mounting bracket and panel gasket
Integral Mount		
for ½ to 4 in. pipes		
3-8150-P0*	159 000 931	Mounted on type 515 Paddlewheel (Part No. 3-8150-P0), w/polypropylene body, black Polypropylene retaining nut, Black PVDF rotor, and Titanium shaft
3-8150-T0*	159 001 011	Mounted on type 515 Paddlewheel (Part No. 3-8150-T0), with a natural PVDF body, natural PVDF retaining nut, rotor and shaft
for 5 to 8 in. pipes		
3-8150-P1*	159 000 932	Mounted on type 515 Paddlewheel (Part No. 3-8150-P1), w/ polypropylene body, black Polypropylene retaining nut, Black PVDF rotor, and Titanium shaft



* See individual sensor sheets for more sensor information.

Accessories and Replacement Parts

Mfr. Part	Code	Description
Mounting		
3-8050	159 000 184	Universal mounting kit
3-8050.390-1	159 001 702	Retaining Nut Replacement Kit, NPT yellow, Valox
3-8050.390-3	159 310 116	Retaining Nut Replacement Kit, NPT black, PP
3-8050.390-4	159 310 117	Retaining Nut Replacement Kit, NPT natural, PVDF
3-0000.596	159 000 641	Heavy duty wall mount bracket (panel mount only)
3-5000.399	198 840 224	Panel adapter, 5 x 5 in. to ¼ DIN
3-5000.598	198 840 225	Surface mount bracket (panel mount only)
3-8050.395	159 000 186	Splashproof rear cover (panel mount only)
3-9900.396	159 001 701	Angle adjustment adapter kit
Liquid Tight Connectors		
3-9000.392	159 000 368	Liquid tight connector kit (include 3 connectors)
3-9000.392-1	159 000 839	Liquid tight connector, NPT (1 connector)
3-9000.392-2	159 000 841	Liquid tight connector, PG 13.5 (1 connector)
Other		
7400-0011	159 000 935	Lithium battery, 3.6 V, size AA (2 required)
5523-0222	159 000 392	Cable (per foot), 2 cond. w/shield, 22 AWG
Replacement Parts for Integral Mount Units – see type 515 catalog pages for information		
3-8051	159 000 187	Flow Sensor Integral Mounting Kit, NPT, Valox
3-8051-1	159 001 755	Flow Sensor Integral Mounting Kit, NPT, PP
3-8051-2	159 001 756	Flow Sensor Integral Mounting Kit, NPT, PVDF
3-8510-P0	198 864 504	Sensor for ½ to 4 in. pipes, Polypropylene body
3-8510-P1	198 864 505	Sensor for 5 to 8 in. pipes, Polypropylene body
3-8510-T0	159 000 622	Sensor for ½ to 4 in. pipes, all natural PVDF
3-8510-V0	198 864 506	Sensor for ½ to 4 in. pipes, PVDF body

Planning Fundamentals

of Measurement and Control

In-line Rotor Flow Sensors

Content

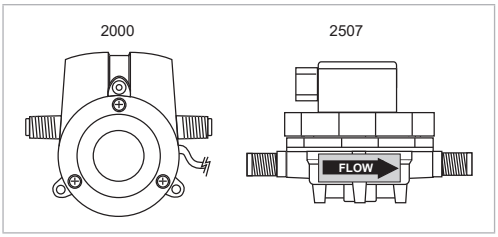
Introduction 301
Type 2000 Micro Flow Rotor Sensor 303
Type 2100 Turbine Flow Sensor 307
Type 2507 Mini Flow Sensor 311

Introduction

Principles of operation

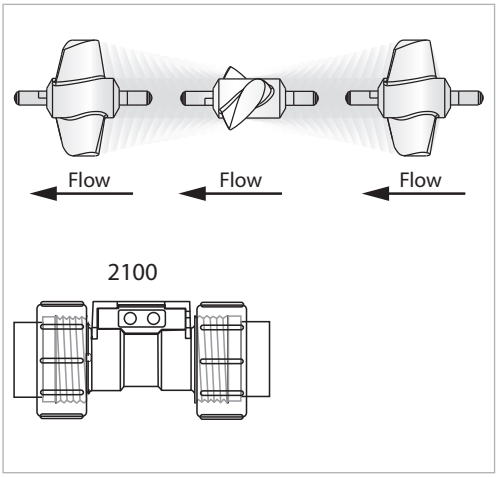
In-Line Rotor flow sensors

In-Line Rotor flow sensors like the types 2000 and 2507 are similar to paddle-wheel sensors, except the rotor is positioned in a flow cell. These types of sensors have a transistor-type output signal and are able to measure lower flow rates.



Turbine flow sensors

Turbine flow sensors are full-bore devices designed for low-flow measurements. type 2100 is offered in 6.4 mm and 12.7 mm (¼ in. and ½ in.) line sizes. Many self-aligning end-connector options are available for installation simplicity and application versatility. Similar to paddlewheels, they rely upon the energy in the flow stream to spin a rotor (turbine). The difference is that the shaft is in the centre of, and parallel to, the flow stream. The velocity of the fluid spins the turbine for detection by external electronic circuitry, producing a transistor-type square wave output with a frequency directly proportional to the flow rate.



Flow Range Charts In-line Rotor and Turbine Sensors (GPM and LPM)

Types 2000, 2100, and 2507

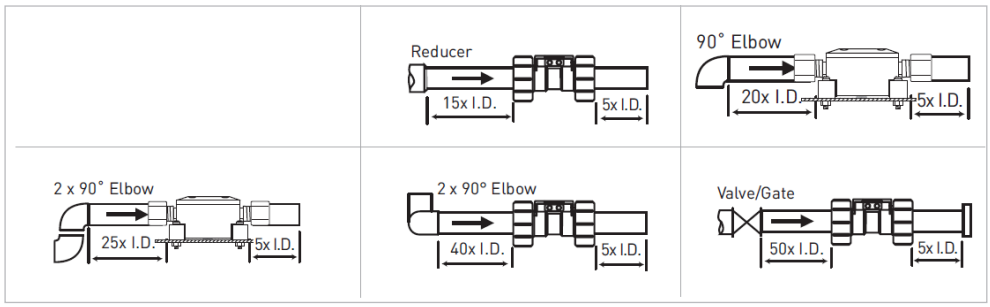
GPM and LPM Flow Rates

		GPM		LPM	
Type and Size	**Description**	**Min**	**Max**	**Min**	**Max**
3-2000-1X	Micro Flow - Low	0.030	0.700	0.110	2.600
3-2000-2X	Micro Flow - High	0.300	3.200	1.130	12.110
3-2100-XL and -31 Kits	Turbine Low - ½ in. Tubing	0.100	1.000	0.380	3.800
3-2100-XL and -32 Kits	Turbine Low - ⅜ in. Tubing	0.100	1.000	0.380	3.800
3-2100-XL and -33 Kits	Turbine Low - ¼ in. Tubing	0.100	1.000	0.380	3.800
3-2100-XL and -34 thru -38 Kits	Turbine Low - ½ in. Pipe	0.100	1.000	0.380	3.800
3-2100-XH and -31 kits	Turbine High - ½ in. Tubing	0.800	10.000	3.000	38.000
3-2100-XH and -34 thru -38 Kits	Turbine High - ½ in. Pipe	0.800	10.000	3.000	38.000
3-2507.100-2V	Mini Flow - 2 mm Insert	0.106	0.740	0.500	2.800
3-2507.100-3V	Mini Flow - 3 mm Insert	0.198	1.123	0.750	4.250
3-2507.100-4V	Mini Flow - 4 mm Insert	0.330	1.585	1.250	6.000
3-2507.100-6V	Mini Flow - 6 mm Insert	0.792	3.170	3.000	12.000

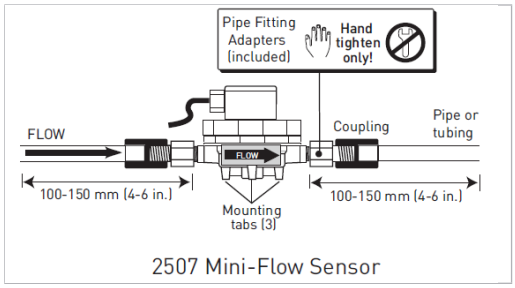
Installation of In-Line Rotor and Turbine Flow Sensors

Piping Location

- The location of the sensor in the piping system determines the flow profile that the sensor is monitoring. The ideal location is to have sufficient straight pipe immediately upstream of the sensor to create “fully developed turbulent flow.” Such a flow profile provides the stability required for the paddlewheel to measure accurately.
- The diagrams below illustrate the minimum distances recommended from various obstructions.
- In all scenarios, it is recommended to choose a location with the maximum length of straight, uninterrupted pipe.
- Six common installation configurations are shown below as guidelines to help you select the best location in your piping system for the flow sensor. Always maximize distance between sensors and pump sources.
- Never install immediately downstream of valves, fittings, etc.
- Observe minimum Reynolds Number
- The flow sensors are not for bi-directional operation.



For optimal performance of the 2507, a straight flow run of at least 100 to 150 mm (4 to 6 in.) should be allowed before and after the sensor.



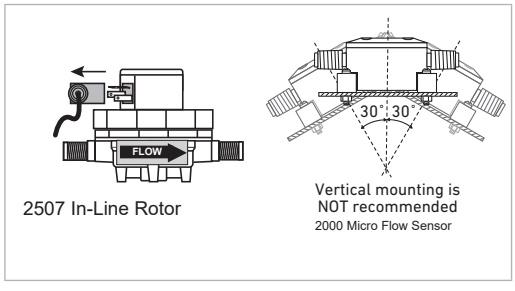
2507 Mini-Flow Sensor

Mounting Angle

The mounting angle of the sensor may affect the performance of the system.

In-line Rotors

- Type 2507 and 2000 flow sensors are designed to be mounted on a flat surface, although the sensors may be tilted up to ±30° if necessary.
- Installation in excess of 30° will affect the accuracy of the sensor.
- For type 2507, two pipe fitting adapters (included) convert the straight threads G-¼ in. to ¼ in. NPT.
- These sensors should be installed securely to their supporting surface to prevent vibrations from affecting the performance.

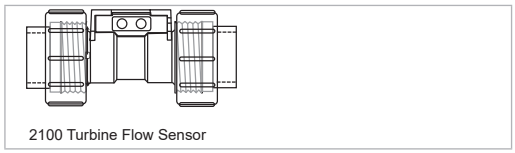


2507 In-Line Rotor

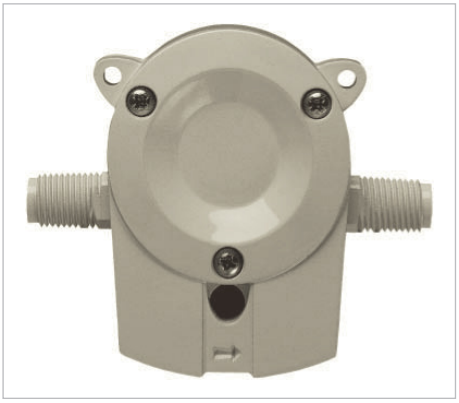
Vertical mounting is NOT recommended
2000 Micro Flow Sensor

Turbine Flow Sensors

- All mounting angles are acceptable for these sensors if the basic parameters are met: the pipe must be full with no entrapped air.
- Install the sensor with the arrow pointing in the direction of the flow of liquid.


2100 Turbine Flow Sensor

Type 2000 Micro Flow Rotor Sensor



Product description

The type 2000 Micro Flow Rotor Sensor is constructed of Polyphenylene Sulfide (PPS) which provides high material strength. The 2000 offers two flow ranges starting at 0.11 or 1.13 lpm (0.03 or 0.3 gpm), for clean process liquids, regardless of fluid color or opacity.

This sensor can be connected to flexible tubing or rigid pipe, and uses standard hardware for mounting. Only one moving part and a low pressure drop across the sensor reduces operating costs and maintenance requirements.

Features

- Operating range 0.11 to 12.11 lpm (0.03 to 3.2 U.S. gpm)
- Simple mounting
- ¼ in. NPT or ISO threads for simple pipe or tubing connection
- Measures opaque and transparent liquids
- Low pressure drop
- Standard cable 7.6 m (25 ft)

Applications

- Coolant Flow
- Dosing
- Batch Dispensing
- Not recommended for Strong Oxidizers

Technical Details

General			
Operating Range	-11 & -12 version	0.11 to 2.6 lpm	0.03 to 0.7 U.S. gpm
	-21 & -22 version	1.13 to 12.11 lpm	0.3 to 3.2 U.S gpm
Linearity	±1.2% of full range		
Repeatability	±0.5% of full range		
Connections	¼ in. NPT (male) or ISO 7/1 - R¼ (male)		

Wetted Materials	
Sensor Body and Cover	40% glass filled Polyphenylene Sulfide (PPS)
Rotor	PEEK®, natural, unfilled
Cover O-ring	FKM

Electrical	
Power	5 to 24 VDC ±10%, regulated, 10 mA max.
Output type	Open-collector, sinking, 20 mA max.
Cable Length	7.6 m (25 ft), can be extended up to 300 m (1000 ft)
Cable type	2-conductor twisted pair w/shield, 22 AWG

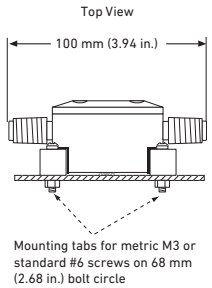
Max. Temperature/Pressure Rating		
	0 °C to 80 °C @ 5.5 bar max.	32 °F to 176 °F @ 80 psi max

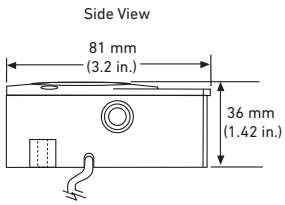
Shipping Weight		
	0.03 kg	0.7 lb

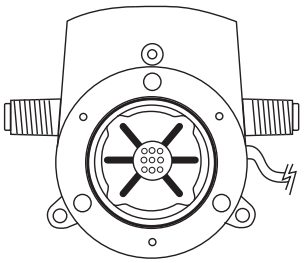
Standards and Approvals	
	Manufactured under ISO 9001, ISO 14001 and ISO 45001
	Not available in EU

Dimensions

Top View	Side View	Cover Removed

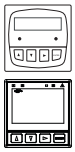
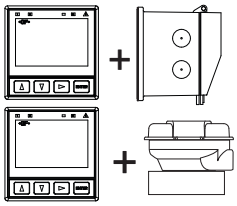
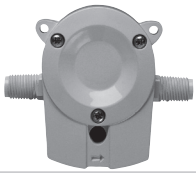
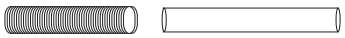






Mounting tabs for metric M3 standard #6 screws on 68 mm (2.68 in.) bolt circle

System Overview

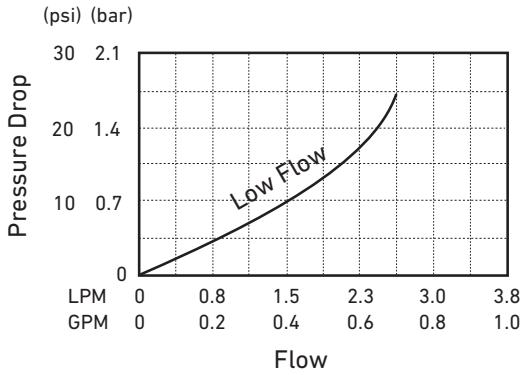
Panel Mount	Pipe, Tank, Wall	Automation System
GF Instruments - 9900-1P - 9900-1BC - 9950	GF Instruments - 9900-1P with Rear Enclosure - 9900-1 with 3-8050 Universal Mount Kit	- 0486 Profibus Concentrator and Customer Supplied Programmable Logic Controller or - Programmable Automation Controller
		
Type 2000 Sensor		**All sold separately**
Flexible tubing or rigid pipe (customer supplied)		

Pressure-temperature diagram

Note

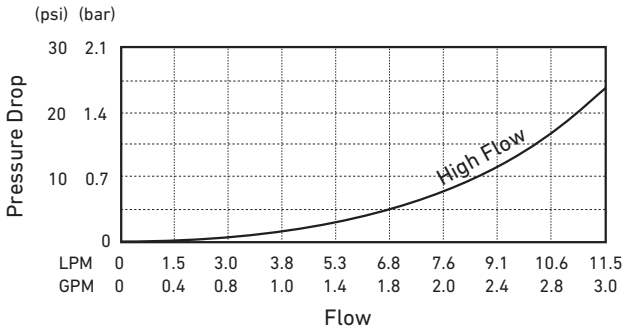
The pressure-temperature diagrams are speciafically for the GF sensor. During system designs the specifications of all components must be considered. In the case of a metal piping system, a plastic sensor will reduce the system specification

Low Flow



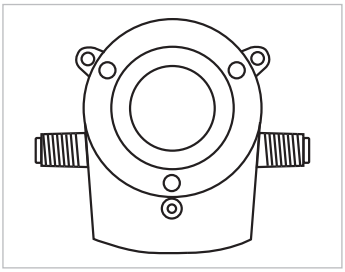
High Flow

2000 - Pressure Drop-High Flow



Ordering Information

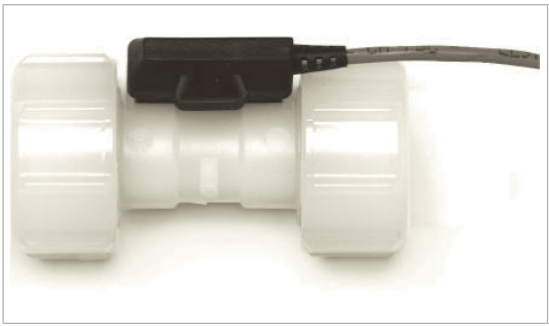
Mfr. Part No.	Code	Flow Range	End Fittings
3-2000-11	198 822 000	Low flow, 0.11 to 2.61 lpm (0.03 to 0.7 gpm)	¼ NPT threads
3-2000-12	198 822 001	Low flow, 0.11 to 2.61 lpm (0.03 to 0.7 gpm)	ISO 7/1-R1/4 threads
3-2000-21	198 822 002	High flow, 1.13 to 12.11 lpm (0.3 to 3.2 gpm)	¼ NPT threads
3-2000-22	198 822 003	High flow, 1.13 to 12.11 lpm (0.3 to 3.2 gpm)	ISO 7/1-R1/4 threads

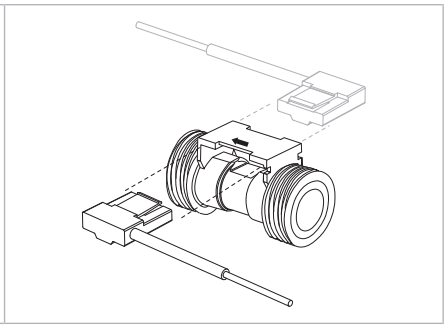


Accessories

Mfr. Part	Code	Description
3-2000.390	159 000 248	Replacement rotor kit
1220-0029	198 820 049	Cover O-ring
2450-0620	198 820 051	Cover screw, each
5523-0222	159 000 392	Cable (per foot), 2 cond. w/shield, 22 AWG
3-8050-1	159 000 753	Universal junction box

Type 2100 Turbine Flow Sensor





Product description

Engineered specifically for small pipe diameter applications, the type 2100 Turbine Flow Sensor provides accurate readings in two flow ranges: 0.3 to 3.8 lpm and 3 to 38 lpm (0.1 to 1 gpm and 0.8 to 10 gpm).

The injection-molded PVDF body and ceramic bearings provide excellent chemical compatibility and long service in dosing and batching applications. Union piping and tubing connections along with removable NEMA 4X electronics allow for easy assembly and field replaceability. The 2100 can be used with DN8 (¼ in.), DN10 (3/8 in.), DN15 (½ in.) tubing, or DN15 (½ in.) piping for simple installation. End connections are available in PVDF for hose barbs, fusion socket or IR/ butt fusion, and in PVC for socket or NPT thread.

Features

- Operating range of 0.38 to 38 lpm (0.10 to 10 U.S. gpm)
- Non-magnetic turbine
- Union ends for various connector types
- End connector kits for rigid or flexible tubing or DN15 (½ in.) pipe
- PVDF & ceramic wetted parts provide superior chemical compatibility
- For use with both clear and opaque fluids
- Small and compact design
- 4.6 m (15 ft) cable
- Features removable electronics that installs from either side of the sensor

Applications

- Chemical Addition
- Textile Dyeing
- High-purity Chemical Dispensing
- Water Addition
- Fertigation
- Dosing
- Pump Protection
- Not suitable for gases

Technical Details

General		
Flow Range	-L = 0.38 to 3.8 lpm	(0.10 to 1 U.S gpm)
	-H = 3 to 38 lpm	(0.8 to 10 U.S gpm)
Accuracy	±3% of reading	
Repeatability	±0.5% of reading	
Pipe Size Range	DN15 (½ in.)	
Tubing Size	DN8 (¼ in.), DN10 (⅜ in.), DN15 (½ in.)	

Wetted Materials	
Sensor Body/Rotor	PVDF
Shaft/Bearings	Ceramic
O-rings	-1 = FKM, -2 = EPR (EPDM)
Electronics Housing	PBT (polybutylene terephtalate)
	EVA (ethylene vinyl acetate)

Electrical	
Power	5 to 24 VDC ±10%, regulated, 1.5 mA max.
	Reverse polarity protected
Output	Open collector, sinkin, max 30 mA, (S³L)
Cable Length	4.6 m (15 ft) can be extended up to 300 m (1'000 ft)
Cable type	PVC jacketed, 2 conductor twisted pair with shield (22 AWG)

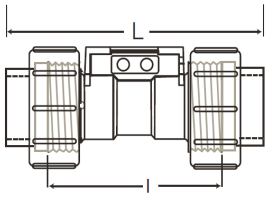
Max. Temperature/Pressure Rating		
	16 bar @ 20 °C	232 psi @ 68 °F
	9.3 bar @ 70 °C	130 psi @ 158 °F
Operating Temperature	-20 °C to 70 °C	-4 °F to 158 °F
Storage Temperature	-15 °C to 80 °C	5 °F to 176 °F

Shipping Weight		
	0.15 kg	0.33 lb

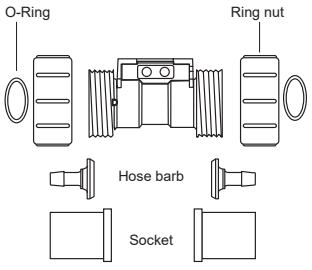
Standards and Approvals
CE, UKCA, FCC
RoHS compliant, China RoHS
Manufactured under ISO 9001, ISO 14001 and ISO 45001

Dimensions

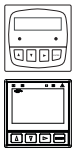
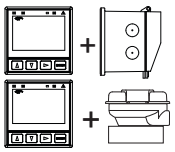
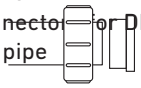
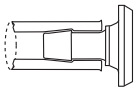
L = overall length		
All sockets	102 mm	4 in.
Butt fusion/IR	170 mm	6.7 in.
¼ in. Barb	124 mm	4.9 in.
⅜ in. Barb	127 mm	5 in.
½ in. Barb	132 mm	5.2 in.



l = 64 mm (2½ in.) Electronics module



System Overview

Panel Mount	Pipe, Tank, Wall	Automation System
GF Instruments - 9900-1P - 9900-1BC - 9950 	GF Instruments - 9900-1P with Rear Enclosure - 9900-1 with 3-8050 Universal Mount Kit* 	- 0486 Profibus Concentrator and Customer Supplied Programmable Logic Controller or - Programmable Automation Controller 
Type 2100 Sensor		**All sold separately**
End Connector options	Fusion, threaded or solvent socket connectors for DN15 (1/2 in.) pipe 	Hose barb connectors for DN8, DN10, or DN15 (1/4 in., 3/8 in. or 1/2 in.) flexible tubing 

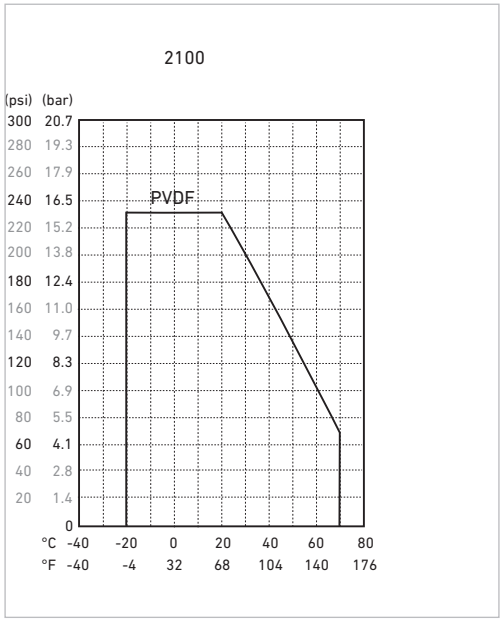
Application Tips

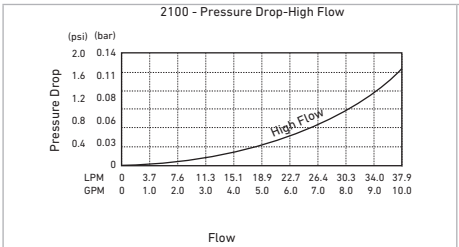
- All socket and hose barb connector kits are sold individually. Two kits are required for each sensor.

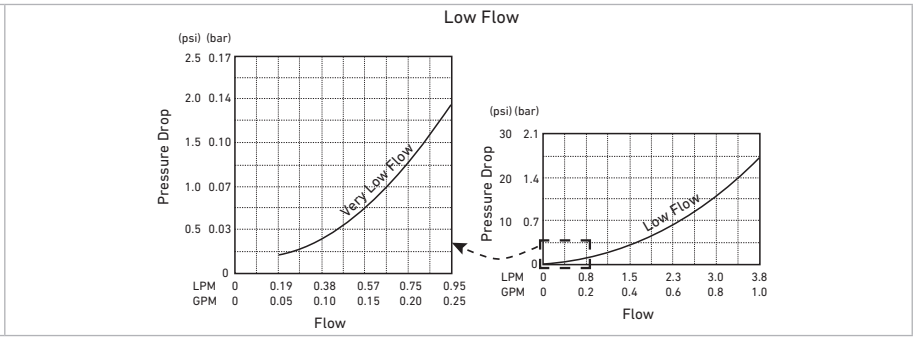
Pressure-temperature diagram

Note

The pressure-temperature diagrams are specifically for the GF sensor. During system design the specifications of all components must be considered. In the case of a metal piping system, a plastic sensor will reduce the system specification. When using a PVDF sensor in a PVC piping system, the fitting will reduce the system specification.

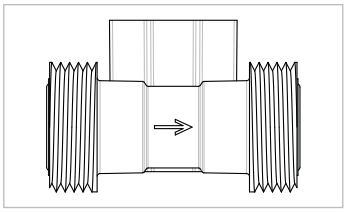






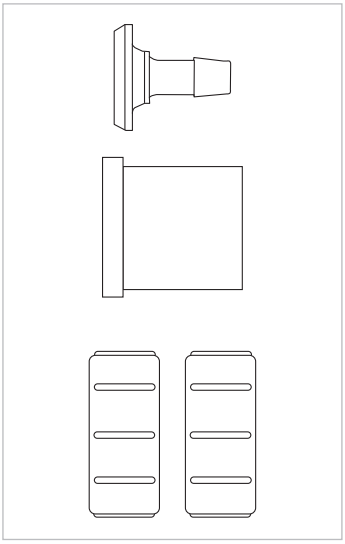
Ordering Information

Mfr. Part No.	Code	O-ring Material	Flow Range
Turbine flow sensor, PVDF body and rotor, for use with various end-connectors			
3-2100-1L	159 000 001	FKM	Low, 0.38 to 3.8 lpm (0.10 to 1 gpm)
3-2100-2L	159 000 003	EPR (EPDM)	Low, 0.38 to 3.8 lpm (0.10 to 1 gpm)
3-2100-1H	159 000 002	FKM	High, 3 to 38 lpm (0.8 to 10 gpm)
3-2100-2H	159 000 004	EPR (EPDM	High, 3 to 38 lpm (0.8 to 10 gpm)



* Note: To install this flow sensor, end fittings must be installed on both ends of the sensor

Mfr. Part No.	Code	Type of End Fitting
End fitting for type 2100 sensor		
3-2100-31	159 000 005	Hose barb connector kit, PVDF, ½ inch (1-hose barb and 1-ring nut)
3-2100-32	159 000 006	Hose barb connector kit, PVDF, ⅜ inch (1-hose barb and 1-ring nut)
3-2100-33	159 000 007	Hose barb connector kit, PVDF, ¼ inch (1-hose barb and 1-ring nut)
3-2100-34	159 000 008	Fusion socket connector, PVDF, d20 (1-fusion socket and 1 ring nut)
3-2100-35	159 000 009	Butt Fusion/IR connector kit, PVDF, d20, DN15 (1-IR socket and 1 ring nut)
3-2100-36	159 000 010	Metric socket connector kit, PVC, d20 (1-solvent socket and 1 ring nut)
3-2100-37	159 000 011	SCH 80 socket connector kit, PVC, ½ inch (1-solvent socket and 1 ring nut)
3-2100-38	159 000 012	NPT thread socket connector kit, PVC, ½ inch (1-threaded socket and 1 ring nut)



Accessoires

Mfr. Part	Code	Description
1220-0018	159 000 019	O-rings FKM (2 required per sensor)
1224-0018	159 000 020	O-rings EPR (EPDM) (2 required per sensor)
3-8050-1	159 000 753	Universal Junction Box with terminal blocks for cable extension

Type 2507 Mini Flow Sensor



Product description

The type 2507 Mini Flow Sensor contains a free-running rotor that is driven by the fluid flow. Within the given measurement range, the rotational speed of the rotor is proportional to the fluid flow rate.

Magnets built into the rotor trigger an electronic switch in the top of the sensor creating a square-wave output. Both opaque and transparent fluids can be measured with kinematic viscosities between 0.2 to 20.0 centistokes.

Features

- Operating range 100 to 12,000 ml/m (0.026 to 3.2 U.S. gpm)
- Detachable signal connector for easy servicing
- Simple installation with a G 1/4 in. (¼ in. NPT) threaded connection
- Standard 7.6 m (25 ft) cable
- PVDF construction
- Compact assembly

Applications

- Fluid Dispensing
- Laboratory and Clinical Wet Benches
- Chemical Dosing
- Batch Processes

Technical Details

General			
Operating Range	-1V sensor	100 to 2'000 mL/m	(0.026 to 0.528 U.S. gpm)
	-2V sensor	400 to 2'800 mL/m	(0.105 to 0.740 U.S. gpm)
	-3V sensor	700 to 4'200 mL/m	(0.185 to 1.123 U.S gpm)
	-4V sensor	1'300 to 6'000 mL/m	(0.343 to 1.585 U.S gpm)
	-6V sensor	3'200 to 12'000 mL/m	(0.845 to 3.170 U.S gpm)
Accuracy	±2% of reading		
Repeatability	±0.25% of full range		
Viscosity range	0.2 to 20.0 centistokes		
Connections	G ¼ in. ports, ¼ in. NPT pipe adapters (2 included)		

Wetted Materials	
Housing	PVDF
Flow insert	PTFE
Quad ring seal	FKM
Rotor	PVDF
Pipe thread adapters	PVDF

Electrical	
Power	5 to 24 VDC ±10 %, regulated, 10 mA max.
Output type	Open-collector, sinking, 10 mA max.
Cable Length	7.6 m (25 ft), can be extended up to 300 m (1000 ft)
Cable type	2-conductor shielded twisted-pair, 22 AWG

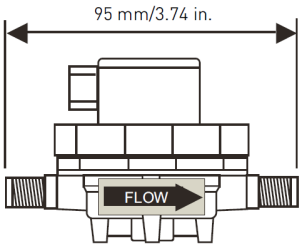
Max. Temperature/Pressure Rating		
	5.5 bar @ -18 °C	80 psi @ 0 °F
	5.5 bar @ 24 °C	80 psi @ 75 °F
	3 bar @ 120 °C	45 psi @ 248 °F

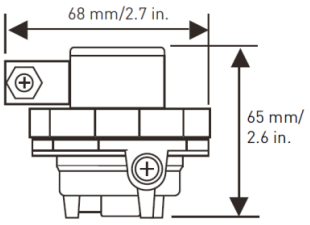
Shipping Weight	
	0.115 kg	0.25 lb

Standard and Approvals
CE, UKCA, FCC
RoHS compliant, China RoHS
Manufactured under ISO 9001, ISO 14001 and ISO 45001

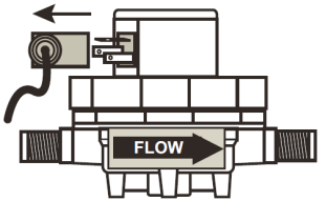
Dimensions

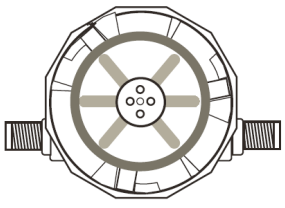
Detachable Signal Connector





Top View(cover removed)

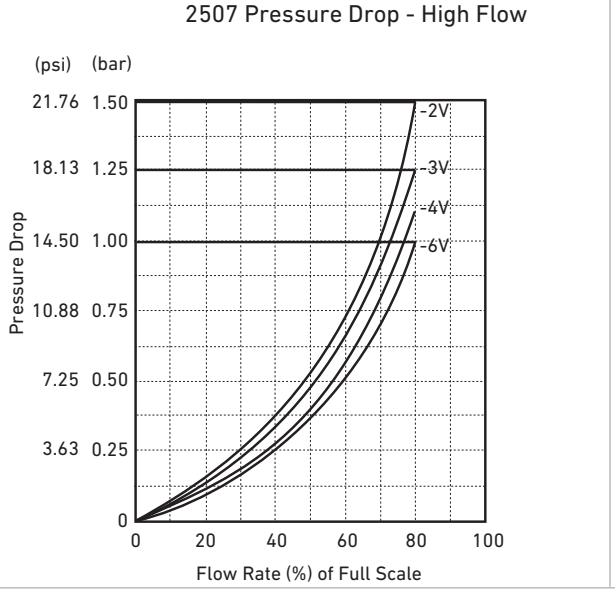


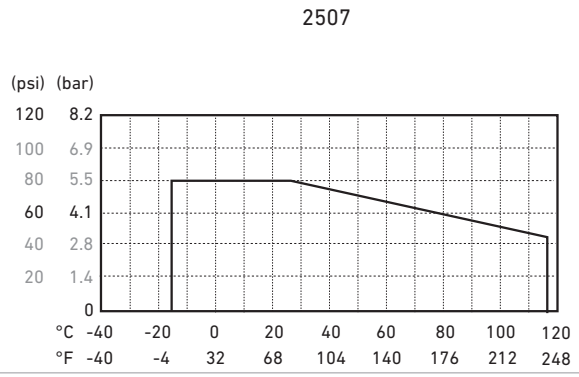


Pressure-temperature diagram

Note

The pressure-temperature diagrams are specifically for the GF sensor. During system design the specifications of all components must be considered. In the case of a metal piping system, a plastic sensor will reduce the system specification. When using a PVDF sensor in a PVC piping system, the fitting will reduce the system specification.





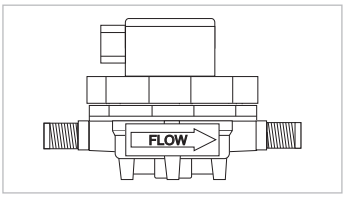
Application Tips

- Use the threaded ports on bottom of sensor to secure the sensor to any flat surface.
- The range of any sensor can be changed by replacing the flow insert.
- Suitable only for clean fluids without particles.

System Overview

Panel Mount	Pipe, Tank, Wall	Automation System
GF Instruments - 9900-1P - 9900-1BC - 9950	GF Instruments - 9900-1P with Rear Enclosure - 9900-1 with 3-8050 Universal Mount Kit	- 0486 Profibus Concentrator and Customer Supplied Programmable Logic Controller or - Programmable Automation Controller
Type 2507 Sensor		**All sold separately**
GF Pipe Fitting Adapters (two included) Used to convert the sensor's G1/4 in. straight threads into 1/4 in. NPT threads		

Ordering Information



Mfr. Part No	Code	Insert Option
Mini Flow low flow sensor with free-running rotor		
3-2507.100-1V	198 801 731	With 1 mm insert; for 0.026 to 0.528 gpm (100 to 2000 mL/m)
3-2507.100-2V	198 801 732	With 2 mm insert; for 0.15 to 0.740 gpm (400 to 2800 mL/m)
3-2507.100-3V	198 801 733	With 3 mm insert, for 0.185 to 1.123 gpm (700 to 4200 mL/m)
3-2507.100-4V	198 801 734	With 4 mm insert, for 0.343 to 1.585 gpm (1300 to 6000 mL/m)
3-2507.100-6V	198 801 736	With 6 mm inlet, no insert, for 0.845 to 3.170 gpm (3200 to 12000 mL/m)

Accessories and replacement parts

Mfr. Part	Code	Description
3-2507.080-2	198 801 550	Rotor, 2507
3-2507.080-3	198 801 547	Quad ring, 2507
3-2507.080-5	198 801 508	DIN connector, 2507
3-2507.081-1	198 801 548	1 mm insert
3-2507.081-2	198 801 502	2 mm insert
3-2507.081-3	198 801 503	3 mm inser
3-2507.081-4	198 801 558	4 mm insert
5523-0222	198 000 392	Cable (per foot), 2 cond. w/shield, 22 AWG

Planning Fundamentals

of Measurement and Control

Variable Area Flowmeters

Content

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Type 335/350/123 Variable Area Flowmeter 317

Introduction

Principles of operation

Variable Area Flow Meters

If a medium flows upwards through the vertically mounted measuring tube at a sufficient flow velocity, the float is raised to the point at which a state of equilibrium sets in between the lifting force of the medium and the weight of the float. As the mean flow velocity is proportional to the quantity flowing through per unit of time, this state of equilibrium corresponds to the measurement of the current flow volume.

Installation of Variable Area Flow Sensors

Installation notes

- Variable area flow meters are not recommended for media containing solids.
- To avoid unstable flow conditions, a damping zone must be considered before and after the variable area flow meter.
- The maximum permitted pressure for gases is 0.5 bar.

Type 335/350/123 Variable Area Flowmeter



Variable area flow meter Type 335	Variable area flow meter Type 350	Variable area flow meter Type 123 (short version)	Variable area flow meter Type 335 PVDF-HP

Product description

Variable area flowmeters Type 335/350 and 123 are radially installed, dismountable meters for measuring the flow rate in industrial piping system constructions. The measuring principle is advanced and efficient. The measurement ranges, which are tailored to our customers' needs, and the range of materials available for the tubes and screwed fittings, allow the flow meters to be used for a wide range of applications and a great variety of media.

Function

If a medium flows upwards through the vertically mounted measuring tube at a sufficient flow velocity, the float is raised to the point at which a state of equilibrium sets in between the lifting force of the medium and the weight of the float. As the mean flow velocity is proportional to the quantity flowing through per unit of time, this state of equilibrium corresponds to the measurement of the current flow volume.

Applications

- Water treatment
- Chemical process industry
- Microelectronics
- Food industry
- Ship building
- Building services engineering

Benefits/features

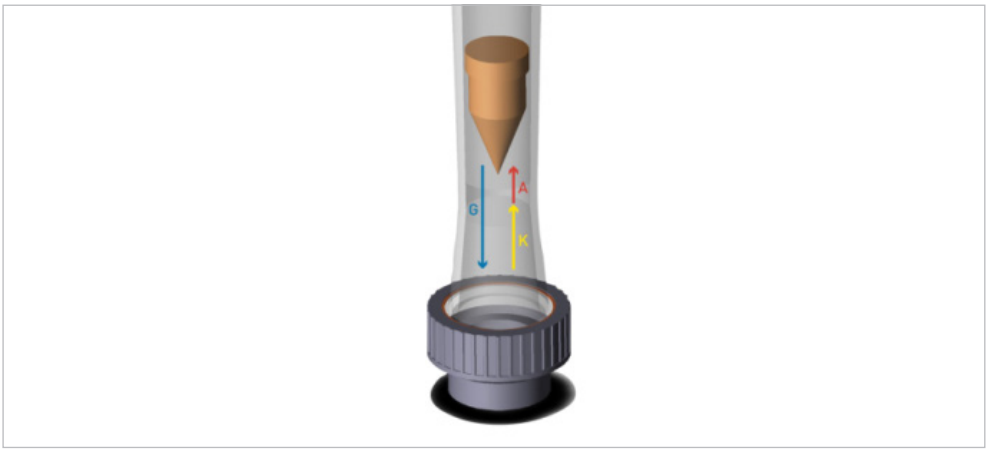
- Easy and cost effective measurement principle
- No additional energy required for operation
- Easy reading of the measured value
- Available scale range from 50 l/h up to 60'000 l/h
- Printed double scale for water in percent and l/h
- Special scales for liquid and gaseous media can be attached
- Wide range of materials
- Break-proof and corrosion resistant
- Large dimensions with guiding rod (PVDF-coated)

Flow media

For liquid media and air (at max. 0.5 bar), see online tool ChemRes PLUS.

Handling

Measurement principle



G Weight force
A Buoyant force
K Flow force

All flow meters are equipped with a double scale: a percent scale as well as a scale for the flow rate in l/h for water (H_2O). In addition, special scales in m^3/h, GPM and special scales for HCL, NaOH and air are available and can be subsequently attached to the measuring tubes without a scale. More scales are available on request.

Accurate reading

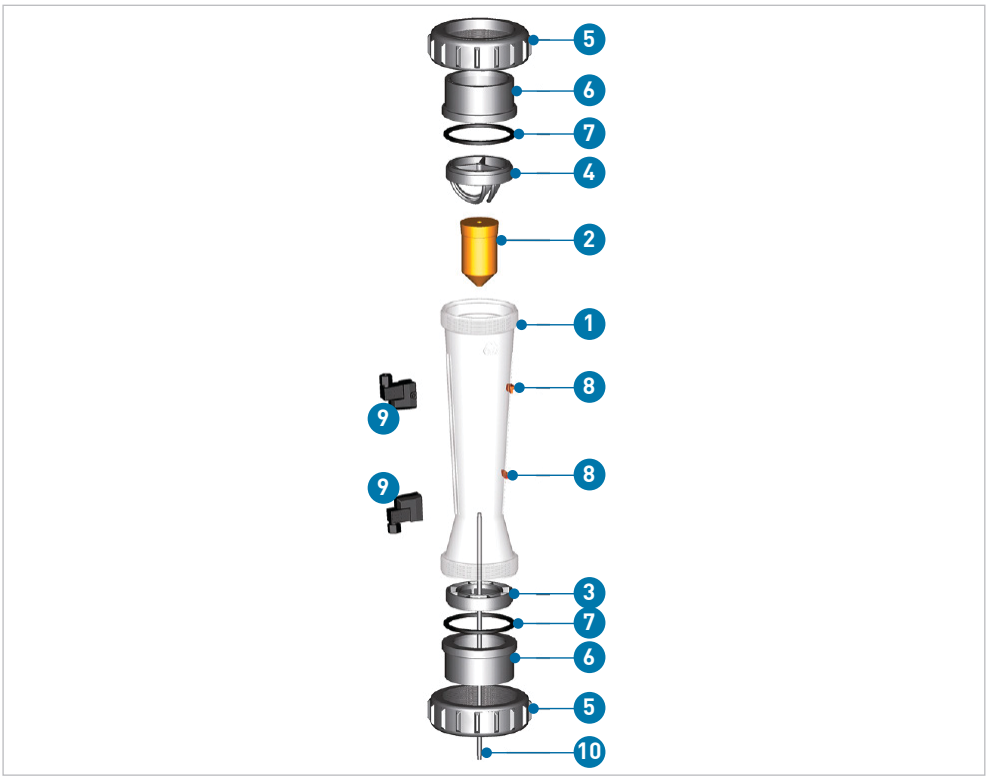
The top edge of the float with the largest diameter indicates the flow volume. If special scales are applied subsequently, it is important to ensure that the scale marking >< is affixed so that it aligns precisely with the one on the measuring tube.

Installation notes

- Variable area flow meters are not recommended for media containing solids.
- To avoid unstable flow conditions, a damping zone must be considered before and after the variable area flow meter.
- The maximum permitted pressure for gases is 0.5 bar.

⚠ Installation and maintenance must be performed in accordance with the corresponding installation manual. The installation manual is provided with the product, see also the online product catalogue at www.gfps.com

Technical data



1 Taper tube
2 Float
3 Bottom insert
4 Top insert
5 Union nut
6 Union end
7 O-Ring
8 Flow value indicator
9 Limit contact [1]
10 Guiding rod [2]

[1] Optional
[2] Only for DN50 and DN65

Specification		
Dimensions	Type 335	d32/DN25 - d75/DN65, 1" - 2 ½"
	Type 350	d32/DN25 - d75/DN65, 1" - 2 ½"
	Type 123 (short version)	d16/DN10 - d32/DN25, 3/8" - 1"
	Special version	d32/DN25 - d75/DN65, 1" - 2 ½"
Taper tube materials	Type 335	PA, PSU, PVC-U transparent
	Type 350	PA, PSU, PVC-U transparent
	Type 123 (short version)	PVC-U transparent, PSU
	Special version	PSU-HP
Float materials	PVDF, PTFE*	
Gasket material	O-rings	EPDM, FKM
Pressure rating	PN10	
Scale ranges	Type 335	50 - 60'000 l/h
	Type 350	50 - 60'000 l/h
	Short version	2.5 - 1'000 l/h
	Special version	50 - 30'000 l/h
Connections	Type 335, 350, SK	PVC-U solvent cement sockets
	Special version	PVDF-HP fusion spigots
	Additional designs and materials (e.g. stainless steel) upon request	

*special version type 123

Pressure losses

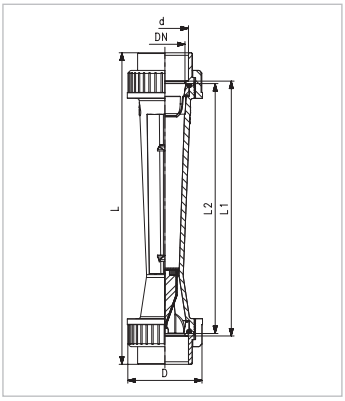
Pressure loss of type 335/350		
Scale range (l/h)	Type	Pressure loss (mbar)
50 - 500	335 / 350	22.84
100 - 1'000	335 / 350	22.84
150 - 1'500	335 / 350	22.84
250 - 2'500	335 / 350	22.84
200 - 2'000	335 / 350	24.99
300 - 3'000	335 / 350	24.99
600 - 6'000	335 / 350	24.99
1'000 - 10'000	335 / 350	24.99
1'500 - 15'000	335 / 350	28.23
2'000 - 20'000	335 / 350	45.67
3'000 - 30'000	335 / 350	45.67
8'000 - 60'000	335 / 350	47.24

Pressure loss of type 123 (short version)		
Scale range (l/h)	Type	Pressure loss (mbar)
2.5 - 25	SK 50/500	4.31
5 - 50	SK 51/510	4.31
10 - 100	SK 52/520	4.31
8 - 80	SK 60/600	8.14
15 - 150	SK 61/610	8.14
20 - 200	SK 62/620	8.14
15 - 150	SK 70/700	4.51
30 - 300	SK 71/710	4.51
50 - 500	SK 72/720	4.51
100 - 1'000	SK 73/730	4.51

Dimensions

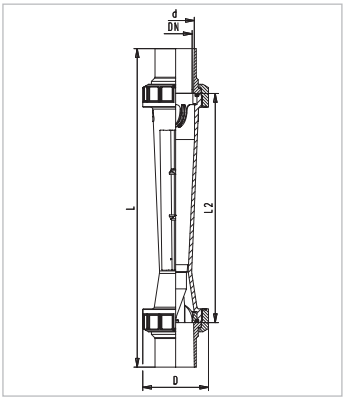
Type 335

Scale range (l/h)	Type	D (mm)	DN (mm)	L (mm)	L1 (mm)	L2 (mm)	G (Inch)
50 - 500	335	58	25	385	341	335	1 ½
100 - 1'000	335	58	25	385	341	335	1 ½
150 - 1'500	335	72	32	393	341	335	2
250 - 2'500	335	72	32	393	341	335	2
200 - 2'000	335	83	40	403	341	335	2 ¼
300 - 3'000	335	83	40	403	341	335	2 ¼
600 - 6'000	335	83	40	403	341	335	2 ¼
600 - 6'000	335	101	50	417	341	335	2 ¾
1'000 - 10'000	335	101	50	417	341	335	2 ¾
1'500 - 15'000	335	101	50	417	341	335	2 ¾
2'000 - 20'000	335	135	65	429	341	335	3 ½
3'000 - 30'000	335	135	65	429	341	335	3 ½
8'000 - 60'000	335	135	65	429	341	335	3 ½



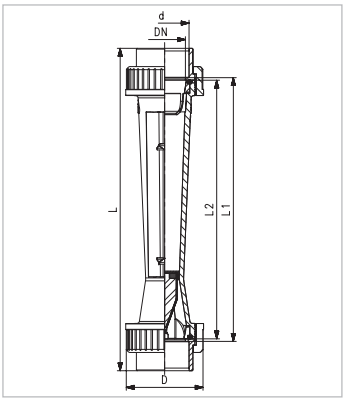
Special version type 335 PVDF-HP

Scale range (l/h)	Type	D (mm)	DN (mm)	L (mm)	L2 (mm)	G (Zoll)
100 - 1'000	335	60	25	453	335	1 ½
300 - 3'000	335	83	40	466	335	2 ¼
600 - 6'000	335	83	40	466	335	2 ¼
1'000 - 10'000	335	101	50	472	335	2 ¾
1'500 - 15'000	335	101	50	472	335	2 ¾
2'000 - 20'000	335	122	65	495	335	3 ½
3'000 - 30'000	335	122	65	495	335	3 ½



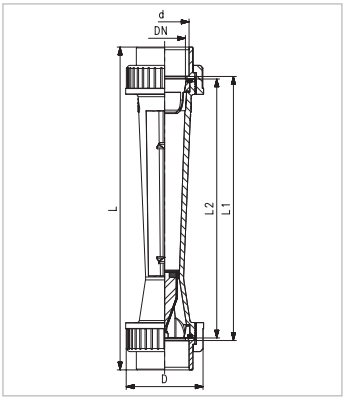
Type 350

Scale range (l/h)	Type	D (mm)	DN (mm)	L (mm)	L1 (mm)	L2 (mm)	G (Inch)
50 - 500	350	58	25	400	356	350	1 ½
100 - 1'000	350	58	25	400	356	350	1 ½
150 - 1'500	350	72	32	408	356	350	2
250 - 2'500	350	72	32	408	356	350	2
200 - 2'000	350	83	40	418	356	350	2 ¼
300 - 3'000	350	83	40	418	356	350	2 ¼
600 - 6'000	350	83	40	418	356	350	2 ¼
600 - 6'000	350	101	50	432	356	350	2 ¾
1'000 - 10'000	350	101	50	432	356	350	2 ¾
1'500 - 15'000	350	101	50	432	356	350	2 ¾
2'000 - 20'000	350	135	65	444	356	350	3 ½
3'000 - 30'000	350	135	65	444	356	350	3 ½
8'000 - 60'000	350	135	65	444	356	350	3 ½



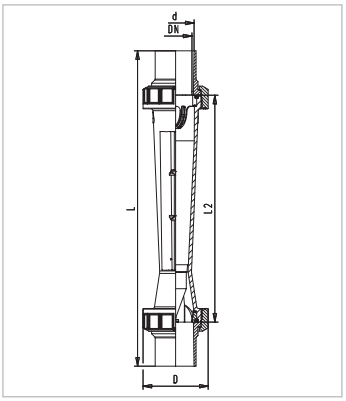
Type 123 (short version)

Scale range (l/h)	Type	D (mm)	DN (mm)	L (mm)	L1 (mm)	L2 (mm)	G (Inch)
2.5 - 25	SK 50/500	35	10	199	171	165	¾
5 - 50	SK 51/510	35	10	199	171	165	¾
10 - 100	SK 52/520	35	10	199	171	165	¾
8 - 80	SK 60/600	43	15	223	191	185	1
15 - 150	SK 61/610	43	15	223	191	185	1
20 - 200	SK 62/620	43	15	223	191	185	1
15 - 150	SK 70/700	60	25	250	206	200	1 ½
30 - 300	SK 71/710	60	25	250	206	200	1 ½
50 - 500	SK 72/720	60	25	250	206	200	1 ½
100 - 1'000	SK 73/730	60	25	250	206	200	1 ½



Special version type 123 PVDF-HP

Scale range (l/h)	Type	D (mm)	DN (mm)	L (mm)	l2 (mm)	G (Inch)
68 - 204	SK 70	60	25	318	200	1 ½
90 - 295	SK 71	60	25	318	200	1 ½
136 - 795	SK 73	60	25	318	200	1 ½



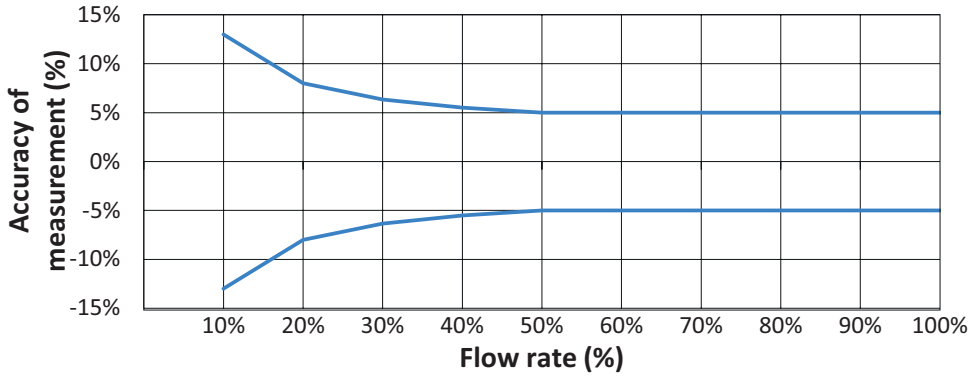
Measuring accuracy

Type 335/350

Measuring accuracy according to VDI/VDE 3513, error limit value G = 5%, range of linearity q_G= 50%, this means up to max. +/- 5% of the final value.

Flow rate in %	10	20	30	40	50	60	70	80	90	100
Total measurement error % of measured value	13.0	8.0	6.3	5.5	5.0	5.0	5.0	5.0	5.0	5.0
Total measurement error % of full scale value	1.3	1.6	1.9	2.2	2.5	3.0	3.5	4.0	4.5	5.0

Measuring accuracy

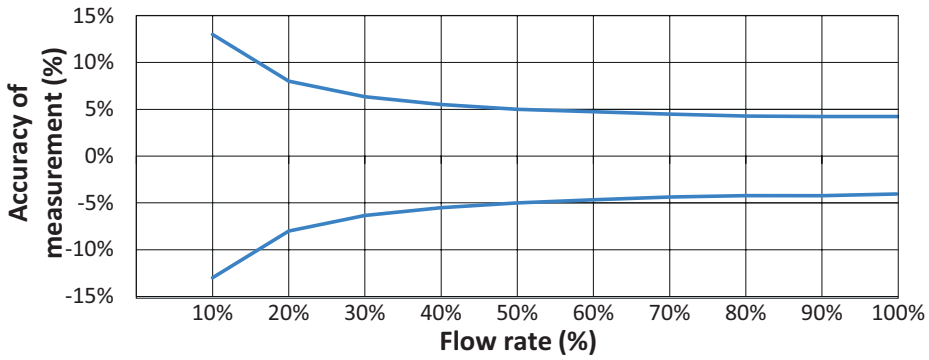


VAFM type 123 (short version)

Accuracy class 4 according VDE/DIN 3513 page 2.

Flow rate in %	10	20	30	40	50	60	70	80	90	100
Total measurement error % of measured value	13.0	8.0	6.3	5.5	5.0	4.7	4.4	4.3	4.1	4.0
Total measurement error % of full scale value	1.3	1.6	1.9	2.2	2.5	2.9	3.1	3.4	3.7	4.0

Measuring accuracy

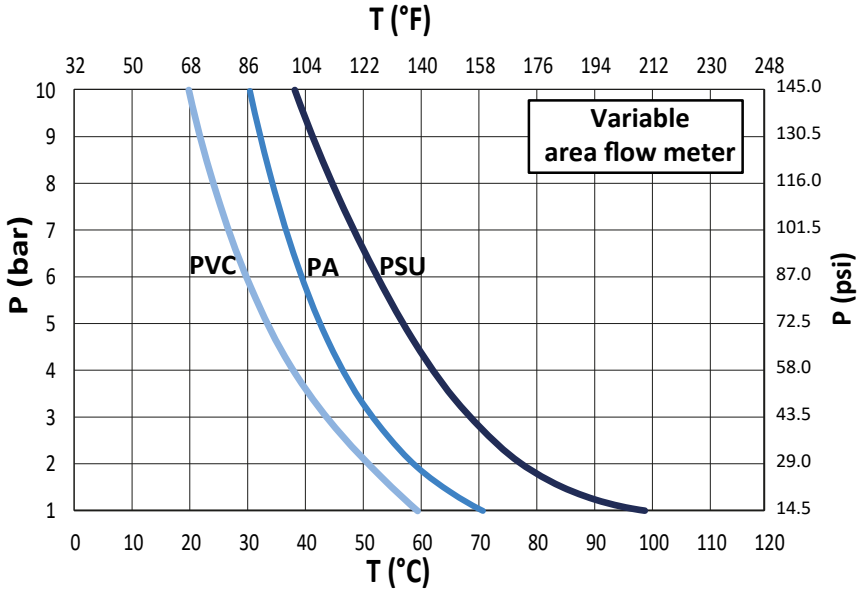


Temperature range

To determine the maximum internal pressure at high temperatures, we refer you to our material-related pressure-temperature diagrams for reference values.

Measuring tube	Union	Max. temperature at 1 bar
PVC-U	PVC-U	0 – 60°C
PA	PVC-U	0 – 60°C
PSU	PVC-U	0 – 60°C
PSU	PVDF	0 – 90°C

Pressure-Temperature diagram



Adjustment factors

Temperature correction table for gases

Operating temperature (°C)	Calibrating temperature (°C)								
	0	10	20	30	40	50	60	70	80
0	1	1.018	1.035	1.052	1.07	1.088	1.103	1.12	1.135
10	0.983	1	1.018	1.035	1.051	1.068	1.084	1.1	1.116
20	0.965	0.983	1	1.015	1.032	1.05	1.065	1.08	1.096
30	0.948	0.966	0.983	1	1.015	1.031	1.047	1.062	1.08
40	0.933	0.95	0.967	0.984	1	1.015	1.031	1.046	1.061
50	0.92	0.936	0.953	0.968	0.984	1	1.015	1.03	1.045
60	0.905	0.922	0.938	0.955	0.968	0.985	1	1.015	1.03
70	0.892	0.907	0.924	0.94	0.955	0.97	0.985	1	1.014
80	0.88	0.895	0.912	0.927	0.943	0.965	0.971	0.987	1

Example

Calibrating temperature is 20 °C and operating temperature is 70 °C. Take the factor 0.924 from the calibrating temperature column for 20 °C and the operating temperature row for 70 °C. The values shown by the flow meter have to be multiplied by this factor in order to calculate the actual flow volume at an operating temperature of 70 °C. Use the following formula to get the factor:

$$\sqrt{\frac{Tc + 237}{To + 237}} = \sqrt{\frac{20 + 237}{70 + 237}} = 0.924$$

T_c Calibrating temperature
T_o Operating temperature

Note

Operating temperature > calibrating temperature: factor < 1
Operating temperature < calibrating temperature: factor > 1

Density correction table for liquids

Density of operating liquid (kg/l)	Density of liquid (kg/l) float material PVDF							
	0.5	0.6	0.7	0.8	0.9	1	1.1	1.2
0.5	1	1.105	1.2	1.29	1.38	1.464	1.545	1.63
0.6	0.903	1	1.084	1.168	1.248	1.32	1.397	1.475
0.7	0.834	0.923	1	1.078	1.15	1.22	1.29	1.36
0.8	0.775	0.856	0.928	1	1.066	1.133	1.196	1.262
0.9	0.724	0.802	0.87	0.937	1	1.06	1.12	1.18
1.0	0.683	0.755	0.818	0.883	0.94	1	1.055	1.114
1.1	0.645	0.715	0.771	0.836	0.892	0.946	1	1.055
1.2	0.613	0.678	0.735	0.793	0.845	0.896	0.947	1
1.3	0.585	0.648	0.7	0.755	0.807	0.857	0.903	0.955
1.4	0.56	0.62	0.671	0.723	0.773	0.82	0.865	0.913
1.5	0.537	0.595	0.645	0.695	0.743	0.787	0.832	0.877
1.6	0.515	0.57	0.618	0.665	0.712	0.755	0.798	0.84
1.7	0.496	0.548	0.595	0.641	0.685	0.726	0.767	0.81
1.8	0.478	0.538	0.574	0.617	0.66	0.7	0.74	0.78
1.9	0.462	0.511	0.555	0.597	0.638	0.676	0.715	0.755
2.0	0.446	0.495	0.536	0.578	0.617	0.654	0.691	0.73

Density of operating liquid (kg/l)	Density of liquid (kg/l) float material PVDF							
	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2
0.5	1.71	1.785	1.86	0.94	2.02	2.09	2.16	2.24
0.6	1.545	1.615	1.68	0.754	1.82	1.89	1.95	2.02
0.7	1.425	1.49	1.55	1.615	1.68	1.745	18	1.865
0.8	1.325	1.38	1.43	1.5	1.56	1.62	1.67	1.73
0.9	1.24	1.295	1.35	1.405	1.46	1.515	1.57	1.62
1.0	1.17	1.22	1.27	1.325	1.375	1.43	1.48	1.53
1.1	1.106	1.155	1.2	1.255	1.3	1.35	1.4	1.45
1.2	1.05	1.095	1.14	1.19	1.235	1.28	1.33	1.37
1.3	1	1.044	1.088	1.134	1.176	1.22	1.264	1.305
1.4	0.958	1	1.042	1.085	1.13	1.17	1.21	1.25
1.5	0.92	0.96	1	1.042	1.084	1.125	1.16	1.205
1.6	0.882	0.92	0.958	1	1.04	1.08	1.11	1.15
1.7	0.848	0.886	0.923	0.961	1	1.038	1.072	1.11
1.8	0.817	0.853	0.888	0.926	0.962	1	1.032	1.07
1.9	0.79	0.826	0.858	0.897	0.93	0.968	1	1.034
2.0	0.798	0.798	0.83	0.867	0.9	0.935	0.965	1

The data in the table serve to correct the values displayed by the flow meter for gaseous media when the operating temperature deviates from the specific weight of 1.0 kg/l (water) used for the calibration.

Example

Specific weight at calibration 1.0 kg/l (water). The liquid media with a specific weight of 0.9 kg/l is to be measured. If you have a calibrating solution of 1.0 kg/l, you can find the factor 1.06 in column 5 under operating liquid density 0.9 kg/l. The values shown by the flow meter have to be multiplied by this factor in order to calculate the actual flow volume at a specific weight of 0.9 kg/l.

Note

New density is larger: factor < 1

New density is lower: factor > 1

Pressure correction factor for air

This table is used to correct air flow readings when the applied pressure differs from the standard operating pressure. Multiply the displayed value by the corresponding pressure factor to compensate for the pressure deviation.

Pressure (bar)	Operating factor x display value
0.0	1.000
0.1	1.048
0.2	1.095
0.3	1.140
0.4	1.184
0.5	1.225

Accessories

Limit contacts type GK10/11



Variable area flow meters from GF Industry & Infrastructure Flow Solutions are equipped with two dovetail guides. For external electrical monitoring, these can be used for fitting magnetically actuated limit contacts.

Function of the limit contact (GK)

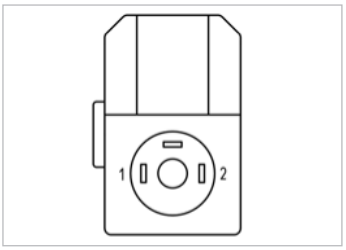
The limit contact serves to monitor externally the limited flow values and can be adjusted to any flow value on the corresponding scale. The magnet built into the float closes or opens a reed contact in the limit contact. This is a bistable switching function, the switching status remains when the float is taken from the contact.

Note: When subsequently mounting limit contacts, mind that you have to replace the standard float with a magnetic float.

The limit contacts GK10/GK11 are only suitable for the VAFM type 335/350 as well as the short version of the existing range. The same contact type can not be used for monitoring both the min. and max. levels (GK10 min./GK11 max.).

Even a brief overshoot is not permitted. This is uncontrollable with inductive or capacitive peaks, e.g. with solenoid valves. Therefore it is recommended to use a limit valve switch or a contact protection relay.

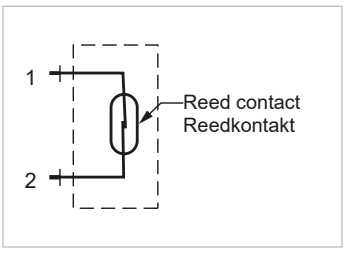
Technical data	
Connection	Standard connector DIN 40050
Contact fitted	Dry reed contact
Protection rating	IP 65
Max. nominal voltage	250 V
Max. switching rating	10W / 10VA
Max. Peak-switching current	0.5 A
Continuous rating	0.2A
Contact resistance	<150 mOhm
Leakage resistance	$>10^{11}$ Ohm
Ambient temperature	0°C to +55°C
Protection rating	IP65



Contact function

Position of float in relation to limit contacts.

The contacts remain in these positions, even if the float leaves the corresponding contact. When the float moves back to the desired position, the corresponding contact is deactivated.



	Top	Bottom
Max. contact (GK11)	Closed	Open
Min. contact (GK10)	Open	Closed

Assembly

1. Replace the float with a magnetic float
2. Position the limit contact on the dovetail guide of the VAFM
3. Tighten fastening screw

4-20mA measured value sensor type GK15

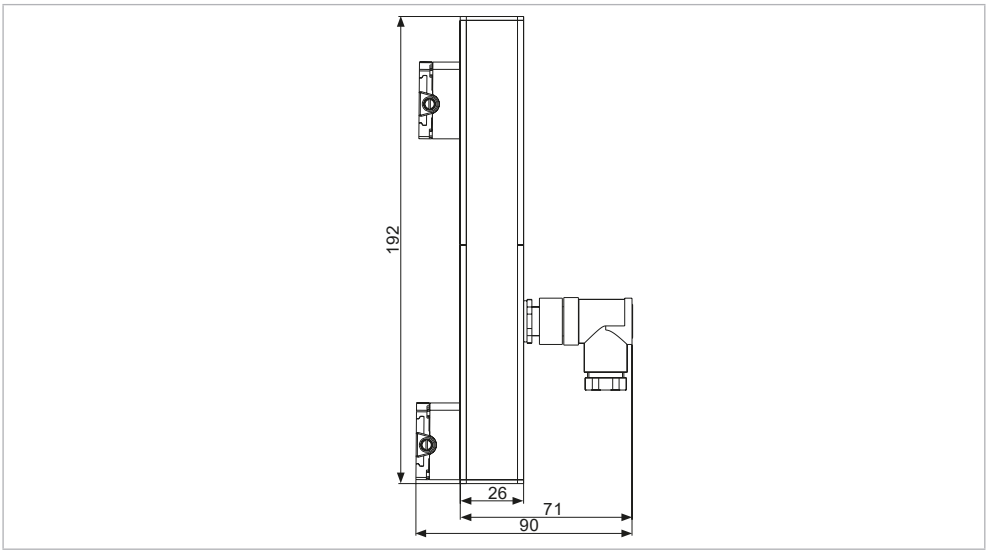


The measured value sensor type GK15 uses a special, newly developed electronic system with a microprocessor and sensors. The GK15 provides an output signal of 4-20mA, according to the level setting of the magnetic float in the flow meter. This signal could be used by a PLC, for example, to control processes or to show the precise flow rate on an external display. For use with inductive loads, use a relay to protect the contacts.

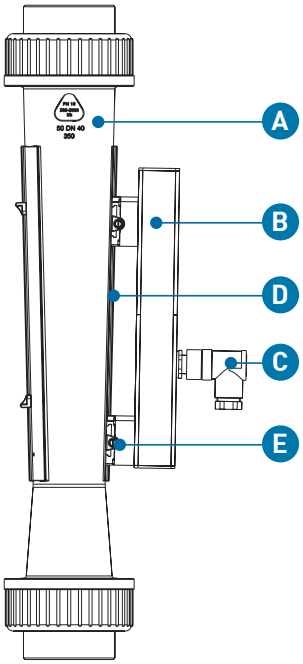
⚠ As the resolution of the various scales differs, the sensor is programmed individually at the factory for each measurement range. Therefore, please identify your required measurement range when you place the order.

Technical data	
Supply voltage	12-24 VDC (+ - 10%)
Current consumption	<50 mA
Load resistance	Min. 0 max. 500 Ω
Current output	4-20mA (3 wire)
Protection rating	IP65
Ambient temperature	0 °C to 50 °C
Process Connection	Plug DIN 43650
Measuring accuracy	<1%

Dimensions



GK15 function elements

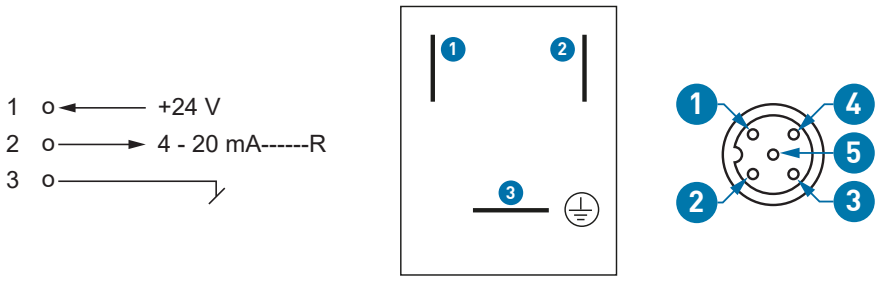


- A Flow Meter type 335/350 with magnetic float
- B Sensor GK15
- C Cable plug
- D Dovetail guide
- E Clamping screws, for fastening and adjusting sensor

Assembly

1. Push the GK15 sensor onto the dovetail guide of the flow meter.
2. Remove the plug and wire according to the wiring diagram.
3. Set the following parameters by measuring the output signal: 10% = 4 mA.
4. Tighten the clamping screws.

Electrical connection



Pin1	Operating voltage 12 – 24 V
Pin2	Output signal 4-20mA
Pin3	0 V
Pin4	Must not be used or wired. For programming only.
Pin5	Must not be used or wired. For programming only.

For further information on accessories, refer to the online product catalogue at www.gfps.com

Planning Fundamentals

of Measurement and Control

Magmeters

Content

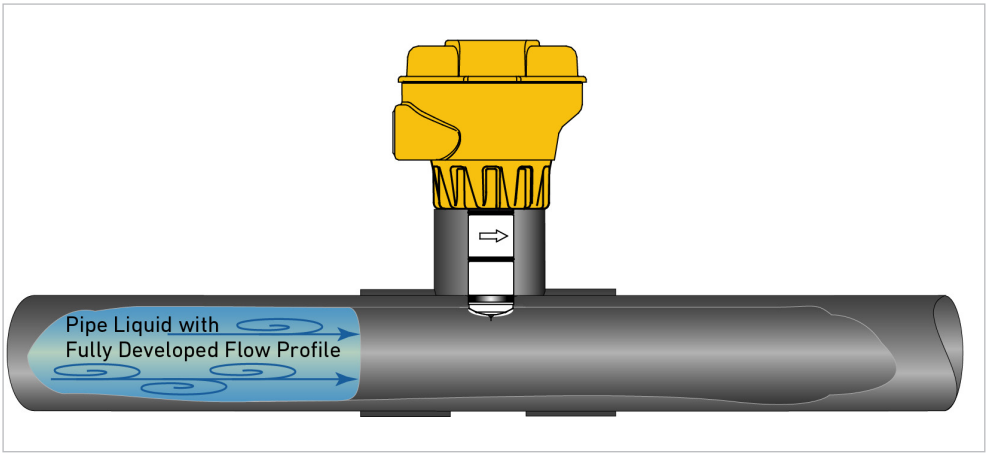
Introduction 330
Type 2581 FlowtraMag® Meter 337
Type 2551 Magmeter Flow Sensor 347
Type 2551 Wet-Tap Magmeter Flow Sensor 355
Type 2552 Metal Magmeter Flow Sensor 359

Introduction

Principles of operation

Electromagnetic flow sensors

Electromagnetic flow sensors, like types 2551 and 2552, operate on Faraday's principle of electromagnetic induction, and have no moving parts. As fluid (must be conductive >20 µS) moves through the magnetic field produced at the sensor tip, a voltage occurs that is directly proportional to the fluid velocity. Internal electronics then convert this voltage into a frequency and/or a 4 to 20 mA output. GF electromagnetic flow sensors are insertion-style, suitable for use in a wide range of pipe sizes.



Flow Range Charts Electromagnetic Sensors (GPM)

GPM Flow Rates for DN15 to DN450 (½ in. to 18 in.) pipe sizes

Nominal Pipe Size		2581		2551/2552	
Inch	Metric DN (mm)	Min 0.07 ft/s	Max 33 ft/s	Min 0.15 ft/s	Max 33 ft/s
0.5	15			0.14	31.25
0.75	20			0.25	54.85
1	25	0.14	70.36	0.4	88.89
1.25	32			0.7	153.84
1.5	40	0.389	183	0.95	209.4
2	50	0.59	293.92	1.57	345.15
2.5	65			2.24	492.45
3	80	1.4	660	3.46	760.39
4	100	2.3	1151.22	5.95	1309.4
5	125			9.35	2057.74
6	150			13.51	2971.57
8	200			23.39	5145.63
10	250			36.86	8110.72
12	300			52.87	11632.86
14	350			64.46	14182.6
16	400			85.38	18787.27
18	450			109.25	24038.21
20	500			136.05	29935.43
22	550			165.79	36478.91
24	600			198.47	43668.67
26	650			234.08	51504.69
28	700			272.63	59986.98
30	750			314.12	69115.55
32	800			358.54	78890.38
34	850			405.9	89311.48
36	900			456.2	100378.86
42	1050			624.72	137458.6
48	1200			819.68	180354.77

All numbers with the exception of 2581 are nominal values based on SCH 40 pipe.

2581 is based on SCH 80 PVC pipe.

Flow Range Charts Electromagnetic Sensors (LPM)

LPM Flow Rates for DN15 to DN450 (½ in. to 18 in.) pipe sizes

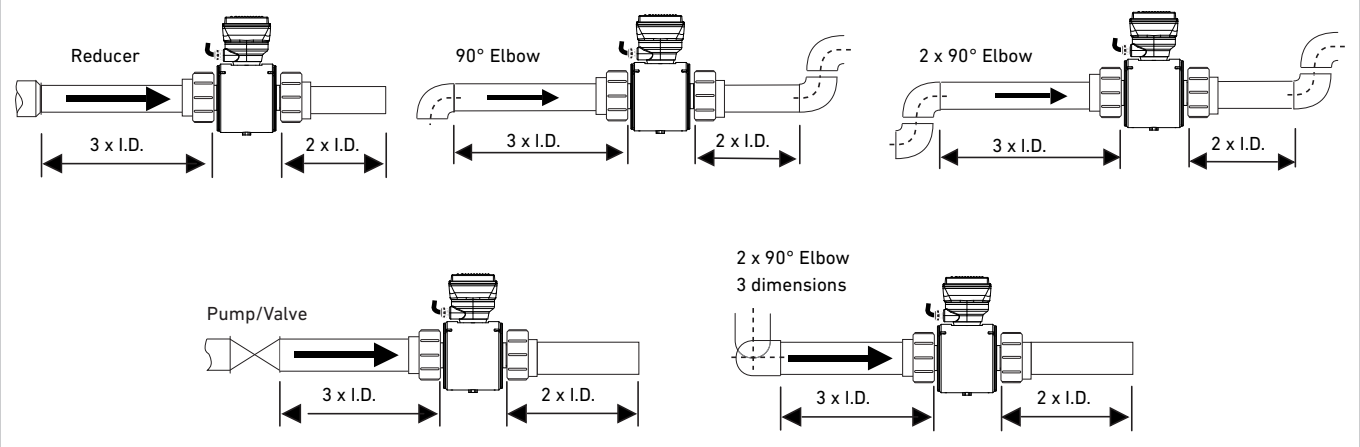
Nominal Pipe Size		2581		2551/2552	
Inch	Metric DN (mm)	Min 0.02 m/s	Max 10 m/s	Min 0.05 m/s	Max 10 m/s
0.5	15			0.59	117.62
0.75	20			1.03	206.43
1	25	0.53	266.35	1.67	334.55
1.25	32			2.89	578.98
1.5	40	1.41	666.13	3.94	788.06
2	50	2.23	1112.6	6.49	1298.94
2.5	65			9.27	1853.32
3	80	5.32	2508.09	14.31	2861.67
4	100	8.72	4357.83	24.64	4927.83
5	125			38.72	7744.17
6	150			55.92	11183.3
8	200			96.83	19365.24
10	250			152.62	30524.15
12	300			218.9	43779.49
14	350			266.88	53375.25
16	400			353.52	70704.64
18	450			452.33	90466.21
20	500			563.3	112659.98
22	550			686.43	137285.94
24	600			821.72	164344.1
26	650			969.17	193834.45
28	700			1128.78	225756.99
30	750			1300.56	260111.73
32	800			1484.49	296898.66
34	850			1680.59	336117.79
36	900			1888.85	377769.11
42	1050			2586.58	517316.23
48	1200			3393.77	678753.1

All numbers with the exception of 2581 are nominal values based on SCH 40 pipe.

2581 is based on SCH 80 PVC pipe.

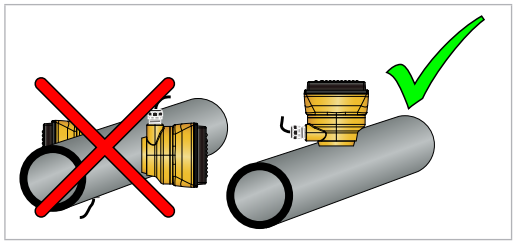
Installation of Flow Sensors: FlowtraMag

The 2581 requires a minimum of 3x ID upstream and 2 x ID downstream of the sensor for best performance.



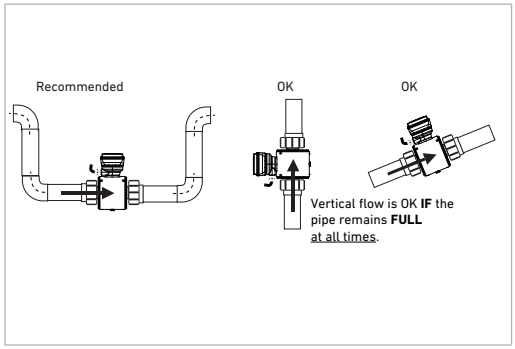
Horizontal Pipe Runs

GF recommends installing the sensor electronics at the 12 o'clock position.



Vertical Pipe Runs

To ensure pipe is flowing full with some back pressure, it is highly recommended that the fluid flows upward.



Gravity and Discharge Lines

It is recommended to install a u-trap to ensure the pipe remains full at all times, and to minimize air bubbles.
A vacuum breaker may be required downstream of the FlowtraMag to ensure pipe doesn't drain and fill with air.

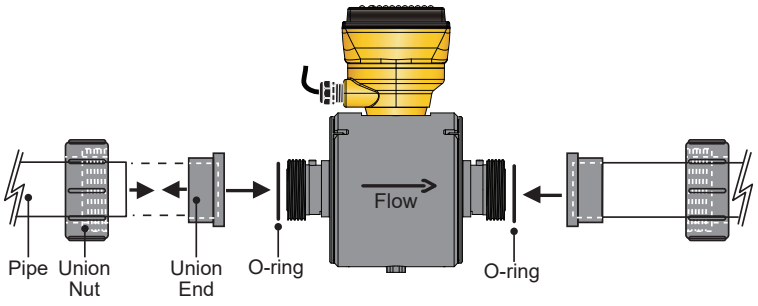
2581 DN25 (1 in.) and DN50 (2 in.) Mounting

1. Choose a mounting location that satisfies the requirements.
2. Select appropriate (Metric or ASTM) union end for installation.
3. Install sensor with flow arrow pointing in the direction of flow.

Note: Gland fittings should point upstream of flow.

2581 DN25 (1 in.)
2581 DN25 (1½ in.)
2581 DN50 (2 in.)
Union Ends

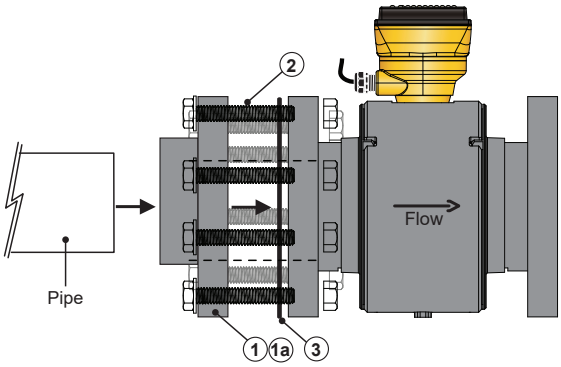
Hand Tighten Only!



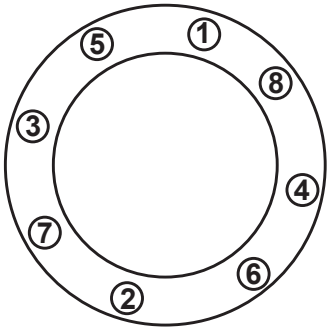
2581 DN100 (4 in.) Mounting

2581 DN100 (4 in.) Bolts
DO NOT OVER TORQUE!
Recommended bolt torque for the DN100 (4") flange of 27-41 Nm. (20 to 30 ft-lbs)

Tighten bolts by first assembling and hand tightening the nuts to position the gasket in place. Then tighten the bolts in a diagonal pattern 50% the recommended torque, then 100% of recommended torque.



Tightening Pattern

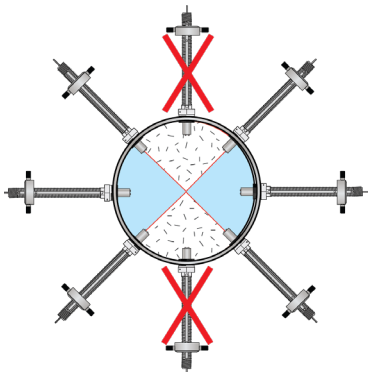


	Part No.	Description
1	854-040	DN100 Flange Adapter, PVC-U Metric
1a	721790114	DN100 Flange Adapter, PVC-U Metric (with backing flange, below)
1a	721700014	DN100 Backing Flange, PVC-U Metric
2	37Z000069	Van Stone Flange Bolt Kit, 8 hole
3	749440714	DN100 Profile Gaskets

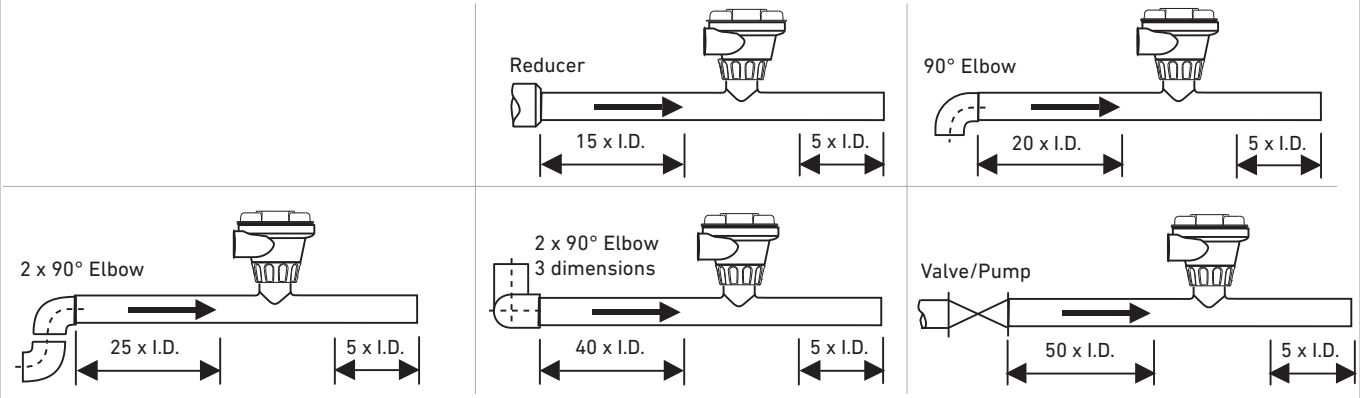
Sold separately, 2 required. See Ordering Information.

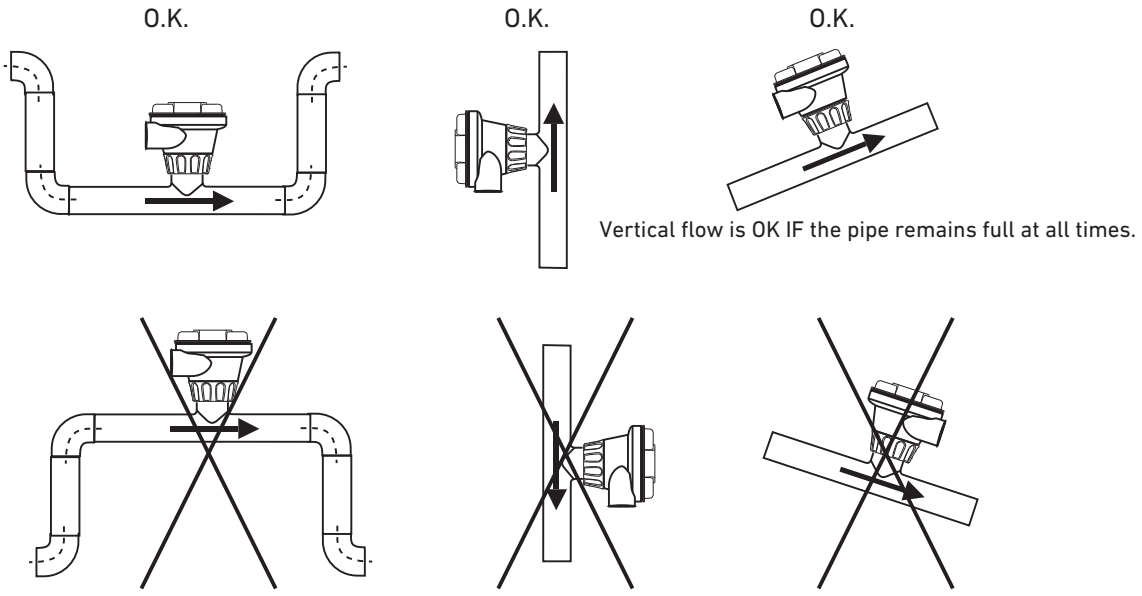
Installation of Flow Sensors: Magnetic Flow Sensors

- All mounting angles are acceptable for these sensors if the basic parameters are met: the pipe must be full with no entrapped air.
- On horizontal pipe runs, sensor may be mounted in any position around the pipe. If air bubbles or sediments are expected, mount at a slight angle.
- On vertical pipe runs, sensor may be mounted in any orientation with UPWARD flow preferred to ensure a full pipe.



12 o'clock and 6 o'clock position not recommended





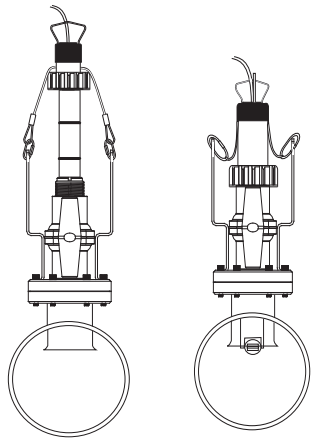
Vertical flow is OK IF the pipe remains full at all times.

Installation of Flow Sensors: Wet-Tap and Hot-Tap Installation

3519 Wet-Tap Valve

- The 3519 Wet-Tap consists of a flange and support plate that threads onto the pipe fitting insert, and a PVC ball valve through which an extended length, wet-tap style sensor is inserted into the pipe.
- No special tools are required to install the 3519.
- The type 3519 Wet-Tap Valve mounts directly onto standard GF installation fittings for the 515 and 2536 flow sensors. The Wet-Tap sensors are identified in their part number as -P3, -P4 and -P5, depending on the pipe size.
- The 3519 Wet-Tap valve can only be installed in an empty pipe. Once installed, the sensor can be removed and re-inserted while the process is active.
- Pressure must be reduced prior to insertion and removal of sensor (please see individual product page for more information).

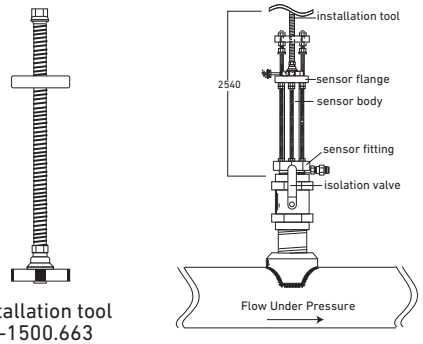
3519 Wet-Tap valve with a 515 Paddlewheel Sensor



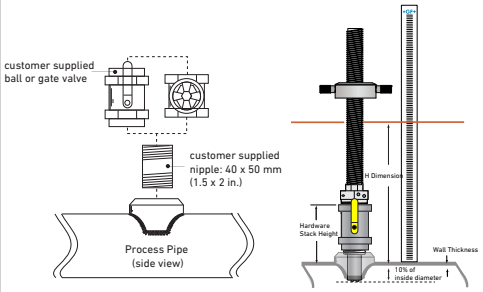
Before insertion After insertion

2540 and 2552 Hot-Tap

- The type 2540 and 2552 Metal High Performance flow sensors accommodate hot-tap installations. One sensor can be installed in various pipe sizes.
- The valve for Hot-Tap sensors can be installed while the pipe is full if a hot-tap drill is used.
- To install a Hot-tap sensor, you will need a hot-tap drilling machine, a metal ball or gate valve, a metal pipe nipple with 1½ inch threads and the GF Hot-Tap installation tool (2540 only).
- Consult with your piping supplier for information regarding drills.
- The necessary metal valve and pipe nipple are not available from GF. You can purchase these standard hardware items from a local supplier.
- Hot-Tap sensors can be installed and removed without process shutdown.
- Care must be taken while removing sensor under process conditions.
- The installation tool serves to hold the sensor against the line pressure as it is retracted or inserted into the pipe (2540 only).
- The Hot-Tap installation fitting has a bleed valve to relieve the pressure when retracting the sensor (2540 only).



Installation tool
3-1500.663
(purchased separately)



Type 2581 FlowtraMag® Meter



Product description

The type 2581 FlowtraMag is a full-bore plastic PVC in line style magnetic flowmeter. The PVC body with Titanium or Hastelloy® C electrodes has no moving parts, and is two to three times lighter in weight compared to traditional metal magmeters on the market. It is designed for high accuracy flow measurement in short pipe runs, making it an ideal solution for industrial applications where performance and ease of use are important. The FlowtraMag design is factory calibrated with certificate at ±1% of reading accuracy. It is offered in corrosion resistant materials to provide long-term reliability with minimal maintenance costs. The LED indicators show at-a-glance system status, including normal operation, zero flow and partially filled pipe detection.

The flow meter provides three different outputs;
field selectable frequency or digital (S³L) as well as analog 4 to 20 mA in both passive and active configuration. The GF Config Tool Bluetooth® app supports iOS and Android for simple on-the-fly user configuration with in with instantaneous flow reading.

These versatile, easy-to-install meters deliver accurate flow measurement in pipe sizes of DN25 (1 in.), DN40 (1.5 in.), DN50 (2 in.), DN80 (3 in.) and DN100 (4 in.), optimized for performance in short pipe runs often associated with final effluent lines, well heads and water treatment skids.

Features

- No moving parts
- Lighter in weight compared to traditional metal magmeters
- Reduced straight run requirements, ideal for final effluent lines, wellheads and skids
- Factory calibrated with certificate (±1% of reading accuracy)
- Partially filled pipe detection status indicator
- Reverse flow direction configurable with 0252 Configuration Tool or GF Config Tool Bluetooth® App
- One device with three different outputs: field selectable Frequency or Digital (S^3L), and analog 4 to 20 mA in both passive and active configuration
- On-the-fly configuration with GF Config Tool Bluetooth® App
- Bluetooth® 4.2 capable, support iOS and Android for simple user configuration with instantaneous flow reading

Certified to NSF/ANSI 61 & 372
(Titanium only)

* Patent #: US 10,712,184 B1. Other U.S. and International Patents Pending.
Hastelloy® is a registered trademark of Haynes International.

Download on the App Store
ANDROID APP ON Google play

Applications

- Chemical Processing/Production
- Cooling Tower
- Filtration Systems
- Water and Wastewater Treatment
- Municipal and Industrial Water Distribution
- Pool and Aquatics
- Process Control, Water Process Flow
- Reverse Osmosis
- Scrubber Systems
- Metal Recovery and Landfill Leachate
- Mining

Specifications

General		
Pipe Size Range	DN25, DN40, DN50, DN80, DN100	1 in., 1.5 in., 2 in., 3 in., 4 in.
Flow Range Titanium or Hastelloy C	0.02 to 10 m/s	0.07 to 33 ft/s
DN25 (1")	0.53 LPM to 266.35 LPM	0.14 to 70.36 GPM
DN40 (1.5")	1.36 LPM to 662.34 LPM	0.36 to 174.97 GPM
DN50 (2")	2.23 LPM to 1112.60 LPM	0.59 to 293.92 GPM
DN80 (3 in.)	5.11 LPM to 2493.75 LPM	1.35 to 658.78 GPM
DN100 (4")	8.72 LPM to 4357.83 LPM	2.30 to 1151.22 GPM
Minimum Conductivity	20 µS/cm – water based	
Power Cable Wire	7.6 m (25 ft) 2-conductor shielded	
Output Cable Wire	7.6 m (25 ft) 5-conductor shielded	
Cable wires may be extended up to 305 m (1,000 ft), field splice or special order		
Wetted Materials		
Flow Tube Body	PVC	
Electrode	Titanium, grade 2 or Hastelloy C-276	
O-rings	FKM or EPDM	
Performance		
Accuracy	± 1% of reading plus ± 0.01 m/s (0.033 ft/s), reference condition 50 µS/cm and water based	
Repeatability	± 0.5% of reading @ 25 °C (77 °F)	
Low Flow Cutoff	0.02 m/s (0.07 ft/s) (adjustable via GF Config Tool App or 0252 Configuration Tool)	
Electrical		
DC Power (Functional Rating)	24 VDC, max 24 W (12 to 32 VDC)	
Reverse Polarity Protected	Up to 35 VDC	
Over-Voltage Maximum Rating	35 VDC	
Current Output		
Passive (low power)	4 to 20 mA per ANSI-ISA 50.00.01 Class H	
Active Output	4 to 20 mA	
Passive / Active	User selectable	
Passive Loop Voltage	12 to 32 VDC	
Loop Accuracy	±32 µA (@ 25 °C @ 24 VDC)	
Loop Resolution	5 µA	
Loop Span	3.8 mA to 21 mA	
Error Condition	None, 3.6 mA or 22 mA	
Max. Cable	305 m (1'000 ft)	
Max. Loop Resistance	600 Ω @ 24 VDC	
	Compatible with PLC, PC or similar equipment	
Frequency Output		
Frequency	5 to 24 VDC, 50 mA max.	
Frequency Range	0 to 1500 Hz	

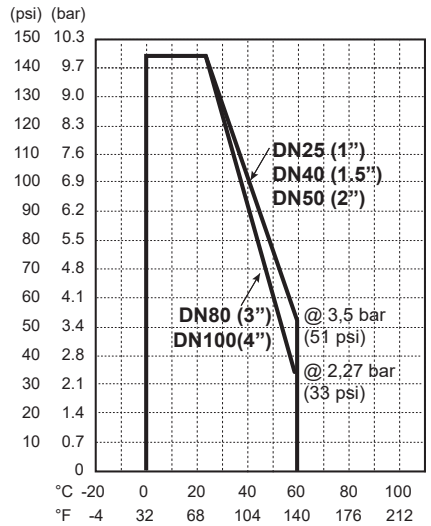
Frequency Output		
Max. Cable	305 m (1'000 ft)	
Max. Pull-up Voltage	30 VDC, 10k pull-up recommended	
	Compatible with type 9900, 9950, and 0486 Profibus Concentrator	
Digital (S^3L) Output		
Digital (S^3L)	4.5 to 5.5 VDC	
	Serial ASCII, TTL level 9600 bps Compatible with type 9900, 9950 and 0486 Profibus Concentrator	
Max. Cable Length	Application dependent	
Environmental Requirements		
Enclosure	NEMA 4X / IP65	
Relative Humidity	0 to 95% non-condensing	
Storage Temperature	-10 °C to 60 °C (14 °F to 140 °F)	
Operating Temperature		
Ambient	-10 °C to 60 °C	14 °F to 140 °F
Media	0 °C to 60 °C	32 °F to 140 °F
UL Environmental Rating	UL 50, type 6P Storage	
Altitude	4,000 m	13,123 ft
Pressure/Temperature Ratings		
Maximum Operating Pressure	10 bar @ 23 °C (145 psi @ 73 °F)	
DN25 (1"), DN40 (1.5"), DN50 (2")	3.5 bar @ 60 °C (51 psi @ 140 °F)	
DN80 (3"), DN100 (4")	2.27 bar @ 60 °C (33 psi @ 140 °F)	
Shipping Weight -Titanium or Hastelloy C		
DN25 (1")	3.4 kg	7.5 lbs
DN40 (1.5")	4.1 kg	9.1 lbs
DN50 (2")	4.5 kg	9.9 lbs
DN80 (3")	7.5 kg	16.5 lbs
DN100 (4")	8.3 kg	18.3 lbs
Standards and Approvals		
	CE, UKCA, FCC, NSF (Titanium only, does not include flange gaskets)	
	UL, CUL Recognized Component	
	RoHS compliant, China RoHS	
	Manufactured under ISO 9001, ISO 14001 and ISO 45001	

Pressure-temperature diagram

Note:

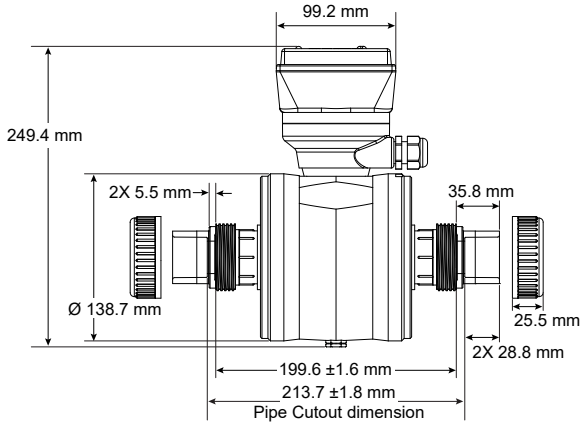
The pressure/temperature graphs are specifically for the GF sensor. During system design the specifications of all components must be considered.

In the case of a metal piping system, a plastic sensor will reduce the system specification.

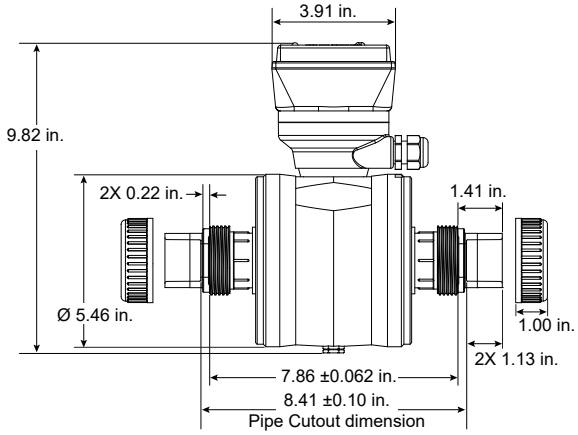


Dimensions

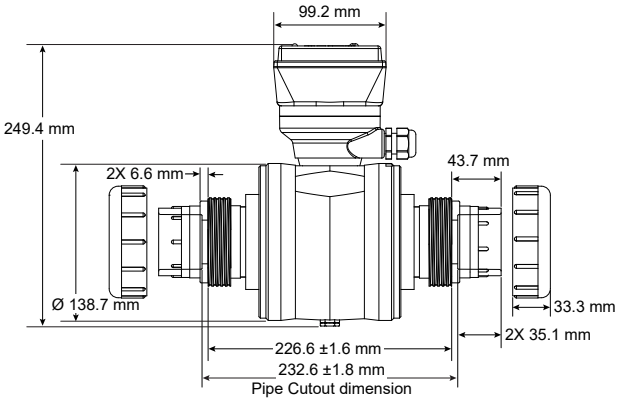
DN25
Metric Union ends and union nuts shown



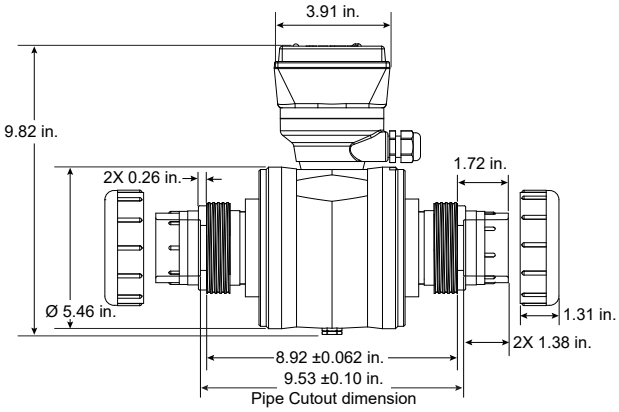
1 in.
ASTM Union ends and union nuts shown



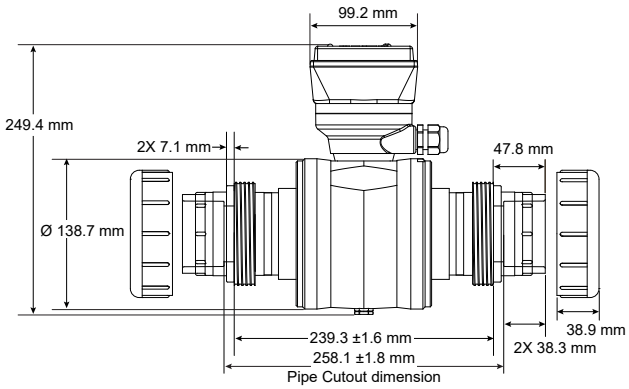
DN40
Metric Union ends and union nuts shown



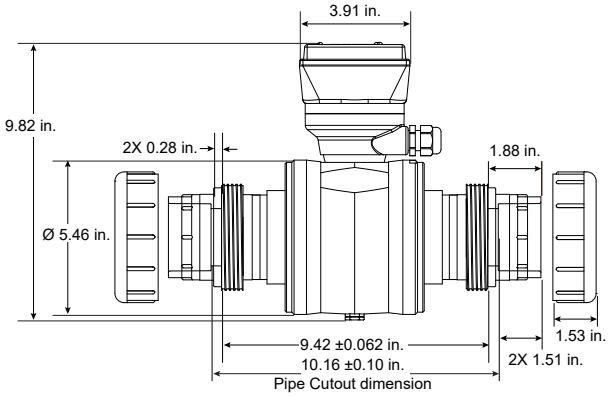
1.5 in.
ASTM Union ends and union nuts shown



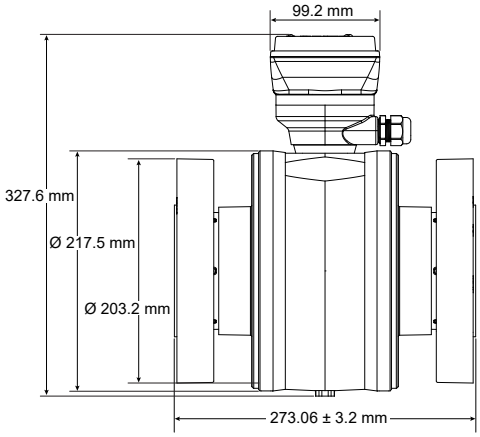
DN50
Metric Union ends and union nuts shown



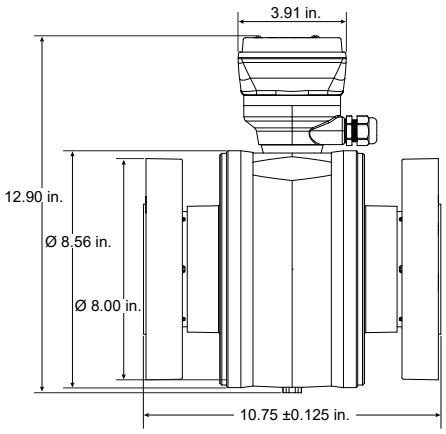
2 in.
ASTM Union ends and union nuts shown



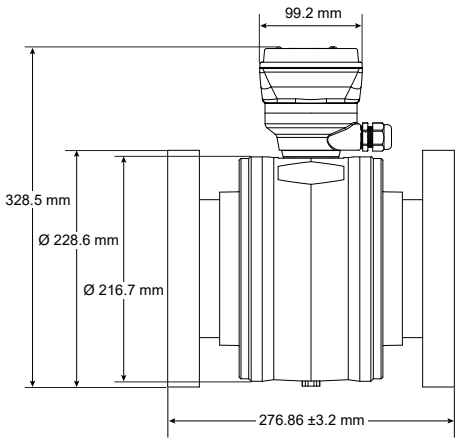
DN80
Flange bolt kits and gaskets not shown (Sold separately)



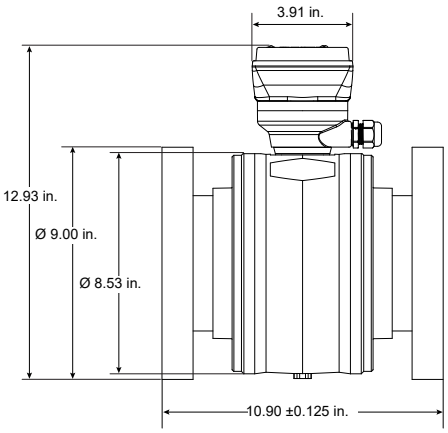
3 in.
Flange bolt kits and gaskets not shown (Sold separately)



DN100
Flange bolt kits and gaskets not shown (Sold separately)



4 in.
Flange bolt kits and gaskets not shown (Sold separately)



GF Configuration Tool Bluetooth® App

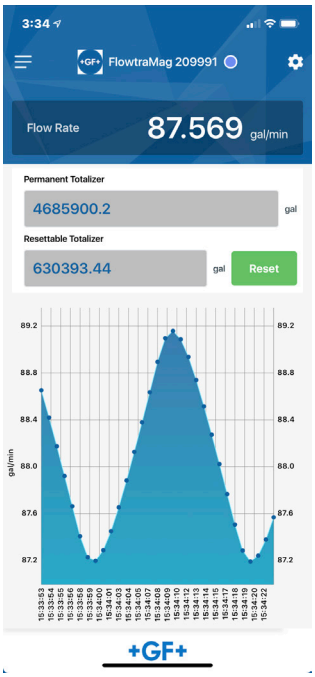


On-the-fly configuration, sensor Information at your fingertips

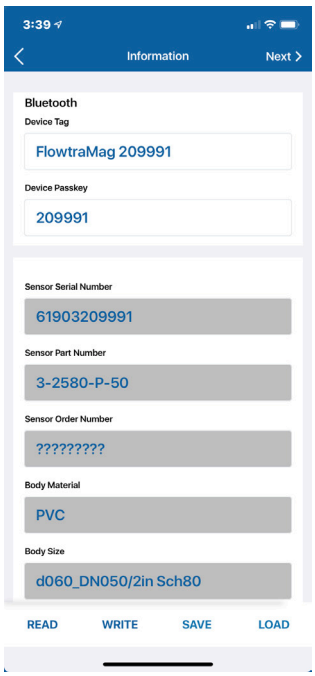
- **Bluetooth® 4.2 capable, support iOS and Android for simple user configuration**
- **Application setup**
  Set Averaging, Sensitivity, Low Flow Cut Off, Direction of Flow, Flow Units and Totalizer Unit
- **Name files**
- **Share and/or Save files**
- **Monitor flow and totalizer**
- **Loop adjustment is a live update**
  Set 4 mA, 20 mA, Error condition of the current output alarm (3.6 or 22 mA), adjust your 4 to 20 mA setting and select output mode
- **Calibration**
  Custom Calibration of Rate, Volumetric, Zero Flow Calibration

(example shows Menu)

Live Logging while connected
to mobile / tablet device, set 1 sec or more increments.



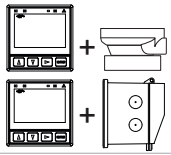
Sensor Information when you need it
Sensor information, Bluetooth Device Tag, Permanent Totalizer, Resettable Totalizer, Calibration Adjustment Factor, Zero Offset Adjustment.



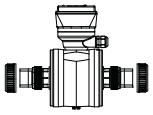
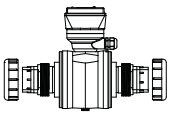
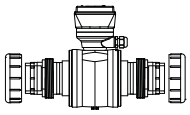
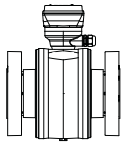
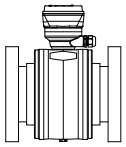
Download on the App Store

Google play

System Overview

Stand-Alone	Panel Mount	Pipe, Tank, Wall	4 to 20 mA Output	Automation System
Type 2581 FlowtraMag 	GF Instruments - 9900-1P - 9900-1BC - 9950 	GF Instruments - 9900-1 with 3-8050-1 Universal Mount Kit - 9900-1BC with Rear Enclosure 	- Customer Supplied Chart Recorder, Programmable Logic Controller or - Programmable Automation Controller 	- 0486 Profibus Concentrator and Customer Supplied Programmable Logic Controller or - Programmable Automation Controller 
	Type 2581 FlowtraMag - 3-2581PTXX-10X - 3-2581PHXX-10X			

Ordering information

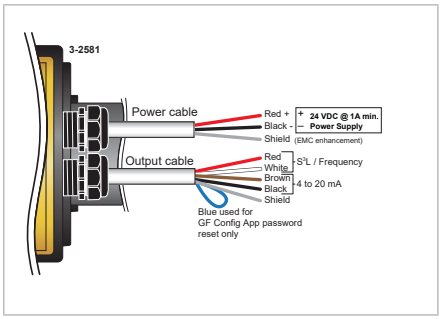
	Mfr. Part No.	Code	Description
	3-2581-PT01-101	159 001 970	FlowtraMag, PVC, Titanium, FKM O-Ring, Union, DN25 (1 in.)
	3-2581-PT15-101	159 001 971	FlowtraMag, PVC, Titanium, FKM O-Ring, Union, DN40 (1.5 in.)
	3-2581-PT02-101	159 001 972	FlowtraMag, PVC, Titanium, FKM O-Ring, Union, DN50 (2 in.)
	3-2581-PT03-101	159 001 973	FlowtraMag, PVC, Titanium, FKM O-Ring, Flange, DN80 (3 in.)
	3-2581-PT04-101	159 001 974	FlowtraMag, PVC, Titanium, FKM O-Ring, Flange, DN100 (4 in.)
			
	3-2581-PH01-101	159 001 975	FlowtraMag, PVC, Hastelloy C, FKM O-Ring, Union, DN25 (1 in.)
	3-2581-PH15-101	159 001 976	FlowtraMag, PVC, Hastelloy C, FKM O-Ring, Union, DN40 (1.5 in.)
	3-2581-PH02-101	159 001 977	FlowtraMag, PVC, Hastelloy C, FKM O-Ring, Union, DN50 (2 in.)
	3-2581-PH03-101	159 001 978	FlowtraMag, PVC, Hastelloy C, FKM O-Ring, Flange, DN80 (3 in.)
	3-2581-PH04-101	159 001 979	FlowtraMag, PVC, Hastelloy C, FKM O-Ring, Flange, DN100 (4 in.)
	3-2581-PT01-102	159 001 980	FlowtraMag, PVC, Titanium, EPDM O-Ring, Union, DN25 (1 in.)
	3-2581-PT15-102	159 001 981	FlowtraMag, PVC, Titanium, EPDM O-Ring, Union, DN40 (1.5 in.)
	3-2581-PT02-102	159 001 982	FlowtraMag, PVC, Titanium, EPDM O-Ring, Union, DN50 (2 in.)
	3-2581-PT03-102	159 001 983	FlowtraMag, PVC, Titanium, EPDM O-Ring, Flange, DN80 (3 in.)
	3-2581-PT04-102	159 001 984	FlowtraMag, PVC, Titanium, EPDM O-Ring, Flange, DN100 (4 in.)
	3-2581-PH01-102	159 001 985	FlowtraMag, PVC, Hastelloy C, EPDM O-Ring, Union, DN25 (1 in.)
	3-2581-PH15-102	159 001 986	FlowtraMag, PVC, Hastelloy C, EPDM O-Ring, Union, DN40 (1.5 in.)
	3-2581-PH02-102	159 001 987	FlowtraMag, PVC, Hastelloy C, EPDM O-Ring, Union, DN50 (2 in.)
	3-2581-PH03-102	159 001 988	FlowtraMag, PVC, Hastelloy C, EPDM O-Ring, Flange, DN80 (3 in.)
	3-2581-PH04-102	159 001 989	FlowtraMag, PVC, Hastelloy C, EPDM O-Ring, Flange, DN100 (4 in.)

Accessories

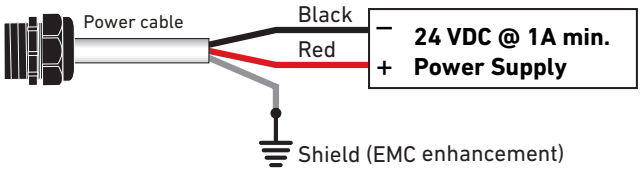
Mfr. Part No.	Code	Description
3-0252	159 001 808	0252 Configuration Tool (optional for configuring with PC)
5523-0222	159 000 392	Cable (per foot), 2 cond. w/shield, 22 AWG
5523-0224	159 855 034	Cable (per foot), 6 cond. w/shield, 22 AWG
3-2581-PX01-10X Accessories		
857 375 010	857 375 010	PVC 80 type 375 Union FKM (SxS) 1 in. (ASTM)
1220-0218	159 812 039	1.234IDX.139 FKM O-ring RMS 1071 (1 in.) (2 required per unit)
897 375 010	897 375 010	PVC 80 type 375 Union EPDM (SxS) 1 in. (ASTM)
1224-0218	159 812 044	NSF 1.234IDX.139 EPDM O-ring (1 in.) (2 required per unit)
161 375 904C	161 375 904C	Union End, PVC, PN16, d32DN25 (Metric)
3-2581-PX15-10X Accessories		
857 375 015	857 375 015	PVC 80 type 375 Union FKM (SxS) 1.5 in. (ASTM)
1220-0327	159 812 040	1.725IDX.210 FKM O-ring RMS1071 (1.5 in.) (2 required per unit)
897 375 015	897 375 015	PVC 80 type 375 Union EPDM (SxS) 1.5 in. (ASTM)
1224-0327	159 812 045	NSF 1.725IDX.210 EPDM O-RING (1.5 in.) (2 required per unit)
161 375 906C	161 375 906C	Union End, PVC, PN16, d50DN40 (Metric)
3-2581-PX02-10X Accessories		
857 375 020	857 375 020	PVC 80 type 375 Union FKM (SxS) 2 in. (ASTM)
1220-0331	159 812 041	2.225X.210 FKM O-RING RMS1071 (2 in.) (2 required per unit)
897 375 020	897 375 020	PVC 80 type 375 Union EPDM (SxS) 2 in. (ASTM)
1224-0331	159 812 046	NSF 2.225X.210 EPDM O-RING (2 in.) (2 required per unit)
161 375 907C	161 375 907C	Union End, PVC, PN16, d63DN50 (Metric)
3-2581-PX03-10X Accessories		
854-030	854-030	3 in. PVC80 Van-Stone Flange (S)
37X 002 117	37X 002 117	FKM Full Face Flange Gasket - 150# ANSI Bolt Pattern - 3 in.
37X 002 008	37X 002 008	EPDM Full Face Flange Gasket - 150# ANSI Bolt Pattern - 3 in.
37Z 000 068	37Z 000 068	Van Stone Flange 316SS Bolt Kit, 4-hole, 3 in. ASTM
721 790 113	721 790 113	DN80 Flange Adapter, PVC-U, Metric (Use with backing flange 721 700 013)
721 700 013	721 700 013	DN80 Backing Flange, PVC-U, Metric
749 440 713	749 440 713	DN80 FKM Profile Flange Gasket, Metric
748 440 713	748 440 713	DN80 EPDM Profile Flange Gasket, Metric
3-2581-PX04-10X Accessories		
854-040	854-040	4 in. PVC80 Van-Stone Flange (S)
37X 002 118	37X 002 118	FKM Full Face Flange Gasket - 150# ANSI Bolt Pattern - 4 in.
37X 002 009	37X 002 009	EPDM Full Face Flange Gasket - 150# ANSI Bolt Pattern - 4 in.
37Z 000 069	37Z 000 069	Van Stone Flange 316SS Bolt Kit, 8-hole, 4 in. ASTM
721 790 114	721 790 114	DN100 Flange Adapter, PVC-U, Metric (Use with backing flange 721 700 014)
721 700 014	721 700 014	DN100 V-Flange Ring PVC-U, Metric
749 440 714	749 440 714	DN100 FKM Profile Flange Gasket, Metric
748 440 714	748 440 714	DN100 EPDM Profile Flange Gasket, Metric

Wiring Information

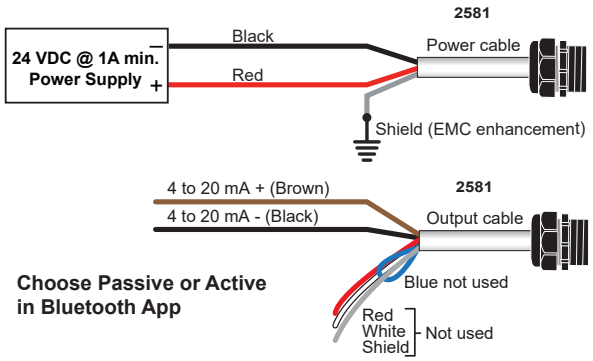
When wiring the 2581 FlowtraMag output cable to a 9900/9950, use the red wire for Frequency/DATA and the white wire as ground.



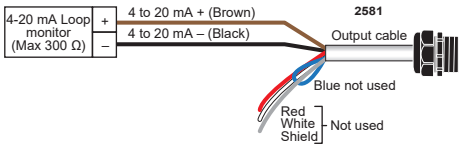
Power Wiring



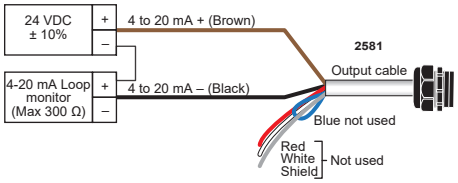
4 to 20 mA Loop Output Wiring



Active 4-20mA Output Wiring



Passive 4-20mA Output Wiring

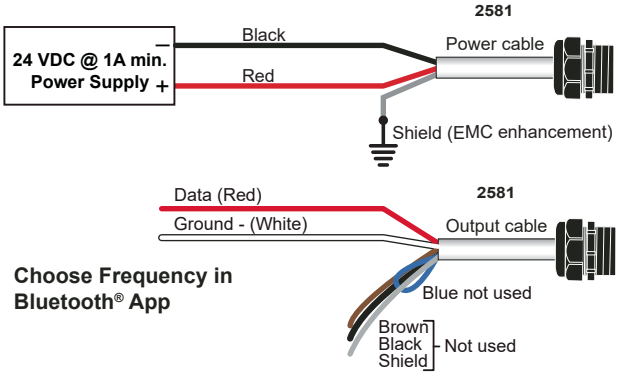


Frequency Output Wiring

Compatible with all POWERED GF Flow Instruments.

- When choosing Frequency in the Bluetooth® App, the 2581 outputs an open collector frequency signal that can be connected to any powered GF flow meter (Types 9900, 9900-1BC or 9950).
- 24 VDC power at 1 amp should always be connected.

NOTE: The frequency output will be displayed as positive flow regardless of the flow direction.

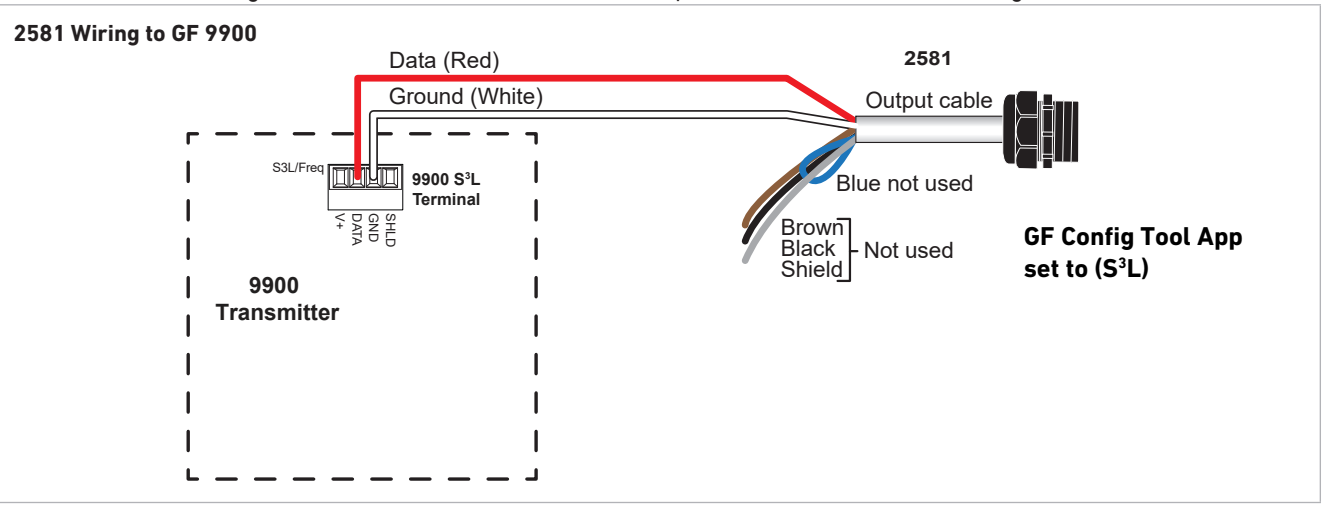


2581 Wiring to type 9900

Flow Meter Wiring Details for 2581 FlowtraMag Meter

Digital (S³L) Output (Compatible with 9900 and 9950)

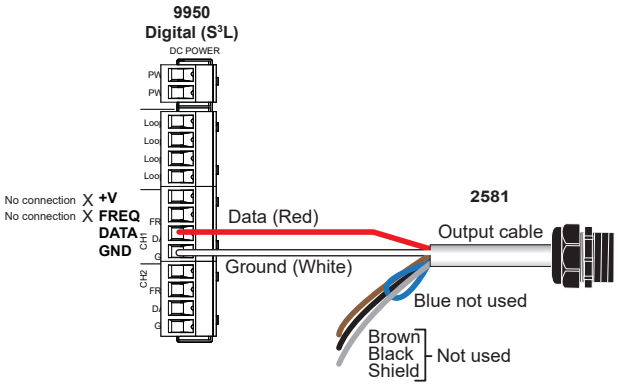
- To select (S³L), use Bluetooth® App.
- 24 VDC power at a minimum of 1 amp should always be connected to the 2581.
- The 9900 and 9950 will display negative numbers to indicate reverse flow
- The maximum cable length from the 2581 to the 9900 or 9950 depends on the 9900 or 9950 configuration.

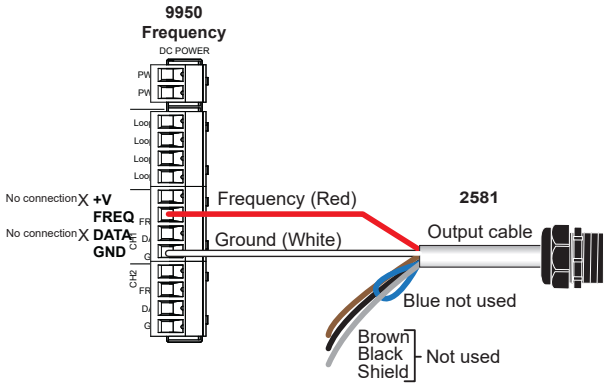


2581 Wiring to type 9950

GF Config Tool App set to (S³L)

Refer to the 0486 Profibus Concentrator manual for Frequency wiring and programing instructions.





Type 2551 Magmeter Flow Sensor



Available in a variety of wetted materials and ideal for pipe sizes up to DN900 (36. in.)

Product description

The type 2551 Magmeter is an insertion style magnetic flow sensor that features no moving parts. The patented* sensor design is available in corrosionresistant materials to provide long-term reliability with minimal maintenance costs. Material options include PP with stainless steel, PVDF with Hastelloy-C, or PVDF with Titanium. Utilizing the comprehensive line of GF installation fittings, sensor alignment and insertion depth is automatic. These versatile, simple-to-install sensors deliver accurate flow measurement over a wide dynamic range in pipe sizes ranging from DN15 to DN900 (½ to 36 in.), satisfying the requirements of many diverse applications.

Type 2551 Magmeters offer many output options of frequency/digital (S^3L) or 4 to 20 mA which are available on both the blind and display versions. The frequency or digital (S^3L) sensor output can be used with GF 's extensive line of flow instruments while the 4 to 20 mA output can be used for a direct input to PLCs, chart recorders, etc. Both the 4 to 20 mA output and digital (S^3L) sensor interface is available for long distance signal transmission. An additional benefit is the empty pipe detection which features a zero flow output when the sensors are not completely wetted. Also, the frequency output is bi-directional while the 4 to 20 mA output can be set for uni- or bi-directional flow using the display or the 3-0252 Configuration Tool which connects to PCs for programming capabilities.

In addition the display version of the 2551 Magmeter is available with relays and features permanent and resettable totalizer values which can be stored and seen on the display. Also, the display contains multilanguages with English, Spanish, German, French, Italian and Portuguese menu options.

Features

- Test certificate included for -X0, -X1
- Patented Magmeter technology*
- No moving parts
- Bi-directional flow
- Empty pipe detection
- Installs into pipe sizes DN15 to DN900 (½ to 36 in.)
- Operating range 0.05 to 10 m/s (0.15 to 33 ft/s)
- Accurate measurement even in dirty liquids
- Polypropylene and PVDF retaining nuts standard, Valox optional
- 4 to 20 mA, digital (S^3L), frequency, relay output (display only)
- No pressure drop
- Corrosion resistant materials; PP or PVDF with SS, Hastelloy-C, or Titanium
- Multi-language display menu available

Certified to NSF/ANSI 61 & 372

(3-2551-PX-XX version only)

Applications

- Chemical Processing
- Water and Wastewater Monitoring
- Metal Recovery and Landfill Leachate
- Commercial Pools, Spas, and Aquariums
- HVAC
- Irrigation
- Scrubber Control
- Neutralization Systems
- Industrial Water Distribution

Technical Details

General		
Operating Range	0.05 to 10 m/s	0.15 to 33 ft/s
Pipe Size Range	DN15 to DN900	½ in. to 36 in.
Linearity	± 1% reading plus 0.1% of full scale	
Repeatability	±0.5% of reading @ 25 °C (77 °F)	
Minimum Conductivity	20 µS/cm	

Wetted Materials	
Sensor Body/Electrodes and Grounding Ring	-P0, -P1, -P2: PP/316L SS
	-T0, -T1, -T2: PVDF/Titanium
	-V0, -V1, -V2: PVDF/Hastelloy-C
O-rings	FKM (standard) EPR (EPDM), FFKM (optional)
Case	PBT
Display Window	Polyamide (transparent nylon)
Protection Rating	NEMA 4X/IP65

Electrical		
Power Requirements	4 to 20 mA	24 VDC ±10%, regulated, 22.1 mA max.
	Frequency	5 to 24 VDC ±10%, regulated, 15 mA max.
	Digital (S^3L)	5 to 6.5 VDC, 15 mA max.
Auxiliary (only required for units with relays)		9 to 24 VDC, 0.4 A max.
Reverse Polarity and Short Circuit Protected		
Current Output 4 to 20 mA	Loop Accuracy	32 µA max. error (25 °C @ 24 VDC)
	Isolation	Low Voltage < 48 VAC/DC from electrodes and auxiliary power
	Maximum Cable	300 m (1000 ft)
	Error Condition	22.1 mA
	Max. Loop Resistance	300 Ω
	Compatible with PLC, PC or similar equipment	
	4 to 20 mA load needed	
Frequency Output	Output Modes	Freq., or Mirror Relay (display version only)
	Max. Pull-up Voltage	30 VDC
	Max. Current Sink	50 mA, current limited
	Maximum Cable	300 m (1'000 ft)
	Compatible with type type 9900, 9900-1BC, 9950	
Digital S^3L Output	Serial ASCII, TTL level 9600 bps	
	Compatible with type type 9900, 9950, 0486 Profibus Concentrator	

Relay Specifications	
#1, #2 type	Mechanical SPDT
Rating	5 A @ 30 VDC max., 5 A @ 250 VDC max.

Relay Specifications	
#3 type	Solid State
Rating	50 mA @ 30 VDC, 50 mA @ 42 VAC
Hysteresis	User adjustable for exiting alarm condition
Alarm On Trigger Delay	Adjustable (0 to 9999.9 sec)
Relay Modes	Off, Low, High, Window and Proportional Pulse
Relay Source	Flow Rate, Resettable Totalizer
Error Condition	Selectable; Fail Open or Closed

Display	
Characters	2 x 16
Contrast	User-set in four levels
Backlighting (only on relay versions)	Requires external 9-24 VDC, 0.4 mA max.

Max. Temperature/Pressure Rating			
Storage Temperature		-20 °C to 70 °C	-4 °F to 158 °F
Relative Humidity		0 to 95% (non-condensing)	
Operating Temperature	Ambient	-10 °C to 70 °C	14 °F to 158 °F
	Media	0 °C to 85 °C	32 °F to 185 °F
Maximum Operating Pressure		10.3 bar @ 25 °C	150 psi @ 77 °F
		1.4 bar @ 85 °C	20 psi @ 185 °F

Shipping Weight		
	0.680 kg	1.50 lb

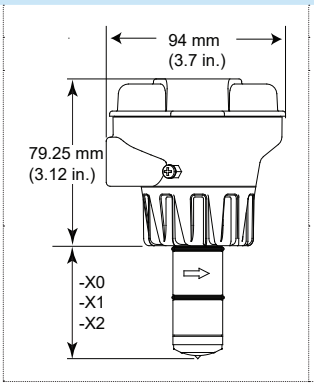
Standards and Approvals
CE, FCC, UL, CUL, NSF (3-2551-PX-XX version only)
RoHS compliant, China RoHS
NEMA 4X / IP65 Enclosure (with cap installed)
Manufactured under ISO 9001, ISO 14001 and ISO 45001

Dimensions

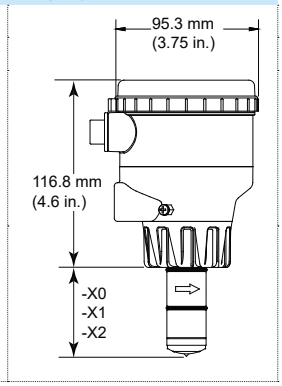
Pipe Range	
½ to 4 in.	-X0 = 58 mm (2.3 in.)
5 to 8 in.	-X1 = 91 mm (3.6 in.)
10 to 36 in.	-X2 = 167 mm (6.6 in.)

X = Sensor Body P, T, or V

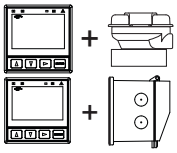
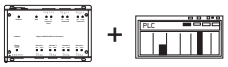
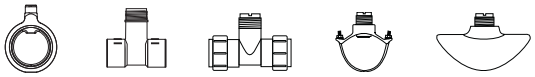
Blind version



Display version



System Overview

Stand-Alone	Panel Mount	Pipe, Tank, Wall	4 to 20 mA Output	Automation System
Type 2551 Magmeter 	GF Instruments - 9900-1P - 9900-1BC - 9950 	GF Instruments - 9900-1 with 3-8050-1 Universal Mount Kit - 9900-1BC with Rear Enclosure 	- Customer Supplied Chart Recorder, Programmable Logic Controller or - Programmable Automation Controller 	- 0486 Profibus Concentrator and Customer Supplied - Programmable Logic Controller or Programmable Automation Controller 
	Type 2551 Magmeter 			
GF Fittings				All Sold Separately

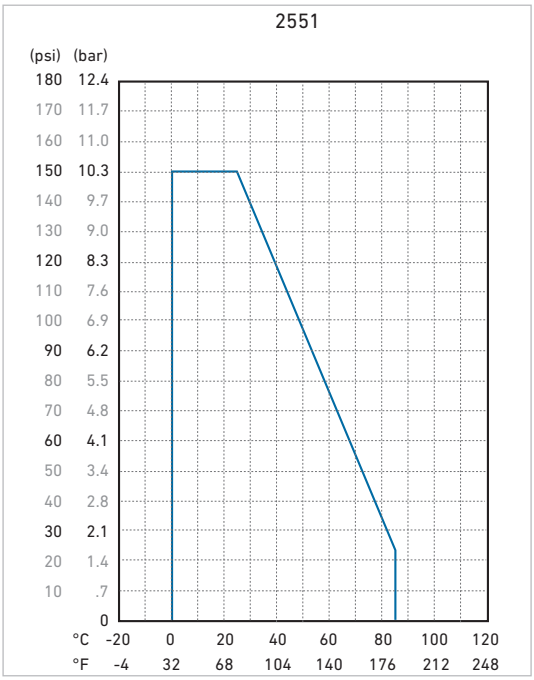
Application Tips

- Note minimum process liquid conductivity requirement is 20 µs/cm.
- Install sensor using standard GF installation fittings for best results.
- Sensor is capable of retrofitting into existing 515 and 2536 fittings

Pressure-temperature diagram

Note

The pressure-temperature diagrams are specifically for the GF sensor. During system design the specifications of all components must be considered. In the case of a metal piping system, a plastic sensor will reduce the system specification. When using a PVDF sensor in a PVC piping system, the fitting will reduce the system specification.



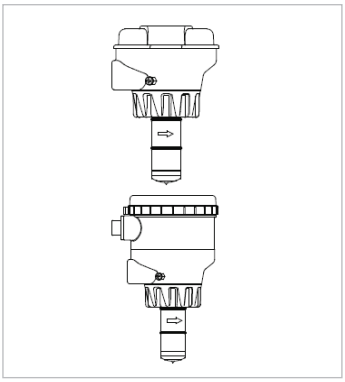
Ordering Information

Pipe Size	Mfr. Part No.	Code	Sensor Body

Frequency or Digital (S^3L) output

Programmable open collector for use with any GF Flow Instrument or the 9900 or 9950 Instruments. This option is a programmable open collector output that is available with display versions only.

DN15 to DN100 (½ to 4 in.)



No Display

3-2551-P0-11	159 001 105	Polypropylene and 316L SS
3-2551-T0-11	159 001 108	PVDF and Titanium
3-2551-V0-11	159 001 257	PVDF and Hastelloy-C

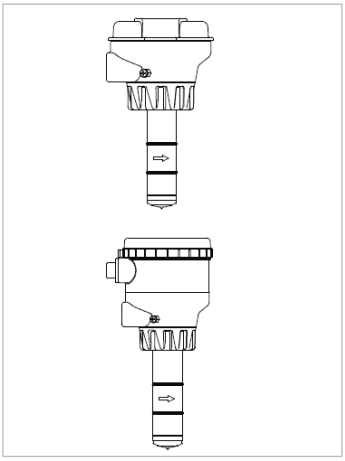
With Display, two SPDT relays, one solid state relay

3-2551-P0-21	159 001 267	Polypropylene and 316L SS
3-2551-T0-21	159 001 436	PVDF and Titanium
3-2551-V0-21	159 001 269	PVDF and Hastelloy-C

With Display

3-2551-P0-41	159 001 261	Polypropylene and 316 L SS
3-2551-T0-41	159 001 433	PVDF and Titanium
3-2551-V0-41	159 001 263	PVDF and Hastelloy-C

DN125 to DN200 (5 to 8 in.)



No Display

3-2551-P1-11	159 001 106	Polypropylene and 316L SS
3-2551-T1-11	159 001 109	PVDF and Titanium
3-2551-V1-11	159 001 258	PVDF and Hastelloy-C

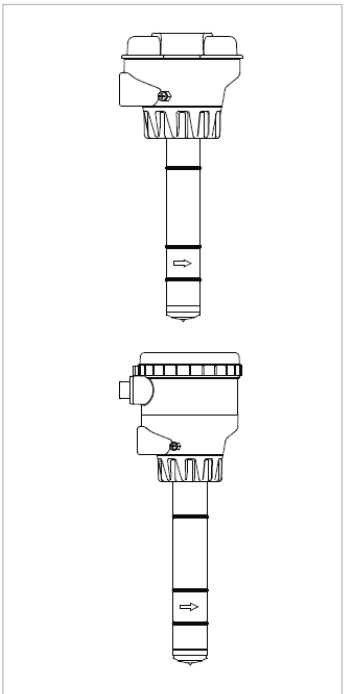
With Display, two SPDT relays, one solid state relay

3-2251-P1-21	159 001 268	Polypropylene and 316L SS
3-2551-T1-21	159 001 437	PVDF and Titanium
3-2551-V1-21	159 001 270	PVDF and Hastelloy-C

With Display

3-2551-P1-41	159 001 262	Polypropylene and 316L SS
3-2551-T1-41	159 001 434	PVDF and Titanium
3-2551-V1-41	159 001 264	PVDF and Hastelloy-C

DN250 to DN900 (10 to 36 in.)



No Display

3-2551-P2-11	159 001 107	Polypropylene and 316L SS
3-2551-T2-11	159 001 448	PVDF and Titanium
3-2551-V2-11	159 001 450	PVDF and Hastelloy-C

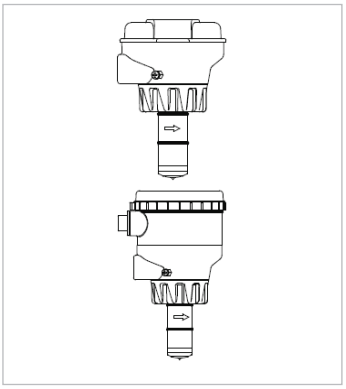
With Display, two SPDT relays, one solid state relay

3-2551-P2-21	159 001 435	Polypropylene and 316L SS
3-2551-T2-21	159 001 454	PVDF and Titanium
3-2551-V2-21	159 001 456	PVDF and Hastelloy-C

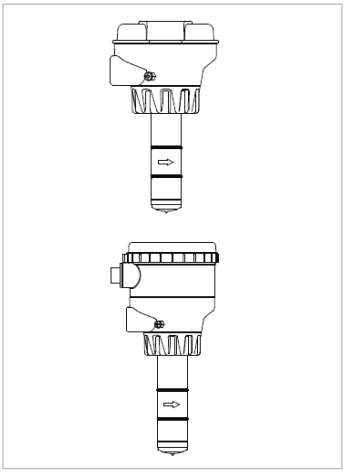
With Display

3-2551-P2-41	159 001 432	Polypropylene and 316L SS
3-2551-T2-41	159 001 460	PVDF and Titanium
3-2551-V2-41	159 001 462	PVDF and Hastelloy-C

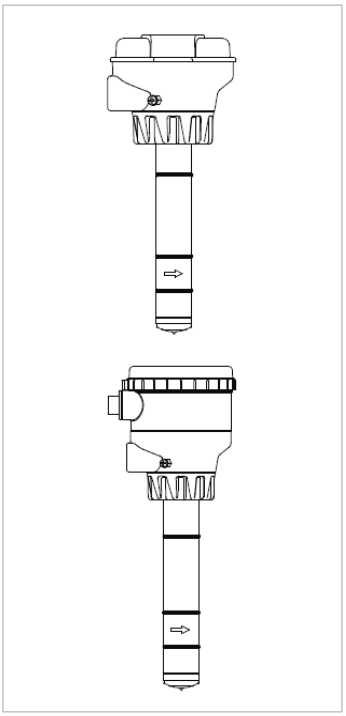
Pipe Size	Mfr. Part No.	Code	Sensor Body
4 to 20 mA output for use with PLC, PC or similar equipment			
DN15 to DN100 (1/2 to 4 in.)			
No Display			
	3-2551-P0-12	159 001 110	Polypropylene and 316L SS
	3-2551-T0-12	159 001 113	PVDF and Titanium
	3-2551-V0-12	159 001 259	PVDF and Hastelloy-C
With Display, two SPDT relays, one solid state relay			
	3-2551-P0-22	159 001 273	Polypropylene and 316L SS
	3-2551-T0-22	159 001 439	PVDF and Titanium
	3-2551-V0-22	159 001 275	PVDF and Hastelloy-C
With Display			
	3-2551-P0-42	159 001 279	Polypropylene and 316 L SS
	3-2551-T0-42	159 001 442	PVDF and Titanium
	3-2551-V0-42	159 001 281	PVDF and Hastelloy-C



DN125 to DN200 (5 to 8 in.)			
No Display			
	3-2551-P1-12	159 001 111	Polypropylene and 316L SS
	3-2551-T1-12	159 001 114	PVDF and Titanium
	3-2551-V1-12	159 001 260	PVDF and Hastelloy-C
With Display, two SPDT relays, one solid state relay			
	3-2251-P1-22	159 001 274	Polypropylene and 316L SS
	3-2551-T1-22	159 001 440	PVDF and Titanium
	3-2551-V1-22	159 001 276	PVDF and Hastelloy-C
With Display			
	3-2551-P1-42	159 001 280	Polypropylene and 316L SS
	3-2551-T1-42	159 001 443	PVDF and Titanium
	3-2551-V1-42	159 001 282	PVDF and Hastelloy-C



DN250 to DN900 (10 to 36 in.)			
No Display			
	3-2551-P2-12	159 001 112	Polypropylene and 316L SS
	3-2551-T2-12	159 001 449	PVDF and Titanium
	3-2551-V2-12	159 001 451	PVDF and Hastelloy-C
With Display, two SPDT relays, one solid state relay			
	3-2551-P2-22	159 001 438	Polypropylene and 316L SS
	3-2551-T2-22	159 001 455	PVDF and Titanium
	3-2551-V2-22	159 001 457	PVDF and Hastelloy-C
With Display			
	3-2551-P2-42	159 001 441	Polypropylene and 316L SS
	3-2551-T2-42	159 001 461	PVDF and Titanium
	3-2551-V2-42	159 001 463	PVDF and Hastelloy-C



Accessories and Replacement Parts

Mfr. Part	Code	Description
O-Rings		
1220-0021	198 801 000	O-ring, FKM (2 required per sensor)
1224-0221	198 820 006	O-ring, EPR (EPDM) (2 required per sensor)
1228-0221	198 820 007	O-ring, FFKM (2 required per sensor)
Replacement Transducers		
3-2551-P0	159 001 211	PP/316L SS, DN15 to DN100 (1/2 to 4 in.) pipe
3-2551-P1	159 001 212	PP/316L SS, DN125 to DN200 (5 to 8 in.) pipe
3-2551-P2	159 001 444	PP/316L SS, DN250 to DN900 (10 to 36 in.) pipe
3-2551-T0	159 001 213	PVDF/Titanium, DN15 to DN100 (1/2 to 4 in.) pipe
3-2551-T1	159 001 214	PVDF/Titanium, DN125 to DN200 (5 to 8 in.)
3-2551-T2	159 001 445	PVDF/Titanium, DN250 to DN900 (10 to 36 in.) pipe
3-2551-V0	159 001 376	PVDF/ Hastelloy-C, DN15 to DN100 (1/2 to 4 in.) pipe
3-2551-V1	159 001 377	PVDF/Hastelloy-C, DN125 to DN 200 (5 to 8 in.) pipe
3-2551-V2	159 001 446	PVDF/Hastelloy-C, DN250 to DN900 (10 to 36 in.)
Replacement Electronics Module		
3-2551-11	159 001 215	Magmeter electronics, frequency or digital (S^3L) output
3-2551-12	159 001 216	Magmeter electronics, 4 to 20 mA output
3-2551-21	159 001 372	Magmeter display electronics, frequency or digital (S^3L) output, with relays
3-2551-22	159 001 373	Magmeter display electronics, 4 to 20 mA output w/relays
3-2551-41	159 001 374	Magmeter display electronics, frequency or digital (S^3L) output
3-2551-42	159 001 375	Magmeter display electronics, 4 to 20 mA output
3-2551.395	159 310 096	Display Cap Magmeter w/relays
3-2551.395-1	159 310 097	Display Cap Magmeter no relays
Other		
P31536	198 840 201	Sensor plug, Polypropylene
7310-1024	159 873 004	24 VDC Power Supply, 0.42 A, 10W
7310-2024	159 873 005	24 VDC Power Supply, 1.0 A, 24W
7310-4024	159 873 006	24 VDC Power Supply, 1.7 A, 40W
7310-6024	159 873 007	24 VDC Power Supply, 2.5 A , 60W
7310-7024	159 873 008	24 VDC Power Supply, 4.0 A, 96W
3-8050.390-1	159 001 702	Retaining Nut Replacement Kit, NPT, Valox
3-8050.390-3	159 310 116	Retaining Nut Replacement Kit, NPT, PP
3-8050.390-4	159 310 117	Retaining Nut Replacement Kit, NPT, PVDF
3-8551.521	159 001 378	Clear plastic cap for display
1222-0042	159 001 379	O-ring for clear plastic cap, EPR (EPDM)
3-0252	159 001 808	Configuration Tool (blind version only)
3-9900.392-1	159 000 839	Liquid Tight Connector Kit, NPT (1 pc.)
3-8050.396	159 000 617	RC Filter kit (for relay use, inductive loads), 2 per kit

Wiring Information

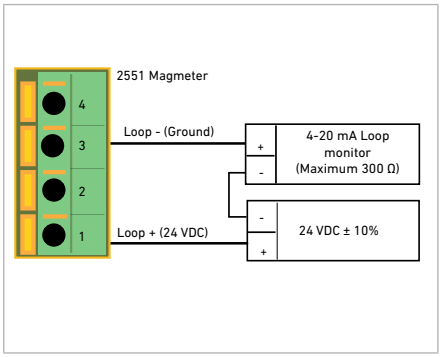
Loop Wiring

The 2551-XX-12 Magmeter is a traditional 2-wire passive 4 to 20 mA loop transmitter. External loop power (24 VDC ±10% regulated) is required.

⚠ The maximum loop resistance the Magmeter can accommodate is 300 Ω.

All 2551-XX-12 Magmeters are shipped from the factory with the 4 to 20 mA output scaled for 0 to 5 m/s (0 to 16.4 ft/s). If this operating range is suitable, no adjustments are necessary.

The 3-0252 Configuration Tool is required to change the operating range.

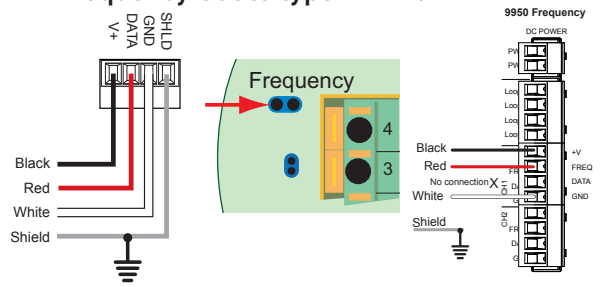


Frequency Wiring

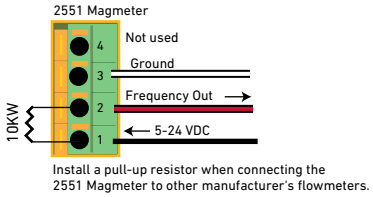
- When the blue jumper illustrated here is placed over both pins, the 2551-XX-11 outputs an open collector frequency signal that can be connected to any powered GF flow meter. (Types 9900, 9900-1BC, 9950).
- 5 VDC power is provided to the 2551 Magmeter by all GF flow instruments. No additional power is required.
- If connecting the 2551 Magmeter to a flow instrument from another manufacturer, 5 to 24 VDC ±10% regulated power must be provided to the 2551.
- A 10 KΩ pull up resistor must also be connected between terminals 1 and 2.
- The frequency output will be displayed as positive flow regardless of the flow direction.

2551 Frequency Out

2551 Frequency Out to type 9900 or 9950



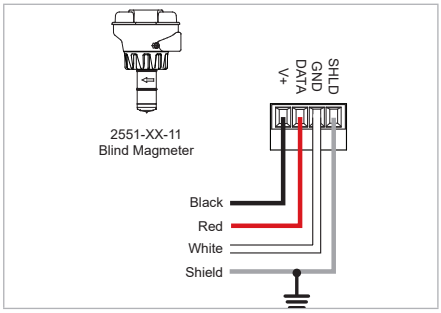
2551 Frequency Out to other Manufacturer's Equipment



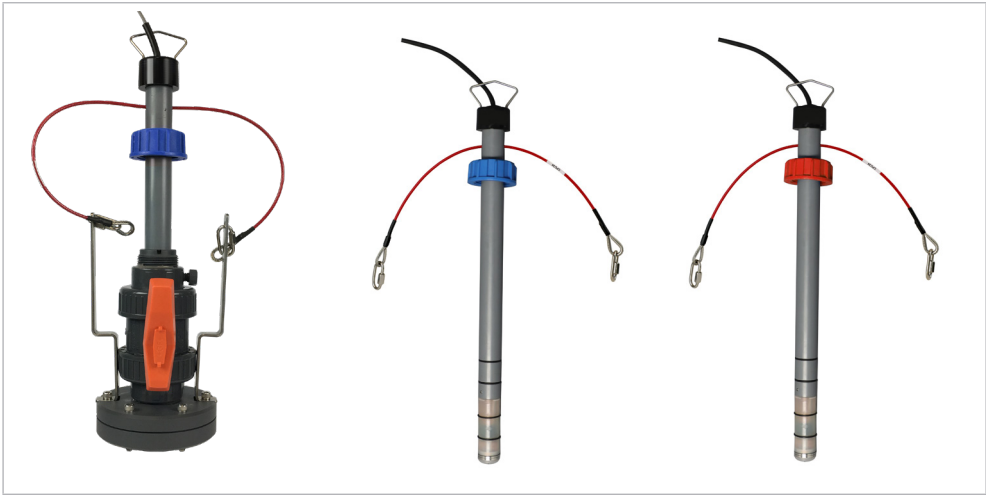
Install a pull-up resistor when connecting the 2551 Magmeter to other manufacturer's flowmeters.

Digital (S³L) Wiring:

- When the blue jumper illustrated here is removed (or placed over one pin for storage) the 2551-XX-11 outputs a digital (S³L) signal compatible with the type 9900 or 9950.
- The 2551 receives 5 VDC power from the 9900 or 9950. No additional power is required.
- The 9900 or 9950 will display negative flow rate during periods of reverse flow.
- The maximum cable length from the 2551 to the 9900 or 9950 is 1000 ft.



Type 2551 Wet-Tap Magmeter Flow Sensor



Note: Image for illustration only. Red cap indicates Frequency/Digital (S³L) output; blue cap indicates 4–20 mA output.

Product description

The Type 2551 Wet-Tap Magmeter is an insertion-style magnetic flow sensor with no moving parts. The ball valve enables safe and controlled pressure relief when the sensor is retracted during operation, without interrupting the process flow. The patented* sensor design is available in the corrosion resistant material combination PVDF/Hastelloy-C to provide long-term reliability with minimal maintenance costs.

Utilizing the comprehensive line of GF installation fittings, sensor alignment and immersion depth are already predefined. These versatile, simple-to-install sensors deliver accurate flow measurement over a wide dynamic range in pipe sizes ranging from DN15 to DN900 (½ to 36 in.), satisfying the requirements of many diverse applications.

Type 2551 Magmeters offer the output options of frequency/digital (S³L) or 4 to 20 mA. The frequency or digital (S³L) sensor output can be used with GF's line of transmitters (9900 and 9950-XX), while the 4 to 20 mA output can be used for a direct input to PLCs, chart recorders, etc. An additional benefit is the empty pipe detection which features a zero flow output when the sensors are not completely wetted.

Features

- Test certificate included
- Patented Magmeter technology*
- No moving parts
- Bi-directional flow
- Empty pipe detection
- Installs into pipe sizes DN15 to DN900 (0.5 to 36 in.)
- Operating range 0.05 to 10 m/s (0.15 to 33 ft/s)
- Reliable measurement even in dirty liquids
- Frequency/digital (S³L) output (with red cap), or 4 to 20 mA output (with blue cap)
- No pressure drop
- Corrosion resistant materials PVDF with Hastelloy-C

Applications

- Aquariums, Life Support
- Commercial Pools, Spas
- Ship Building (Marine)
- Chemical Processing
- Water and Wastewater Monitoring
- Metal Recovery and Landfill Leachate
- Commercial Pools, Spas, and Aquariums
- Irrigation
- Scrubber Control
- Neutralization Systems
- Industrial Water Distribution

* U.S. Patent No: 7,055,396 B1

Technical Details

General		
Operating Range	0.05 to 10 m/s	0.15 to 33 ft/s
Pipe Size Range	DN15 to DN900	½ in. to 36 in.
Linearity	± 1% reading plus 0.1% of full scale	
Repeatability	±0.5% of reading @ 25 °C (77 °F)	
Minimum Conductivity	20 µS/cm	

Wetted Materials	
Sensor Body/Electrodes and Grounding Ring	-V3, -V4, -V5: PVDF/Hastelloy-C
O-rings	FKM (standard) EPR (EPDM), FFKM (optional)

Electrical		
Power Requirements	4 to 20 mA	24 VDC ±10%, regulated, 22.1 mA max.
	Frequency	5 to 24 VDC ±10%, regulated, 15 mA max.
	Digital (S^3L)	5 to 6.5 VDC, 15 mA max.
Reverse Polarity and Short Circuit Protected		
Cable Length	7.6 m (25 ft), can be extended up to 300 m (1,000 ft)	
Current Output 4 to 20 mA	Loop Accuracy	32 µA max. error (25 °C @ 24 VDC)
	Isolation	Low Voltage < 48 VAC/DC from electrodes and auxiliary power
	Maximum Cable	300 m (1,000 ft)
	Error Condition	22.1 mA
	Max. Loop Resistance	300 Ω
	Compatible with PLC, PC or similar equipment	
	4 to 20 mA load needed	
Frequency Output	Output Modes	Frequency
	Max. Pull-up Voltage	30 VDC
	Max. Current Sink	50 mA, current limited
	Maximum Cable	300 m (1,000 ft)
	Compatible with type type 9900, 9950	
Digital S^3L Output	Serial ASCII, TTL level 9600 bps	
	Compatible with type type 9900, 9950, 0486 Profibus Concentrator	

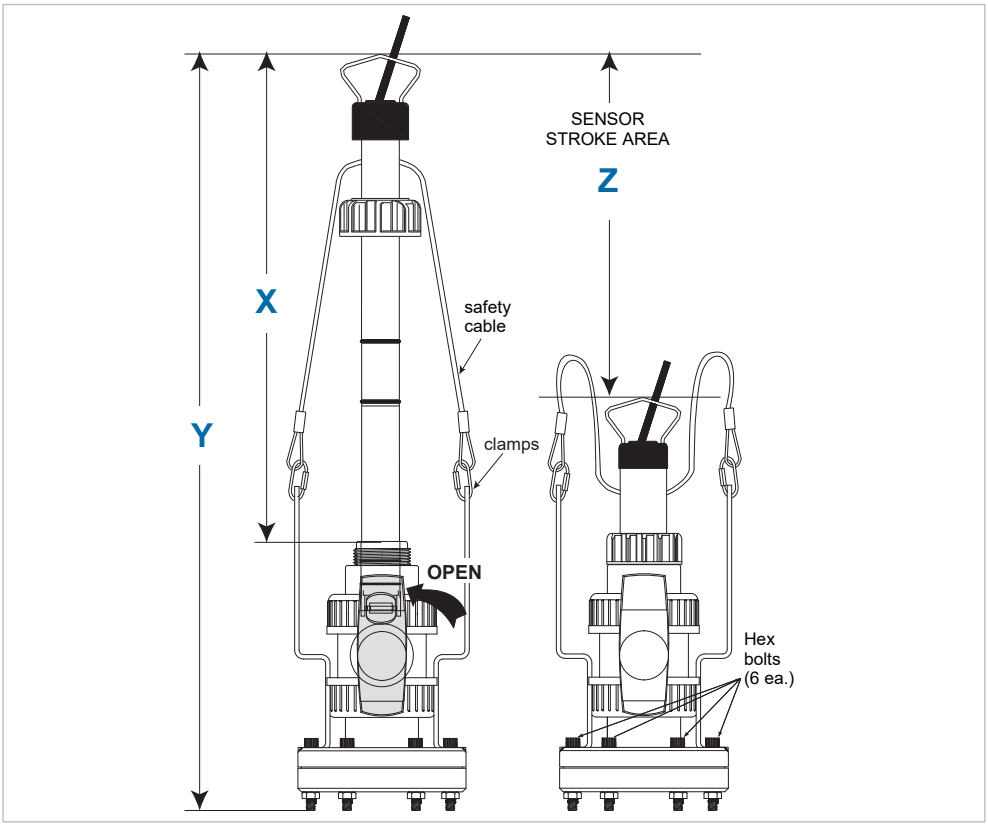
Max. Temperature/Pressure Rating			
Storage Temperature		-20 °C to 70 °C	-4 °F to 158 °F
Relative Humidity		0 to 95% (non-condensing)	
Operating Temperature (with Wet-Tap Valve)	Ambient	-10 °C to 70 °C	14 °F to 158 °F
	Media	0 °C to 65 °C	32 °F to 149 °F
Maximum Operating Pressure	-V3, -V4, -V5	6.9 bar (100 psi) @ 0 °C (32 °F) 1.4 bar (20 psi) @ 65 °C (149 °F)	
Max. Wet-Tap Sensor Removal Rating		1.7 bar (25 psi) @ 22 °C (72 °F)	

See Temperature and Pressure graphs for more information.

Shipping Weight		
	0.680 kg	1.50 lb

Standards and Approvals
CE, UKCA, FCC
RoHS compliant, China RoHS
Manufactured under ISO 9001, ISO 14001 and ISO 45001

Dimensions

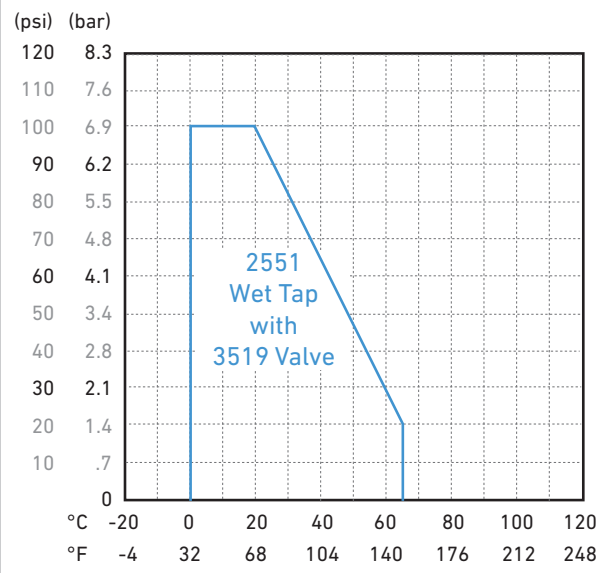


Sensor type	Sensor length X	Total length Y	Sensor stroke area Z
3-2551-V3-1x	297 mm (11.7 in.)	737 mm (29 in.)	197 mm (7.75 in.)
3-2551-V4-1x	332 mm (13.1 in.)	762 mm (30 in.)	229 mm (9 in.)
3-2551-V5-1x	408 mm (16.1 in.)	813 mm (32 in.)	305 mm (12 in.)

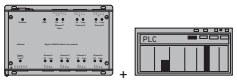
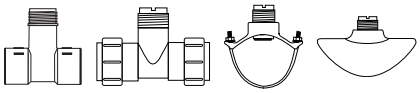
Pressure-temperature diagram

Note

The pressure-temperature diagrams are specifically for the GF sensor. During system design the specifications of all components must be considered. In the case of a metal piping system, a plastic sensor will reduce the system specification. When using a PVDF sensor in a PVC piping system, the fitting will reduce the system specification.



System Overview

Stand-Alone	Panel Mount	Pipe, Tank, Wall	4 to 20 mA Output	Automation System
GF 2551 Wet-Tap Magmeter 	GF Instruments - 9900-1P - 9950-1/-2 - 9950-10/-12 	GF Instruments - 9900-1 with 3-8050-1 Universal Mount Kit 	- Customer Supplied Chart Recorder, Programmable Logic Controller or - Programmable Automation Controller 	- 0486 Profibus Concentrator and Customer Supplied - Programmable Logic Controller or Programmable Automation Controller 
	GF 3519 Wet-Tap Valve (required)			
GF Fittings				All Sold Separately

Ordering information

Frequency or Digitial (S³L) output, with red cap

Mfr. Part No.	Code	Description
3-2551-V3-11	159 002 208	Wet-Tap Magmeter, Frequency/S³L output, PVDF/Hastelloy-C, 0.5 to 4" pipe
3-2551-V4-11	159 002 214	Wet-Tap Magmeter, Frequency/S³L output, PVDF/Hastelloy-C, 5 to 8" pipe
3-2551-V5-11	159 002 220	Wet-Tap Magmeter, Frequency/S³L output, PVDF/Hastelloy-C, 10 to 36" pipe

4 to 20 mA output, with blue cap

Mfr. Part No.	Code	Description
3-2551-V3-12	159 002 209	Wet-Tap Magmeter, 4-20 mA output, PVDF/Hastelloy-C, 0.5 to 4" pipe
3-2551-V4-12	159 002 215	Wet-Tap Magmeter, 4-20 mA output, PVDF/Hastelloy-C, 5 to 8" pipe
3-2551-V5-12	159 002 221	Wet-Tap Magmeter, 4-20 mA output, PVDF/Hastelloy-C, 10 to 36" pipe

Accessories and Replacement Parts

Please refer to Wiring, Installation, Accessories and Fitting section for more information.

Mfr. Part No.	Code	Description
3-3519	159 000 757	Wet-Tap Valve for Wet-Tap flow sensors
1220-0021	198 801 000	O-ring, FKM (4 required per sensor)
1224-0021	198 820 006	O-ring, EEPR (EPDM) (4 required per sensor)
1228-0021	198 820 007	O-ring, FFKM (4 required per sensor)

Type 2552 Metal Magmeter Flow Sensor



Product description

The type 2552 Metal Magmeter from Georg Fischer features all-stainless steel construction. The PVDF nosepiece and FKM O-rings are the only other wetted materials. The 2552 installs quickly into standard 1¼ in. or 1½ in. pipe outlets, and is adjustable to fit pipes from DN50 to DN2550 (2 to 102 inches). Two sensor lengths allow maximum flexibility to accommodate a variety of hardware configurations, including ball valves for hot-tap installations.

When equipped with the frequency output, the 2552 is compatible with any externally powered GF flow instrument, while the digital (S^3L) output enables multi-channel compatibility with the type 9900 or 9950 Multi-Parameter instruments. Select the blind 4 to 20 mA current output to interface directly with Dataloggers, PLCs or telemetry systems. Key features include Empty Pipe Detection, LED-assisted troubleshooting, and bi-directional span capability (in 4 to 20 mA types).

The type 3-0252 Configuration Tool is available to customize every performance feature in the 2552 so it can be adapted to the user's application requirements.

Features

- Test certificate included
- Award winning hot-tap magnetic flow sensor up to DN2550 (102 in.)
- Patented Magmeter technology*
- Operating range 0.05 to 10 m/s (0.15 to 33 ft/s)
- Reliable operation in harsh environments
- Repeatable: ±0.5% of reading @ 25 °C
- Three output options: 4 to 20 mA, Frequency/Digital (S^3L)
- ISO or NPT Threads

* U.S. Patent No: 7,055,396 B1

Applications

- Municipal Water Distribution
- Process and Coolant Flow
- Chemical Processing
- Wastewater
- Mining Applications
- Water Process Flow
- HVAC

Technical Details

General			
Operating Range	Minimum	0.05 m/s	0.15 ft/s
	Pipes to DN1200 (48 in.)	10 m/s	33 ft/s
	Pipes over DN1200 (48 in.)	3 m/s	10 ft/s
Pipe Size Range	DN50 to DN2550	2 in. to 102 in.	
Linearity	±1% of reading plus 0.1% of full scale		
Repeatability	±0.5% of reading @ 25 °C		
Accuracy	±2% of measured value*		
Minimum Conductivity	20 µs/cm		

Wetted Materials	
Body and Electrodes	316L stainless steel
Insulator	PVDF
O-rings	FKM
Cable	4-cond + shield, PVC jacket (Fixed cable types) or Water-resistant rubber cable assembly with Turck NEMA 6P connector

Power Requirements	
4 to 20 mA	24 VDC ±10%, regulated, 22.1 mA maximum
Frequency	5 to 24 VDC ±10%, regulated, 15 mA maximum
Digital (S^3L)	5 to 6.5 VDC 15 mA maximum

Reverse Polarity and Short Circuit Protected

Cable Options		
Fixed Cable	7.6 m	25 ft

Detachable water tight sensor cable with Turck connector (sold separately) two lengths: 4 m (13 ft) or 6 m (19.5 ft)

Electrical			
Current Output (4 to 20 mA)	Programmable and Reversible		
	Loop Accuracy	32 µA max. error (@ 25 °C @ 24 VDC)	
	Temperature Drift	±1 µA per °C max.	
	Power Supply Rejection	±1 µA per V	
	Isolation	Low voltage < 48 VAC/DC from electrodes and auxiliary power	
	Maximum Cable	300 m	1000 ft
	Max. Loop Resistance	300 Ω	
	Error Condition	22.1 mA	
Frequency Output	Compatible with	Type 9900, 9900-1BC and 9950	
	Max. Pull-up Voltage	30 VDC	
	Short Circuit Protected	≤30 V @ 0 Ω pull-up for one hour	
	Reverse Polarity Protected	To -40 V for 1 hour	
	Over-voltage Protected to +40 V for 1 hour		
	Max. Current Sink	50 mA, current limited	
	Maximum Cable	300 m	
Digital (S^3L)Output	Compatible with	Type 9900, 9950 and 0486	
	Serial ASCII, TTL level 9600 bps		
	Maximum Cable	Application dependent (See 9900 or 9950 manual) in non-icing conditions	
Operating Temp.	Ambient (non-icing conditions)	-15 °C to 70 °C	5 °F to 158 °F
	Media	-15 °C to 85 °C	5 °F to 185 °F
Max. Operating Pressure	20.7 bar @ 25 °C	300 psi @ 777 °F	

* In reference conditions where the fluid is water at ambient temperature, the sensor is inserted at the correct depth and there is a fully developed flow profile which is in compliance with ISO 7145-1982 (BS 1042 section 2.2)

Hot-Tap Installation Requirements		
Maximum Installation Pressure	20.7 bar	300 psi
Maximum Installation Temp (Insertion/Removal)	40 °C	104 °F

Do not use hot-tap installation where temperatures will exceed 40 °C or if hazardous liquids are present.

Shipping Weights		
3-2552-2X-A-11/A-12	2.50 kg	5.51 lb
3-2552-2X-B-11/B-12	2.30 kg	5.07 lb
3-2552-3X-A-11/B-11	4.00 kg	8.81 lb
3-2552-3X-A-12/B-12	4.00 kg	8.81 lb

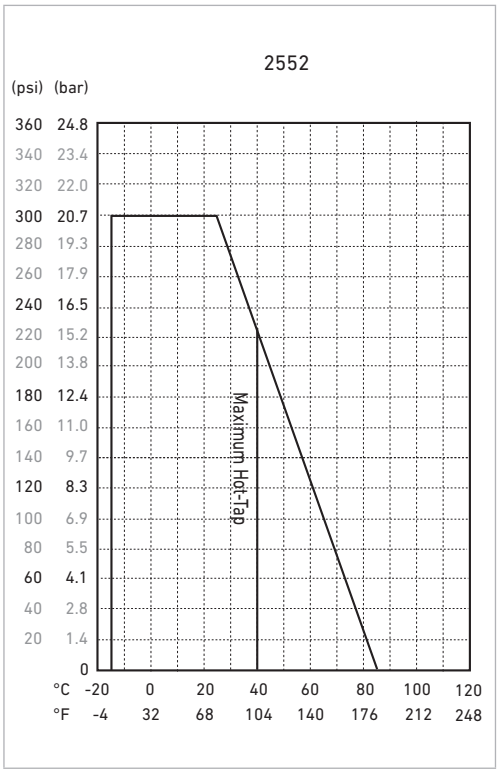
Standards and Approvals	
CE, UKCA, FCC	
RoHS compliant, China RoHS	
NEMA 4 (IP65)	Fixed cable types
NEMA 6P (IP68)	Submersible cable types only. GF recommends maximum 3 m (10 ft) submersion depth for maximum 10 days continuous submersion.

Manufactured under ISO 9001, ISO 14001 and ISO 45001

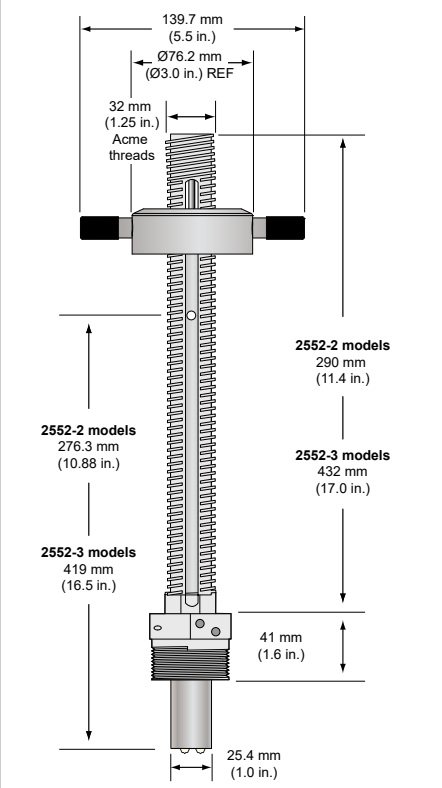
Pressure-temperature diagrams

Note

The pressure-temperature diagrams are specifically for the GF sensor. During system design the specifications of all components must be considered. In the case of a metal piping system, a plastic sensor will reduce the system specification. When using a PVDF sensor in a PVC piping system, the fitting will reduce the system specification.



Dimensions



System Overview

Panel Mount	Pipe, Tank, Wall	4 to 20 mA Output	Automation System
GF Instruments - 9900-1P - 9900-1BC - 9950	GF Instruments - 9900-1 with 3-8050 Universal Mount Kit - 9900-1BC with Rear Enclosure	- Customer Supplied Chart Recorder, Programmable Logic Controller or - Programmable Automation Controller	- 0486 Profibus Concentrator and Customer Supplied Programmable Logic Controller or - Programmable Automation Controller
Type 2552 Magmeter			
ball or gate valve 1¼" or 1½"	closed nipple 1¼" or 1½"	Weld-on weldolet 1¼" or 1½" outlet*	Iron strap-on saddle 1¼" or 1½" outlet*

* Contact GF for ordering information
All Sold Separately

Application Tips

- Minimum process liquid conductivity requirement is 20 µS/cm.
- 1½ x 1¼ inch and 2 x 1¼ inch (2552-2x only) retrofit adapters are available for replacement installations of type 2550 and 2540 sensors

Sensor Selection Guide

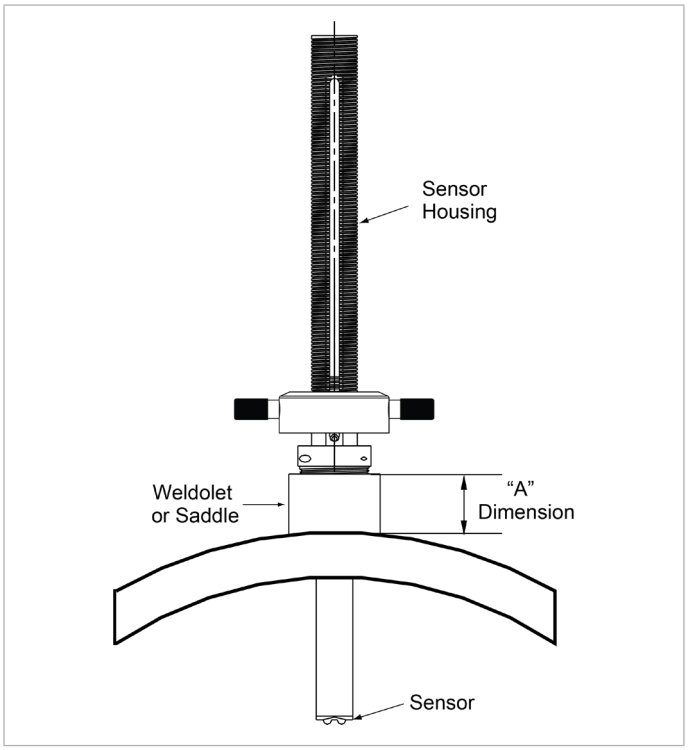
The 2552 Magmeter can be installed into a variety of pipe sizes. Follow the steps below to ensure that you choose the right sensor for your application.

Step 1: Determine how the sensor will be installed

A For standard (non Hot-Tap) installation:

The height of the weldolet (threadolet) and pipe adapter(s) should be determined before the sensor is purchased.

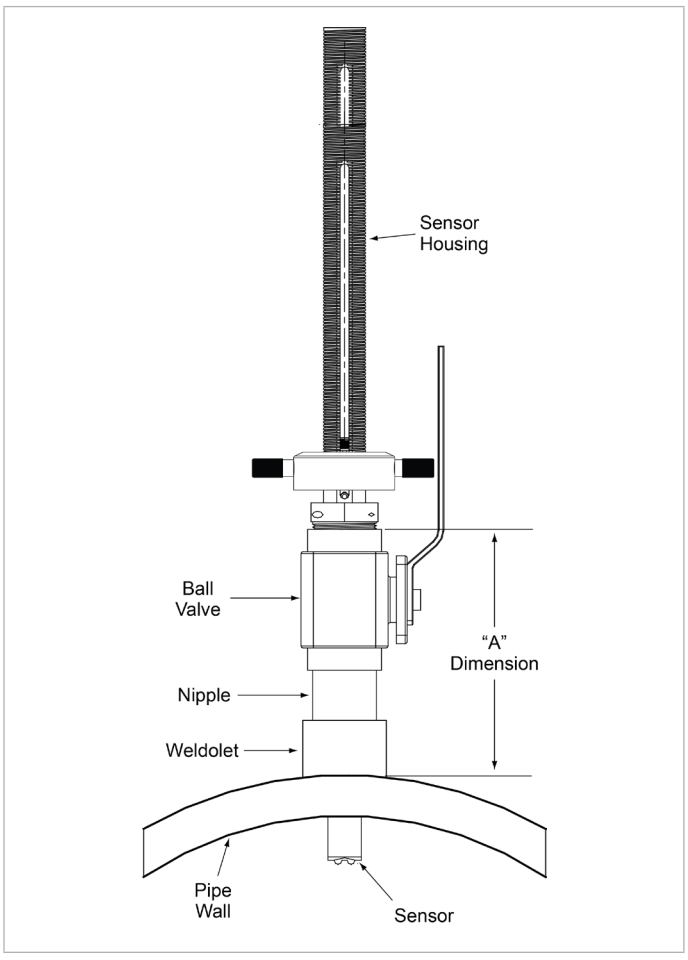
- For retrofit installations, the stack height, or "A" dimension, is the overall height from the top oof the pipe to the highest point of the stack.
- Sensor tip must be positioned at 10% of pipe ID
- For new installations, GF recommends a weldolet (threadolet) and and adapter to accommodate the 1¼ in. (or 1½ in. for 3-2552-3X) sensor process threads. The stack height, or "A" dimension, is the overall height from the top of the pipe to the highest point of the stack before the sensor is connected.



B For Hot-Tap installations:

The stack height of the ball valve, nipple, weldolet (threadolet) and pipe adapters should be determined before the sensor is purchased.

- For retrofit installations, the ball valve must be at least a 1¼ in. (or 1½ in. for 3-2552-3X) valve. The stack height, or "A" dimension (see Fig. 2), is the overall height from the top of the pipe to the top of the ball valve.
- Sensor tip must be positioned at 10% of pipe ID
- For new installations, GF recommends a 1¼ in. or 1½ in. full port ball valve, a closed nipple and a weldolet (threadolet). The stack height or "A" dimension (see Fig. 2) is the overall height from the top of the pipe to the top of the ball valve before the sensor is connected.



Step 2: Determine how the sensor will be installed

Once the "A" dimension is determined, go to the sensor selection table and find you "A" dimension on the left column. Next, find the appropriate pipe size at the top of the chart. To determine the correct sensor size locate where the pipe size column meets the max "A" dimension row.

			Pipe Size																										
		inches	2	2.5	3 to 3 ½	4	5	6 to 8	10	12 to 14	16	18	20	22	24	26 to 28	30 to 32	34	36 to 38	40 to 42	48	54	60	66	72	78	84	102
		DN	50	65	80 to 90	100	125	150 to 200	250	300 to 350	400	450	500	550	600	650 to 700	750 to 800	850	900 to 950	1000 to 1100	1200	1400	1500	1700	1800	2000	2100	2.58
Max. "A" Dim	mm	inches																											
	50.8	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3
	63.5	2.5	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3
	76.2	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3
	88.9	3.5	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3
	101.6	4	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3
	114.3	4.5	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	
	127	5	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	
	139.7	5.5	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	
	152.4	6	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	2	3	3	3	3	3	3	3	3	3	
	165.1	6.5	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3		
	177.8	7	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3			
	190.5	7.5	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3				
	228.6	9	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3						
	241.3	9.5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3							
	254	10	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3								
	266.7	10.5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3									
	279.4	11	3	3	3	3	3	3	3	3	3	3	3	3		3	3	3										
	292.1	11.5	3	3	3	3	3	3	3	3	3	3	3			3												
	304.8	12	3	3	3	3	3	3	3	3	3	3																
	317.5	12.5	3	3	3	3	3	3	3	3																		
	330.2	13	3	3	3	3	3	3	3																			
	342.9	13.5	3	3	3	3	3	3																				
	355.6	14	3	3	3	3	3																					
	375.9	14.8	3	3																								
	381	15																										

2 Use 3-2552-2, max. insertion = 236 mm (9.3 in.)
3 Use 3-2552-3, max. insertion = 368 mm (14.8 in.)
This chart is based on the thickest commonly available pipe.

Step 3: Refer to Ordering Information to select corresponding part numbers

Ordering Notes:

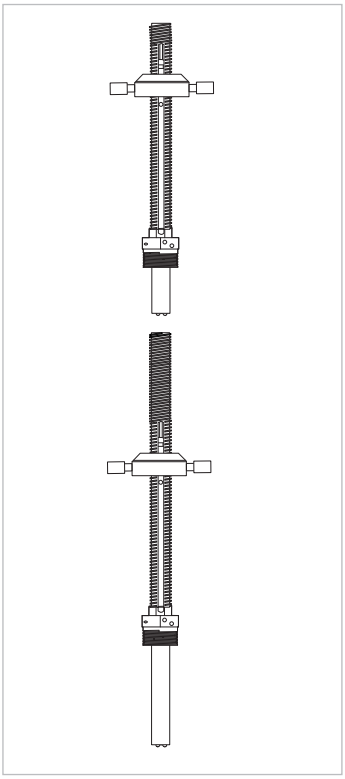
- Sensor insertion depth is the distance from the bottom of the sensor housing to the tip of the sensor.
- Hot-Tap installations require a 1¼ in. or 1½ in. ball valve.
- See Sensor Selection Guide on previous page to determine the sensor length required.

Application Tips

- Minimum process liquid conductivity requirement is 20 µS/cm.
- 1½ x 1¼ in. and 2 x 1¼ in. (3-2552-2x only) retrofit adapters are available for replacement installations of GF 2552 and 2540 sensors.

Ordering Information

Mfr. Part	Code	Sensor Insertion Depth	Process Connection Thread Options
Frequency or Digital (S³L) output For use with any GF Flow or Multi-Parameter Instruments			
Fixed Cable, 7.6 m (25 ft); no connector			
3-2552-21-A-11	159 001 513	9.3 inches*	1¼ inch NPT**
3-2552-22-A-11	159 001 517	9.3 inches*	1¼ inch ISO**
3-2552-33-A-11	159 001 521	14.8 inches*	1½ inch NPT**
3-2552-34-A-11	159 001 522	14.8 inches*	1½ inch ISO**
Watertight sensor connector; cable sold separately			
3-2552-21-B-11	159 001 515	9.3 inches*	1¼ inch NPT**
3-2552-22-B-11	159 001 519	9.3 inches"	1¼ inch ISO**
3-2552-33-B-11	159 001 523	14.8 inches*	1½ inch NPT**
3-2552-34-B-11	159 001 524	14.8 inches*	1½ inch ISO**
4 to 20 mA output			
Fixed Cable, 7.6 m (25 ft); no connector			
3-2552-21-A-12	159 001 514	9.3 inches*	1¼ inch NPT**
3-2552-22-A-12	159 001 518	9.3 inches"	1¼ inch ISO**
3-2552-33-A-12	159 001 525	14.8 inches*	1½ inch NPT**
3-2552-34-A-12	159 001 526	14.8 inches*	1½ inch ISO**
Watertight sensor connector; cable sold separately			
3-2552-21-B-12	159 001 516	9.3 inches*	1¼ inch NPT**
3-2552-22-B-12	159 001 520	9.3 inches"	1¼ inch ISO**
3-2552-33-B-12	159 001 527	14.8 inches*	1½ inch NPT**
3-2552-34-B-12	159 001 528	14.8 inches*	1½ inch ISO**



* Customer must determine stack height (ball valve, nipple, weldolet, etc.). Refer to Sensor Selection on previous page to determine "A" dimension. Sensor tip must be positioned at 10% of pipe ID.

** 1¼ inch process connection is the standard thread size on the 3-2552-2X-X-XX: For the 2552-3X the 1½ inch process connection is standard and the 1¼ inch is available as a special order.

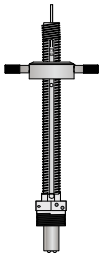
Accessories and Replacement Parts

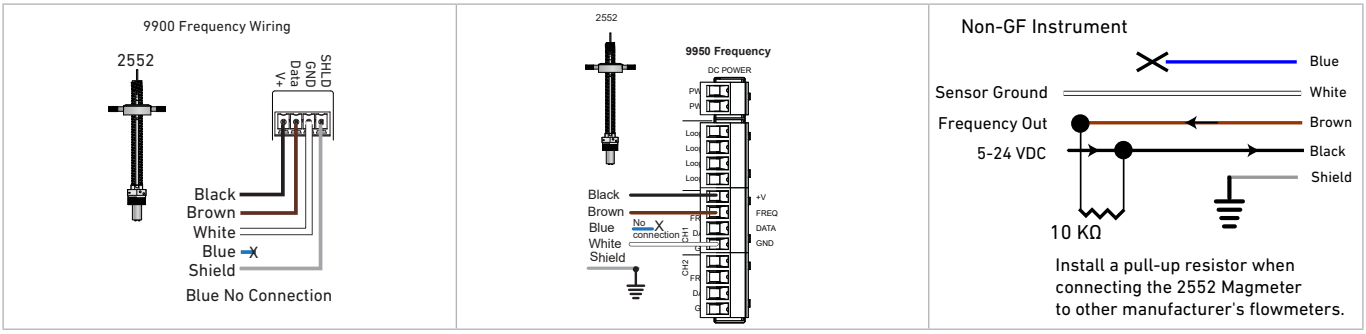
Mfr. Part	Code	Description
2120-1512	159 001 425	1½ x 1¼ inch NPT adapter for retrofitting 2540 installation to 2552 - 316 SS
3-2552.392	159 001 530	1¼ inch NPT full port stainless steel ball valve and nipple kit
3-2552.393	159 001 531	1¼ inch NPT full port brass ball valve and nipple kit
3-2552.394	159 011 532	1½ inch NPT conduit adapter, aluminum for -1 and -2 units
4301-2125	159 001 533	1¼ inch NPT full port ball valve – brass
4301-2125	159 001 387	1¼ inch NPT full port ball valve - stainless steel
5541-4184	159 001 388	4-conductor cable assembly with water-tight connector, 4 m (13 ft)
5541-4186	159 001 389	4-conductor cable assembly with water-tight connector, 6 m (19.5 ft)
Special order	Special order	1¼ in. NPT Iron saddle
Special order	Special order	1½ in. NPT Iron saddle
Special order	Special order	1¼ in. NPT threadolet (SS, Carbon Steel, Brass or copper)
Special order	Special order	1½ in. NPT threadolet (SS, Carbon Steel, Brass or copper)
Special order	Special order	1½ in. NPT full port ball valve with closed nipple - stainless steel
Special order	Special order	4-conductor cable assembly with water-tight connector, cable length in 25 ft increments
Special order	Special order	1¼ in. NPT or ISO process connection threads to replace 1½ in. NPT or ISO threads
3-0252	159 001 808	Configuration Tool

Wiring information

Frequency Wiring

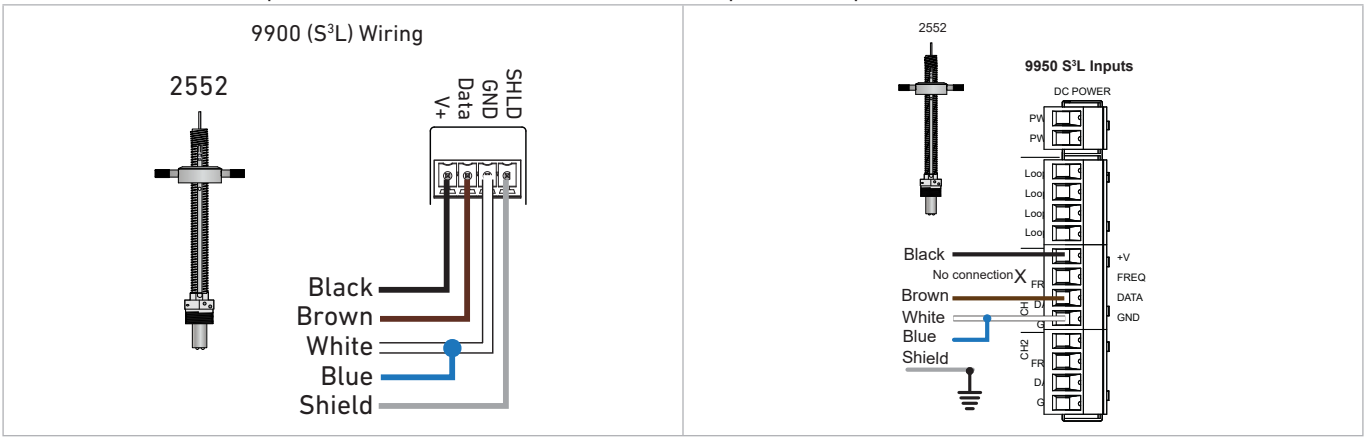
- The 2552 outputs an open collector frequency signal that can be connected to any powered GF flow meter (Types 9900, 9900-1BC, 9950)
- DC power is provided to the 2552 Magmeter by all GF flow instruments. No additional power is required.
- If connecting the 2552 Magmeter to a flow instrument from another manufacturer, 5 to 24 VDC power must be provided to the 2552. A 10 KΩ pull up resistor must also be connected between the +V (Black) and the Freq. Out (Brown) wires.





Digital (S³L) Wiring

The 2552 receives 5 VDC power from the 9900 or 9950. No additional power is required.



NOTE: The maximum cable length from the 2552 to the 9900 or 9950 is 300m (1000 ft.).

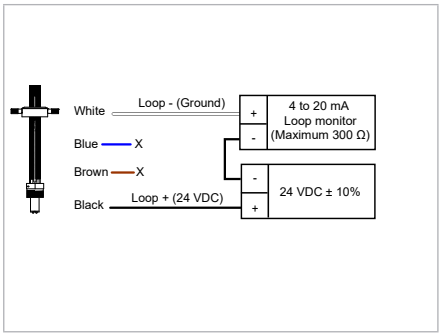
Loop Wiring

The 2552 is a traditional 2-wire passive 4 to 20 mA loop transmitter. External loop power (24 VDC ±10% regulated) is required. Please refer to the type 7310 Power Supplies.

⚠ The maximum loop resistance the Magmeter can accommodate is 300 Ω.

⚠ The cable length from the Magmeter to the loop monitor cannot exceed 300 m (1000 ft).

All 2552 Magmeters are shipped from the factory with the 4 to 20 mA output scaled for 0 to 5 m/s (0 to 16.4 ft/s). If this operating range is suitable, no adjustments are necessary.



Planning Fundamentals

of Measurement and Control

Ultrasonic Flowmeters

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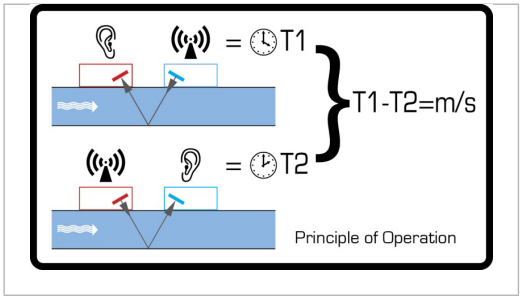
Introduction

Principles of operation

Transducers are mounted onto the outer pipe. A periodically voltage pulse causes piezo crystals inside of the measuring transducers to swing which generates a sound at ultrasonic frequency.

First the ultrasonic sound is transmitted downstream where is received by the second transducer. Then the same process takes place in the opposite direction.

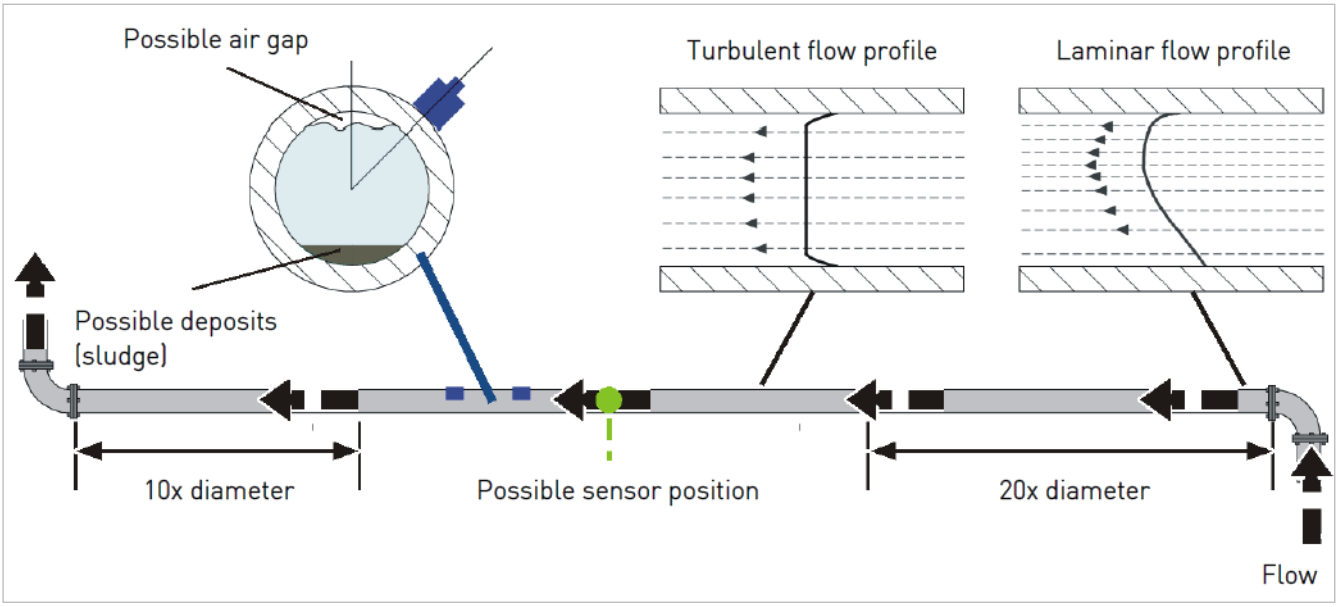
The resulting time difference T1-T2 is directly proportional to the speed at which the liquid is flowing through the pipe.



Installation of Flow Sensors: Ultrasonic Flow Sensors

Technical basics

GF ultrasonic flow sensors require a uniform and even flow profile, since a flow which is distorted can lead to unpredictable measurement errors. In many applications it is not possible, however, to attain a flow profile with even speed all around. Reasons for this can be, for example, air bubbles on the upper inner wall of the pipe, turbulence in the pipe or sludge on the bottom of the pipe.



The most accurate results are attained in our experience when the guide rail of the measuring transducer is not installed on top of the pipe, but is rather turned 45° to the right or the left of the pipe.

Incorrect measurements

The measurement can be distorted when the measuring transducer is positioned in the vicinity of upstream pipe segments such as bends, tees, valves, pumps and other similar hindrances.

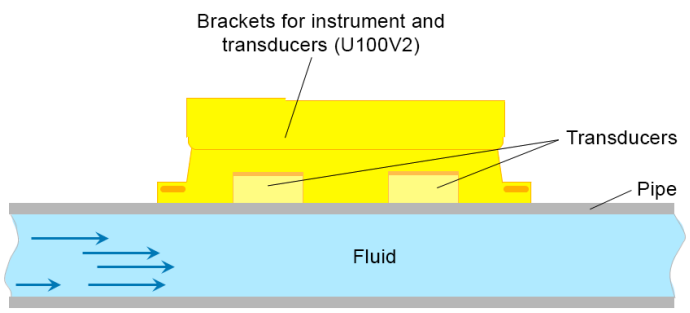
In order to ensure that the ultrasonic flow sensors are positioned such that an undistorted flow profile is possible, the measuring transducers must be installed far enough away from possible sources of disruption that they have no influence on the measurement.

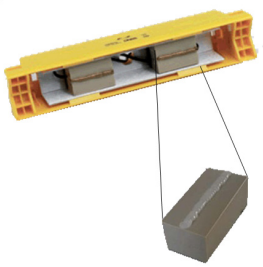
Installation notes

Maximum accuracy through optimal contact surfaces

In order to attain the most precise measurements, the following points must be observed at the installation site:

- A smooth and even contact between the pipe surface and the measuring transducer is an important factor in attaining a sufficiently strong ultrasonic signal.
- The pipe surface must be free of any residual grease.
- Contamination and peeling paint must be removed in order to guarantee an even contact surface.
- Rust preventer must be removed from the contact surfaces. Thick layers of paint can unintentionally reflect ultrasonic signals. No measurement is thereby possible.
- Ultrasonic conductive paste must be applied sufficiently in the middle of the sound transducers.
- The sensor distance must be chosen properly. The correct numbers for the U1000 V2 are summarized in a table. All other devices display the distance in the setup during installation.





⚠ The quality of the contact surface and the software settings each influence the measurement decisively. Ultrasonic conductive paste must be used for every installation and must be applied on the center of the sound transducers.

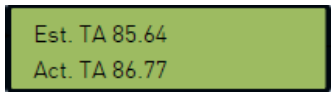
Tips for installation

Measuring point diagnosis

The quality of an installed measuring point can be subjected to a diagnosis in all devices. In case problems occur, one can discover whether there is a fundamental technical problem, whether settings can be optimized or whether the physical installation itself should be rechecked. The diagnosis is a variance analysis of the initial situation for which the device was configured and the actual situation at the measuring point. The following information can support troubleshooting, see Diagnosis menu:

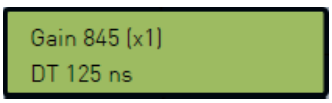
Estimated/actual transmission time (Est. TA / Act. TA)

The two values Est. TA and Act. TA should be close to one another in a good installation.



Gain

This factor refers to the signal quality. The switch position is stated in parentheses. For a good setup, values between 600 and 970 can be expected, as well as a switch position of (x1).



In the case that one of the mentioned data points does not meet expectations, one should analyze the following points more closely.

Possible causes for faulty measurements

Faulty installation/settings

If the signal quality is bad (PF220 and PF330, U3000/4000 less than two bars, U1000 V2 under 60 %), there may be problems with the installation. The following points are to be checked:

- Check input data for the measurement point

- Check whether the correct sound transducers are being used – A or B
- Sufficient ultrasonic conductive paste must be applied in the middle of the sound transducers
- The correct sensor distance was set according to specifications
- The cables connecting the measuring device and the sensors are correctly plugged in

Application-specific causes		
Surface quality	Unfavorable consistency of the raw surface	Uneven surfaces do not ensure good contact to the sound transducers
	Paint/rust	Should be removed at the measuring point to the extent possible
	Entrapped air	Between the materials, lead to measuring problems especially with networked pipes
Inner surface of pipe	Roughness	The roughness factor may have to be adjusted for in the settings
	Fusion seams	The sensors should not be positioned on fusion seams.
Wrong sensor position	Run-in distances	Are the sound transducers too close to a bend?
	Other sensors	There is an invasive sensor upstream of the measuring point
State of the medium	Air bubbles	The medium should be as free of bubbles as possible.
	Air in the pipe	The sensors should be installed on the sides in horizontal stretches of pipe.
Flow is too low	Blocked pipe	Check pipe for blockages
	Valve position	Check whether upstream valves are open.

Sound speeds in different materials

Ultrasonic penetrates different material and liquids at different speeds. Therefore, the entry of the material and liquid type of fundamental importance when using GF ultrasonic flow sensors. The pipe material must be defined, as well as the medium itself. Some specifications are already included in the software menu, others can be found under the following link. These can then be entered manually (not in the U1000 V2).

i For a list with numbers on the speed of sound in a wide variety of materials, see http://www.gfps.com/appgate/ecat/common_flow/100021/DE/en/252706/download/document.html

Speed of sound in various liquids and solids

Speed of sound in liquids at 25°C and atmospheric pressure

Substance	Chem. Formula	Specific Gravity	Speed of Sound (m/s)	Δv/°C (m/s/°C)
Acetic anhydride (22)	$(CH_3CO)_2O$	1.082 (20°C)	1'180	2.5
Acetic acid, anhydride (22)	$(CH_3CO)_2O$	1.082 (20°C)	1'180	2.5
Acetic acid, nitrile	C_2H_3N	0.783	1'290	4.1
Acetic acid, ethyl ester (33)	$C_4H_8O_2$	0.901	1'085	4.4
Acetic acid, methyl ester	$C_3H_6O_2$	0.934	1'211	
Acetone	C_3H_6O	0.791	1'174	4.5
Acetonitrile	C_2H_3N	0.783	1'290	4.1
Acetonylacetone	$C_6H_{10}O_2$	0.729	1'399	3.6
Acetylene dichloride	$C_2H_2Cl_2$	1.26	1'015	6.8
Acetylene tetrabromide (47)	$C_2H_2Br_4$	2.966	1'027	
Acetylene tetrachloride (47)	$C_2H_2Cl_4$	1.595	1'147	
Alcohol	C_2H_6O	0.789	1'207	4
Alkazene-13	$C_{15}H_{24}$	0.86	1'317	3.9
Alkazene-25	$C_{10}H_{12}Cl_2$	1.2	1'307	3.4
2-Amino-ethanol	C_2H_7NO	1.018	1'724	3.4
2-Aminotolidine (46)	C_7H_9N	0.999 (20°C)	1'618	
4-Aminotolidine (46)	C_7H_9N	0.966 (45°C)	1'480	
Ammonia (35)	NH_3	0.771	1'729	6.68
Amorphous Polyolefin		0.98	962.6	
t-Amyl alcohol	$C_5H_{12}O$	0.81	1'204	
Aminobenzene (41)	$C_6H_5NO_2$	1.022	1'639	4
Aniline (41)	$C_6H_5NO_2$	1.022	1'639	4
Argon (45)	Ar	1.400 (-188°C)	853	
Azine	C_6H_5N	0.982	1'415	4.1
Benzene (29,40,41)	C_6H_6	0.879	1'306	4.65
Benzol (29,40,41)	C_6H_6	0.879	1'306	4.65
Bromine (21)	Br_2	2.928	889	3
Bromo-benzene (46)	C_6H_5Br	1.522	1'170	
1-Bromo-butane (46)	C_4H_9Br	1.276 (20°C)	1'019	
Bromo-ethane (46)	C_2H_5Br	1.460 (20°C)	900	
Bromoform (46,47)	$CHBr_3$	2.89 (20°C)	918	3.1
n-Butane (2)	C_4H_{10}	0.601 (0°C)	1'085	5.8
2-Butanol	$C_4H_{10}O$	0.81	1'240	3.3
sec-Butylalcohol	$C_4H_{10}O$	0.81	1'240	3.3
n-Butyl bromide (46)	C_4H_9Br	1.276 (20°C)	1'019	
n-Butyl chloride (22,46)	C_4H_9Cl	0.887	1'140	4.57
tert Butyl chloride	C_4H_9Cl	0.84	984	4.2
Butyl oleate	$C_{22}H_{42}O_2$		404	3
2,3 Butylene glycol (7)	$C_4H_{10}O_2$	1.019	1'484	1.51
Cadmium	Cd		2'237.7	
Carbinol (40,41)	CH_4O	0.791 (20°C)	1'076	2.92
Carbitol	$C_6H_{14}O_3$	0.988	1'458	
Carbon dioxide (26)	CO_2	1.101 (-37°C)	839	7.71
Carbon disulphide	CS_2	1.261 (22°C)	1'149	
Carbon tetrachloride (33,35,47)	CCl_4	1.595 (20°C)	926	2.48
Carbon tetrafluoride (14)	CF_4	1.75 (-150°C)	875.2	6.61
Cetane (23)	$C_{16}H_{34}$	0.773 (20°C)	1'338	3.71
Chloro-benezene	C_6H_5Cl	1.106	1'273	3.6
1-Chloro-butane (22,46)	C_4H_9Cl	0.887	1'140	4.57
Chloro-di Fluoromethane (3) (Freon 22)	$CHClF_2$	1.491 (-69°C)	893.9	7.79
Chloroform (47)	$CHCl_3$	1.489	979	3.4
1-Chloro-propane (47)	C_3H_7Cl	0.892	1'058	

Substance	Chem. Formula	Specific Gravity	Speed of Sound (m/s)	Δv/˚C (m/s/˚C)
Chlorotrifluoromethane (5)	$CClF_3$		724	5.26
Cinnamaldehyde	C_9H_8O	1.112	1'554	3.2
Cinnamic aldehyde	C_9H_8O	1.112	1'554	3.2
Colamine	C_2H_7NO	1.018	1'724	3.4
o-Cresol (46) m-	C_7H_8O	1.047 (20°C)	1'541	
Cresol (46)	C_7H_8O	1.034 (20°C)	1'500	
Cyanomethane	C_2H_3N	0.783	1'290	4.1
Cyclohexane (15)	C_6H_{12}	0.779 (20°C)	1'248	5.41
Cyclohexanol	$C_6H_{12}O$	0.962	1'454	3.6
Cyclohexanone	$C_6H_{10}O$	0.948	1'423	4
Decane (46)	$C_{10}H_{22}$	0.73	1'252	
1-Decene (27)	$C_{10}H_{20}$	0.746	1'235	4
n-Decylene (27)	$C_{10}H_{20}$	0.746	1'235	4
Diacetyl	$C_4H_6O_2$	0.99	1'236	4.6
Diamylamine	$C_{10}H_{23}N$		1'256	3.9
1,2 Dibromo-ethane (47)	$C_2H_4Br_2$	2.18	995	
trans-1,2-Dibromoethene(47)	$C_2H_2Br_2$	2.231	935	
Dibutyl phthalate	$C_8H_{22}O_4$		1'408	
Dichloro-t-butyl alcohol	$C_4H_8Cl_2O$		1'304	3.8
2,3 Dichlorodioxane	$C_2H_6Cl_2O_2$		1'391	3.7
Dichlorodifluoromethane (3) (Freon 12)	CCl_2F_2	1.516 (-40°C)	774.1	4.24
1,2 Dichloro ethane (47)	$C_2H_4Cl_2$	1.253	1'193	
cis 1,2-Dichloro-Ethene (3,47)	$C_2H_2Cl_2$	1.284	1'061	
trans 1,2-Dichloro-ethene(3,47)	$C_2H_2Cl_2$	1.257	1'010	
Dichloro-fluoromethane (3) (Freon 21)	$CHCl_2F$	1.426 (0°C)	891	3.97
1-2-Dichlorohexafluoro cyclobutane (47)	$C_4Cl_2F_6$	1.654	669	
1-3-Dichloro-isobutane	$C_4H_8Cl_2$	1.14	1'220	3.4
Dichloro methane (3)	CH_2Cl_2	1.327	1'070	3.94
1,1-Dichloro-1,2,2,2 tetra fluoroethane	$CClF_2$-$CClF_2$	1.455	665.3	3.73
Diethyl ether	$C_4H_{10}O$	0.713	985	4.87
Diethylene glycol, monoethyl ether	$C_6H_{14}O_3$	0.988	1'458	
Diethylenimide oxide	C_4H_9NO	1	1'442	3.8
1,2-bis(DiFluoramino) butane (43)	$C_4H_8(NF_2)_2$	1.216	1'000	
1,2bis(DiFluoramino)- 2-methylpropane (43)	$C_4H_9(NF_2)_2$	1.213	900	
1,2bis(DiFluoramino) propane (43)	$C_3H_6(NF_2)_2$	1.265	960	
2,2bis(DiFluoramino) propane (43)	$C_3H_6(NF_2)_2$	1.254	890	
2,2-Dihydroxydiethyl ether	$C_4H_{10}O_3$	1.116	1'586	2.4
Dihydroxyethane	$C_2H_6O_2$	1.113	1'658	2.1
1,3-Dimethyl-benzene (46)	C_8H_{10}	0.868 (15°C)	1'343	
1,2-Dimethyl-benzene(29,46)	C_8H_{10}	0.897 (20°C)	1'331.5	4.1
1,4-Dimethyl-benzene (46)	C_8H_{10}		1'334	
2,2-Dimethyl-butane (29,33)	C_6H_{14}	0.649 (20°C)	1'079	
Dimethyl ketone	C_3H_6O	0.791	1'174	4.5
Dimethyl pentane (47)	C_7H_{16}	0.674	1'063	
Dimethyl phthalate	$C_8H_{10}O_4$	1.2	1'463	
Diiodo-methane	CH_2I_2	3.235	980	
Dioxane	$C_4H_8O_2$	1.033	1'376	
Dodecane (23)	$C_{12}H_{26}$	0.749	1'279	3.85
1,2-Ethanediol	$C_2H_6O_2$	1.113	1'658	2.1
Ethanenitrile	C_2H_3N	0.783	1'290	
Ethanoic anhydride (22)	$(CH_3CO)_2O$	1.082	1'180	
Ethanol	C_2H_6O	0.789	1'207	4
Ethanol amide	C_2H_7NO	1.018	1'724	3.4
Ethoxyethane	$C_4H_{10}O$	0.713	985	4.87
Ethyl acetate (33)	$C_4H_8O_2$	0.901	1'085	4.4
Ethyl alcohol	C_2H_6O	0.789	1'207	4

Substance	Chem. Formula	Specific Gravity	Speed of Sound (m/s)	Δv/˚C (m/s/˚C)
Ethyl benzene (46)	C_8H_{10}	0.867(20°C)	1'338	
Ethyl bromide (46)	C_2H_5Br	1.461 (20°C)	900	
Ethyliodide (46)	C_2H_5I	1.950 (20°C)	876	
Ether	$C_4H_{10}O$	0.713	985	4.87
Ethyl ether	$C_4H_{10}O$	0.713	985	4.87
Ethylene bromide (47)	$C_2H_4Br_2$	2.18	995	
Ethylene chloride (47)	$C_2H_4Cl_2$	1.253	1'193	
Ethylene glycol	$C_2H_6O_2$	1.113	1'658	2.1
50% Glycol/ 50% H_2O			1'578	
d-Fenochone	$C_{10}H_{16}O$	0.947	1'320	
d-2-Fenechanone	$C_{10}H_{16}O$	0.947	1'320	
Fluorine	F	0.545 (-143°C)	403	11.31
Fluoro-benzene (46)	C_6H_5F	1.024 (20°C)	1'189	
Formaldehyde, methyl ester	$C_2H_4O_2$	0.974	1'127	4.02
Formamide	CH_3NO	1.134 (20°C)	1'622	2.2
Formic acid, amide	CH_3NO	1.134 (20°C)	1'622	
Freon R12			774	
Furfural	$C_5H_4O_2$	1.157	1'444	
Furfuryl alcohol	$C_5H_6O_2$	1.135	1'450	3.4
Fural	$C_5H_4O_2$	1.157	1'444	3.7
2-Furaldehyde	$C_5H_4O_2$	1.157	1'444	3.7
2-Furancarboxaldehyde	$C_5H_4O_2$	1.157	1'444	3.7
2-Furyl-Methanol	$C_5H_6O_2$	1.135	1'450	3.4
Gallium	Ga	6.095	2'870 (@30°C)	
Glycerin	$C_3H_8O_3$	1.26	1'904	2.2
Glycerol	$C_3H_8O_3$	1.26	1'904	2.2
Glycol	$C_2H_6O_2$	1.113	1'658	2.1
Helium (45)	He_4	0.125(-268.8°C)	183	
Heptane (22,23)	C_7H_{16}	0.684 (20°C)	1'131	4.25
n-Heptane (29,33)	C_7H_{16}	0.684 (20°C)	1'180	4
Hexachloro-Cyclopentadiene (47)	C_5Cl_6	1.718	1'150	
Hexadecane (23)	$C_{16}H_{34}$	0.773 (20°C)	1'338	3.71
Hexalin	$C_6H_{12}O$	0.962	1'454	3.6
Hexane (16,22,23)	C_6H_{14}	0.659	1'112	2.71
n-Hexane (29,33)	C_6H_{14}	0.649 (20°C)	1'079	4.53
2,5-Hexanedione	$C_6H_{10}O_2$	0.729	1'399	3.6
n-Hexanol	$C_6H_{14}O$	0.819	1'300	3.8
Hexahydrobenzene (15)	C_6H_{12}	0.779	1'248	5.41
Hexahydrophenol	$C_6H_{12}O$	0.962	1'454	3.6
Hexamethylene (15)	C_6H_{12}	0.779	1'248	5.41
Hydrogen (45)	H_2	0.071 (-256°C)	1'187	
2-Hydroxy-toluene (46)	C_7H_8O	1.047 (20°C)	1'541	
3-Hydroxy-tolune (46)	C_7H_8O	1.034 (20°C)	1'500	
Iodo-benzene (46)	C_6H_5I	1.823	1'114	
Iodo-ethane (46)	C_2H_5I	1.950 (20°C)	876	
Iodo-methane	CH_3I	2.28 (20°C)	978	
Isobutyl acetate (22)	$C_6H_{12}O$		1'180	4.85
Isobutanol	$C_4H_{10}O$	0.81 (20°C)	1'212	
Iso-Butane			1'219.8	
Isopentane (36)	C_5H_{12}	0.62 (20°C)	980	4.8
Isopropanol (46)	C_3H_8O	0.785 (20°C)	1'170	
Isopropyl alcohol (46)	C_3H_8O	0.785 (20°C)	1'170	
Kerosene		0.81	1'324	3.6
Ketohexamethylene	$C_6H_{10}O$	0.948	1'423	4
Lithium fluoride (42)	LiF		2'485	1.29
Mercury (45)	Hg	13.594	1'449	

Substance	Chem. Formula	Specific Gravity	Speed of Sound (m/s)	Δv/˚C (m/s/˚C)
Mesityloxide	$C_6H_{16}O\ CH_4$	0.85	1'310	
Methane (25,28,38,39)		0.162	405(-89.15°C)	17.5
Methanol (40,41)	CH_4O	0.791 (20°C)	1'076	2.92
Methyl acetate	$C_3H_6O_2$	0.934	1'211	
o-Methylaniline (46)	C_7H_9N	0.999 (20°C)	1'618	
4-Methylaniline (46)	C_7H_9N	0.966 (45°C)	1'480	
Methyl alcohol (40,44)	CH_4O	0.791 (20°C)	1'076	2.92
Methyl benzene (16,52)	C_7H_8	0.867	1'328	4.27
2-Methyl-butane (36)	C_5H_{12}	0.62 (20°C)	980	
Methyl carbinol	C_2H_6O	0.789	1'207	4
Methyl-chloroform (47)	$C_2H_3Cl_3$	1.33	985	
Methyl-cyanide	C_2H_3N	0.783	1'290	
3-Methyl cyclohexanol	$C_7H_{14}O$	0.92	1'400	
Methylene chloride (3)	CH_2Cl_2	1.327	1'070	3.94
Methylene iodide	CH_2I_2	3.235	980	
Methyl formate (22)	$C_2H_4O_2$	0.974 (20°C)	1'127	4.02
Methyl iodide	CH_3I	2.28 (20°C)	978	
α-Methyl naphthalene	$C_{11}H_{10}$	1.09	1'510	3.7
2-Methylphenol (46)	C_7H_8O	1.047 (20°C)	1'541	
3-Methylphenol (46)	C_7H_8O	1.034 (20°C)	1'500	
Milk, homogenized			1'548	
Morpholine	C_4H_9NO	1	1'442	3.8
Naphtha		0.76	1'225	
Natural Gas (37)		0.316 (-103°C)	753	
Neon (45)	Ne	1.207 (-246°C)	595	
Nitrobenzene (46)	$C_6H_5NO_2$	1.204 (20°C)	1'415	
Nitrogen (45)	N_2	0.808 (-199°C)	962	
Nitromethane (43)	CH_3NO_2	1.135	1'300	4
Nonane (23)	C_9H_2O	0.718 (20°C)	1'207	4.04
1-Nonene (27)	C_9H_{18}	0.736 (20°C)	1'207	4
Octane (23)	C_8H_{18}	0.703	1'172	4.14
n-Octane (29)	C_8H_{18}	0.704 (20°C)	1'212.5	3.5
1-Octene (27)	C_8H_{16}	0.723 (20°C)	1'175.5	4.1
Oil of Camphor Sassafrassy			1'390	3.8
Oil, Car (SAE 20a.30)	1.74		870	
Oil, Castor	$C_{11}H_{10}O_{10}$	0.969	1'477	3.6
Oil, Diesel		0.8	1'250	
Oil, Fuel AA gravity		0.99	1'485	3.7
Oil (Lubricating X200)			1'530	5091.9
Oil (Olive)		0.912	1'431	2.75
Oil (Peanut)		0.936	1'458	
Oil (Sperm)		0.88	1'440	
Oil, 6			1'509	
2,2-Oxydiethanol	$C_4H_{10}O_3$	1.116	1'586	2.4
Oxygen (45)	O_2	1.155 (-186°C)	952	
Pentachloro-ethane (47)	C_2HCl_5	1.687	1'082	
Pentalin (47)	C_2HCl_5	1.687	1'082	
Pentane (36)	C_5H_{12}	0.626 (20°C)	1'020	
n-Pentane (47)	C_5H_{12}	0.557	1'006	
Perchlorocyclopentadiene(47)	C_5Cl_6	1.718	1'150	
Perchloro-ethylene (47)	C_2Cl_4	1.632	1'036	
Perfluoro-1-Hepten (47)	C_7F_{14}	1.67	583	
Perfluoro-n-Hexane (47)	C_6F_{14}	1.672	508	
Phene (29,40,41)	C_6H_6	0.879	1'306	4.65
β-Phenyl acrolein	C_9H_8O	1.112	1'554	3.2
Phenylamine (41)	$C_6H_5NO_2$	1.022	1'639	4

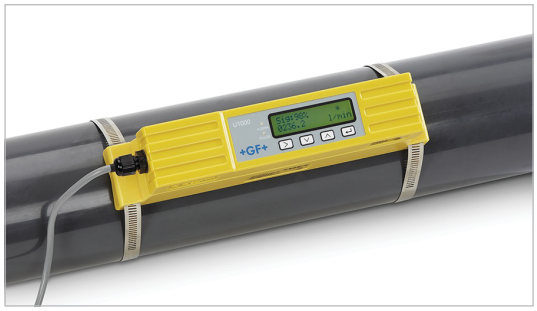
Substance	Chem. Formula	Specific Gravity	Speed of Sound (m/s)	Δv/˚C (m/s/˚C)
Phenyl bromide (46)	C_6H_5Br	1.522	1'170	
Phenyl chloride	C_6H_5Cl	1.106	1'273	3.6
Phenyl iodide (46)	C_6H_5I	1.823	1'114	
Phenyl methane (16,52)	C_7H_8	0.867 (20°C)	1'328	4.27
3-Phenyl propenal	C_9H_8O	1.112	1'554	3.2
Phthalardione	$C_8H_4O_3$		1'125	
Phthalic acid, anhydride	$C_8H_4O_3$		1'125	
Phthalic anhydride	$C_8H_4O_3$		1'125	
Pimelic ketone	$C_6H_{10}O$	0.948	1'423	4
Plexiglas, Lucite, Acrylic			2'651	
Polyterpene Resin		0.77	1'099.8	
Potassium bromide (42)	Kbr		1'169	0.71
Potassium fluoride (42)	KF		1'792	1.03
Potassium iodide (42)	KI		985	0.64
Potassium nitrate (48)	KNO_3	1.859 (352°C)	1'740.1	1.1
Propane (2,13)(-45 to -130°C)	C_3H_8	0.585 (-45°C)	1'003	5.7
1,2,3-Propanetriol	$C_3H_8O_3$	1.26	1'904	2.2
1-Propanol (46)	C_3H_8O	0.78 (20°C)	1'222	
2-Propanol (46)	C_3H_8O	0.785 (20°C)	1'170	
2-Propanone	C_3H_6O	0.791	1'174	4.5
Propene (17,18,35)	C_3H_6	0.563 (-13°C)	963	6.32
n-Propyl acetate (22)	$C_5H_{10}O_2$	1280 (2°C)	4.63	
n-Propyl alcohol	C_3H_8O	0.78 (20°C)	1'222	
Propylchloride (47)	C_3H_7Cl	0.892	1'058	
Propylene (17,18,35)	C_3H_6	0.563 (-13°C)	963	6.32
Pyridine	C_6H_5N	0.982	1'415	4.1
Refrigerant 11 (3,4)	CCl_3F	1.49	828.3	3.56
Refrigerant 12 (3)	CCl_2F_2	1.516 (-40°C)	774.1	4.24
Refrigerant 14 (14)	CF_4	1.75 (-150°C)	875.24	6.61
Refrigerant 21 (3)	$CHCl_2F$	1.426 (0°C)	891	3.97
Refrigerant 22 (3)	$CHClF_2$	1.491 (-69°C)	893.9	4.79
Refrigerant 113 (3)	CCl_2F-$CClF_2$	1.563	783.7	3.44
Refrigerant 114 (3)	$CClF_2$-$CClF_2$	1.455	665.3	3.73
Refrigerant 115 (3)	C_2ClF_5		656.4	4.42
Refrigerant C318 (3)	C_4F_8	1.62 (-20°C)	574	3.88
Selenium (8)	Se		1'072	0.68
Silicone (30 cp)		0.993	990	
Sodium fluoride (42)	NaF $NaNO_3$	0.877	2'082	1.32
Sodium nitrate (48)	$NaNO_3$	1.884 (336°C)	1'763.3	0.74
Sodium nitrite (48)	$NaNO_2$	1.805 (292°C)	1'876.8	
Solvesso 3		0.877	1'370	3.7
Spirit of wine	C_2H_6O	0.789	1'207	4
Sulphur (7,8,10)	S		1'177	-1.13
Sulphuric acid (1)	H_2SO_4	1.841	1'257.6	1.43
Tellurium (7)	Te		991	0.73
1,1,2,2-Tetrabromo-ethane(47)	$C_2H_2Br_4$	2.96612	1'027	
1,1,2,2-Tetrachloro-ethane(67)	$C_2H_2Cl_4$	1.595	1'147	
Tetrachloroethane (46)	$C_2H_2Cl_4$	1.553 (20°C)	1'170	
Tetrachloro-ethene (47)	C_2Cl_4	1.632	1'036	
Tetrachloro-methane (33,47)	CCl_4	1.595 (20°C)	926	
Tetradecane (46)	$C_{14}H_3O$	0.763 (20°C)	1'331	
Tetraethylene glycol	$C_8H_{18}O_5$	1.123	1'586/5'203.4	3
Tetrafluoro-methane (14) (Freon 14)	CF_4	1.75 (-150°C)	875.24	6.61
Tetrahydro-1,4-isoxazine	C_4H_9NO		1'442	3.8
Toluene (16,52)	C_7H_8	0.867 (20°C)	1'328	4.27
o-Toluidine (46)	C_7H_9N	0.999 (20°C)	1'618	

Substance	Chem. Formula	Specific Gravity	Speed of Sound (m/s)	Δv/˚C (m/s/˚C)
p-Toluidine (46)	C_7H_9N	0.966 (45°C)	1'480	
Toluol	C_7H_8	0.866	1'308	4.2
Tribromo-methane (46,47)	$CHBr_3$	2.89 (20°C)	918	
1,1,1-Trichloro-ethane (47)	$C_2H_3Cl_3$	1.33	985	
Trichloro-ethene (47)	C_2HCl_3	1.464	1'028	
Trichloro-fluoromethane (3) (Freon 11)	CCl_3F	1.49	828.3	3.56
Trichloro-methane (47)	$CHCl_3$	1.489	979	3.4
1,1,2-Trichloro-1,2,2-Trifluoro-Ethane	$CCl_2F\text{-}CClF_2$	1.563	783.7	
Triethyl-amine (33)	$C_6H_{15}N$	0.726	1'123	4.47
Triethylene glycol	$C_6H_{14}O_4$	1.123	1'608	3.8
1,1,1-Trifluoro-2-Chloro-2-Bromo-Ethane	$C_2HClBrF_3$	1.869	693	
1,2,2-Trifluorotrichloro- ethane (Freon 113)	$CCl_2F\text{-}CClF_2$	1.563	783.7	3.44
d-1,3,3-Trimethylnor- camphor	$C_{10}H_{16}O$	0.947	1'320	
Trinitrotoluene (43)	$C_7H_5(NO_2)_3$	1.64	1'610	
Turpentine		0.88	1'255	
Unisis 800		0.87	1'346	
Water, distilled (49,50)	H_2O	0.996	1'498	-2.4
Water, heavy	D^2O		1'400	
Water, sea		1.025	1'531	-2.4
Wood Alcohol (40,41)	CH_4O	0.791 (20°C)	1'076	2.92
Xenon (45)	Xe		630	
m-Xylene (46)	C_8H_{10}	0.868 (15°C)	1'343	
o-Xylene (29,46)	C_8H_{10}	0.897 (20°C)	1'331.5	4.1
p-Xylene (46)	C_8H_{10}		1'334	
Xylene hexafluoride	$C_8H_4F_6$	1.37	879	
Zinc (7)	Zn		3'298	

Speed of sound in solids at 25°C and atmospheric pressure

Material	Shear Wave Velocity (m/s)	Long Wave Velocity (m/s)
Steel 1% Carbon (hardened)	3'150	5'880
Carbon Steel	3'230	5'890
Mild Steel	3'235	5'890
Steel 1% Carbon	3'220	
302 - Stainless Steel	3'120	5'660
303 - Stainless Steel	3'120	5'660
304 - Stainless Steel	3'075	
316 - Stainless Steel	3'175	5'310
347 - Stainless Steel	3'100	5'470
410 - Stainless Steel	2'990	5'390
430 - Stainless Steel	3'360	
Aluminium	3'100	6'320
Aluminium (rolled)	3'040	
Copper	2'260	4'660
Copper (annealed)	2'325	
Copper (rolled)	2'270	
CuNi (70%Cu, 30%Ni)	2'540	5'030
CuNi (90%Cu, 10%Ni)	2'060	4'010
Brass (Naval)	2'120	4'430
Gold (hard-drawn)	1'200	3'240
Inconel	3'020	5'820
Iron (electrolytic)	3'240	5'900
Iron (Armco)	3'240	5'900
Ductile Iron	3'000	4'550
Cast Iron	2'500	
Monel	2'720	5'350
Nickel	2'960	5'630
Tin (rolled)	1'670	3'320
Titanium	3'125	6'100
Tungsten (annealed)	2'890	5'180
Tungsten (drawn)	2'640	
Tungsten (carbide)	3'980	
Zinc (rolled)	2'440	4'170
Glass (Pyrex)	3'280	5'610
Glass (heavy silicate flint)	2'380	
Glass (light borate crown)	2'840	5'260
Nylon	1'150	2'400
Nylon (6-6)	1'070	
Polyethylene (HD)		2'310
Polyethylene (LD)	540	1'940
PVC, PVC-C		2'400
Acrylic	1'430	2'730
Asbestos Cement		2'200
Tar Epoxy		2'000
Rubber		1'900

Type U1000 V2 Ultrasonic Flowmeter



Product description

The type U1000 V2 is an ultrasonic permanent Clamp-On flowmeter. This cost effective device can either be used as a stand-alone meter or as an integral part of a control loop.

The type U1000 V2 is very simple to install – clamp it on to the pipe, connect it to power and enter the pipe diameter. No expertise or special tools are required.

The "Clamp-On" concept allows for easy installations without process disruption. Compact, robust and reliable – the type U1000 V2 was designed for long-term use in industrial applications.

The type U1000 V2 is especially configured for pure water and can be used on PVDF, ABS, PVC, CPVC, PP, PE, PB-Instaflex, iron and steel pipes. Processes can be monitored directly by a higher-level system via 4 to 20 mA, Modbus, pulse or frequency output.

Benefits/features

- Large, easy to read graphic display with backlighting
- Easy to install without special tools
- „Clamp-on“ design
- Expanded size range (¾ inch to 6 inch pipes)
- Simple to follow programming menu
- Simple quick-start set up procedure
- Compact integral design

Applications

- Ultrapure water measurement
- Chilled water metering
- Flow measurement for energy metering
- Monitoring of manufacturing processes
- New Water / Glycol Measurement

Technical data

Specifications

General		
Measuring method	Ultrasonic transit-time measurement	
Flow range	0.1 m/s – 10 m/s (0.3 ft/s - 32 ft/s)	
Accuracy	± 3 % of the flow value with a flow rate > 0.3 m/s	
Repeatability	± 0.5 % of the measured value	
Response time	< 500 ms	
Selectable flow units	Velocity	m/sec, ft/sec.
	Volume	l/s, l/min, gal/s, gal/min, USgal/s, USgal/min, m3/min, m3/hr
Selectable totalizer units	Liter, m3, gals, USgals	
Menu languages	EN	
Environment		
Maximum Pipe temperature	0 °C to +85 °C	32 °F to 185 °F
Operating temperature	0 °C to +50 °C	32 °F to 122 °F
Storage temperature	-10 °C to +60 °C	14 °F to 140 °F
Temperature of pipe wall	0 °C to +85 °C	32 °F to 185 °F
Humidity during operation	Max. 90 % relative humidity at +50 °C (122 °F)	
Maximum altitude	4,000 m	
Indoors/outdoors	Indoors	
Wet locations	A location in which water or other liquid can drip, splash, or flow on or against electrical equipment.	
Pollution degree	3: Conductive pollution or dry nonconductive pollution that becomes conductive due to condensation.	
Suitable pipe types		
Pipe materials	PVDF, PP-H, PE, PB, ABS, PVC, CPVC, steel, iron, stainless steel 316	
Pipe diameter (OD)	22 - 180 mm*	¾ - 7 inch*
Electronics		
Power supply	12 - 24 V AC/DC	
Power consumption	Max. 7 VA	
Outputs		
Analog output		
Range	4 - 20mA	
Resolution	0.1 % of measurement range	
Load max.	620 Ω	
Insulation	1MΩ at 100 V	
Alarm current	3.5 mA	
Pulse output		
Type	Opto-Isolated MOSFET volt free contact (NO/NC)	
Pulse sequence	1 – 166 pps user-programmable frequency mode max. 200 Hz	
Pulse width	50 ms standard value, 3 – 99 ms user-programmable	
Max. voltage	24V DC or 24V AC	
Max. current	500 mA	
Insulation	1MΩ at 100V	
Modbus		
Format	RTU	
Baud Rate	1200, 2400, 4800, 9600, 19200, 38400	
Data-Parity-StopBits	8-None-2, 8-None-1, 8-Odd-2, 8-Even-1	
Standards	PI–MBUS–300 Rev. J	
Physical connection	RS485	

Housing and display		
Material	Polycarbonate	
Dimensions	250 x 48 x 90 mm	9.85 x 1.9 x 3.55 Inch
Weight	0.5 kg	1.1 lb
Keyboard	Keypad with 4 buttons	
Display		
Type	LCD, 2 lines x 16 characters	
Viewing angle	Min. 30°, max. 40°	
Active area	83 x 18.6 mm	3.3 x 0.73 Inch
Protection class	IP 54	

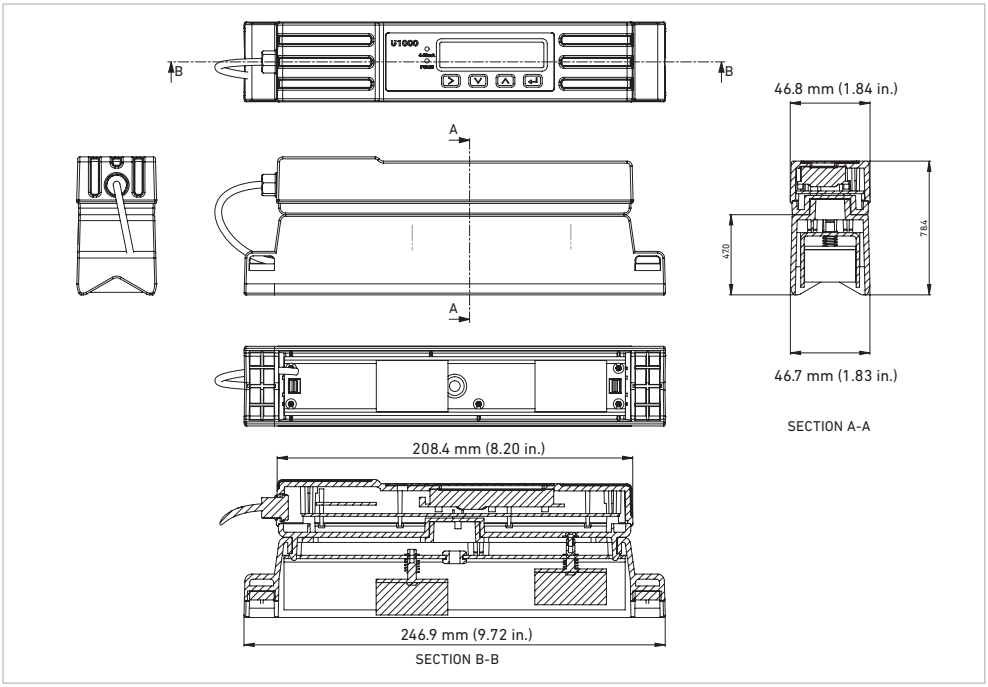
Shipping information		
Packet dimensions	290 x 280 x 100 mm	11.4 x 11 x 4 Inch
Weight	1.4 kg	3 lbs
Volume weight	1.4 kg	3 lbs

Standards/approvals		
CE, UKCA, RoHS compliant		
UL listed		
Security	BS EN 61010-1:2010	
EMV	BS EN 61326-1:2013	BS EN 61326-2-3:2013
Environment	BS EN 60068-1:2014	
	BS EN 60068-2-1:2007	BS EN 60068-2-2:2007

* Note: Pipe size is dependant on pipe material and inner pipe diameter

Default Values		
Parameters	Metric	Imperial
Dimensions	mm	Inches
Flow Units	l/min	USgal/min
Pipe size (ID)	1" to 4" pipes: 50 mm 4" to 6" pipes: 127 mm	1" to 4" pipes: 1.969 in 4" to 6" pipes: 5.000 in
Pulse Output	Off	Off
Volume per Pulse	10 litres	2.642 US gallons
Pulse Width	50 ms	50 ms
Damping	20 seconds	20 seconds
Calibration Factor	1.000	1.000
Zero Cut-off	0.02 m/s	0.07 ft/s
Zero Offset	0.000 m/s	0.000 ft/s

Dimensions



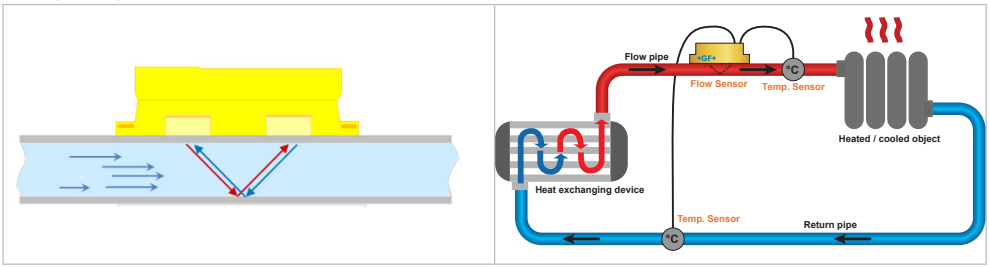
Packaging content



1 Guide rail
2 Type U1000 V2 head-unit incl. cable (5 m length)
3 Gel pads
4 Pipe adapters
5 S/steel hose-clips for guide rail
6 Modbus cable (Modbus models only)
7 Product documentation(- Quick-start guide & factory assembly certificate)

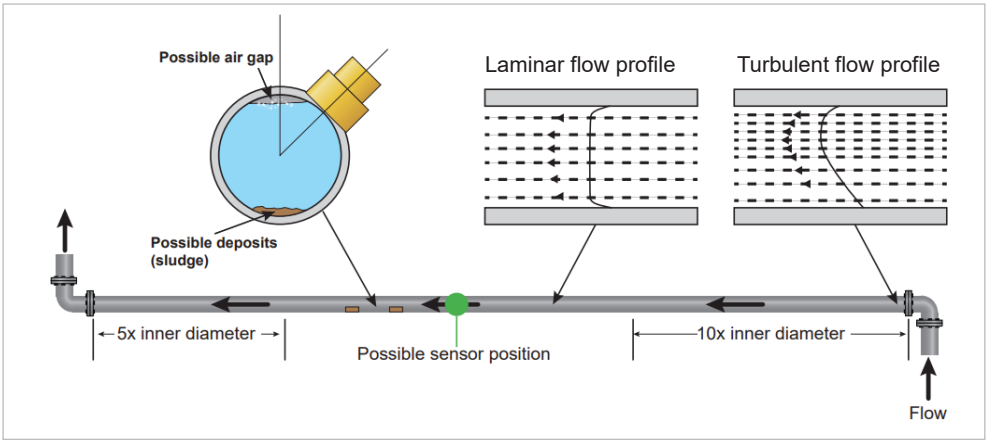
Function

The U1000 V2 functions, as do all GF current ultrasonic flow meters, according to the transit time principle of ultrasonic waves.



The type U1000 V2 functions, as do all current ultrasonic flowmeters, according to the path-time principle of ultrasonic waves.

The device is installed directly on a pipe surface and transmits ultrasonic waves back and forth between the two sound transducers. Depending on the flow, a small time difference arises between the two ultrasonic signals – this is proportional to the flow speed.



Ordering Information

Code	Type	Description
159 300 300	U1000 V2	Type U1000 V2 | Flowmeter | 12-24 VAC | d22-d115 | 0.75 in. to 4 in. | 4 to 20 mA, Pulse
159 300 301	U1000 V2	Type U1000 V2 | Flowmeter | 12-24 VAC | d125-d180 | 5 in. to 6 in. | 4 to 20 mA, Pulse
159 300 302	U1000 V2	Type U1000 V2 | Flowmeter | 12-24 VAC | d22-d115 | 0.75 in. to 4 in. | Modbus, Pulse
159 300 303	U1000 V2	Type U1000 V2 | Flowmeter | 12-24 VAC | d125-d180 | 5 in. to 6 in. | Modbus, Pulse

Spare Parts and Accessories

Code	Description
159 300 088	Ultrasonic Flowmeter | Spare parts | Transducer gel pads (2 pcs)
159 300 038	Ultrasonic Flowmeter | Spare parts | Super Lube® coupling grease (85 g)
159 300 089	Ultrasonic Flowmeter | type U1000 V2 | Spare parts | Guide rail incl. transducers

Type U1000 V2 Ultrasonic Heatmeter (HM)



Product description

The type U1000 V2 Heatmeter (HM) is an ultrasonic permanent Clamp-On heatmeter / energy meter / BTU meter. Additionally to an ultrasonic flowmeter it is equipped with Pt100 temperature sensors to calculate the energy of a heat exchanging system.

The type U1000 V2 (HM) is very simple to install – clamp it on to the pipe, connect it to power and enter the pipe diameter. No expertise or special tools are required.

The "Clamp-On" concept allows for easy installations without process disruption. Compact, robust and reliable – the type U1000 V2 (HM) was designed for long-term use in industrial applications.

The type U1000 V2 (HM) is especially configured for pure water and can be used on PVDF, ABS, PVC, CPVC, PP, PE, PB-Instaflex, iron and steel pipes. Processes can be monitored directly by a higher-level system via 4 to 20 mA, Modbus, pulse or frequency output.

Benefits/features

- Large, easy to read graphic display with backlighting
- Easy to install without special tools
- „Clamp-on“ design
- Expanded size range (¾ inch to 6 inch pipes)
- Simple to follow programming menu
- Simple quick-start set up procedure
- Compact integral design
- Automatic energy calculation with integrated Pt100 temperature sensors (HM version)

Applications

- Ultrapure water measurement
- Flow measurement for heat metering
- Chilled water metering
- Flow measurement for energy metering
- Monitoring of manufacturing processes
- Water / Glycol Measurement

Technical data

Technical specifications

General		
Measuring method	Ultrasonic runtime measurement	
Flow range	0.1 m/s – 10 m/s (0.3 ft/s - 32 ft/s)	
Accuracy	± 3 % of the flow value with a flow rate > 0.3 m/s	
Repeatability	± 0.5 % of the measured value	
Response time	< 500 ms	
Selectable flow units	Velocity	m/sec, ft/sec.
	Volume	l/s, l/min, gal/s, gal/min, USgal/s, USgal/min, m3/min, m3/hr
Selectable totalizer units	Liter, m3, gals, USgals	
Menu languages	EN	
Environment		
Maximum Pipe temperature	0 °C to +85 °C	32 °F to 185 °F
Operating temperature	0 °C to +50 °C	32 °F to 122 °F
Storage temperature	-10 °C to +60 °C	14 °F to 140 °F
Temperature of pipe wall	0 °C to +85 °C	32 °F to 185 °F
Humidity during operation	Max. 90 % relative humidity at +50 °C (122 °F)	
Maximum altitude	4,000 m	
Indoors/outdoors	Indoors	
Wet locations	A location in which water or other liquid can drip, splash, or flow on or against electrical equipment.	
Pollution degree	3: Conductive pollution or dry nonconductive pollution that becomes conductive due to condensation.	
Temperature sensors		
Type	PT100 Class B 4 wire	
Range	2 to 85 °C (36 to 185 °F)	
Resolution	0.1 °C / 1 °F	
Sensor Accuracy	±0.725 °C (±1.305 °F)	
Suitable pipe types		
Pipe materials	PVDF, PP-H, PE, PB, ABS, PVC, CPVC, steel, iron, stainless steel 316	
Pipe diameter (d)	d22 - d180 mm*	¾ - 7 inch*
Electronics		
Power supply	12 - 24 V AC/DC	
Power consumption	Max. 7 VA	
Outputs		
Analog output		
Range	4 - 20mA	
Resolution	0.1 % of measurement range	
Load max.	620 Ω	
Insulation	1MΩ at 100 V	
Alarm current	3.5 mA	
Pulse output		
Type	Opto-Isolated MOSFET volt free contact (NO/NC)	

Outputs		
Pulse sequence	1 – 166 pps user-programmable frequency mode max. 200 Hz	
Pulse width	50 ms standard value, 3 – 99 ms user-programmable	
Max. voltage	24V DC or 24V AC	
Max. current	500 mA	
Insulation	1MΩ at 100V	
Modbus		
Format	RTU	
Baud Rate	1200, 2400, 4800, 9600, 19200, 38400	
Data-Parity-StopBits	8-None-2, 8-None-1, 8-Odd-2, 8-Even-1	
Standards	PI–MBUS–300 Rev. J	
Physical connection	RS485	

Housing and display		
Material	Polycarbonate	
Dimensions	250 x 48 x 90 mm	9.85 x 1.9 x 3.55 Inch
Weight	0.5 kg	1.1 lb
Keyboard	Keypad with 4 buttons	
Display		
Type	LCD, 2 lines x 16 characters	
Viewing angle	Min. 30°, max. 40°	
Active area	83 x 18.6 mm	3.3 x 0.73 Inch
Protection class	IP 54	

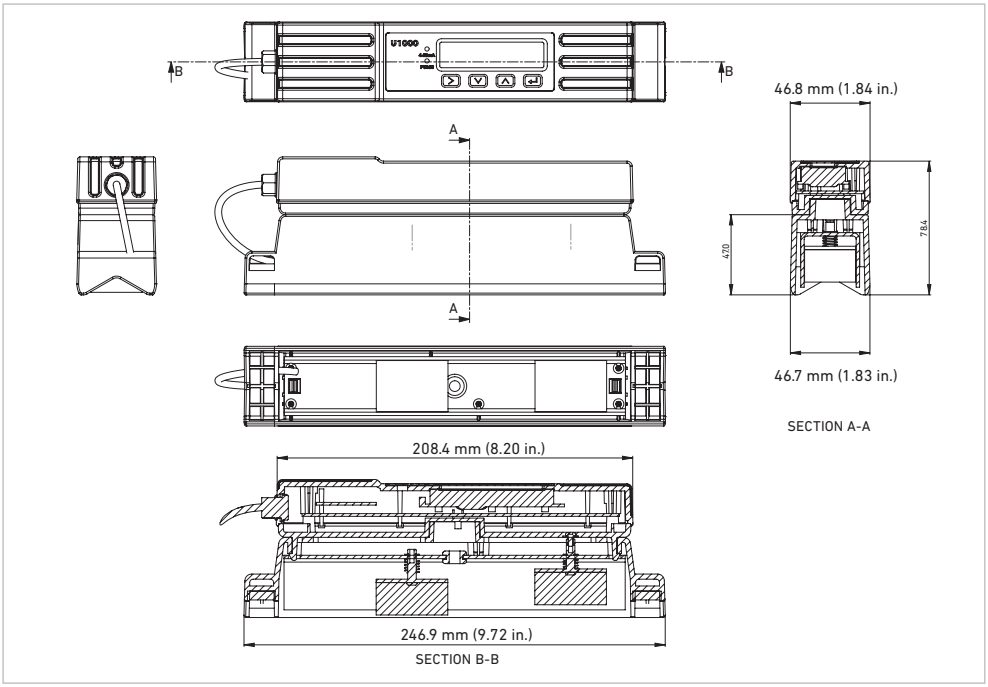
Shipping information		
Packet dimensions	290 x 280 x 100 mm	11.4 x 11 x 4 Inch
Weight	1.4 kg	3 lbs
Volume weight	1.4 kg	3 lbs

Standards/approvals		
CE, UKCA, RoHS compliant		
UL listed		
Security	BS EN 61010-1:2010	
EMV	BS EN 61326-1:2013	BS EN 61326-2-3:2013
Environment	BS EN 60068-1:2014	
	BS EN 60068-2-1:2007	BS EN 60068-2-2:2007
Heat Meter Standard	The Heat/Energy calculation is designed to comply with EN1434 section 6	

* Note: Pipe size is dependant on pipe material and inner pipe diameter

Default Values		
Parameters	Metric	Imperial
Dimensions	mm	Inches
Flow Units	l/min	USgal/min
Pipe size (ID)	1" to 4" pipes: 50 mm 4" to 6" pipes: 127 mm	1" to 4" pipes: 1.969 in 4" to 6" pipes: 5.000 in
Pulse Output	Off	Off
Energy per Pulse	1 kW	1 kBTU
Volume per Pulse	10 litres	2.642 US gallons
Pulse Width	50 ms	50 ms
Damping	20 seconds	20 seconds
Calibration Factor	1.000	1.000
Zero Cut-off	0.02 m/s	0.07 ft/s
Zero Offset	0.000 m/s	0.000 ft/s

Dimensions



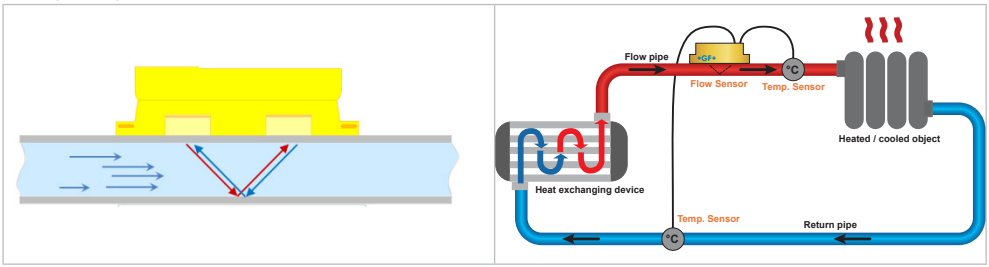
Packaging content



1 Guide rail
2 Type U1000 V2 (HM) head-unit incl. cable (5 m length)
3 Gel pads
4 Pipe adapters
5 S/steel hose-clips for guide rail
6 Pt100 temperature probes incl. cable (3 m length) (HM models only)
7 S/steel hose-clips for temperature probes (HM models only)
8 Modbus cable (Modbus models only)
9 Product documentation(- Quick-start guide & factory assembly certificate)

Function

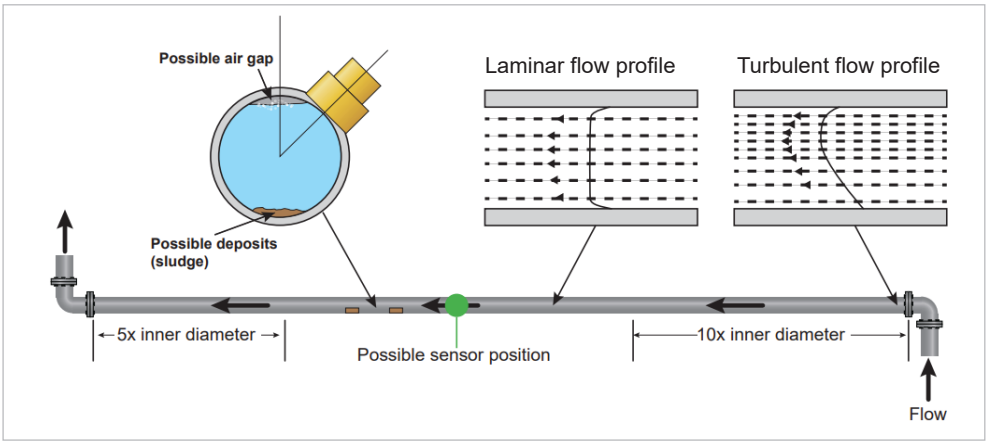
The U1000 V2 functions, as do all GF current ultrasonic flow meters, according to the transit time principle of ultrasonic waves.



The type U1000 V2 (HM) functions, as do all current ultrasonic flowmeters, according to the path-time principle of ultrasonic waves.

The device is installed directly on a pipe surface and transmits ultrasonic waves back and forth between the two sound transducers. Depending on the flow, a small time difference arises between the two ultrasonic signals – this is proportional to the flow speed.

By measuring the temperature change between the flow and return pipe of the heat exchanging system with the integrated Pt100 sensors the type U1000 V2 (HM) is additionally calculating its thermal energy (in BTU, J or kWh).



Ordering Information

Code	Type	Description
159 300 304	U1000 V2 HM	Type U1000 V2 HM | Heatmeter | 12-24 VAC | d22-d115 | 0.75 in. to 4 in. | Modbus, Pulse
159 300 305	U1000 V2 HM	Type U1000 V2 HM | Heatmeter | 12-24 VAC | d125-d180 | 5 in. to 6 in. | Modbus, Pulse

Spare Parts and Accessories

Code	Description
159 300 088	Ultrasonic Flowmeter | Spare parts | Transducer gel pads (2 pcs)
159 300 038	Ultrasonic Flowmeter | Spare parts | Super Lube® coupling grease (85 g)
159 300 089	Ultrasonic Flowmeter | type U1000 V2 | Spare parts | Guide rail incl. transducers

Type U1000 V2 WM Ultrasonic Flowmeter/ WHM Ultrasonic Heatmeter



Product description

The type U1000 V2 Wallmount (WM) is a permanent ultrasonic clamp-on flowmetering solution with wallmounted head unit. This cost effective device can either be used as a stand-alone meter or as an integral part of a control loop.

The type U1000 V2 Wallmount Heatmeter (WHM) is an ultrasonic permanent Clamp-On heatmeter / energy meter / BTU meter. Additionally to an ultrasonic flowmeter it is equipped with Pt100 temperature sensors to calculate the energy of a heat exchanging system.

The type U1000 V2 WM (WHM) is very simple to install – clamp it on to the pipe, connect it to power and enter the pipe diameter. No expertise or special tools are required.

The "Clamp-On" concept makes the installation of the sensors in running systems possible. The pipe does not have to be opened. Compact, robust and reliable – the type U1000 V2 WM (WHM) was designed for long-term use in industrial applications.

The type U1000 V2 WM (WHM) is especially configured for pure water and can be used on PVDF-ABS, PVC, PP, PE, PB-Instaflex, iron and steel pipes. Processes can be monitored directly by a higher-level system via 4 to 20 mA, Modbus, pulse or frequency output.

Benefits/features

- Easy to install, compact, robust and reliable - designed for long-term use in industrial applications
- Accurate flow measurement on virtually any pipe
- Automatic energy calculation with integrated Pt100 temperature sensors (HM version only)
- Ready for Industry 4.0 with various communications options. Including: Modbus, 4 to 20 mA, pulse & alarm output
- 'Clamp-on' flowmetering solution with external wallmount head unit
- Large, easy to read graphic display with backlighting
- Expanded size range (¾ inch to 8 inch)

Applications

- Ultrapure water measurement
- Flow measurement for heat metering
- Chilled water metering
- Flow measurement for energy metering
- Monitoring of manufacturing processes
- Water / Glycol Measurement

Technical data

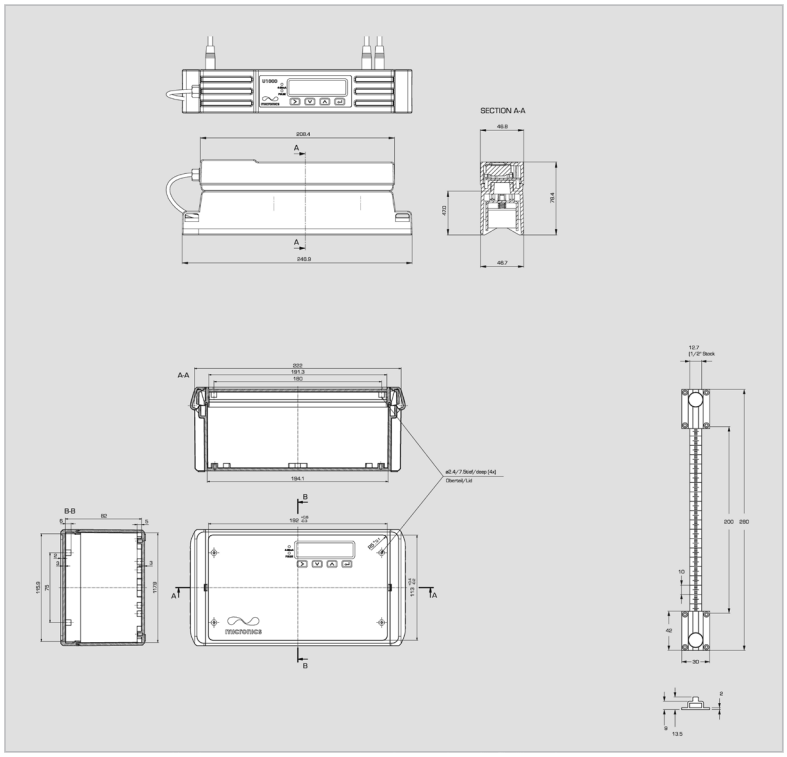
Specification

General			
Measuring Method		Ultrasonic transit-time measurement	
Flow Range		0.1 m/s – 10 m/s (0.3 ft/s - 32 ft/s), bi-directional	
Accuracy		± 3 % of the flow value with a flow rate > 0.3 m/s (1.0 ft/s)	
Repeatability		±0.5 % of measured value	
Response Time		< 500 ms	
Selectable Flow Units		Velocity	m/sec, ft/sec.
		Volume	l/s, l/min, gal/s, gal/min, USgal/s, USgal/min, m3/min, m3/hr
Selectable Totalizer Units		liter, gallons, US gallons, m^3	
Menu Languages		EN	
Temperature sensors (Heatmeter types only)			
Operating Temperature		0 °C to 50 °C	32 °F to 122 °F
Storage Temperature		-10 °C to +60 °C	14 °F to 140 °F
Temperature of Pipe Wall		0 °C to 135 °C	32 °F to 275 °F
Accuracy		Pt100 Class B 4-wire	
Resolution		0.1 °C (0.2 °F)	
Humidity During Operation		Max. 90% relative humidity at +50 °C (122 °F)	
Suitable Pipe types			
Pipe Materials		PVDF, PP-H, PE, PB, ABS, PVC, CPVC, steel, iron, stainless steel 316, copper	
Pipe Dimension (OD)		22 mm to 225 mm*	¾ - 8 inch*
Electronics			
Power Supply		12 to 24 V AC/DC	
Power Consumption		Max. 7 VA	
Outputs			
Analog Output	Range	4 to 20 mA	
	Resolution	0.1 % of measurement range	
	Load max.	620 Ω	
	Insulation	1MΩ at 100 V	
	Alarm Current	3.5 mA	
Pulse Output	Type	Opto-isolated MOSFET volt free contact (NO/NC)	
	Pulse Sequence	1 – 166 pps user-programmable frequency mode max. 200 Hz	
	Pulse Width	50 ms standard value, 3 – 99 ms user-programmable	
	Max. Voltage	24V DC or 24V AC	
	Max. Current	500 mA	
	Insulation	1MΩ at 100V	
Modbus Output	Format	RTU	
	Baud Rate	1200, 2400, 4800, 9600, 19200, 38400	
	Data-Parity-Stop-Bits	8-None-2, 8-None-1, 8-Odd-2, 8-Even-1	
	Standards	PI–MBUS–300 Rev. J	
	Physical Connection	RS485	
Housing and Display			
Material		Polycarbonate	
Dimensions		250 x 48 x 90 mm	9.85 x 1.9 x 3.55 inch
Weight		0.5 kg	1.1 lb
Keyboard		Keypad with 4 buttons	

Display	Type	LCD, 2 lines x 16 characters	
	Viewing Angle	Min. 30°, Max. 40°	
	Active Area	83 x 18.6 mm	3.3 x 0.73 inch
Protection Class		IP 54	
Shipping Information			
Packaging Dimensions		290 x 280 x 100 mm	11.4 x 11 x 4 inch
Weight		1.4 kg	3 lbs
Volume Weight		1.4 kg	3 lbs
Standards and Approvals			
	CE, UKCA, RoHS compliant		
	Safety	BS EN 61010-1:2010	
	EMC	BS EN 61326-1:2013	BS EN 61326-2-3:2013
	Environment	BS EN 60068-1:2014	
		BS EN 60068-2-1:2007	BS EN 60068-2-2:2007

* Measurable pipe sizes are dependent on pipe material and inner pipe diameter.

Dimensions



Packaging Content



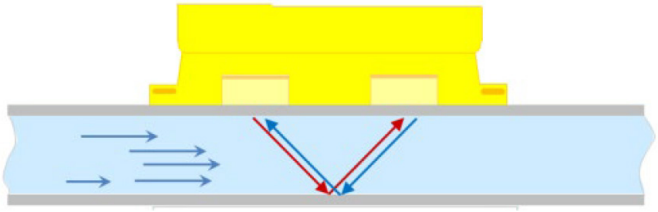
1 Type U1000 V2 WM (WHM)
2 Flow sensors / transducers incl. cable (5 m length)
3 Gel pads
4 Ruled guide rail
5 S/steel hose-clips for flow sensors
6 Pt100 temperature probes incl. cable (3 m length) (HM types only)
7 S/steel hose-clips for temperature probes (HM types only)
8 Power supply (optional)
9 Product documentation (User manual & factory assembly certificate)

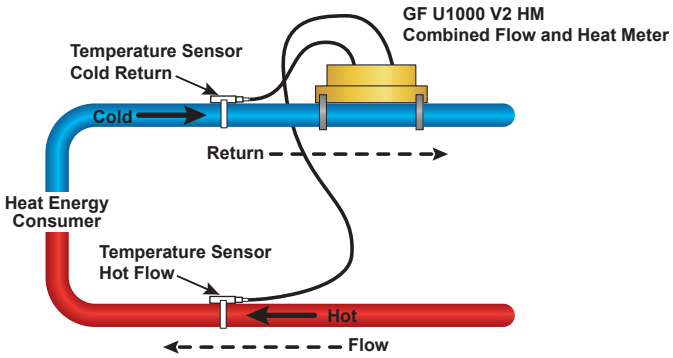
Function

The type U1000 V2 WM (WHM) functions, as do all current ultrasonic flowmeters, according to the path-time principle of ultrasonic waves.

The device is installed directly on a pipe surface and transmits ultrasonic waves back and forth between the two sound transducers. Depending on the flow, a small time difference arises between the two ultrasonic signals – this is proportional to the flow speed.

By measuring the temperature change between the flow and return pipe of the heat exchanging system with the integrated Pt100 sensors the type U1000 V2 WHM is calculating its thermal energy (in BTU, J or kWh).





Ordering Information

Mfr. Part No.	Code	Description
U1000 V2 WM	**159 300 310**	Type U1000 V2 WM | Flowmeter | 12-24 VAC | d22-d115 | 0.75 in. to 4 in. | 4-20 mA, Pulse
U1000 V2 WM	**159 300 311**	Type U1000 V2 WM | Flowmeter | 12-24 VAC | d22-d115 | 0.75 in. to 4 in. | Modbus, Pulse
U1000 V2 WM	**159 300 312**	Type U1000 V2 WM | Flowmeter | 12-24 VAC | d22-d115 | 0.75 in. to 4 in. | Modbus, 4-20 mA, Pulse
U1000 V2 WM	**159 300 313**	Type U1000 V2 WM | Flowmeter | 12-24 VAC | d125-d225 | 5 in. to 8 in. | 4-20 mA, Pulse
U1000 V2 WM	**159 300 314**	Type U1000 V2 WM | Flowmeter | 12-24 VAC | d125-d225 | 5 in. to 8 in. | Modbus, Pulse
U1000 V2 WM	**159 300 315**	Type U1000 V2 WM | Flowmeter | 12-24 VAC | d125-d225 | 5 in. to 8 in. | Modbus, 4-20 mA, Pulse
U1000 V2 WHM	**159 300 316**	Type U1000 V2 WHM | Heatmeter | 12-24 VAC | d22-d115 | 0.75 in. to 4 in. | Modbus, 4-20 mA, Pulse
U1000 V2 WHM	**159 300 317**	Type U1000 V2 WHM | Heatmeter | 12-24 VAC | d125-d225 | 5 in. to 8 in. | Modbus, 4-20 mA, Pulse

Spare Parts and Accessories

Mfr. Part No.	Code	Description
-	**159 300 088**	Ultrasonic Flowmeter | Transducer gel pads (2 pcs)
-	**159 300 038**	Ultrasonic Flowmeter | Super Lube® coupling grease (85 mg)
-	**159 300 406**	Ultrasonic Flowmeter | type U1000 V2 WM/WHM | type U1000 V2 WM Guide rail incl. transducers
	159 300 413	Ultrasonic Flowmeter | 12V external power supply (incl. US, Euro, UK adaptors)

Type PF220/330 V2 (HM) – Ultrasonic Flowmeter or Heatmeter



Product description

The Portaflow range brings simplicity to the noninvasive measurement of liquid flow. Portaflow offers the user quick and accurate flow measurementwith its easy to follow menu and simple set up. Results can be achieved within minutes of opening the case. Compact, rugged and reliable, the Portaflow range has been designed to provide sustained performance in industrial environments.

The type PF220 V2 and type PF330 V2 Portable Ultrasonic Flowmeter range is designed for temporary or semistationary use.

The type PF330 V2 Heatmeter (HM) is an ultrasonic flowmeter equipped with Pt100 temperature sensors to calculate the energy of a heat exchanging system. Thus the device is able to work as a heatmeter / energy meter / BTU meter for temporary or semi-stationary use.

The flowmeter range enables easy, simple and accurate flow measurement on virtually any pipe. Including PVDF, ABS, PVC, CPVC, PP, PE, PB-Instaflex, iron and steel pipes. Measurements can be viewed directly on-site with the large graphic display or optionally logged and exported to a PC for further analysis (type PF330 V2 (HM) versions). One 4-20 mA output and three individually configurable pulse outputs enable easy integration into 9900/9950 and higher-level systems.

The 'Clamp-On' concept allows for easy installation without process disruption. Compact, rugged and reliable – the type PF220 V2 and type PF330 V2 (HM) portable ultrasonic flowmeters have been designed to provide sustained performance in industrial environments.

Benefits/features

- Large, easy to read graphic display with backlighting
- Easy to install with 'Clamp-On' design
- Datalogger option (up to 100 million datapoints) (PF330 version)
- USB port for easy data export (PF330 version)
- Analog, pulse & alarm outputs
- Battery lifetime up to 14 hours
- Compatible with almost all pipe types
- Automatic energy calculation with two Pt100 temperature sensors (HM version)

CE UK CA

Applications

- Potable water
- Intake water
- Cooling water
- Demineralized Pure Water
- Water/Glycol Solutions
- Chemicals
- Leak detection
- Boiler testing

Technical data

Specification

General		
Measuring method	Ultrasonic transit-time measurement	
Flow range	0.1 m/s – 20 m/s bidirectional	
Accuracy	Pipes > DN75	± 0.5 % – ± 2 % measured value for flow throughput rates
	Pipes DN13 – DN75	± 3 % of the measured value for flow throughput rates > 0.2 m/s
	All pipes ID's	± 6 % of the measured value for flow throughput rates < 0.2 m/s
Repetition accuracy	± 0.5 % of the measured value for flow or ± 0.02 m/s depending on which value is larger	
Response time	< 500 ms, depending on pipe diameter	
	Velocity	m/s, ft/s
	Volume	l/s, l/min, l/h, gal/min, gal/h, USgals/min, USgals/h, Barrel/h, Barrel/day, m^3/s, m^3/min, m^3/h
Selectable totalizer units	Liters, m^3, gallons, US gallons, barrels	
Totalizer	12 digits	
Menu languages	EN, DE, FR, RU, SE, IT, SP, P, NO, DEN	

Temperature sensors (Heatmeter models only)		
Operating temperature	0 °C to +50 °C	32 °F to +122 °F
Storage temperature	-10 °C to +60 °C	14 °F to +140 °F
Pipe wall temperature	-20 °C to +85 °C	-4 °F to +185 °F
Accuracy	Pt100 Class B 4-wire	
Resolution	0.1 °C (0.2 °F)	
Humidity during operation	Max. 90 % relative humidity at +50 °C (122 °F)	

Environment		
Operating temperature	-20 °C to +50 °C	-4 °F to +122 °F
Storage temperature	-25 °C to +65 °C	-13 °F to +149 °F
Pipe wall temperature	-20 °C to +135 °C	-4 °F to +275 °F
Humidity during operation	Max. 90 % relative humidity at +50 °C (122 °F)	

Suitable pipe types		
Pipe material	PVDF, PP-H, PE, PB, ABS, PVC, CPVC, steel, iron, stainless steel, copper	
Pipe dimensions (OD)	13 mm to 2000 mm	0.5 inch to 78 inch
Pipe wall strength	1 mm to 75 mm	0.04 inch to 3 inch
Pipe Lining	Possible materials: rubber, glass, concrete, epoxy, steel	
Pipe Lining thickness	0 mm to 10 mm	0 inch to 0.4 inch

Electronics	
Power supply	9 - 24 V DC
Power consumption	Max. 10.5 W
Rechargeable battery	
Technology	5-cell NiMH
Capacity	3.8 Ah
Operating time (typical)	Up to 14 hours continuous with backlight and 4 to 20 mA output OFF
Battery charge time	6.5 hours
Service life	> 500 charge/discharge cycles
Power supply	
Input voltage	90 - 264 V AC (47 - 63 Hz)
Output voltage	12 V DC
Output voltage max.	1.5 A

Outputs		
Analog output	Range	4 to 20 mA, 0 to 20 mA, 0 to 16 mA
	Resolution	0.1 % to scale
	Load max.	620 Ω
	Insulation	1,500 V optoisolated
	Alarm current	Adjustable between 0 – 26 mA
Pulse output	Type	3x Opto-isolated MOSFET volt free contact (NO/NC)
	Options	Flow totals, energy (HM version only), loss of signal, low flow alarms.
	Pulse sequence	Volumetric mode: 1 to 50 pulses/sec user-programmable Frequency mode: 200Hz max. pulse frequency
	Pulse width	50 ms standard value, 3 to 99 ms user-programmable
	Max. voltage	48 V
	Max. current	150 mA
	Insulation	>110 V AC/DC
USB interface (only PF330 V2)	Protocol	Supports full speed (12 Mbits/s) data transmission rate
	Software	USB driver software included in delivery
	Push-fit	USB Type-A female

Datalogger (PF330 V2 (HM) only)	
Data Logged	application details, time, date, flowrate, forward total, reverse total, flow velocity, flow side temperature, return side temperature, temperature difference, power, total energy, signal quality, signal SNR, signal status
Number of data points	100 million
Number of data sets	12
Number of data points per set	No limit
Programmable capture rate	5 s – 1 hour
Start/stop	Manual or time-controlled
Data download	USB interface

Measured value sensor pairs	
Type A	13 to 114 mm (½ inch to 4.5 inch) pipe OD (2MHz)
Type B	50 to 2000 mm (2 inch to 40 inch) pipe OD (1MHz)

Housing and display		
Material	ABS	
Dimensions	264 x 168 x 50 mm	10.4 x 6.6 x 2.0 inch
Weight	1.1 kg (incl. battery)	2.45 lb
Keyboard	16 key tactile feedback membrane keypad	

Housing and display			
Display	Type	240 x 64 pixel graphic display, high contrast, backlight	
	Viewing angle	Min. 30°, typically 40°	
	Active area	127 x 34 mm	5 x 1.3 inch
Protection class		IP 54	

Shipping information	PF330		PF220	
Package dimensions	420 x 390 x 220 mm	16.5 x 15.4 x 8.7 inch	510 x 140 x 440 mm	20 x 5.5 x 17.3 inch
Weight	7.5 kg	16.5 lb	6 kg	13.2 lb
Volume weight	5.7 kg	12.5 lb	5.2 kg	11.5 lb

Standards/approvals		
CE, UKCA, RoHS compliant		
Security	BS EN 61010-1:2010	
EMC	BS EN 61326 - 1:2013	BS EN 61326-2-3:2013
Power supply	EN61204 - 3	UL, CUL, TUV, CB, CE, UKCA
Environmental	BS EN 60068-1:2014	
	BS EN 60068-2-1:2007	BS EN 60068-2-2:2007

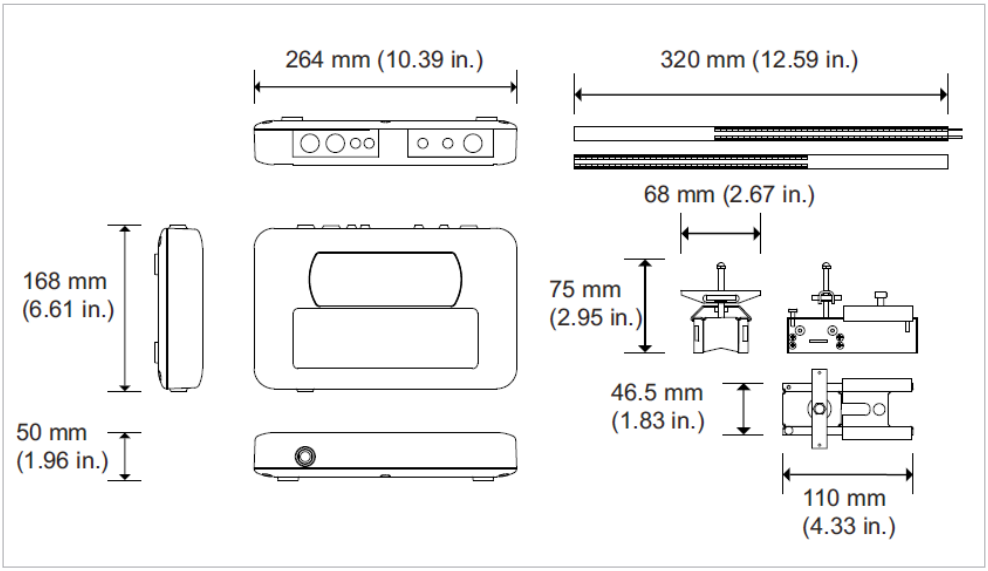
Packaging Content



The type PF330 V2 (HM) models are supplied in a robust IP67 carrying case, which is padded with foam inside to provide additional transport protection.

1 Type PF330 V2 (HM)
2 Transducer cables (2 pcs, each 2 m length)
3 Transducer set 'A' (not all models)
4 Transducer set 'B' (not all models)
5 Ruled guide rail
6 Guide rails
7 Mounting chains (2 pcs, each 3.3 m length)
8 Output signal cable (current loop & 3 digital outputs)
9 Power supply
10 Pt100 temperature sensor. cable included (2 pcs with 2 m length) (HM types only)
11 S/steel hose-clip for temperature probes (HM models only)
12 Tape measure
13 PVDF test block
14 Heatsink compound (HM models only)
15 Syringe for coupling grease
16 Super Lube® coupling grease (85 g)
17 USB-Stick for data export (PF330 models only)
18 Product documentation (User manual & factory calibration certificate)

Dimensions



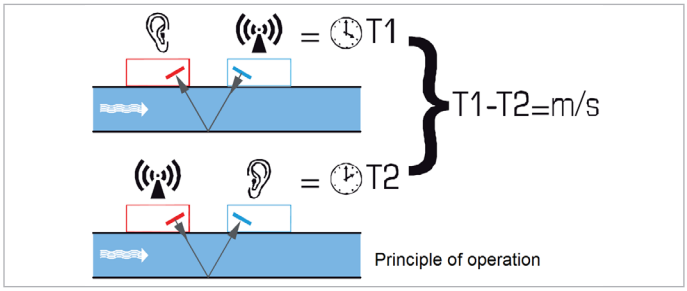
Technical basics

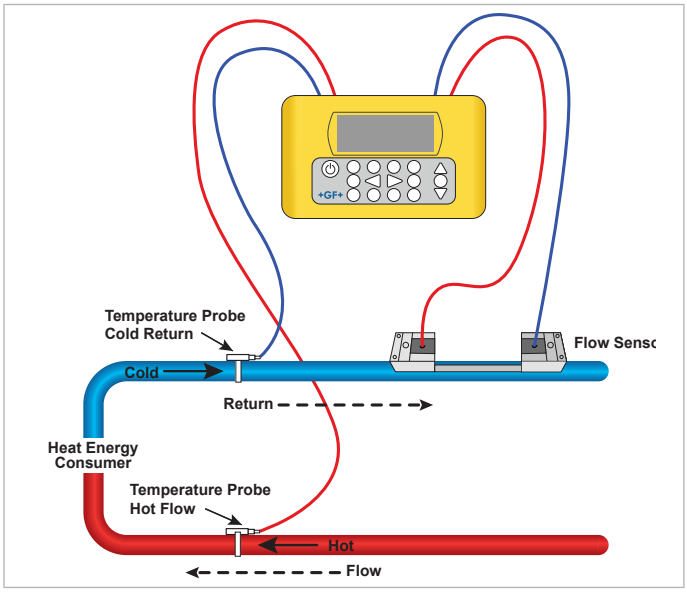
Function

The type PF330 V2 (HM) functions, as do all current ultrasonic flowmeters, according to the transit time principle of ultrasonic waves.

The device is installed directly on a pipe surface and transmits ultrasonic waves back and forth between the two sound transducers. Depending on the flow, a small time difference arises between the two ultrasonic signals – this is proportional to the flow speed.

By measuring the temperature change between the flow and return pipe of the heat exchanging system with the integrated Pt100 sensors the type PF330 V2 HM (without brackets) is additionally calculating its thermal energy (in BTU, J or kWh).





Ordering Information

Mfr. Part No.	Code	Description
PF220 V2	159300360	Type PF220 V2 type A | Portable Ultrasonic Flowmeter | d13-d115 | Battery & external 110/240 VAC
PF220 V2	159300361	Type PF220 V2 type B | Portable Ultrasonic Flowmeter | d115-d2000 | Battery & external 110/240 VAC
PF220 V2	159300362	Type PF220 V2 type A+B | Portable Ultrasonic Flowmeter | d13-d2000 | Battery & external 110/240 VAC
PF330 V2	159300363	Type PF330 V2 type A | Portable Ultrasonic Flowmeter | d13-d115 | Battery & external 110/240 VAC
PF330 V2	159300364	Type PF330 V2 type B| Portable Ultrasonic Flowmeter | d115-d2000 | Battery & external 110/240 VAC
PF330 V2	159300365	Type PF330 V2 type A+B | Portable Ultrasonic Flowmeter | d13-d2000 | Battery & external 110/240 VAC
PF330 V2 HM	159300366	Type PF330 V2 HM type A | Portable Ultrasonic Heatmeter | d13-d115 | Battery & external 110/240 VAC
PF330 V2 HM	159300367	Type PF330 V2 HM type B | Portable Ultrasonic Heatmeter | d115-d2000 | Battery & external 110/240 VAC
PF330 V2 HM	159300368	Type PF330 V2 HM type A+B | Portable Ultrasonic Heatmeter | d13-d2000 | Battery & external 110/240 VAC

Spare Parts and Accessories

Code	Description
159300088	Ultrasonic Flowmeter | Spare parts | Transducer gel pads (2 pcs)
159300038	Ultrasonic Flowmeter | Spare parts | Super Lube® coupling grease (85 g)
159300013	Ultrasonic Flowmeter | type PF220/330 V2 | Spare parts | Transducer assembly A (2x Transducer A)
159300014	Ultrasonic Flowmeter | type PF220/330 V2 | Spare parts | Transducer assembly B (2x Transducer B)
	Ultrasonic Flowmeter | type PF220/330 V2 | Spare parts | Output cable assembly
159300071	Ultrasonic Flowmeter | type PF220/330 V2 | Spare parts | Sensor cable kit (2 meter)
159300072	Ultrasonic Flowmeter | type PF220/330 V2 | Spare parts | Sensor cable kit (5 meter)
159300073	Ultrasonic Flowmeter | type PF220/330 V2 | Spare parts | Sensor cable kit (10 meter)
159300015	Ultrasonic Flowmeter | type PF220/330 V2 | Spare parts | Stainless steel guide rail
159300016	Ultrasonic Flowmeter | type PF220/330 V2 | Spare parts | Magnetic guide rail
159300033	Ultrasonic Flowmeter | type PF220/330 V2 | Spare parts | Link chain zink (3.3 meter)
159300034	Ultrasonic Flowmeter | type PF220/330 V2 | Spare parts | Ruled guide rail
159300035	Ultrasonic Flowmeter | type PF220/330 V2 | Spare parts | Battery assembly
159300036	Ultrasonic Flowmeter | type PF220/330 V2 | Spare parts | Transducer test block
159300037	Ultrasonic Flowmeter | type PF220/330 V2 | Spare parts | Guide rail assembly (guide rail only; no chain; no ruler)
159300039	Ultrasonic Flowmeter | type PF220/330 V2 | Spare parts | Power supply unit (incl. lemo plug & US, Euro, UK adaptors)
159300031	Ultrasonic Flowmeter | type PF220/330 V2 | Spare parts | PF330 V2 carry case with foam
159300032	Ultrasonic Flowmeter | type PF220/330 V2 | Spare parts | PF220 V2 carry case with foam

Type U3000 V2 Ultrasonic Flowsensor / Heatmeter (HM)



Product description

The type U3000 V2 is the solution for permanent ultrasonic Clamp-On flowmetering.

Providing various options for high accuracy measurement, power, communication, pipe dimension, data storage & export it can be customized to almost any application need.

The type U3000 V2 Heatmeter (HM) is an ultrasonic permanent clamp-on heatmeter / energy meter / BTU meter. Additionally to an ultrasonic flowmeter it is equipped with Pt100 temperature sensors to calculate the energy of a heat exchanging system.

The 'Clamp-On' concept allows for easy installation without process disruption. Compact, robust and reliable –the type U3000 V2 (HM) was designed for long-term use in industrial applications.

The type U3000 V2 can be used on PVDF, ABS, PVC, CPVC, PP, PE, PB-Instaflex, iron and steel pipes. Processes can be monitored directly by a higher-level system via 4 to 20 mA, Modbus, pulse or frequency output.

Benefits/features

- Large, easy to read graphic display with backlighting
- Easy to install with 'Clamp-On' design
- Datalogger option (up to 100 million datapoints)
- USB port for easy data export
- Analog, digital Modbus, pulse & alarm outputs
- Reynolds number correction
- Compatible with almost all pipe types
- Automatic energy calculation with two Pt100 temperature sensors (HM version)

CE UK CA

Applications

- HVAC & Energy System Audits
- Pump Verification
- Process Control
- Chemical Addition
- Hydraulic Systems
- Fire Systems
- Leak Detection
- Boiler Testing

Technical data

Specification

General		
Measuring method	Ultrasonic runtime measurement	
Flow range	0.1 m/s - 20 m/s	
Accuracy	Pipes > DN75	± 0.5 % – 3 % of the measured value for flow throughput rates > 0.2 m/s
	Pipes DN13 – DN75	± 0.3 % of the measured value for flow throughput rates > 0.2 m/s
Repetition accuracy	± 0.5 % of the measured value for flow or ± 0.02 m/s depending on which value is larger	
Response time	< 500 ms, depending on pipe diameter	
Selectable flow units	Velocity	m/s, ft/s
	Volume	l/s, l/min, l/h, gal/min, gal/h, USgals/min, USgals/h, Barrel/h, Barrel/day, m^3/s, m^3/min, m^3/h
Selectable totalizer units	Liters, m^3, gallons, US gallons, barrels	
Totalizer	12 digits	
Menu languages	EN, DE, FR, RU, SE, IT, SP, P, NO, DEN	
Temperature sensors (Heatmeter types only)		
Operating temperature	0 °C to +50 °C	32 °F to +122 °F
Storage temperature	-10 °C to +60 °C	14 °F to +140 °F
Pipe wall temperature	-20 °C to +85 °C	-4 °F to +185 °F
Accuracy	Pt100 Class B 4-wire	
Resolution	0.1 °C (0.2 °F)	
Humidity during operation	Max. 90 % relative humidity at +50 °C (122 °F)	
Environment		
Operating temperature	-20 °C to +50 °C	-4 °F to +122 °F
Storage temperature	-25 °C to +75 °C	-13 °F to +167 °F
Pipe wall temperature	-20 °C to +135 °C	-4 °F to +275 °F
Humidity during operation	Max. 90 % relative humidity at +50 °C (122 °F)	
Suitable pipe types		
Pipe material	PVDF-SYGEF, PP-PROGEF, PE-ELGEF, PB-INSTAFLEX, ABS, PVC-U/PVC-C, construction steel, cast iron, stainless steel, copper	
Pipe dimensions [d]	13 - 2'000 mm	0.5 - 78 inch
Pipe wall thickness	1 - 75 mm	0.04 - 3 inch
Pipe coating	Possible materials: rubber, glass, concrete, epoxy, steel	
Pipe coating thickness	0 - 25 mm	0 - 1 inch
Electronics		
Power supply	12 V to 24 V AC/DC, 1A max. or 86 V to 264 V AC (47 Hz to 63 Hz)	
Power consumption	max. 10,5 W	
Outputs (output options depending on type)		
Analog output	Range	4 - 20 mA, 0 - 20 mA, 0 - 16 mA
	Resolution	0.1 % of full scale
	Load max.	620 Ω
	Insulation	1,500 V opto-isolated
	Alarm current	Adjustable between 0 – 26 mA

Outputs (output options depending on type)			
Pulse output	Type	3x Opto-isolated MOSFET volt free contact (NO/NC)	
	Options	Flow totals, energy (HM version only), loss of signal, low flow alarms	
	Pulse sequence	Volumetric mode: 1 to 50 pulses/sec user-programmable Frequency mode: 200Hz max. pulse frequency	
	Pulse width	50 ms standard value, 3 to 99 ms user-programmable	
	Max. Voltage	48 V	
	Max. Current	150 mA	
	Isolation	>110 V AC/DC	
Modbus output	Format	RTU	
	Baud Rate	1200, 2400, 4800, 9600, 19200, 38400	
	Data-Parity-StopBits	8-None-2, 8-None-1, 8-Odd-2, 8-Even-1	
	Standarads	PI–MBUS–300 Rev. J	
	Physical Connection	RS485	
USB interface (Optional)	Protocol	Supports full speed (12Mbits/sec) data connection	
	Software	USB driver software is provided with the package	
	Connector	Mini USB	

Datalogger (optional)	
Data Logged	Application details, time, date, flowrate, forward total, reverse total, flow velocity, flow side temperature, return side temperature, temperature difference, power, total energy, signal quality, signal SNR, signal status
Number of data points	100 million
Number of data sets	12
Number of data points per set	No limit
Programmable capture rate	5 s – 1 hour
Start/stop	Manual or time-controlled
Data download	USB interface

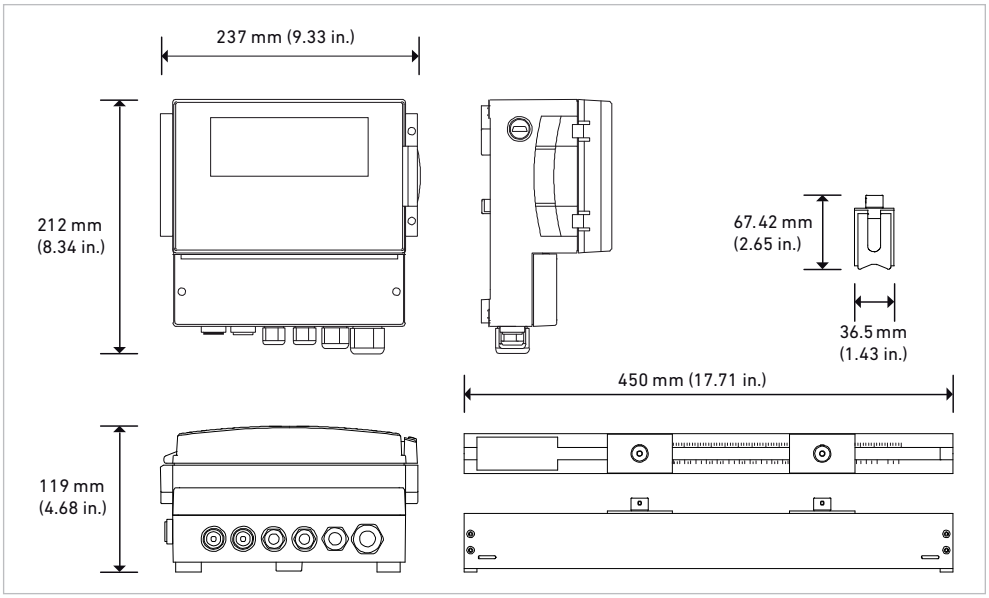
Transducer Sets	
Type A	13 to 114 mm (1/2 inch to 4.5 inch) pipe OD (2MHz)
Type B	50 to 2000 mm (2 inch to 40 inch) pipe OD (1MHz)

Enclosure and Display			
Material		ABS and aluminum	
Dimensions		230 x 180 x 120 mm	9.0 x 7.1 x 4.7 inch
Weight		1.2 kg	2.65 lb
Keypad		15 key tactile feedback membrane keypad	
Display	Type	240 x 64 pixel graphic display, high contrast black-on-white, with backlight.	
	Viewing angle	Min. 30°, typically 40°	
	Active surface	127 x 34 mm	5 x 1.3 inch
Protection class		IP 65	

Shipping information		
Package dimensions	480 x 320 x 230 mm	19 x 12.5 x 9 inch
Weight	4.8 kg	10.6 lb
Volume weight	5.8 kg	12.8 lb

Standards/approvals		
CE, RoHS compliant		
Safety	BS EN 61010-1:2010	
EMV	BS EN 61326-1:2013	BS EN 61326-2-3:2013
Environmental	BS EN 60068-1:2014	
	BS EN 60068-2-1:2007	BS EN 60068-2-2:2007

Dimensions



Packaging content



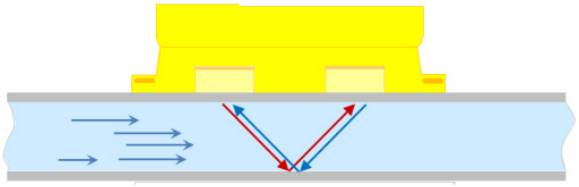
1 Type U3000 V2 (HM)
2 Flow sensors / transducers
3 Sensor cable (2pcs, each 5 m length)
4 Gel pads
5 Guide rail
6 S/steel hose-clips for guide rail
7 Ultrasonic coupling grease
8 Heatsink compound (HM types only)
9 Pt100 temperature probes incl. cable (3 m length) (HM types only)
10 S/steel hose-clips for temperature probes (HM types only)
11 Product documenta-tion(User manual & Factory calibration certificate)

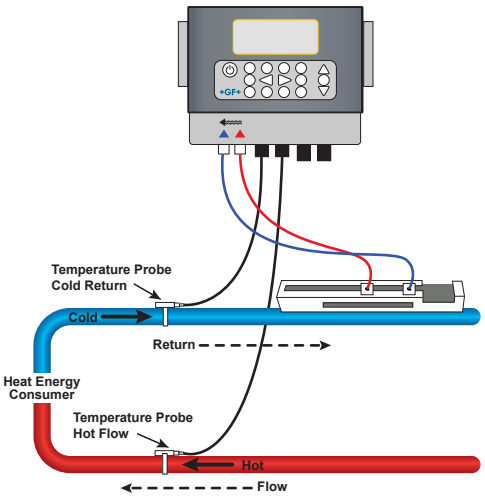
Function

The type U3000 V2 (HM) functions, as do all current ultrasonic flowmeters, according to the transit time principle of ultrasonic waves.

The device is installed directly on a pipe surface and transmits ultrasonic waves back and forth between the two sound transducers. Depending on the flow, a small time difference arises between the two ultrasonic signals – this is proportional to the flow speed.

By measuring the temperature change between the flow and return pipe of the heat exchanging system with the integrated Pt100 sensors the type U3000 V2 HM (without brackets) is additionally calculating its thermal energy (in BTU, J or kWh).





Ordering Information

Article name	Order code	Description
U3000 V2	159 300 370	U3000 V2 | Flowmeter | 110/240 VAC | d13-d115 | 0.5 in. to 4 in. | 4-20 mA, Pulse
U3000 V2	159 300 371	U3000 V2 | Flowmeter | 110/240 VAC | d13-d115 | 0.5 in. to 4 in. | 4-20 mA, Pulse | Datalogger
U3000 V2	159 300 372	U3000 V2 | Flowmeter | 110/240 VAC | d13-d115 | 0.5 in. to 4 in. | Modbus
U3000 V2	159 300 374	U3000 V2 | Flowmeter | 110/240 VAC | d115-d300 | 4 in. to 12 in. | 4-20 mA, Pulse
U3000 V2	159 300 375	U3000 V2 | Flowmeter | 110/240 VAC | d115-d300 | 4 in. to 12 in. | 4-20 mA, Pulse | Datalogger
U3000 V2	159 300 376	U3000 V2 | Flowmeter | 110/240 VAC | d115-d300 | 4 in. to 12 in. | Modbus
U3000 V2	159 300 378	U3000 V2 | Flowmeter | 110/240 VAC | d300-d2000 | 12 in. to 78 in. | 4-20 mA, Pulse
U3000 V2	159 300 379	U3000 V2 | Flowmeter | 110/240 VAC | d300-d2000 | 12 in. to 78 in. | 4-20 mA, Pulse | Datalogger
U3000 V2	159 300 380	U3000 V2 | Flowmeter | 110/240 VAC | d300-d2000 | 12 in. to 78 in. | Modbus
U3000 V2	159 300 382	U3000 V2 | Flowmeter | 12-24 VAC | d13-d115 | 0.5 in. to 4 in. | 4-20 mA, Pulse
U3000 V2	159 300 383	U3000 V2 | Flowmeter | 12-24 VAC | d13-d115 | 0.5 in. to 4 in. | 4-20 mA, Pulse | Datalogger
U3000 V2	159 300 384	U3000 V2 | Flowmeter | 12-24 VAC | d13-d115 | 0.5 in. to 4 in. | Modbus
U3000 V2	159 300 386	U3000 V2 | Flowmeter | 12-24 VAC | d115-d300 | 4 in. to 12 in. | 4-20 mA, Pulse
U3000 V2	159 300 387	U3000 V2 | Flowmeter | 12-24 VAC | d115-d300 | 4 in. to 12 in. | 4-20 mA, Pulse | Datalogger
U3000 V2	159 300 388	U3000 V2 | Flowmeter | 12-24 VAC | d115-d300 | 4 in. to 12 in. | Modbus
U3000 V2	159 300 390	U3000 V2 | Flowmeter | 12-24 VAC | d300-d2000 | 12 in. to 78 in. | 4-20 mA, Pulse
U3000 V2	159 300 391	U3000 V2 | Flowmeter | 12-24 VAC | d300-d2000 | 12 in. to 78 in. | 4-20 mA, Pulse | Datalogger
U3000 V2	159 300 392	U3000 V2 | Flowmeter | 12-24 VAC | d300-d2000 | 12 in. to 78 in. | Modbus
U3000 V2 HM	159 300 394	U3000 V2 HM | Heatmeter | 110/240 VAC | d13-d115 | 0.5 in. to 4 in. | Modbus
U3000 V2 HM	159 300 396	U3000 V2 HM | Heatmeter | 110/240 VAC | d115-d300 | 4 in. to 12 in. | Modbus
U3000 V2 HM	159 300 398	U3000 V2 HM | Heatmeter | 110/240 VAC | d300-d2000 | 12 in. to 78 in. | Modbus
U3000 V2 HM	159 300 400	U3000 V2 HM | Heatmeter | 12-24 VAC | d13-d115 | 0.5 in. to 4 in. | Modbus
U3000 V2 HM	159 300 402	U3000 V2 HM | Heatmeter | 12-24 VAC | d115-d300 | 4 in. to 12 in. | Modbus
U3000 V2 HM	159 300 404	U3000 V2 HM | Heatmeter | 12-24 VAC | d300-d2000 | 12 in. to 78 in. | Modbus

Spare Parts and Accessories

Code	Description
159 300 088	Ultrasonic Flowmeter | Spare parts | Transducer gel pads (2 pcs)
159 300 038	Ultrasonic Flowmeter | Spare parts | Super Lube® coupling grease (85 g)
159 300 017	Ultrasonic Flowmeter | type U3000 V2 | Spare parts | Transducer assembly A (2x Transducer A)
159 300 018	Ultrasonic Flowmeter | type U3000 V2 | Spare parts | Transducer assembly B (2x Transducer B)
159 300 068	Ultrasonic Flowmeter | type U3000 V2 | Spare parts | Sensor cable kit (5 meter, 16.4 ft. 2x cables)
159 300 069	Ultrasonic Flowmeter | type U3000 V2 | Spare parts | Sensor cable kit (10 meter, 32.8 ft. 2x cables)
159 300 290	Ultrasonic Flowmeter | type U3000 V2 | Spare parts | Sensor cable kit (15 meter, 49.2 ft. 2x cables)
159 300 070	Ultrasonic Flowmeter | type U3000 V2 | Spare parts | Sensor cable kit (20 meter, 65.6 2x cables)
159 300 291	Ultrasonic Flowmeter | type U3000 V2 | Spare parts | Sensor cable kit (25 meter, 82 ft. 2x cables)
159 300 292	Ultrasonic Flowmeter | type U3000 V2 | Spare parts | Sensor cable kit (30 meter, 114.8 ft. 2x cables)
159 300 019	Ultrasonic Flowmeter | type U3000 V2 | Spare parts | Diagonal guide rail
159 300 040	Ultrasonic Flowmeter | type U3000 V2 | Spare parts | Stainless steel banding (1 piece = 1 meter, 39.4 in.)
159 300 041	Ultrasonic Flowmeter | type U3000 V2 | Spare parts | Screw clip
159 300 042	Ultrasonic Flowmeter | type U3000 V2 | Spare parts | Hose clip 620-020 S/steel 19mm - 44mm, 0.75 in. to 1.73 in.
159 300 043	Ultrasonic Flowmeter | type U3000 V2 | Spare parts | Hose clip 620-036 S/steel 46mm - 70mm, 1.81 in. to 2.76 in.
159 300 044	Ultrasonic Flowmeter | type U3000 V2 | Spare parts | Hose clip 620-072 S/steel 76mm - 127mm, 3 in. to 5 in.

Type UD2100 Ultrasonic Doppler Flow Meter



Product description

The type UD2100 ultrasonic doppler flow meter is a permanent clamp-on flow meter for non-invasive flow measurement. It is specifically designed for challenging flow applications with dirty, aerated, abrasive, corrosive and/or caustic media – applications where the most regular flow meters would be compromised.

Typical media in applications of the UD2100 contains: Wastewater, slurries, vicious liquids, sewage, abrasives, sediments and others. This flow meter is recommend for use in fully filled pipes and virtually any media that contains solids or bubbles. The UD2100 can be used on PVC, CPVC, PE, PVDF, PP-H, ABS, PB, HDPE, steel and iron pipes. Processes can be monitored directly by a higherlevel system via 4-20 mA, HART or Modbus output.

Benefits/features

- Large, easy to read graphic display with backlighting
- Easy to install without special tools
- "Clamp-on" design
- Made for difficult applications and dirty media
- Compatible with almost all pipe types and diameters
- Simple quick-start set up procedure
- Compact integral design
- Various options for process communication
- Integrated datalogger

Applications

- Wastewater Treatment
- Mining
- Paper Mills
- Monitoring of manufacturing processes with dirty liquids
- Industrial effluent

Recommended for use with liquids containing suspended solids or bubbles with minimum size of 100 microns and minimum concentration of 75 ppm. Most applications (except potable, distilled, or deionized water) will meet this minimum requirement.

Specifications

General		
Measuring method	Ultrasonic doppler measurement	
Flow range	± 0.1 m/s - 12.2 m/s (± 0.1 ft/s - 40 ft/s), bi-directional	
Accuracy	± 2 % of the flow reading at a flow rate > ± 0.3 m/s (11.8 ft/sec). Requires solids or bubbles with minimum size of 100 microns and minimum concentration of 75 ppm	
Repeatability	± 0.5 % of measured value	
Linearity	± 0.5 %	
Response time	1 s	
Selectable flow units	Velocity	m/sec, ft/sec.
	Volume	Liter (L) per sec/min/hour/day US gallons (USG) per sec/min/hour/day Imperial gallons (ISG) per sec/min/hour/day Barrels (bbl) per sec/min/hour/day Cubic meter (m3) per sec/min/hour/day Cubic feet (m3) per sec/min/hour/day
Selectable totalizer units	Liters, m3, US gallons, imperial gallons, barrels, cubic feet	
Menu languages	English, Spanish, French	

Environment		
Operating temperature	-20 °C to +60 °C (head unit) -40 °C to +150 °C (sensor)	-4 °F to +140 °F -40 °F to +300 °F
Storage temperature	-10 °C to +60 °C	14 °F to 140 °F
Humidity during operation	Max. 90 % relative humidity at +50 °C (122 °F)	

Suitable pipe types		
Pipe materials	UPVC, CPVC, PE, PVDF, PP-H, ABS, PB, HDPE, steel, stainless steel, iron, cast iron, ductile iron, metal, line pipes. Pipes with loose insertion liners and pipes with walls containing air are not supported.	
Pipe diameter (d)	16 - 4500 mm*	½ - 180 inch*

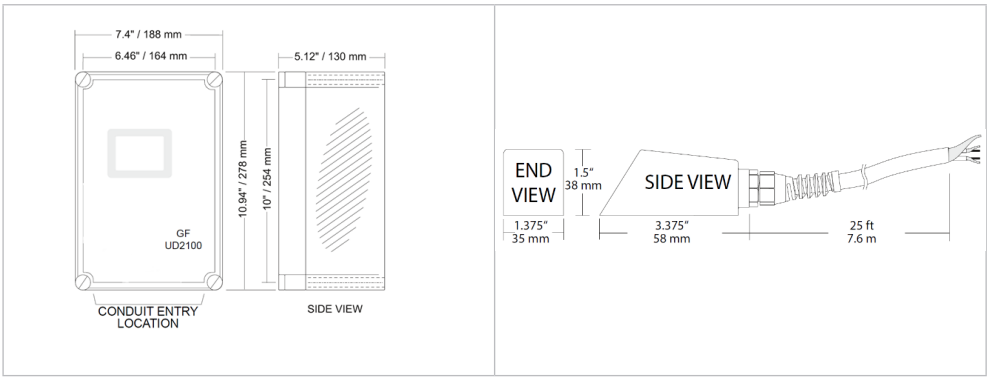
Electronics	
Power supply	100 - 240 V AC 50-60 Hz 9-32 V DC
Power consumption	AC: Max. 10 VA DC: Max 10 Watt

Outputs	
Analog output	
Range	4 – 20 mA or 0-5 VDC
Resolution	0.1 % of measurement range
Load max.	1'000 Ω
Insulation	1'500 V optically isolated
Alarm current	3.5 mA
Pulse output	
Pulse sequence	2.25 s minimum time between pulses
Pulse Duration	350 ms
Max. voltage	250 VAC
Max. current	12 A
Insulation	1'000 V
Modbus	
Type	Modbus RTU via RS485 or HART
Relays	
Type	2x SPDT 5 amp
Programming	Programmable flow alarm and/or proportional pulse

Outputs		
Datalogger		
Interface	USB	
Data points	26 million data points	
Format	CSV	
Housing and display		
Enclosure		
Material	Polycarbonate	
Dimensions	278 x 188 x 130 mm	10.95 x 7.4 x 5.12 inch
Weight	5 kg	11 lbs
Keyboard	Keypad with 5 buttons	
Protection class	IP 66 / NEMA4X (water and dust tight)	
Display		
Type	White, backlit matrix	
Supported languages	English, Spanish, French	
Sensor		
Material	316SS	
Dimensions	85 x35 x 38 mm	3.375 x 1.375 x 1.5 inch
Shipping information		
Package dimensions	380 x 290 x 230 mm	15 x 12 x 10 inch
Weight	5.4 kg	12 lbs
Volume weight	5.4 kg	12 lbs
Standards/approvals		
CE, conforms to RoHS		
Security	BS EN 61010-1:2020	
EMV	BS EN 61326-1:2013	BS EN 61326-2-3:2013
Environment	BS EN 60068-1:2015	
	BS EN 60068-2-1:2008	BS EN 60068-2-2:2008

* Note: Pipe size is dependant on pipe material and inner pipe diameter

Dimensions

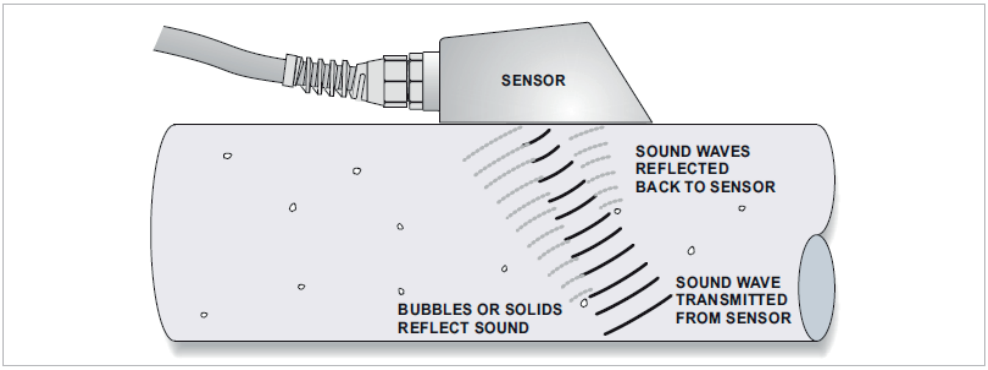


Packaging content



1 Type UD2100 head-unit
2 Type UD2100 Doppler Sensor incl. cable
3 S/steel hose-clip
4 S/steel sensor pipe clamp
5 Super Lube® coupling grease (12 g)
6 Cable ties
7 GF calibration certificate
8 Enclosure mounting hardware
9 USB-Stick incl. product documentation &factory calibration certificate

Function



The UD2100 ultrasonic doppler sensor continuously emits high frequency (ultrasonic) sound pulses through the pipe wall into the flowing liquid.

The ultrasonic sound pulses get reflected back from the particles or gas bubbles in the media. At zero flow the reflected frequency is the same as the emitted frequency. If the liquid is flowing the reflected frequency is different from the emitted (through the doppler effect.

This frequency shift is measured continuously by the UD2100 and used to precisely measure the velocity of the media.

Ordering Information

Config. Code	Code	Description
UD2100-A1-A1-A1-A1-A	159 300 320	UD2100 | 100-240 VAC | 4-20 mA, Pulse | 7.6 m cable | NEMA4X/IP66 | -20-60 °C
UD2100-A1-A1-A1-B1-A	159 300 321	UD2100 | 100-240 VAC | 4-20 mA, Pulse | 15 m cable | NEMA4X/IP66 | -20-60 °C
UD2100-A1-A1-A1-C1-A	159 300 322	UD2100 | 100-240 VAC | 4-20 mA, Pulse | 30 m cable | NEMA4X/IP66 | -20-60 °C
UD2100-A1-A1-A1-A2-A	159 300 323	UD2100 | 100-240 VAC | Modbus, 4-20 mA, Pulse | 7.6 m cable | NEMA4X/IP66 | -20-60 °C
UD2100-A1-A1-A1-B2-A	159 300 324	UD2100 | 100-240 VAC | Modbus, 4-20 mA, Pulse | 15 m cable | NEMA4X/IP66 | -20-60 °C
UD2100-A1-A1-A1-C2-A	159 300 325	UD2100 | 100-240 VAC | Modbus, 4-20 mA, Pulse | 30 m cable | NEMA4X/IP66 | -20-60 °C
UD2100-B1-A1-A1-A1-A	159 300 326	UD2100 | 9-32 VDC | 4-20 mA, Pulse | 7.6 m cable | NEMA4X/IP66 | -20-60 °C
UD2100-B1-A1-A1-B1-A	159 300 327	UD2100 | 9-32 VDC | 4-20 mA, Pulse | 15 m cable | NEMA4X/IP66 | -20-60 °C
UD2100-B1-A1-A1-C1-A	159 300 328	UD2100 | 9-32 VDC | 4-20 mA, Pulse | 30 m cable | NEMA4X/IP66 | -20-60 °C
UD2100-B1-A1-A1-A2-A	159 300 329	UD2100 | 9-32 VDC | Modbus, 4-20 mA, Pulse | 7.6 m cable | NEMA4X/IP66 | -20-60 °C
UD2100-B1-A1-A1-B2-A	159 300 330	UD2100 | 9-32 VDC | Modbus, 4-20 mA, Pulse | 15 m cable | NEMA4X/IP66 | -20-60 °C
UD2100-B1-A1-A1-C2-A	159 300 331	UD2100 | 9-32 VDC | Modbus, 4-20 mA, Pulse | 30 m cable | NEMA4X/IP66 | -20-60 °C

Accessories and replacement parts

Code	Description
159 300 340	Standard clamp-on Sensor with 25 ft / 7.6 m shielded coaxial pair
159 300 341	Standard clamp-on Sensor with 50 ft / 15 m length cable
159 300 342	Standard clamp-on Sensor with 100 ft / 30 m length cable
159 300 343	Sensor cable Junction Box
159 300 344	Sensor Mounting Kit with Couplant and SS clamps for pipes up to 32" (80 cm)
159 300 345	Enclosure Sunscreen (iridite aluminum)
159 300 038	Super Lube® Grease 85 g
159 300 346	Extra sensor cable 20 ft / 6 m length
159 300 347	Extra sensor cable 35 ft / 10 m length
159 300 348	Extra sensor cable 175 ft / 50 m length
	Extra sensor cable custom length (up to 500 ft / 152 m, RG174U shielded coaxial pair)

Level

Content

Point level detection **416**

Continuous level measurement **445**

Introduction

Continuous Level Control Specification Matrix

Type	2284 Ultrasonic Gap Switch	2280 Vibration	2281 Conductive Multipoint Switch	2282 Guided Float	2285 Float Switch
					
Point or Continuous Level	Point	Point	Point	Point	Point
Range (From Sensor Tip)	N/A	N/A	20 in., 40 in., 59 in." (72 in., 108 in. on request)	N/A	Cable Length 5 m (16.5 ft) 10 m (33 ft) 20 m (66 ft)
Output type	Single pole, center off / switch with stable, contactless middle position	2-wire AC; 3-wire PNP-NPN, 1 SPDT relay	SPDT (1-4 outputs, optional)	Reed Contact	Microswitch (SPDT)
Power Requirement	18 to 30 VDC / AC	12 to 55 V DC or 20 to 255 V AC, 50/60 Hz, 20 to 255 V AC and 20 to 60 V DC	24 VAC or VDC	N/A	N/A
Tank Top	Yes	Yes	Yes	No	No
Submersible	Yes	Yes	No	Yes	Yes
Tank Side Mount	Yes	Yes	No	Yes	No
Open Channel (Flow)	No	No	No	No	No
Process Connection	¾ in. or 1 in.	1 in.	1½ in.	½ in.	N/A
ATEX (Intrinsically Safe)	No	Optional	No	No	No
Body Material	PPS	Stainless Steel DIN 1.4571	PBT/PP (Enclosure), Stainless Steel (probes)	PP or PVDF	PP (body), PVC (cable)

Point Level Detection Specification Matrix

Type	2250 Hydrostatic	2270 Ultrasonic	2260 Ultrasonic	2290/2298 Unguided Radar	2291 Guided Radar
					
Point or Continuous Level	Continuous	Continuous	Continuous	Continuous	Continuous
Range (From Sensor Tip)	0 to 10 psig (0-23 ft) 0 to 50 psig (0-115ft)	0.2 to 4 m (0.65 to 13 ft) 0.25 to 6 m (0.82 to 20 ft)	0.2 to 4 m (0.65 to 13 ft) 0.25 to 6 m (0.82 to 20 ft) 0.45 to 15 m (1.5 to 49 ft)	0.2 m – 18 m (0.65 – 59 ft) (depending on εr of the process liquid)	Cable 6 m (19.6 ft) Rod 2 m (6.56 ft) Both customer adjustable
Output type	(S³L) or 4 to 20 mA	4 to 20 mA / HART	4 to 20 mA (HART/ Relay-Optional)	4 to 20 mA / HART	4 to 20 mA / HART
Power Requirement	5 to 6.5 VDC (S³L), 12-24 VDC (4 to 20 mA)	12 to 36 VDC	12 to 36 VDC	20 to 36 VDC	18 V to 35 V DC
Tank Top	No	Yes	Yes	Yes	Yes
Submersible	Yes	No	No	No	Cable/ rod only
Tank Side Mount	Yes	No	No	No	No
Open Channel (Flow)	No	Yes	Yes	No	No
Process Connection	½ in. union male thread	1½ in. or 2 in.	1½ in. 2 in., or 5"ANSI Flange	1½ in.	1 in.
ATEX (Intrinsically Safe)	No	No	Optional	Optional	Optional
Body Material	PVDF, Ceramic, FKM	PP/EPDM or PVDF/FKM	PP/EPDM or PVDF/FKM	Horn: Stainless Steel; enclosure: PP, PTFE	Rod/Cable - 316 SS Special order coated versions available

Point Level Detection Application Matrix

Chart Key	
+	Recommended
o	Conditionally Suitable
-	Not Recommended
*	Specific Part Number

Type	2284 Ultrasonic Gap Switch	2280 Vibration	2281 Conductive Multipoint Switch	2282 Guided Float	2285 Float Switch
					
Point Level	+	+	+	+	+
Continuous Level	-	-	-	-	-
Volume Measurement	-	-	-	-	-
Flow Measurement	-	-	-	-	-
Submersible	+	-	o	+	+
Tank Side Mount	+	+	-	+	-
Non Contacting	-	-	-	-	-
Vapors / Density Changes	+	+	o	+	+
Clean Fluid	+	+	+	+	+
Solids in Fluid	+	o	o	-	+
Residues	+	o	-	-	+
Some Surface Agitation	o	o	+	o	+
High Surface Agitation	-	-	o	-	+
Light Surface Foam	-	o	o	-	+
Dense Surface Foam	-	-	-	-	+
Intrinsically Safe	-	*	-	-	-

Continuous Level Control Application Matrix

Chart Key	
+	Recommended
o	Conditionally Suitable
-	Not Recommended
*	Specific Part Number

Type	2250 Hydrostatic	2270 Ultrasonic	2260 Ultrasonic	2290/2298 Unguided Radar	2291 Guided Radar
					
Point Level	-	-	-	-	-
Continuous Level	+	+	+	+	+
Volume Measurement	+	+	+	+	+
Flow Measurement	-	+	+	-	-
Submersible	+	-	-	-	+
Tank Side Mount	+	-	-	-	-
Non Contacting	-	+	+	+	-
Vapors / Density Changes	+	o	o	o	+
Clean Fluid	+	+	+	+	+
Solids in Fluid	o	+	+	+	+
Residues	o	+	+	+	+
Some Surface Agitation	+	o	o	o	+
High Surface Agitation	o	-	-	o	o
Light Surface Foam	+	o	o	+	+
Dense Surface Foam	+	-	-	o	o
Intrinsically Safe	-	-	*	*	*

Planning Fundamentals

of Measurement and Control

Point level detection

Content

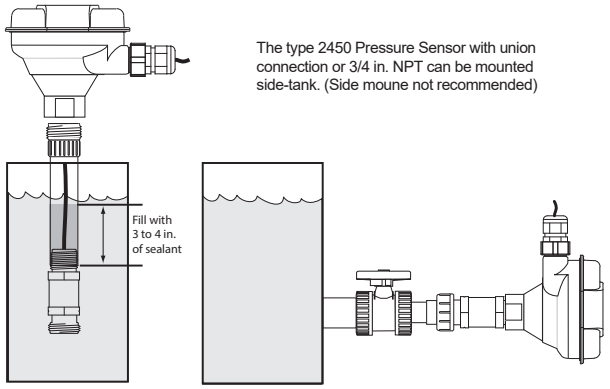
Type 2280 Tuning Forks 419
Type 2281 Multipoint Switch 427
Type 2282 Guided Float Switch 434
Type 2284 Ultrasonic Gap Switch 438
Type 2285 Level Float Switch 442

Technical Basics

Hydrostatic Level Sensor

Submersible Installation

- Use the 2450 and 2250 sensors with 4.6 m (15 ft) cable and 10 m (32.8 ft).
- Mount the sensor to an extension pipe or watertight conduit using thread sealant.
- Use a cable gland at the top of the extension to prevent moisture accumulation inside the pipe.
- For 2450 sensors: DO NOT hermetically seal (i.e. applying silicone sealant or epoxy) the back of sensor. This may introduce measurement errors resulting from changes in atmospheric pressure and/or temperature. Instead, use a 2250 which has an extended atmospheric breather tube (same length of sensor cable). Do not to pinch breather tube.



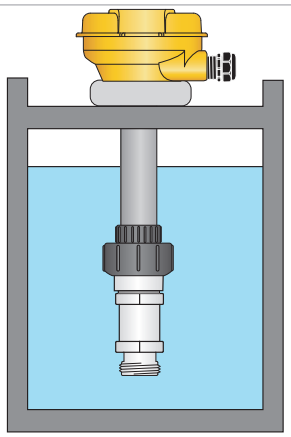
Type 2450 Pressure Sensor

In-Line Installation

- The 2450 can be mounted in a pipe-tee using the threads closest to the sensing end.
- The sensor can be mounted with or without an integral mount kit. This kit mounts a junction box or an instrument.
- See below for more information on instrument integral mount and junction box/remote mount examples.

Installation Tips

8050-1 and 8050-2 junction boxes can be useful for this installation option.



Type 2250 Hydrostatic Level Sensor

Integral Assembly

The 3-8052 Integral Kit connects the 8450 Pressure Transmitter directly onto the 2450 sensors.

- Use the 2450 sensor with 15.2 cm (6 in.) cable and digital (S^3L) output.
- Apply sealant or PTFE tape to the process connection threads, after inspecting threads to ensure integrity. Do not install a sensor with damaged threads.
- Tighten the sensor 1½ turns past finger tight into the process connection.

Remote Assembly

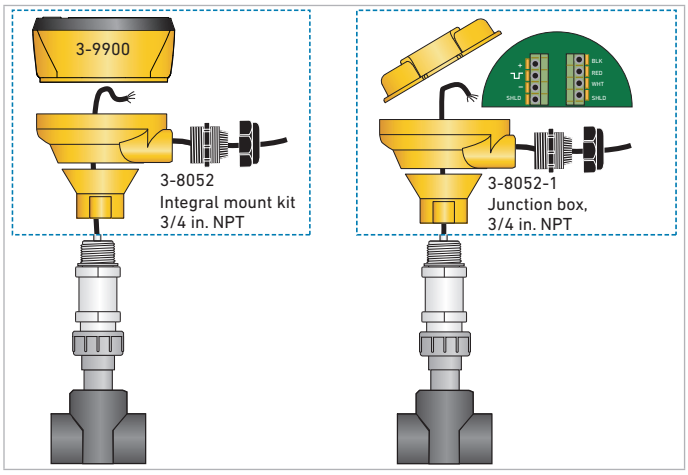
The optional 3-8052-1 Integral Kit with Junction Box and ¾ in. NPT sensor connection provides a convenient terminal point to extend the 2450 and 2250 cable over a distance.

The kit includes:

- ¾ in. NPT sensor connection
- Conduit base and cap with junction terminals
- 3-9000.392-1 liquid tight connector, ½ in. NPT

Installation Tips

Sensors can be mounted into any DN20 (¾ in) FNPT pipe tee (customer supplied)



The in-line 2450 pressure sensor with union connection can be mounted using GF parts. See below for list of GF Part Numbers.

Union Matrix for Pressure Sensor 3-2450 ½ in. (DN15) Union Connection

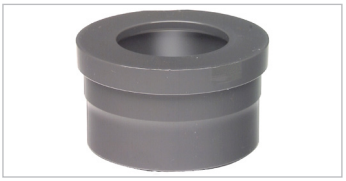
Nuts

Material	Part Number
PVC	721 690 006
PVC-C	723 690 006
PVDF	735 690 406
PP	727 690 406

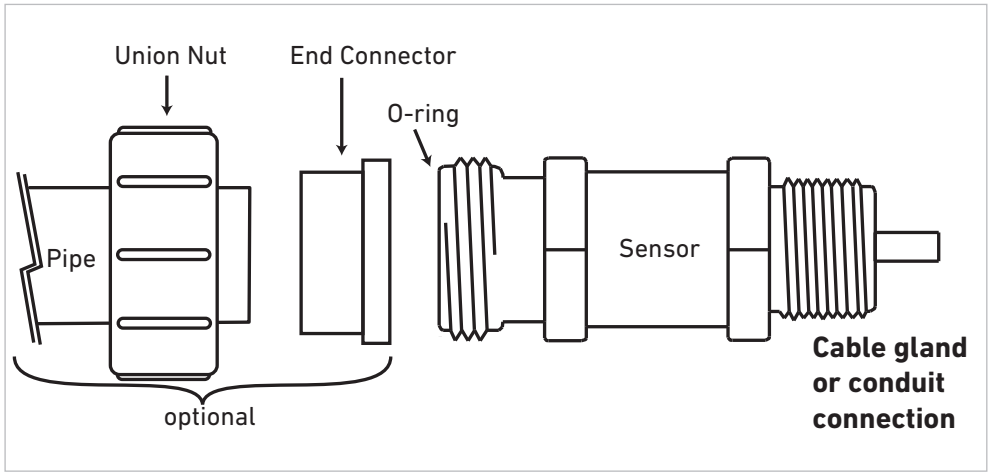


End Connector

Material	Part Number	Description
PVC	721 500 106	Union end metric socket
PVC	721 602 006	Union end IPS socket
PVC	721 602 656	Union end NPT thread
PVC-C	723 602 006	Union end socket
PP-H	727 508 506	Union end butt
PP-H	727 500 106	Union end socket
PP-H	157 203 603	Union end threaded NPT
PP-N	728 608 506	Union end butt
PVDF	735 608 606	Union end butt
PVDF	735 600 106	Union end socket
PVDF	198 203 611	Union end threaded







Type 2280 Tuning Forks



Product description

Type 2280 Tuning Forks are suitable for level detection of liquids or granular, powdered solids. Mounted on tanks filling/emptying can be controlled using these devices just as well they can generate fail-safe alarms providing overfill or dry run protection.

The operating principle is based on the electronic circuit exciting the fork probe making it vibrate. As the medium reaches and covers the fork its vibration changes. The electronic device senses changes in vibration and provides an output signal after a specified delay.

Benefits/features

- Maintenance-free principle of vibration
- Independent of conductivity, permittivity, pressure and temperature
- High pressure
- Selectable sensitivity
- Relay or electronic output
- Temperatures up to 130 degrees
- ATEX and WHG approvals (optional)
- IP67, 65/68 protection

CE UK CA Ex WHG

Applications

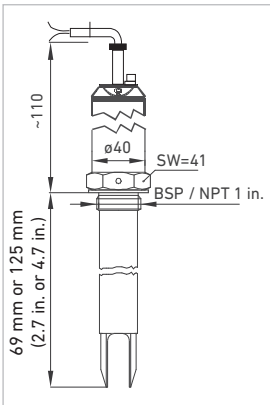
- Potable Water
- Cooling Water
- Demineralized Water
- Water/Glycol Solutions
- Chemicalsy

Technical data

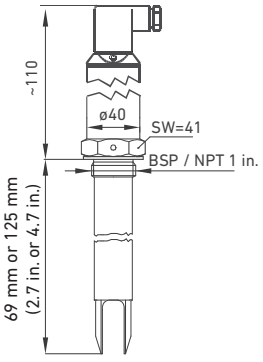
General	2280-S-5xxC-1/-2	2280-S-5xxO-1/-2	2280-S-5xxT-1/-2
Special length	69 mm or 125 mm (2.7 inch or 4.9 inch)		
Indicator light	Bi-color LED		
Environment			
Process temperature	-40 °C ... +130 °C (-40 °F... +266 °F)		
Ambient temperature	-40 °C...+70 °C (-40 °F...+158°F) / -30 °C...+70 °C (-22 °F...+158°F)		
Process pressure (absolute)	4 MPa (40 bar) 580 psi		
Min. medium density Max. medium viscosity	≥ 0.7 kg/dm3 ≤10'000 mm2/s (cSt)		
Housing			
Sensor	Stainless steel DIN 1.4571		
Housing	Stainless steel DIN 1.4571		PBT
Protection rating	IP67		
Process connection	1 in. BSP / NPT		
Electronics			
Switching function	2-wire AC, 3-wire PNP-NPN		1 SPDT relay
Voltage/current outputs	AC 9mA free, 14 mA immersed 3-wire max. 350mA, <4.5V (on)		250 V AC, 8 A AC1
Power supply	12...55 V DC or 20 ... 255 V AC, 50/60 Hz		20 ... 255 V AC and 20 ... 60 V DC
Reaction time	≤ 0.5 s		
Power consumption	0.6 W		AC: 1.2 ... 17 V A; DC: <3 W
Connection	Cable PVC 5 x 0.5 mm 2, 3 m	DIN plug	Terminal
Protection		Class III	Class I
Standards and Approvals			
ATEX approval (optional)	ATEX II 1 G Ex ia IIC T6, IP68		
General approvals	CE, UKCA, RoHS		

Dimensions

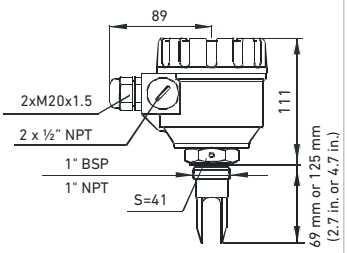
2280-S-5xxC-1/-2



2280-S-5xxO-1/-2

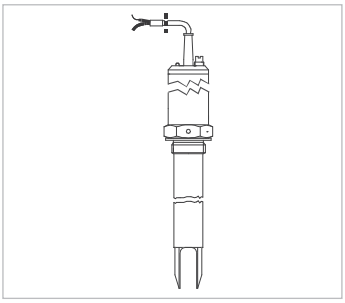


2280-S-5xxT-1/-2



Ordering Information

Manufacturer's part no.	Part no.	Description
2280-S-5WBO-1	159 300 200	Length 69 mm, Stainless Steel, 3-wire PNP-NPN output, DIN connector, BSP thread
2280-S-5WBC-1	159 300 201	Length 69 mm, Stainless Steel, 3-wire PNP-NPN output, cable, BSP thread
2280-S-5WBO-2	159 300 202	Length 125 mm, Stainless Steel, 3-wire PNP-NPN output, DIN connector, BSP thread
2280-S-5WBC-2	159 300 203	Length 125 mm, Stainless Steel, 3-wire PNP-NPN output, cable, BSP thread
2280-S-5XWBO-1	159 300 210	Length 69 mm, Stainless Steel, 2-wire AC, DIN connector, BSP thread, ATEX
2280-S-5XWBC-1	159 300 211	Length 69 mm, Stainless Steel, 2-wire AC output, cable, BSP thread, ATEX
2280-S-5XWBO-2	159 300 212	Length 125 mm, Stainless Steel, 2-wire AC, DIN connector, BSP thread, ATEX
2280-S-5XWBC-2	159 300 213	Length 125 mm, Stainless Steel, 2-wire AC, cable output, cable, BSP thread, ATEX
2280-S-5WNO-1	159 300 220	Length 69 mm, Stainless Steel, 3-wire PNP-NPN output, DIN connector, NPT thread
2280-S-5WNC-1	159 300 221	Length 69 mm, Stainless Steel, 3-wire PNP-NPN output, cable, NPT thread
2280-S-5WNO-2	159 300 222	Length 125 mm, Stainless Steel, 3-wire PNP-NPN output, DIN connector, NPT thread
2280-S-5WNC-2	159 300 223	Length 125 mm, Stainless Steel, 3-wire PNP-NPN output, cable, NPT thread
2280-S-5XWNO-1	159 300 230	Length 69 mm, Stainless Steel, 2-wire AC output, DIN connector, NPT thread, ATEX
2280-S-5XWNC-1	159 300 231	Length 69 mm, Stainless Steel, 2-wire AC output, cable, NPT thread, ATEX
2280-S-5XWNO-2	159 300 232	Length 125 mm, Stainless Steel, 2-wire AC output, DIN connector, NPT thread, ATEX
2280-S-5XWNC-2	159 300 233	Length 125 mm, Stainless Steel, 2-wire AC output, cable, NPT thread, ATEX
2280-S-5WBT-1	159 300 240	Length 69 mm, Stainless Steel, PBT housing, 1 SPDT relay, BSP thread
2280-S-5WBT-1	159 300 241	Length 125 mm, Stainless Steel, PBT housing, 1 SPDT relay, BSP thread
2280-S-5WBT-2	159 300 242	Length 69 mm, Stainless Steel, PBT housing, 1 SPDT relay, NPT thread
2280-S-5WBT-2	159 300 243	Length 125 mm, Stainless Steel, PBT housing, 1 SPDT relay, NPT thread



Technical basics

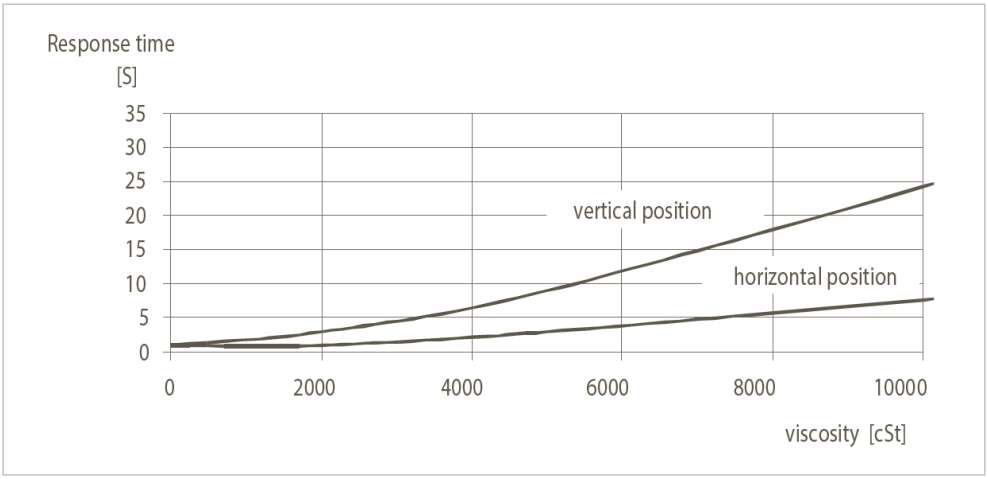
Since this concerns an invasive measuring principle, the composition of the medium to be measured plays an important role with regard to the functionality of the 2280 Tuning Forks.

First check whether the medium is resistant to the sensor housing. The sensor housing consists of stainless steel DIN 1.4571, 316.

Furthermore, the viscosity determines whether the measuring principle can be used. Especially if it is assumed that the liquid repeatedly comes into contact with the switch without it being cleaned in the interim.

Media with a maximum viscosity of 10,000 mm2/s (cSt) can be detected reliably. Liquids with higher values overwhelm the self-cleaning function of the fork. There is a risk that the switch will no longer be able to discern a change in frequency. It remains in the switched state, even though the fill level has already fallen.

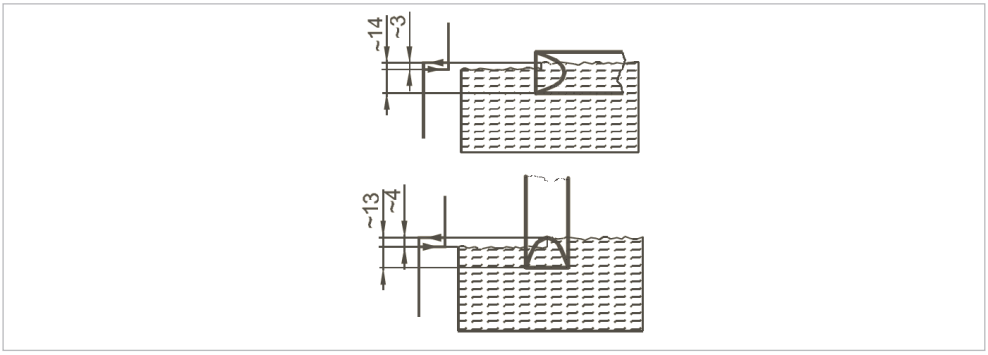
Depending on the viscosity, there is a certain time delay before the fork becomes free.



Reaction time / viscosity

Switching point

The following graphic illustrates the switching point on the fork. This point also depends on the density of the contact liquid.



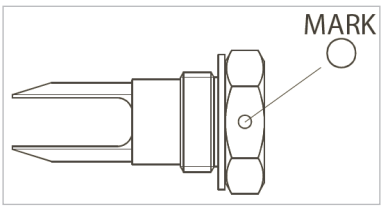
Switching points: values in mm with water 25 °C

Handling

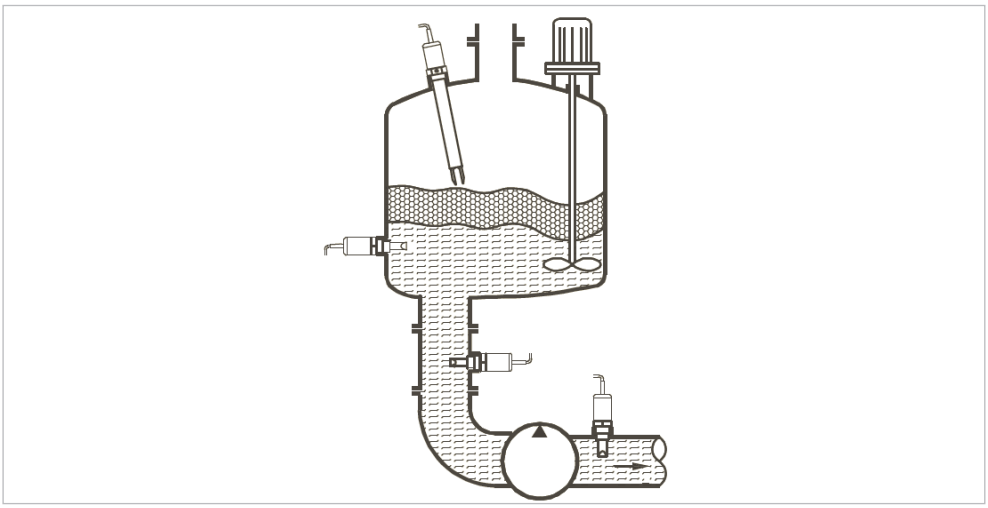
Installation notes

Position

In order to attain the best possible measuring performance, the 2280 Tuning Forks can be installed in different ways. Here, marking the side on the hexagon helps. With PTFE tape on the thread, the required end position can be reached. If no particular position is necessary, installation of the standard sealing ring is sufficient.

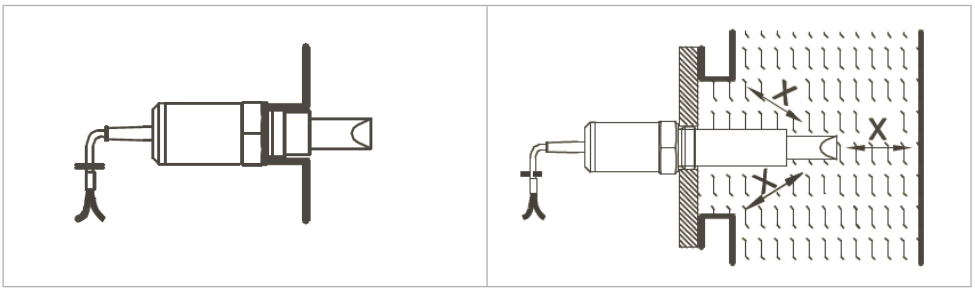


- Low viscosity
  - No particular position is to be maintained here. The sensor can be installed in any desired position.
- High viscosity
  - Install the sensor vertically, if possible. This can substantially improve the reaction time after submersion.



Examples of installation positions of the 2280

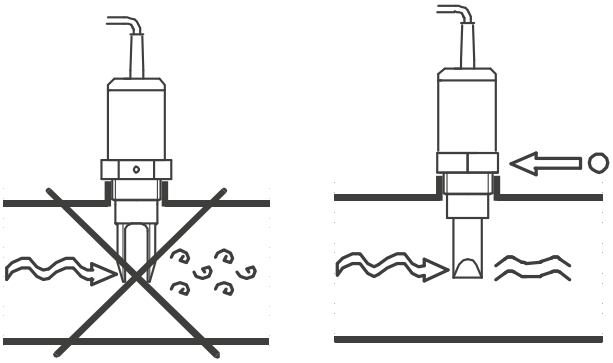
Additionally, it must be ensured that there is sufficient free space around the sensor, in order to prevent deposits. This is particularly true for installations in pipes. The fork must also be able to be completely immersed in the medium.



Caution when assembling fittings and pipes with small dimensions.

Special note on installations in pipes

When installing into pipes it must be ensured that the fork of the 2280 is aligned parallel to the flow. This is necessary in order to prevent deposits and to achieve the best possible reaction time. The mark on the hexagon will help with orientation.

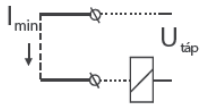
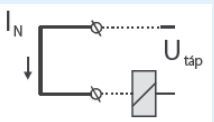
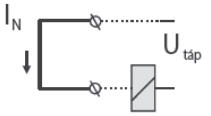
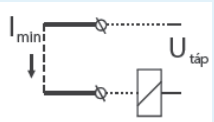
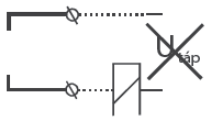


Function test with test magnet

Each 2280 can be checked for proper function as soon as there is power. This requires a magnet (RPS-101). If the test magnet is placed on the marked spot on the housing, the switching state of the 2280 changes.

Function diagram

Overview of the various switching states and LED displays

Voltage	Tuning Forks	Operating mode	LED	Output	
On	Covered	HIGH	Red	OFF	
		LOW	Green	ON	
	Open	HIGH	Green		
		LOW	Red	OFF	
Failure	Open or covered	HIGH or LOW	Off		

Maintenance notes

The 2280 Tuning Forks are rugged sensors for industrial applications. Therefore, in general no maintenance is necessary. In certain cases it may become necessary to clean residues from the Tuning Forks at regular intervals. Heavy soiling can cause the 2280 Tuning Forks to no longer reliably change switching states.

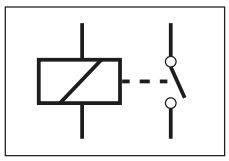
⚠ Installation and maintenance must be performed according to the corresponding installation instructions. The installation manual is included with the product, see also the online product catalog at www.gfps.com

Tips on use

Overfill protection

It is recommended that a level switch also be installed for every continuous measuring system (hydrostatic or ultrasonic). Particularly in order to be able to reliably detect the highest allowed level.

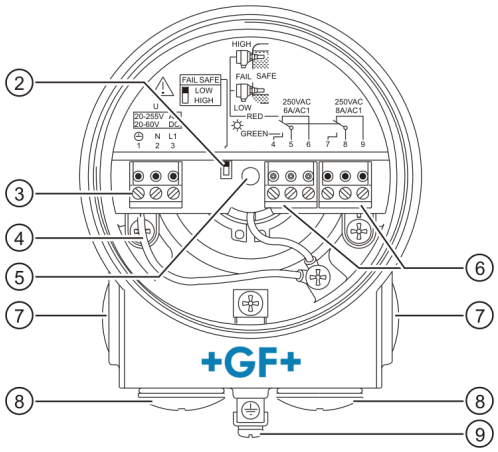
Placed correctly, the 2280 provides a HIGH alarm for this purpose, and can be directly connected to a stop relay in order to stop the feed pump in an emergency.



GF level switches in connection with a stop relay offer a simple, redundant safety concept in case the continuous system fails.

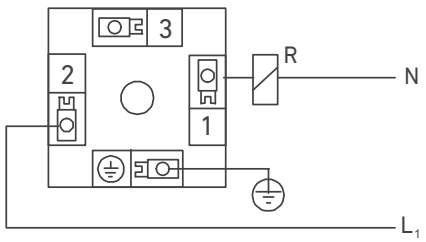
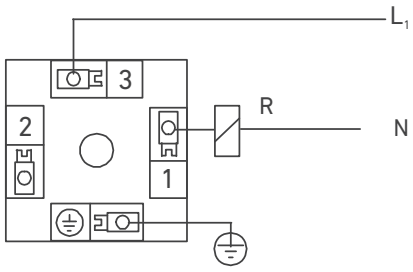
Wiring

PBT Enclosure Version



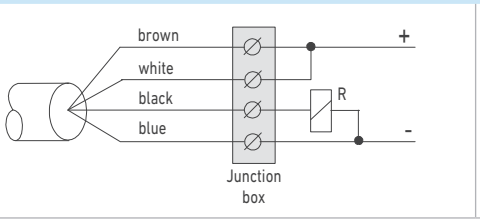
1 n.a.
2 Fail safe mode
3 Mains
4 Grounding
5 Status LED
6 Output
7 ½“ NPT
8 M20 x 1.5
9 Grounding screw

DIN connector and 3 Wire DC version

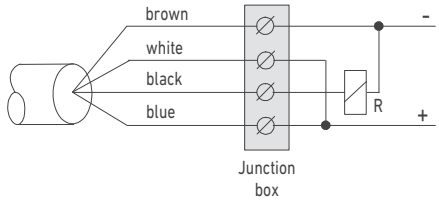
LOW-level limit switch	HIGH-level limit switch
	

Version with DC cable, 3 Wire DC, PNP-wiring

LOW-level limit switch

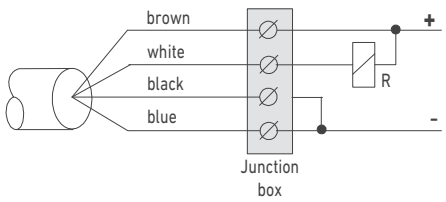


HIGH-level limit switch

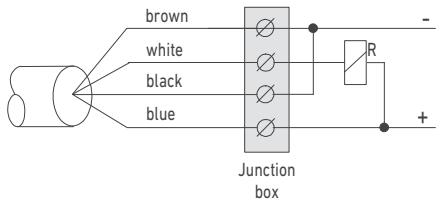


Version with DC cable, 3 Wire DC, NPN-wiring

LOW-level limit switch

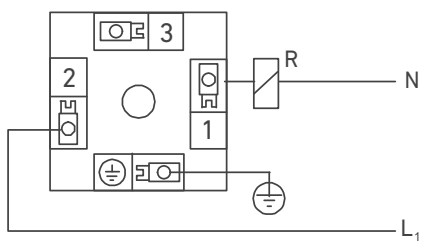


HIGH-level limit switch

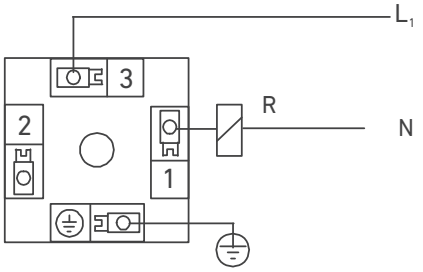


Version with DIN connector and 2-wire AC

LOW-level limit switch

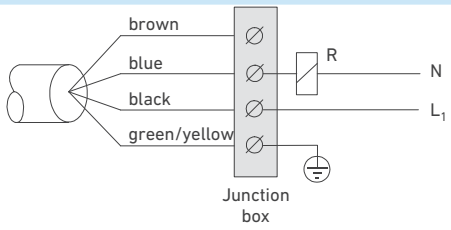


HIGH-level limit switch

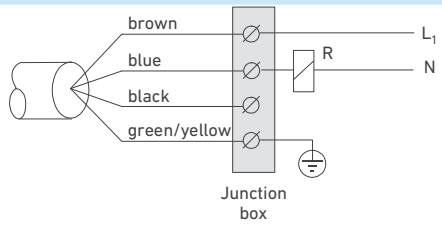


Version with DC cable, 2-wire AC

LOW-level limit switch



HIGH-level limit switch



Type 2281 Multipoint Switch



Product description

The Multipoint Switch type 2281 is based on the conductivity principle. The conductivity must be at least 10 µS/cm.

The probes have to be placed into the tank for level detection. The probe length should be in accordance with the level to be detected. Filling liquid in the tank will change the electrical conductivity between the reference probe and the outer probes. The established connection will be converted and activate a relay providing the output.

Features

- Easy on site customization of probe length
- Fast installation with choice of 2,3, or 4 individual switching points integrated in one sensor
- Up to 4 relays for pump and valve control
- Adjustable sensitivity
- Adjustable delay time

Applications

- Potable Water
- Cooling Water
- Chemicals
- Pump/Valve Control

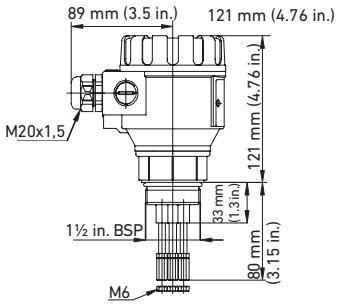
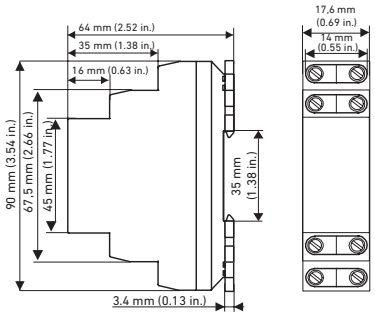
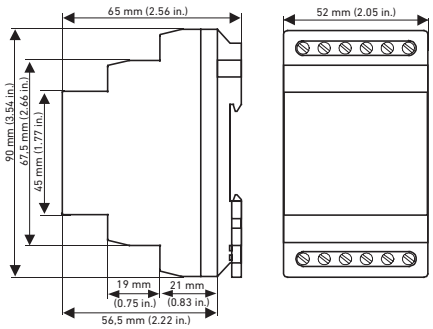
Technical data

	2281-S-BT-x	2281-1-Relay	2281-2-Relay
Switching points	x=2, 3, 4		
Environment			
Process temperature	Max. +80 °C (176 °F)		
Ambient temperature	-20 °C bis +50 °C (-4 °F bis +122 °F)		
Process pressure (absolute)	0.1 MPa (1 bar) 14.5 psi		
Housing			
Housing material	PBT		
Process connection material	PP		
Electrode material	Stainless steel 1.4571		
Protection rating	IP 65, NEMA 4	IP 20, NEMA 1	
Process connection	1 ½ in.		
Electrodes			
Material	Stainless steel 1.4571		
Standard length	0.5m (19.69"), 1.0m (39.37"), 1.5m (59.06"), (72 in., 108 in. on request)		

Please contact GF for special lengths up to 3 m

Spacer			
Material	PP		
Electronics			
Electrode voltage		3.5 V AC	5 V AC
Current through sensor		<0.2 mA AC	<1mA AC
Reaction time		Max. 400 ms	
Delay		Setting range 0.5 – 10 s	
Relay output		1x SPDT	2x SPDT
Max. nominal voltage		250 V AC1, 24 V DC	
Max. nominal current		8 A AC1	16 A AC1
Switching capacity		2500 VA AC1, 240 W DC	4000 VA AC1, 384 W DC
Power supply		24 V bis 240 V AC / DC	24 V AC / DC
Mechanical connection		DIN EN 60715 rail	
Electronic protection		Class II	Class III
Standards/approvals			
General approvals	CE, UKCA, RoHS		

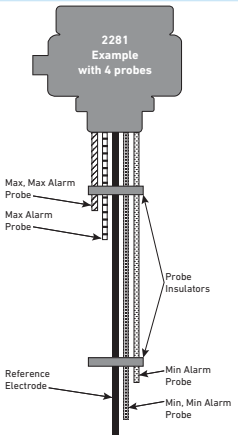
Dimensions

Multiprobe sockets: 2281-S-BT-2, 2 electrodes 2281-S-BT-3, 3 electrodes 2281-S-BT-4, 4 electrodes	Conductive multipoint switch type 2281-1 relay; 1 SPDT relay	Conductive multipoint switch type 2281-2 relay; 2 SPDT relay
		

How to order

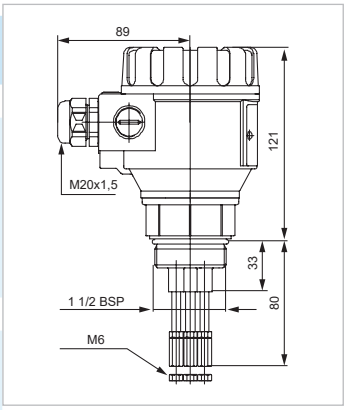
The 2281 can be utilized for alarming 2-4 level set-points, any combination of LO or HI levels. The 2281 housing must always remain out of the fluid being measured.

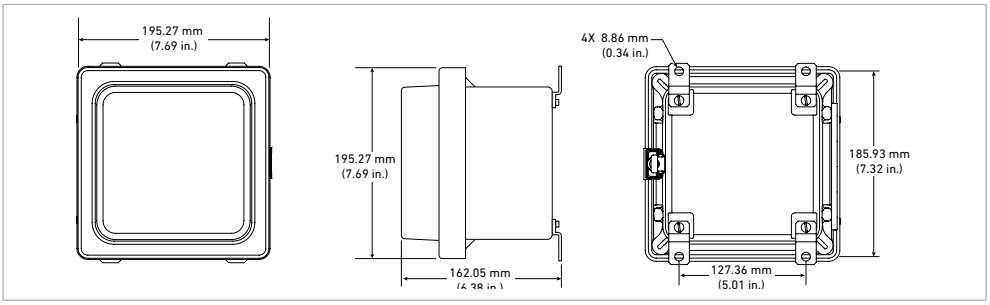
Step	Process
1	Select Multiprobe Enclosure based upon the quantity of desired alarms 2, 3, or 4.
2	Select one stainless steel rod to serve as the reference electrodes. Choose either a 19.69 in., 39.37 in., or 59.06 in., the length should be longer than any of the alarm probes. Note: The rod can be cut shorter onsite with a hack saw for a precise fit.
3	Select one stainless steel rod for each alarm set-point (up to four rods). For each length choose either a 19.69 in., 39.37 in., or 59.06 in. Note: The rod can be cut shorter onsite with a hack saw for a precise dimension.
4	Select probe insulator, a minimum of one is required. It's suggested to add one more for every additional 20 in. of assembly length (maximum 3).
5	Select the amount of alarm relays to match the amount of alarm set-points. Choose either 2 or 1 and 2=3, or 2 and 2=4.



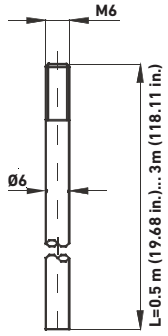
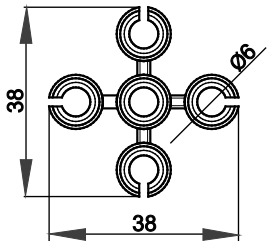
Ordering Information

Manufacturer's part no.	Part no.	Description
Step 1		
2281-S-BT-2	159 300 250	Multiprobe Enclosure, 2 probes + reference probe, PBT enclosure, 1½ in. BSP thread
2281-S-BT-3	159 300 251	Multiprobe Enclosure, 3 probes + reference probe, PBT enclosure, 1½ in. BSP thread
2281-S-BT-4	159 300 252	Multiprobe Enclosure, 4 probes + reference probe, PBT enclosure, 1½ in. BSP thread
Step 2&3		
2281-E-205	159 300 253	Stainless Steel Electrode, 0.5 m (19.69 in.)
2281-E-210	159 300 254	Stainless Steel Electrode, 1.0 m (39.37 in.)
2281-E-215	159 300 255	Stainless Steel Electrode, 1.5 m (59.06 in.)
Step 4		
2281-5-Spacer	159 300 257	Spacer for conductive level switch
Step 5		
2281-1-Relay	159 300 258	Conductive level switch, 1 SPDT relay, 24 – 240 V AC/DC
2281-2-Relay	159 300 259	Conductive level switch, 2 SPDT relay, 24 V AC/DC





Accessories

Probe dimension	Probe separator 2281-5 spacer, to be used every 0.5 m (19.69 in.)
	

Technical basics

The measuring principle requires a minimum conductivity of 10 µS/cm. When the medium covers the reference as well as the measuring electrode, a current < 1 mA AC will flow, which can be detected by the switching unit. The switching state is changed accordingly.

The limit switch consists of 1 or 2 switching units and the sensors of type KLN-2. The sensors are introduced into the sensor frame type 2281, which can be screwed into the container. If the container material or the insulation is not conductive on the inside, a reference sensor should be used in addition to the one, two, three or four sensor(s). If the container material is conductive, the container can serve as a reference sensor.

Handling

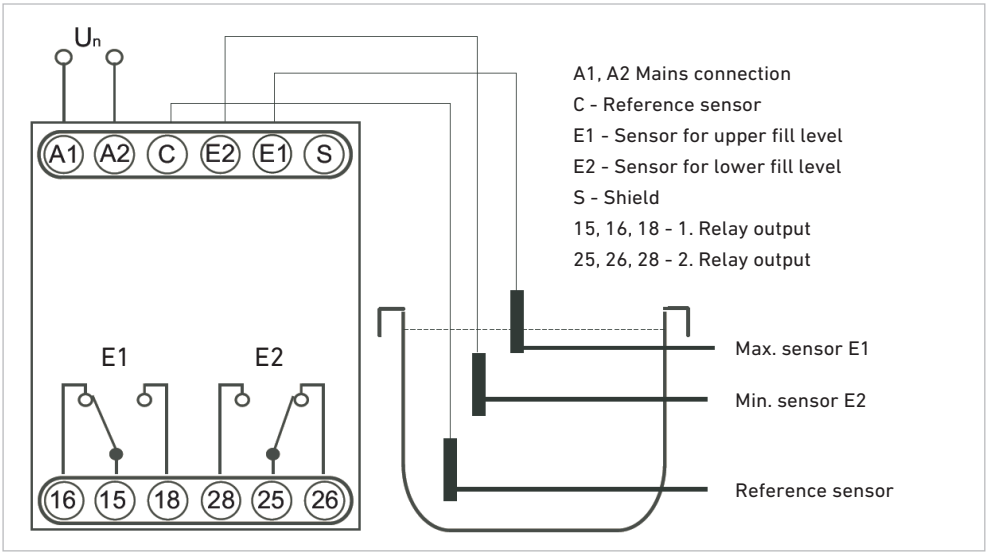
Installation notes

The 2281 is ready for use in only a few steps:

- Install switching unit onto rail (DIN EN 60715).
- Customize the sensors of type KLN-2 on site to the length required for the level measurement.
- Screw sensors into the frames.
- Tighten sensors with M6 nut.
- For devices with several sensors, use all 0.5 m spacers in order to separate the sensors from one another.

Electrical connection

If the container wall is conductive, no reference sensor is necessary. In this case, connection C should be attached to the container. In cases of several sensors, E1 and E2 are to be marked 1 to 4, and the reference sensor C. The permissible cable length between the signal processor and sensors depends on the cable capacity and conductivity. Ensure that E1 reaches the upper fill level, and E2 the lower one.



Maintenance notes

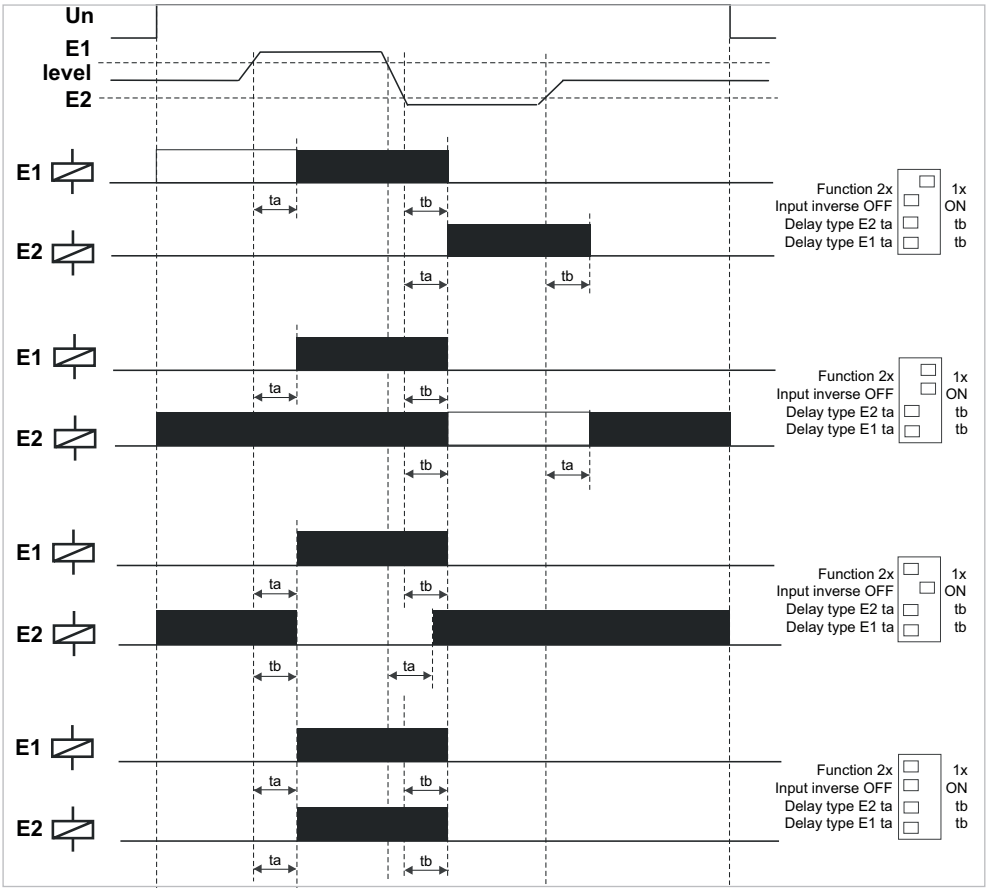
No special maintenance steps are stipulated. Simply make sure that no deposits remain on the reference sensor or the measuring sensors. Such are to be removed in order to ensure full functionality.

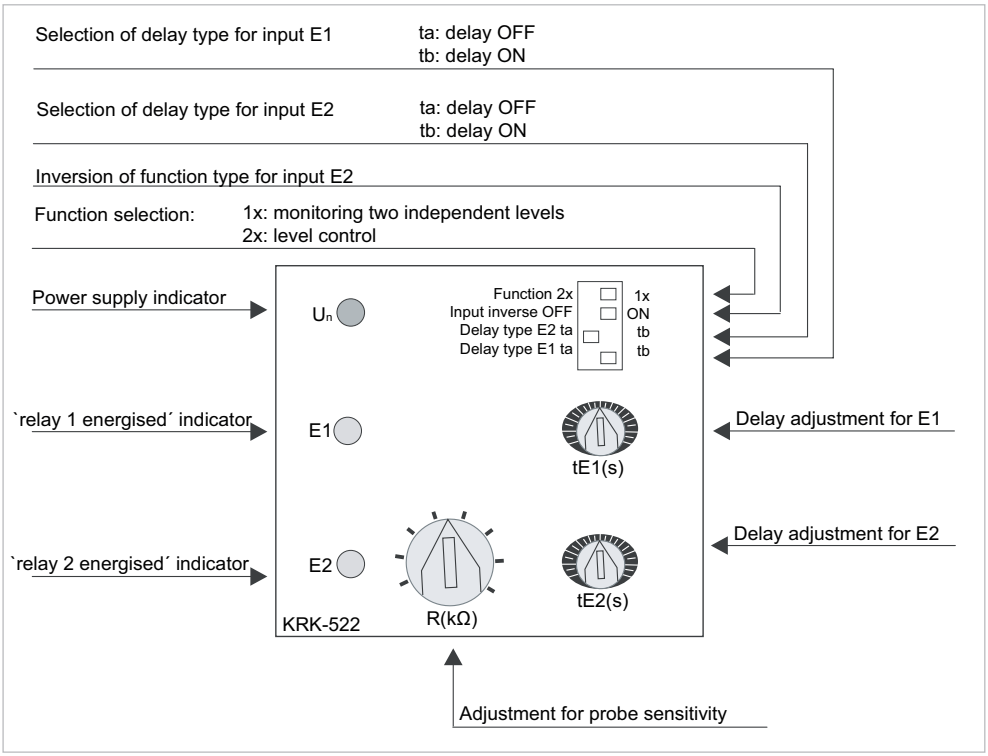
Installation and maintenance must be performed according to the corresponding installation instructions. The installation manual is included with the product, see also the online product catalog at www.gfps.com

Tips for installation

Recommended settings for the switching unit

The green LED (Un) shows that the unit is switched on. The LEDs E1 and E2 show that the relay is in the active state. Operating mode and delay ON or OFF can be set using the DIP switch on the operating panel. On the potentiometers tE1(s) and tE2(s), the delay can be set. The sensitivity setting (potentiometer R) should match the conductivity of the liquid. The sensitivity should not be set higher than required, otherwise there will be precipitation.

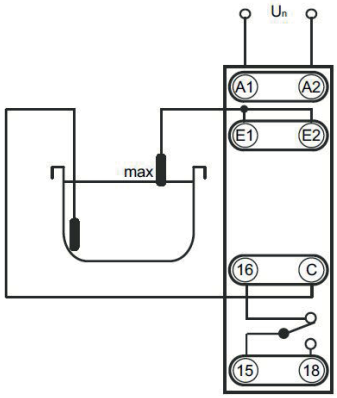
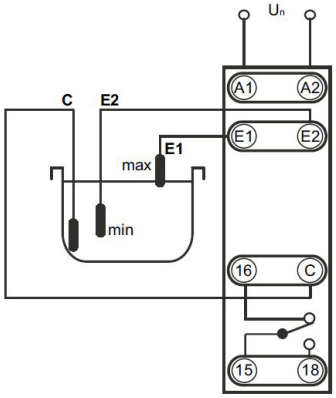




Wiring

1 SPDT Relay: type 2281-2-Relay

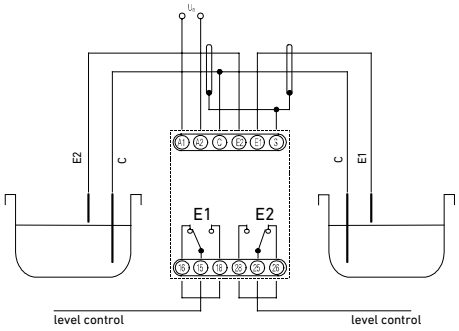
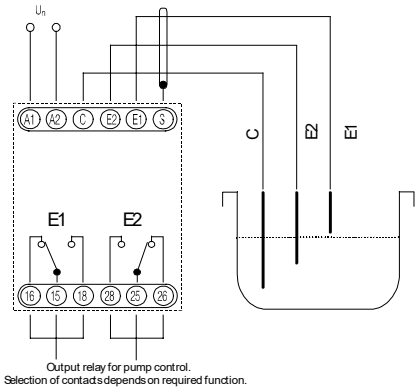
Part No.: 159 300 258

Single Level Monitoring	Level Control
	

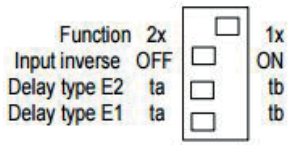
A1, A2	Power supply
C	Reference probe
E1	Upper level probe
E2	Bottom level probe
S	Shielding
15, 16, 18	Relay output

2 SPDT Relay: type 2281-2-Relay

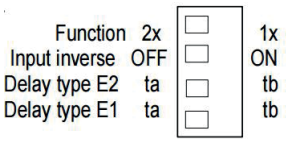
Part No.: 159 300 259

To detect two independent levels in one or two separate tanks	Level Control - Two levels in one tank
	

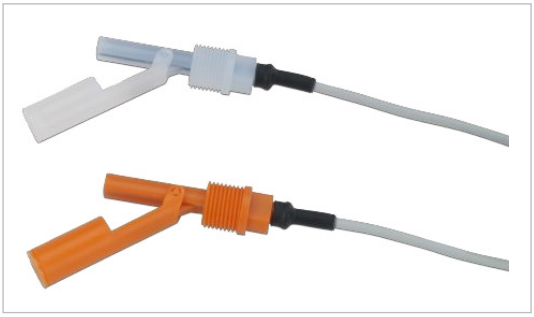
Device Settings



Device Settings



Type 2282 Guided Float Switch



Product description

The Guided Float Switch type 2282 is designed for economical control of liquids in tanks. The switch is remarkable for its maintenance-free compact design. The reed contacts have high switch capacity.

The reed contact in the sensor body is switched with a magnet. The switching function (N/O contact and N/C contact) is determined by the installation position. The function can be changed by simply turning 180°.

Function

The 2282 level switch is specially suited for simple, mechanical monitoring of highest and lowest fill levels. Its compact construction allows it to be installed into very small tanks.

With its housing made of PP or PVDF, the 2282 is especially resistant to a number of chemicals.



Benefits/features

- Optimized chemical compatibility
- Very compact design
- PP and PVDF version available
- For small tanks
- Redundant level sensing

CE UK CA RoHS

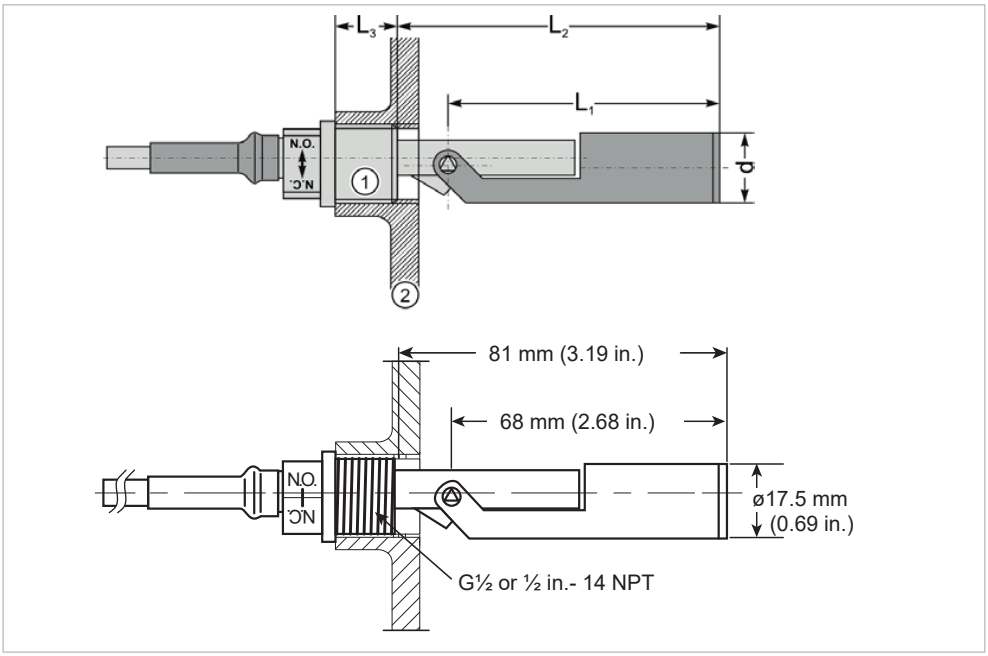
Applications

- Cooling water
- Demineralized water
- Water/glycol solutions
- Chemicals
- Especially fit for small tanks
- Redundant level sensing

Technical data

General	
Type	2282-x-6CN
Environment	
Max. temperature	-65 °C bis +100 °C (-85 °F bis +212 °F)
Max. pressure	1 MPa (10 bar) 145 psi
Medium density	>0.6 g/cm³
Housing	
Housing/float material	PP or PVDF
Cable material	PVC
Protection rating	IP68
Process connection	½“ BSP, NPT
Electrical	
Output	Dry reed contact
Contact resistance	Max. 120 mΩ
Max. nominal voltage	230 V AC/DC
Max. nominal current	2 A / 40 VA
Cable type	AWG 20, 2-wire, PVC, 1m
Switching contact	N/O or N/C depending on the installation
Standards and Approvals	
General Approvals	CE, UKCA, RoHS

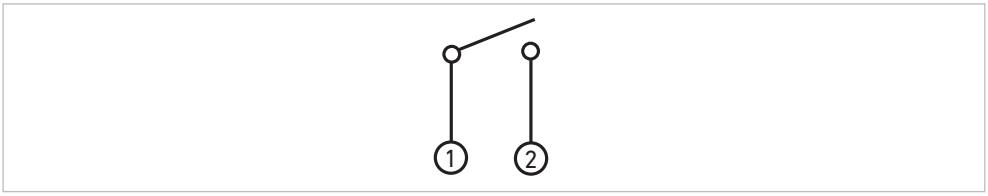
Dimensions



L1 68 mm
L2 81 mm
L3 15 mm
d ∅ 17,5 mm
1 G ½" oder ½" – 14 NPT
2 Container wall

Wiring

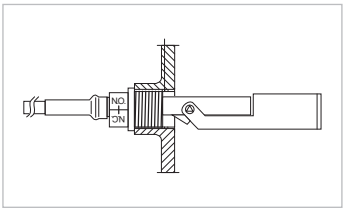
Connection configuration



Max.230 V 2A contact rating:
1 Brown
2 Black

Ordering Information

Manufacturer's part no.	Part no.	Description
Versions with BSP thread		
2282-P-60B	159 300 261	PP housing, cable ½" BSP thread
2282-P-60B	159 300 263	PVDF housing, cable, ½" BSP thread
Versions with NPT thread		
2282-P-6CN	159 300 265	PP housing, cable, ½" NPT thread
2282-V-6CN	159 300 267	PVDF housing, cable, ½" NPT thread



Handling

Installation notes

Ensure before installation that the medium to be measured is free of floating solid matter and ferrous pieces. These can influence the switching mechanics or have a direct effect on the reed contact. It may be possible to protect the switch from floating particles through appropriate precautions.

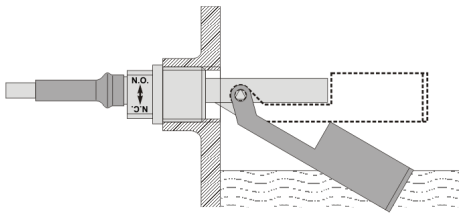
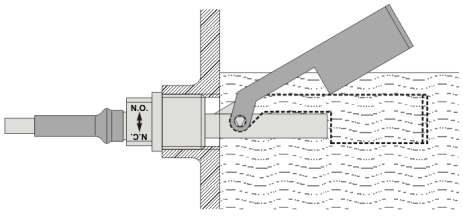
Installation position

- Account for the following points when selecting the position:
- The float switch must be able to be moved along the entire length.
- It does not run into the walls, the bottom or the top of the container.
- Turbulence caused by inlet valves or agitators has been excluded.
- If possible, install in an easily accessible position. This makes later maintenance and replacement steps easier.
- Mounting position is horizontal.
- Observe whether being installated as N/C or N/O contact.

Mechanical installation

- The following should also be observed during installation:
- The cable of the float switch is not connected.
- Ensure that the thread in the container is free of contamination.
- Slide the float switch carefully into the opening and turn it several turns by hand.
- Tighten the float switch with a maximum torque of 4 Nm until the flattened side edges are as vertical as possible.
- Check whether the correct mounting position (NO/NC) has been reached.
- Check whether the connection is leak-tight.
- If it is not leak-tight, remove the sensor completely and reinstall using additional sealing material (e.g. PTFE tape).

Function and mounting position

N/O	N/C
	

Maintenance notes

If the switch is used according to our recommendations, no maintenance will be necessary. If there is a chance that floating particles will be in the medium, then clean the sensor regularly.

Type 2284 Ultrasonic Gap Switch



Product description

The type 2284 Ultrasonic Gap Switch consists of polyphenylene sulphide (PPS) and is highly corrosion resistant in most liquids. The gap switch is designed for high or low level alarms in different tank applications as well as pump control.

If there is a liquid present, the signal will be transmitted across the gap and the integral electronics will switch the output circuitry to signal the presence of a liquid.

It can be mounted in any position in a tank using a ¾ in. or 1 in. thread available in BSP and NPT thread forms.

Function

In one end of the fork there is an ultrasonic generator, on the other end a receiver. The sensor always attempts to transmit an ultrasonic signal over the fork gap. The ultrasonic waves are received when the gap is closed via the medium. As long as there is air between the generator and the receiver, no transfer will take place. When the receiver discerns ultrasonic waves, the load relay switches. The principle makes the 2284 less prone to deposits than other level switches. As long as there is an air gap between the ultrasonic generator and the receiver, the state is recognized accurately.

Since the sensor has no moving parts, it is mechanically particularly rugged and long-lived. The cable connection is completely encapsulated. The entire sensor can therefore be submerged.

Benefits/features

- Relay output
- Corrosion-resistant PPS housing
- 1“- and ¾“ threaded mounting
- Small in-tank dimensions
- Compact sensor for narrow spaces
- Self contained full plastic body
- No moving sensor parts

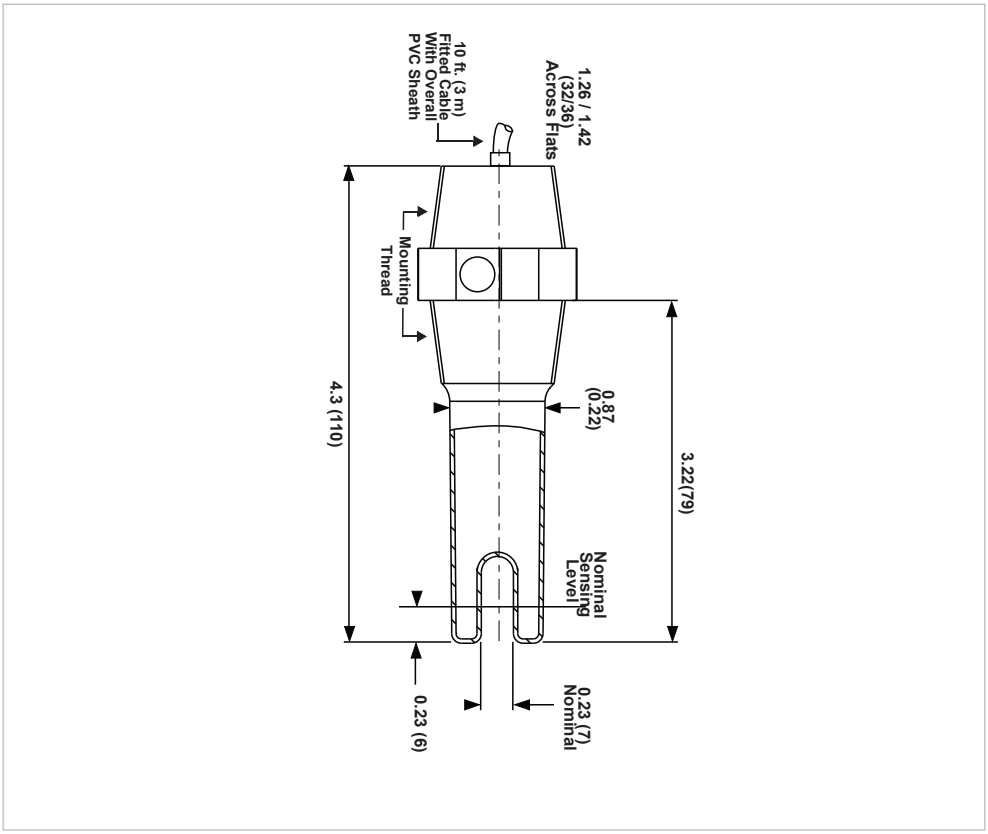
Applications

- Cooling water
- Demineralized water
- Water/Glycol solutions
- Chemicals
- Pump/Valve control

Technical data

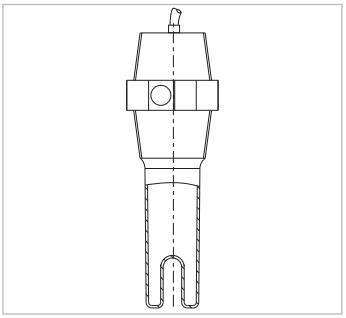
General	
Type	2284-Q-4xC
Repeatability	±2 mm (0.08 in.)
Environment	
Process temperature	-20 °C to + 70 °C (-4 °F to +158 °F)
Ambient temperature	-20 °C to + 70 °C (-4 °F to +158 °F)
Process pressure (absolute)	72.5 psi (5 bar)
Maximum viscosity	5000 cSt 20 °C (68 °F)
Housing	
Housing and sensor material	PPS
Cable material	PVC
Protection rating	IP66/IP68 (3m) / NEMA 6P (10 ft.)
Process connection	¾" or 1" BSP/NPT
Electronics	
Power supply	18 to 30 VDC / AC
Power consumption	≥ 25 mA
Maximum switching voltage	30 VDC / AC
Maximum switching current	1 A at 30 V residual 0.25 A at 30 V inductive
Reaction time	50 ms wet-dry, 0.5 s dry-wet
Cable type	5 core 7/0.2mm, 3m
Switching function	SPCO relay No/NC
Standards/approvals	
General approvals	CE, UKCA, RoHS

Dimensions



Ordering Information

Manufacturer's part no.	Part no.	Description
Versions with BSP thread		
2284-Q-4BC	159 300 270	Body PPS, BSP ¾ in., cable 3 m
2284-Q-4BC	159 300 274	Body PPS, BSP 1 in., cable 3 m
Versions with NPT thread		
2284-Q-4NC	159 300 272	Body PPS, NPT 1 in., cable 3 m



Technical basics

The sensor changes its switch position when the fork gap is covered by a medium. Ensure prior to assembly that the switch can be positioned such that the fork can be freed of the medium without cleaning becoming necessary.

Handling

Installation notes

Position

Also observe the following points when positioning:

- The liquid can run out from the sensor gap.
- The distance between the sensor gap and container walls (or other installations in the container) should be at least 25 mm, so that no air or liquid bubbles can form.
- Turbulence in the vicinity of inlet/outlet valves or agitators is to be avoided.
- Do not install directly in the flow path of the liquid. If necessary, install baffle plates.

Maintenance notes

When used in media that leave behind no residues, no special maintenance steps are necessary. If deposits do occur, the sensor should be cleaned regularly.

⚠ Installation and maintenance must be performed according to the corresponding installation instructions. The installation manual is included with the product, see also the online product catalog at www.gfps.com

Tips for installation

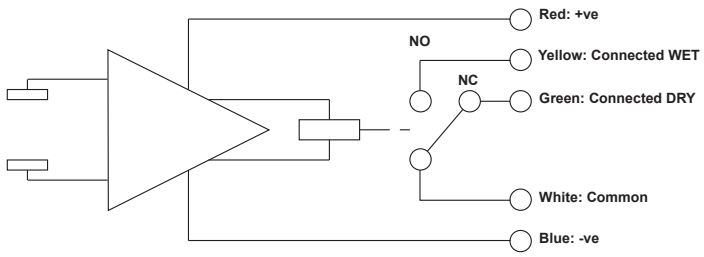
Interior and exterior installation

Since the sensor has a thread on both sides of the hexagonal hub, it can be installed on a tank either from the outside or the inside. Due to its completely encapsulated electronics, the sensor can be submerged entirely, if necessary.

Leak detection

Due to its material composition, the 2284 is also very well suited for use in detecting leaks in double pipes or double-wall tanks. In both cases, one should select as deep of a position as possible, in order to guarantee a quick reaction time in a moment of danger.

Wiring



1 Red, +Ve
2 Yellow, contact NO
3 Green, contact NC
4 White, ground
5 Blue, -Ve

Type 2285 Level Float Switch



Product description

The type 2285 Level Float Switch is suitable for level switching of various liquids, sewage in shafts, tanks, basins or cisterns. The double-chambered float is made of injection molded tough polypropylene that ensures good waterproof protection.

The contacting microswitch is incorporated in the float. The cable of the level switch is absolutely waterproof and PVC insulated. Different control tasks such as liquid level monitoring and pump control can be realized. It is a mercury-free contact and suitable for level switching of drinking water, raw water or polluted liquids with low solid content.

The level switching is done when the contact reaches the ±45° switching angle. The switching differential of the level switch is adjustable by the position of the counterweight on the cable. The level switches should be arranged appropriately in case of multi-level switching tasks to avoid undesired tangling of the cables.

Benefits/features

- Hermetically molded, double chamber
- Mercury free operated micro switch
- Use for drinking and wastewater

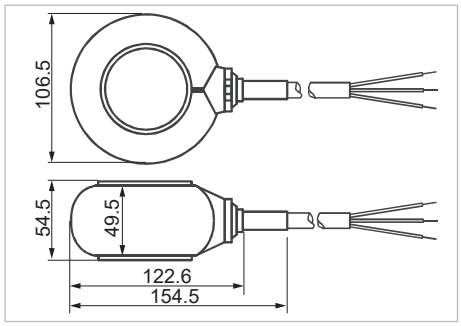
Applications

- Tap water
- River water
- Sump shafts

Technical data

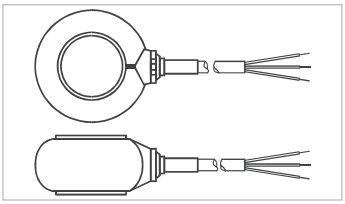
General	Float switch	Optional Counterweight
Type	2285-P-6C-Y	
Cable length	5m (16.5 ft), 10m (33 ft), 20m (66 ft)	
Switching angle	± 45°	
Weight	250 g (0.55 lb), without cable	
Environment		
Medium temperature	0 °C to +50 °C (+32 °F to +122 °F)	
Medium density	min. 0.8g/cm^3	
Medium pressure	0.1 Mpa (1 bar g – 14.5 psi g)	
Housing		
Housing material	PP	PP
Cable material	Neoprene	
Protection rating	IP68, NEMA 6P equivalent	IP68, NEMA 6P
Electronics		
Microswitch	10(4) A, 250 V AC, AC1	
Cable	9 mm (0.35 inch)/ 3 x 1 mm^2 (AWG 17)	
Standards/approvals		
General approvals	CE, UKCA, RoHS	

Dimensions



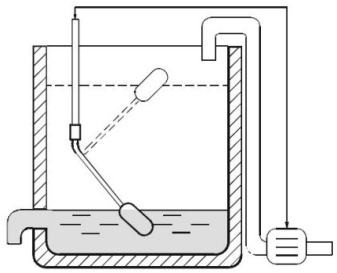
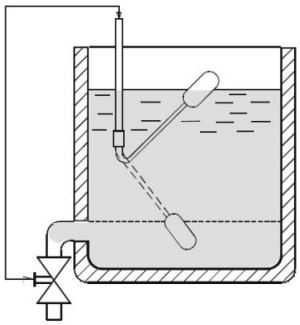
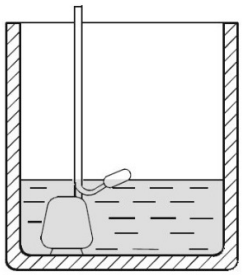
Ordering Information

Manufacturer's part no.	Part no.	Description
2285-P-6C-5	159 300 280	Level Float, PP, cable neoprene 5 m (16.5 ft), microswitch NO/NC
2285-P-6C-10	159 300 281	Level Float, PP, cable neoprene 10 m (33 ft), microswitch NO/NC
2285-P-6C-20	159 300 282	Level Float, PP, cable neoprene 20 m (66 ft), microswitch NO/NC
2285-P-weight	159 300 289	Counterweight for 2285 float (optional)



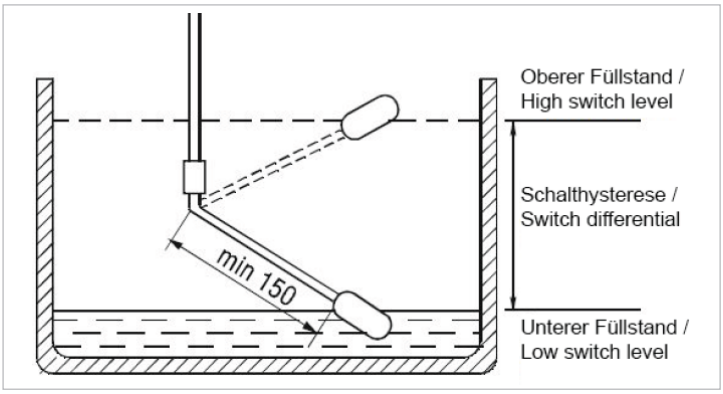
Technical basics

Overview of functions

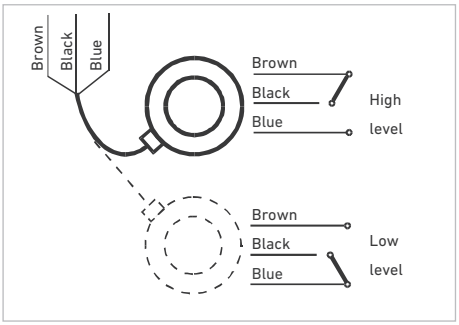
Filling control	Draining control	Pump protection
		

Handling

Installation notes



Wiring



Planning Fundamentals

of Measurement and Control

Continuous level measurement

Content

Type 2291 Guided Wave Radar Level Transmitter 459
Type 2298 80 GHz Radar Level Transmitter 465
Type 2298 80 GHz Radar Level Sensor 469
Type 2260 Ultrasonic Level Transmitters 472
Type 2260 Ultrasonic Level Transmitters with ATEX Approval 478
Type 2270 Ultrasonic Level Sensor 483
Type 2250 Submersible Hydrostatic Level Sensor 488

Technical basics

Ultrasonic Level Sensors

Fill level

GF ultrasonic level sensors are used for continuous monitoring of liquid levels in tanks and shafts. The contact-free measuring principle and the material variants PP and PVDF make measurements possible even in applications with high chemical concentrations. The level sensors are are equipped with intelligent signal processing. Through software, the devices can also be tailored to uses in which conventional ultrasonic products reach their limits. The especially narrow sound beam guarantees especially good flexibility during installation even in very cramped conditions.

Flow

The GF level sensors can be used for flow measurements of open channels that function according to the Venturi principle. In this way, the flow rate can be determined via the detection of the backwater quantity before the tapering of a channel. The measurement results are output via an analog signal with 4 to 20 mA. Furthermore, digital communication via HART is possible.

Function

The basic principle is an ultrasonic distance measurement between the sensor and the surface of the liquid. The sensor generates an ultrasonic pulse which is reflected back to the sensor when it contacts the medium. The time difference between the pulse and detection of the echo allows one to calculate the distance to the medium – a runtime measurement.

If the maximum tank height is known, the level of the liquid can be determined. Additionally, it is possible to perform volume calculations if the other tank dimensions are known.

Benefits/features

- 2-wire compact transmitter
- Contact-free level measurement
- Narrow 5° sound beam angle
- Fully temperature-compensated electronics
- No long-term drift
- Excellent signal processing software that delivers very precise measurements
- PP or PVDF sensor provides superior chemical resistance
- Quick-start operating menu for efficient installation
- Display or blind version available
- Switch relay for high-level/low-level alarm
- 4 – 20 mA / HART interface
- Secondary lightning protection



Technical basics

Ultrasonic technology is one of the most commonly used measuring principles in the area of level measurement. These sensors provide reliable measurement data. There is no long-term drift of the sensor here, as there can be in other technologies. If one assumes a constant atmosphere, only temperature has an influence on the measurement – this factor is compensated for in GF ultrasonic sensors directly for every measurement, however, with an integrated pt100 temperature sensor.

The quality of the useful echo is definitive for good measurements. It is influenced by the state of the surface of the medium to be measured and by the location of the sensor in the tank. The following points must be observed when selecting the proper measuring method:

Use areas for GF ultrasonic level sensors

	Optimal	Limited	Not recommended
No foam	x		
Solids		x	
Moderate amount of foam		x	
Heavy foam			x

Additional factors to be considered

Wind

Strong air turbulence can degrade the quality of measurements. This is only relevant for outdoor installations, for instance in open channels.

Light turbulence in the air

Light air turbulence created by high temperatures directly influences the speed of sound. GF sensors compensate for these effects in cases of process temperatures up to 90 °C.

Vapors, gases

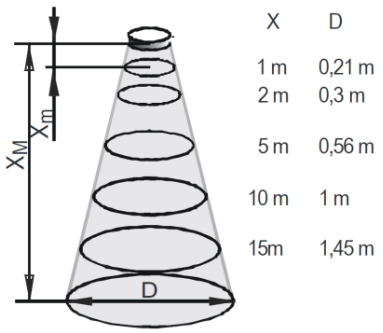
Strong, suddenly occurring chemical vapors and gases can also influence ultrasonic measurement. GF ultrasonic sensors can be adjusted for static conditions using software.

Agitated surface

Oscillations in measurements may result if the medium has an agitated surface. The measuring oscillations can be reduced to a minimum, however, through the attenuating function of the GF sensors.

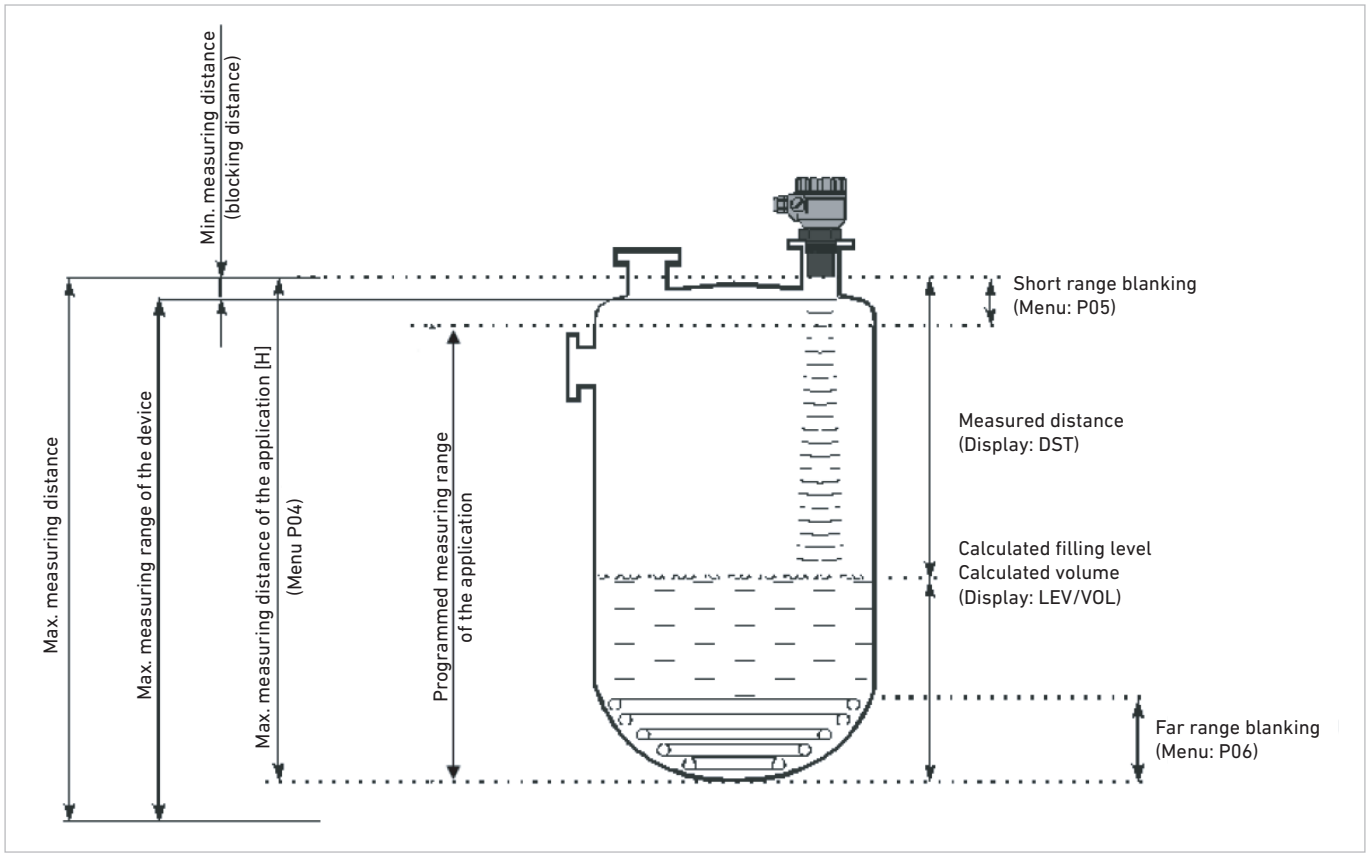
Sound beam in types 2260 and 2270

Both types bundle the sound waves extremely tightly. This ensures that even light foams can be penetrated. Even small concentrations of gases and vapors can be compensated in this way. Additionally, types 2260 and 2270 can be used in small and irregularly formed tanks. Make certain that the sound strikes the surface of the liquid as free from interference as possible.



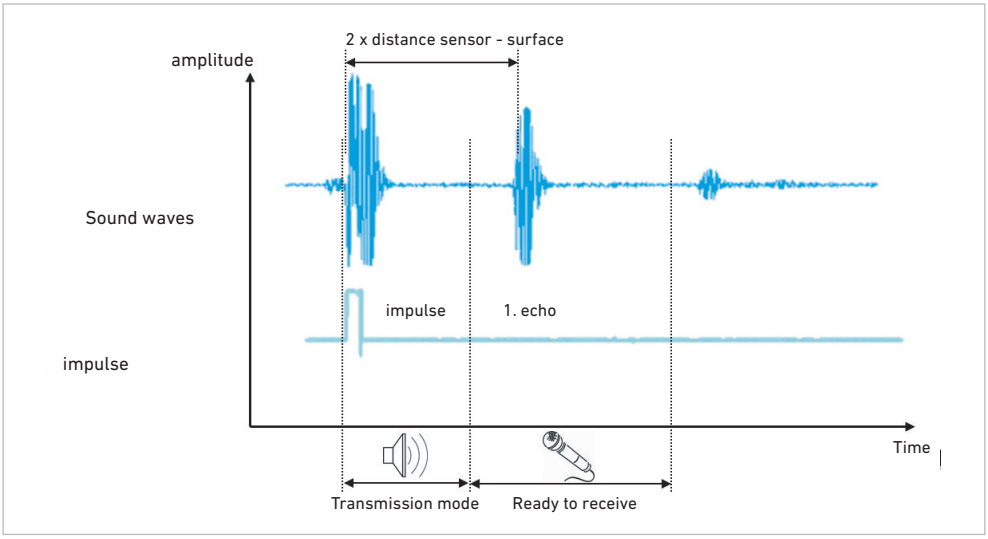
Diameter of the sound beam
5° handling

Basic principle and concepts of ultrasonic level measurement



Minimum measuring distance

With ultrasonic sensors, the entire measuring range cannot be used for technical reasons. A minimum distance from the sensor is necessary so that the medium can be detected. The reason lies in the basic function of the ultrasonic transducer. It is a pulse sensor and receiver simultaneously. Electronic switching between both modes is necessary. During this switching time, no useful echo can be received.



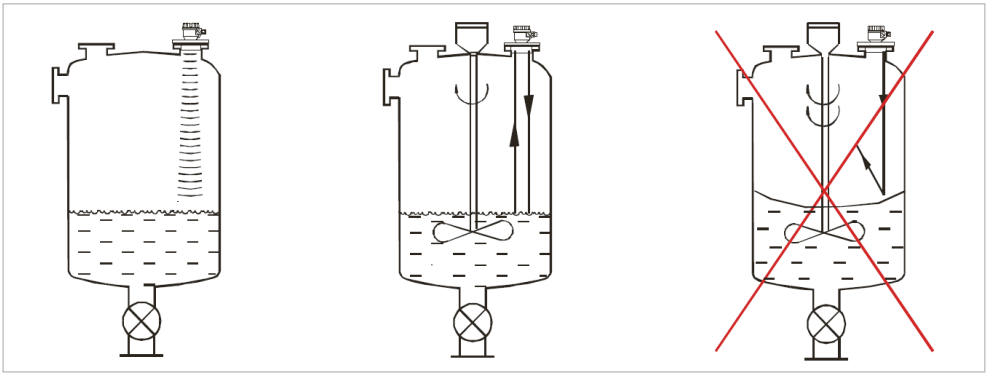
Distance	Distance of the sensor from the medium
Fill level	Maximum distance – measured distance
Long-range blanking	A distance value is measured starting from the sensor. Can be entered in order to not interpret the useful echo of heating or agitating elements on the bottom of a tank as a valid measurement signal. If the level sinks below this point, the level display and the control signal are frozen.

Installation notes

The following points should be taken into consideration both before and during installation:

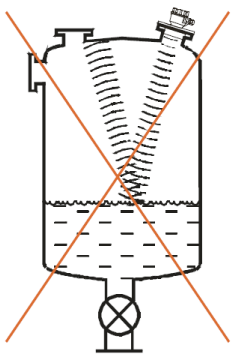
Sensor position

The optimal position for installing GF ultrasonic level sensors is between 0.3 and 0.5 x the radius of a cylindrical tank. It must be ensured that the sound beam from the sensor can strike the surface of the liquid as freely as possible.



Alignment of the sensor

In order to achieve measurements that are as accurate as possible, the sound transducer must be aligned as close to parallel to the surface of the medium as possible. In this way, the sensor receives a clear useful echo after every pulse. If the sensor is installed in a diagonal fashion, the echo is deflected away from the sensor.



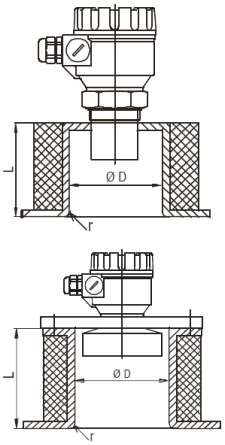
± 2° – 3° deviation are permissible at a maximum

Installation with sensor mount

In certain cases it is necessary to install the sensor on a mount. This is most often the case in relatively small tanks, so that as great a degree of the measuring range of the sensor can be utilized as possible. In this way, the „minimum measuring distance“ can be displaced to a location outside the tank. A maximum level can thereby be detected just under the top of the tank. When selecting the mount, the expansion of the sound beam should be taken into account.

We make the following suggestions:

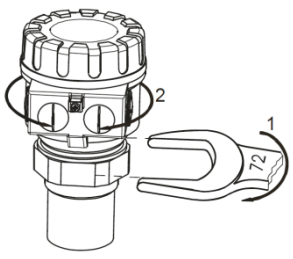
L (mm)	D_{min} (mm) BSP/NPT 1½"	BSP/NPT 2"
150	50	60
200	50	60
250	65	65
300	80	75
350	95	85



L (mm)	D_{min} (mm) Flange Jointing
90	130
200	140
350	150
500	160

Installation of thread types 2260 and 2270

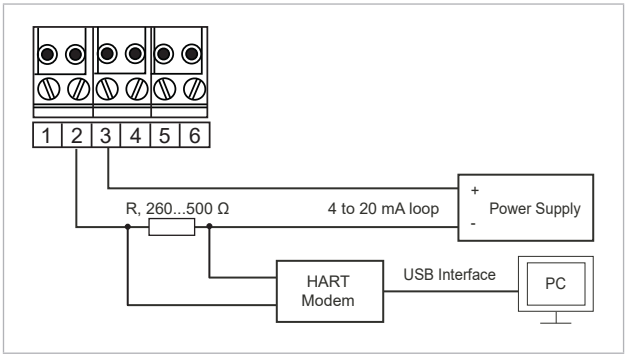
A maximum torque of 20 Nm may not be exceeded when screwing in these thread types.



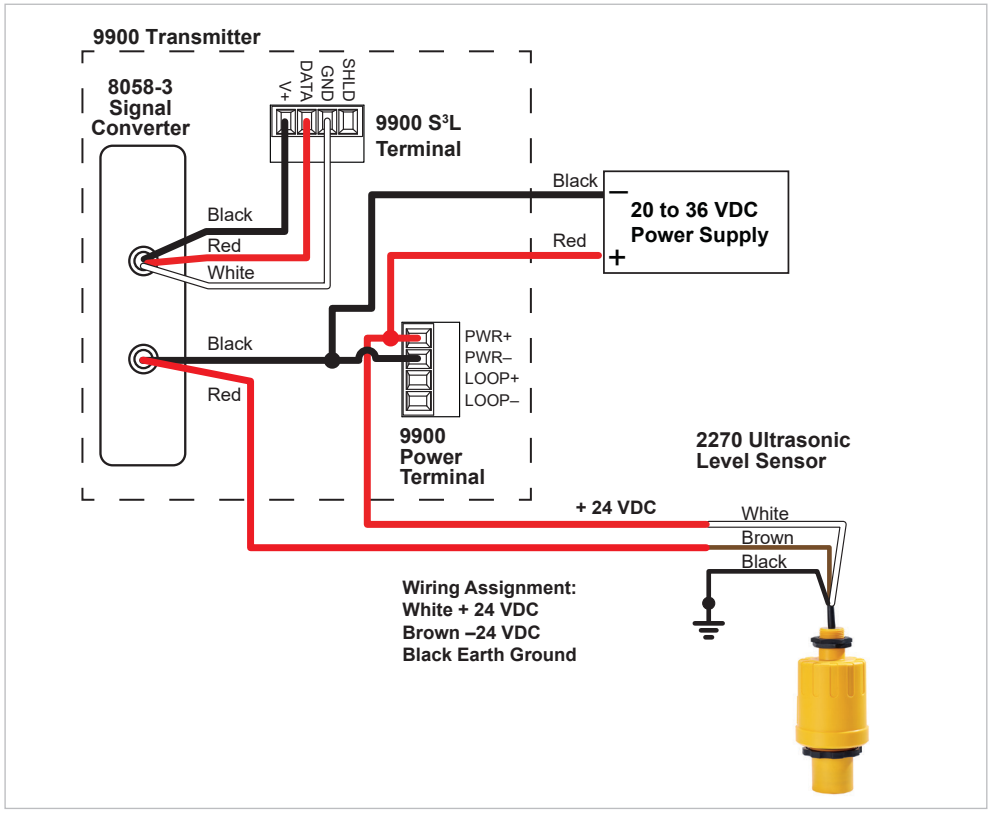
Max. 20 Nm torque

Wiring type 2260 HART digital

Component	Description
HART modem	For parameterization of the level sensors 2260 and 2270 with software GF EView
HART network	Up to 15 HART slaves can be operated simultaneously in a HART loop. The sensors must be properly addressed.
Termination resistor	In both cases, the HART loop must be closed with a termination resistor. A value of 250 to 500 Ω is ideal.

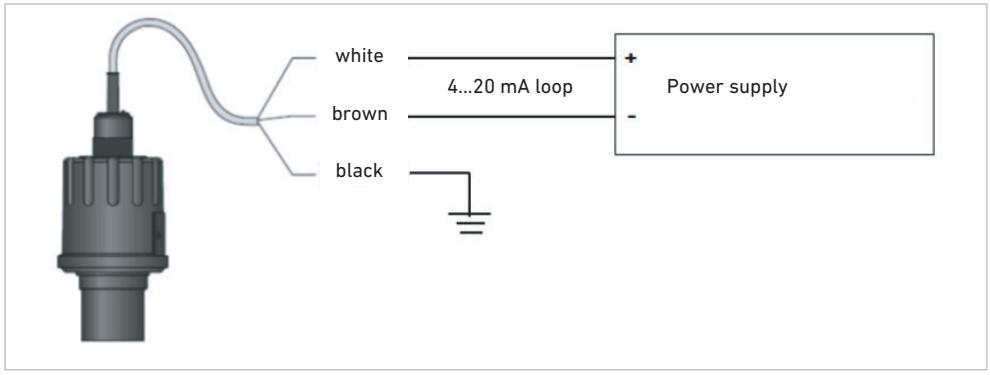


Operation of a 2260 or 2270 on a GF 9900 transmitter via iGo converter



In addition to correct wiring, it must be ensured that the scaling of the input on the 9900 matches the output signal of the ultrasonic level sensor.

Analog connection of 2270



Tips on use

Quick set

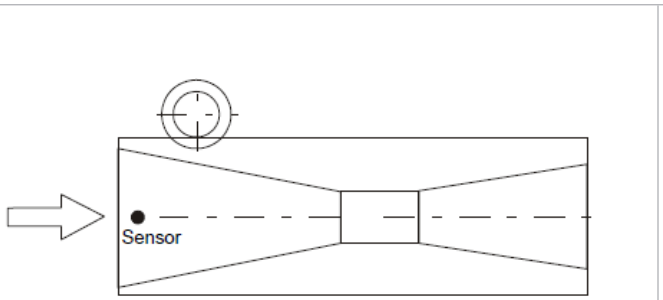
The GF ultrasonic level sensors can have a variety of settings applied to them. For the majority of the level measurements, setting the following 6 parameters will suffice:

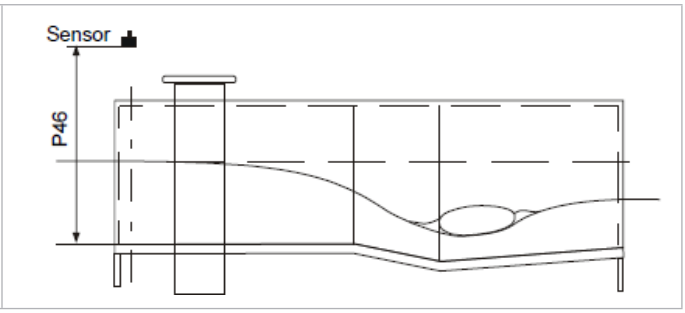
1. Technical dimensional units P00:	metric or US
2. Maximum measuring distance P04:	corresponds in most cases to the height of the tank
3. Establish level value for 4 mA:	mostly empty tank or maximum measuring distance
4. Establish level value for 20 mA:	full tank
5. Error signal:	Select between “Hold value”, 3.8 mA or 22 mA
6. Signal damping:	Establish temporal damping. 0 – 300 s

Flow measurements on open channels

The GF level sensors can be used for flow measurements of open channels that are constructed according to the Venturi principle. In order to measure the flow, all dimensions of the channels must be known. Only the height of the backwater can be detected by the sensor. The sensor calculates the current flow using the known dimensions. If all dimensions are known, the backwater is proportionate to the flow.

A variety of channel types are already preset for sensor types 2260 and 2270. This is an example of a Parshall channel. Also ensure correct positioning of the sensor.







Radar Level Transmitter

Filling level

GF radar level transmitters are chosen when other technologies tend to fail due to challenging process conditions in industrial tank applications.

Those challenges can be dense chemical fumes, vapors, highly variable temperatures or pressure, viscous and residue forming liquids etc.

GF radar level transmitters come in two versions:
- 2290 Non-contacting radar
- 2291 Contacting, guided-wave radar

Both measure the filling level based on the microwave principle which is more resistant to external disruptive factors than for example ultrasonic or hydrostatic sensors.

Function

Radar level transmitters measure the filling level by analyzing the distance between the mounting height of the sensor and the surface of the process liquid. Internal electronics calculate the filling level or even the remaining volume. Same apply to the ultrasonic sensor.

Yet microwaves are extremely robust compared to ultrasonic signals. Whereas ultrasonic pulses easily can be disturbed by any influence on the air (propagation media) in the head space above the liquid, microwaves travel through vapors, gases etc. almost unaffected. This is possible because of the nature of microwaves being a result of positive and negative charges – unswayable by most process conditions.

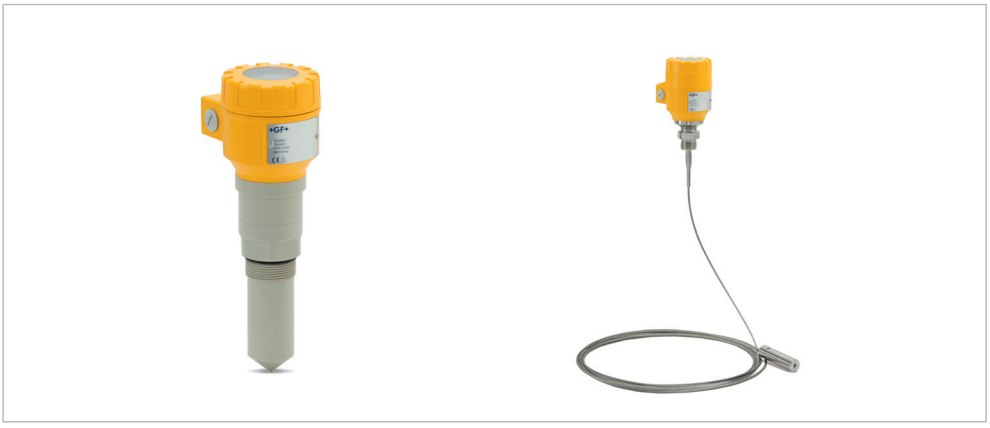
GF radar level transmitters emit high frequency microwaves at 25GHz. The liquid reflects a partial amount of this energy which can be detected by the transmitter. Based on the transit-time principle a microprocessor calculates the exact distance by comparing the time stamp of an emitted signal and the time of a signal received based on the time-of-flight principle.

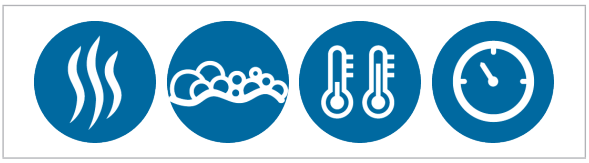
It is crucial to know the exact reflection coefficient also known as dielectric constant. Depending on this value process liquids are measurable or only restricted detectable.

The 2290 provides a reliable non-contact level measurement in challenging conditions. In tanks with an extreme turbulent surface, considerable foaming or process liquids with a low dielectric constant the 2291 with its rod and rope is able to provide steady filling information thanks to the ability to guide signals to the media and back to the sensing electronics.

Benefits

- Non-contacting or contacting technologies
- Plastic enclosures available in PP, PTFE or coatings in PP & PFA
- Tank mapping features to ignore internal obstructions
- Short dead-bands
- Minimum detectable dielectric constant of 1.9
- Customizable volume linearizations
- Output scabable according to level, distance, mass or volume
- Large graphical displays
- Text-based menue structure
- HART or 2 wire current outputs

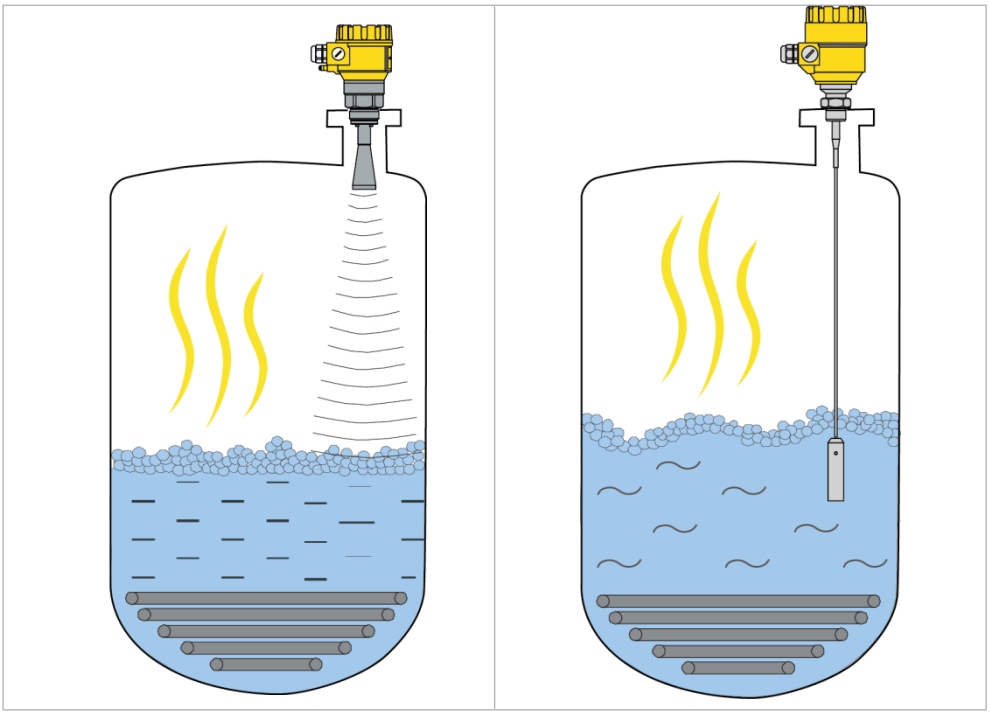




Technical basis

General Information

Hence there are two types or radar level transmitters available it is important to understand the differences of the technologies in order to provide the right choice of cost and benefits. This chapter explains the principle of both non-contacting radar and contacting (GWR guided-wave radar):



Non-contacting radar type 2290

Contacting guided wave radar type 2291

Important application consideration ex ante

Electromagnetic characteristics of the process liquid

The reflection of the emitted microwave varies in quality depending on the relative dielectric constant of the measured medium. The ideal condition of microwave level measurement is that the relative dielectric constant (ε_r) for the medium should be greater than 1.9. The lower the value the shorter the maximum measuring ranges of both types 2290 and 2291. In general the guided type 2291 is less sensitive to low dielectric liquids compared to the 2290.

Verify the dielectric constant value of a wide range of chemicals on www.gfps.com/level

Microwaves travel through plastic materials

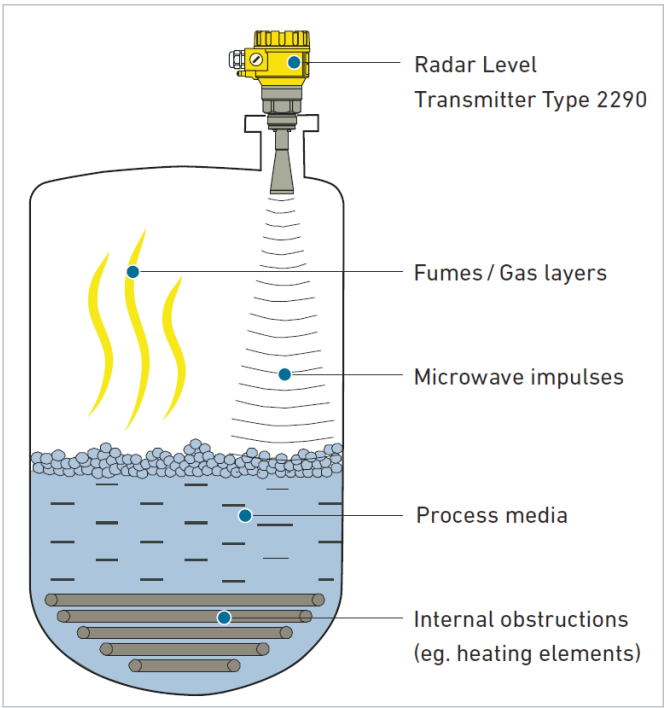
Microwaves have the ability to travel through most plastic materials of low thickness. This ability can be a benefit to protect the radar antenna from the process conditions. Robust plastic enclosures such as PP, PE or PTFE avoid corrosion on the metal antennas.

On the other hand this ability can create additional challenges during the setup on plastic tanks. Here the microwaves could detect obstructions installed around the tank. This phenomenon can make it difficult for the electronics do identify the correct filling level.

Non-Contacting radar level transmitter

Working principle

Non-contacting radar level transmitters are able to provide an excellent non-contact level measurement for those substances which tend to steam, or for liquids with a gas layer. Since microwaves do not need a defined propagation media, these transmitters are applicable in a vacuum.



The operation of the non-contact microwave level transmitters is based on the measurement of the time of flight of the reflected signals, so-called Time Domain Reflectometry (TDR) method.

The propagation speed of microwave impulses is practically the same in air, gases and in vacuum, independently from the process temperature and pressure, so the measured distance is not affected by the physical parameters of medium to be measured.

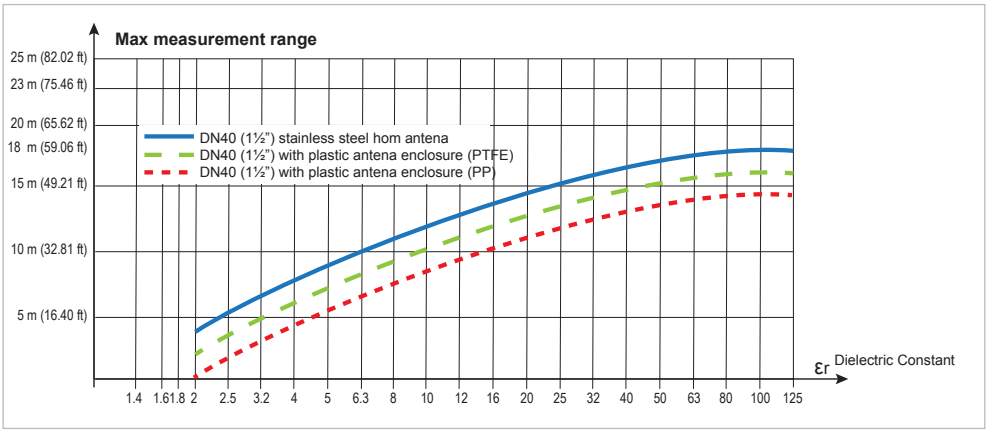
The 2290 level transmitter is a Pulse Burst Radar operating at 25 GHz (K-band) microwave frequency.

The 25 GHz types' most noticeable advantage over the lower frequency (5-12 GHz) radars are the smaller antenna size, the better focusing, lower dead-band and smaller transmission angle.

The level transmitter emits nanosecond length impulses from the antenna, and part of the emitted energy reflects back from the measurement surface, the strength of the reflection varies on the medium being measured. The time of flight of the reflected signal is measured and processed by the electronics, and then this is converted to distance, level or volume proportional data.

Determining the maximum measuring range

The maximum measuring range of the 2290 radar is dependent upon the circumstances of the application environment and on the selected type of antenna enclosure. Depending on the relative dielectric constant of the measuring medium and the process conditions the maximum measurement range (achievable under the reference conditions) may decrease by even 85% (!).



Attention

The maximum measuring distance is illustrated in the above diagram for various Dielectric Constants. This diagram is based upon the following conditions, liquids with still surface, no foam, vapors, and ideally a slow (<5m/h, 16.4 ft/h) rate of level change.

Depending on the process conditions or the plastic antenna enclosure the following typical reducing factors are recommended to be considered in order to calculate the maximum measuring range. When more than one reducing factors occur at the same time then all the factors should be included for the calculation:

Process condition	Reflection reduction in amplitude	Max. measuring range distance decrease	Reducing factor
Slow mixing or slightly waving	2...6 dB	20-50%	0.8...0.5
Foaming	2...6 dB	20-50%	0.8...0.5
Fast mixing, vortex	8...10 dB	60-70%(the measurement might be completely terminated)	0.4...0.3
Vapors, Steam, Condensation	3...10 dB	30-70%(the measurement Might be completely terminated)	0.7...0.3
PP antenna enclosure	2 dB	20%	0.8
PTFE antenna enclosure	1 dB	10%	0.9

Benefits of the non-contacting radar level transmitters

- x Non-contacting principle, great for corrosive chemicals
- x Great performance in vapors
- x Outgassing liquids
- x Applicable in vacuums applications
- x Applicable in high-pressure applications
- x Can penetrate light foam layers (requires detailed applications considerations)

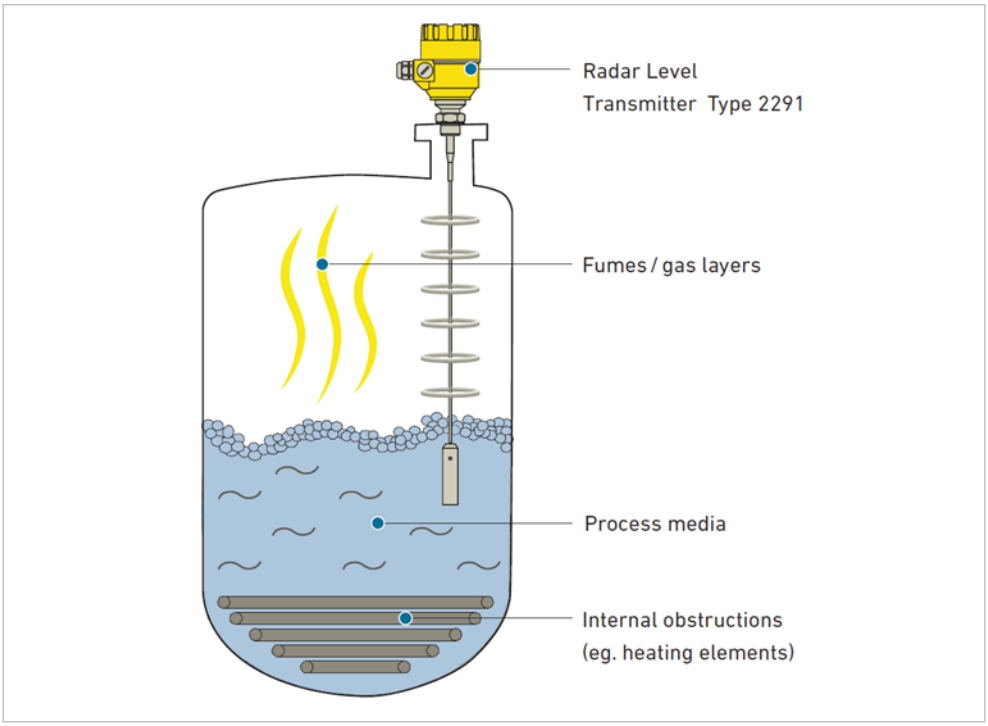
Limitations of the non-contacting radar level transmitters

- Extreme turbulent surfaces may lead to signal loss
- The combination of a low dielectric constant liquid in a tall tank can be impossible
  -> check max. measuring range possible
- Extreme condensation on the antenna can make the signal generation impossible

Guided radar level transmitters

Working principle

The guided radar level transmitters uses the TDR (Time Domain Reflectometry) principle. The instrument sends low power ns wide pulses along an electrically conductive rod or cable with a known propagation speed (the speed of light).



As the pulse reaches the surface of the medium or phase of two liquids (altered dielectric constant), a part of it is reflected back to the electronic module. The efficiency of the reflected signal depends on the dielectric constant difference of the mediums or layers. (From the plain surface of air-water phase the reflected signal's strength will be approx. 80% of the emitted signal).

The reflected pulse is detected as an electrical voltage signal and processed by the electronics. Level distance is directly proportional to the flight time of the pulse.

The measured level data is converted into 4-20 mA current and HART signals and is displayed on the LCD display. From the level data further derived measuring values can be calculated such as volume and mass. The TDR technology is unaffected by the other properties of the medium as well as that of the space above it.

TDR or GWR (Guided Wave Radar) is one of the most robust technologies available at GF and come in place when all other technologies fail.

Gain and voltage

As explained in the measuring principle in the introduction, the level of a product is converted from a return signal (the product reflection) received by the gauge: this signal has taken a certain amount of time to return to the gauge and it has a certain strength / size measured in milli-volts (dependant on the dielectric constant of the product).

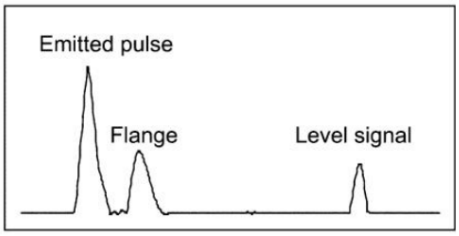
All pulse signals returning to the gauge electronics block (including flange, obstruction and the product surface reflections) are converted to voltage amplitudes. The gauge's microprocessor looks for part of the largest signal that is over a set voltage amplitude, called the "threshold" and identifies this as the product being measured. For this signal to be usable by the gauge, the microprocessor will amplify the signal by increasing the gain.

Once the signal is within a set "working" range, the gauge follows this signal. The gauge registers any changes in time for this part of the signal to return to the converter and translate this into a displayed level or volume.

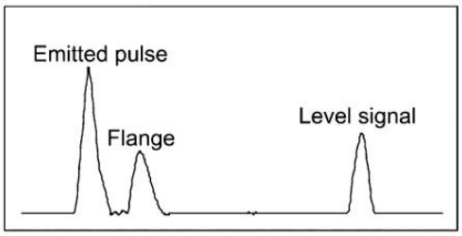
Gain is a function of voltage amplitude. This defines the default threshold value when the gauge is searching for the product level. A strong return signal will be given a low gain (i.e. Gain 0 or a small amplification). However, if the signal is very weak, then a Gain of 3 (i.e. high signal amplification) is given.

Typical signal trends

The following diagrams show characteristic signals that have been recorded with the oscilloscope function.



Rod or cable gain 1



Rod or cable gain 2

The signal from coaxial probes does not include the flange reflection, due to the mechanical setup which does not produce any change in impedance at the flange. The amplitude of reflection from the product surface increases as the level rises and decreases as the level falls.

Benefits of the guided radar level transmitters

- x Best choice for the most challenging tank applications
- x Contacting but safe signal transmission
- x Extreme turbulence has almost no effect on performance
- x Suitable for tall tanks holding low dielectric liquids
- x Handles foam more reliable than non-contacting 2291
- x Easily adjustable in length on site (if not coated)
- x Handles also quick changes in level reliable

Limitations of the guided radar level transmitters

- Contacting principle often requires coating
- Every coated sensor is unique and cannot be adjusted in length anymore
- Might not be suitable along with stirrers etc. installed in a tank

Type 2291 Guided Wave Radar Level Transmitter



Product description

The type 2291 Guided Wave Radar level transmitter is designed for continuous level measuring of conductive or non-conductive liquids, pulps and solids. The 2291 level gauge operates based on the well-known TDR (Time Domain Reflectometry) principle. Micropulses are sent along a probe guide at the speed of light. As soon as the impulse reaches the surface of the medium, it is reflected back to the electronic module. Level distance is directly proportional to the flight time of the impulse.

The reflected signal is dependent on the dielectric constant of the material; the feasibility of the measurement is $\varepsilon_r \geq 1.9$. The TDR technology is unaffected by the properties of the medium as well as that of the space above it. Measurement is also unaffected by the change in the physical properties of the materials such as temperature, pressure, dielectric constant.

Features

- Measuring range up to 6 m (19.6 ft)
- Accuracy: ± 5 mm (0.2 in)
- PP / PFA coated probes available on request
- Rod & cable versions available
- Minimum ε_r 1.9
- 2-wire version
- Graphic LCD display
- 4 to 20 mA + HART output
- Medium temperature range: -30 °C to +90°C (-22 °F to +194 °F)
- Maximum process pressure: 40 bar (580 psi)
- IP67 protection
- ATEX option

Applications

- Inventory Tanks
- Day Tanks
- Process Vessels for Mixing & Batching
- Bypass Applications (requires calibration)
- Stilling-wells
- Powders
- Slightly Conductive Foams
- Low Dielectric Constant Liquids

Specifications

General	
Measured Values	Level, Distance; Calculated values: Volume, Mass
Measuring Range	Depends on the probe type and dielectric constant (ε_r) of the measured medium
Probe types	Mono cable, mono rod
Accuracy: Linearity Error1	For liquids: ± 5 mm (0.2 inch), if probe length ± 10 m (32 feet): ± 0.05 % of the probe length
Accuracy: Resolution	± 3 µA
Minimal ε_r of the Medium	1.9
Power Supply	18 V... 35 V DC
Output: Digital Communication	4-20 mA + HART
Output: Display	Graphical LCD display unit
Medium Temperature	-30 °C... +90 °C (-22 °F... +194 °F),
Maximum Medium Pressure	4 MPa (40 bar g/ 580 psi g); with plastic lined flange: max. 2.5 MPa (25 bar g/ 363 psi g)
Ambient Temperature	-20 °C... +60 °C (-4 °F... +140 °F)
Process Connection	1" BSP, 1" NPT Thread
Ingress Protection	IP 67, NEMA 6 equivalent
Electrical Connection	2x M20x1.5 cable glands + internal thread for 2x ½"NPT cable protective pipe, cable outer diameter: Ø 7 ... Ø 13 mm (0.3 ... 0.5 inch), wire cross section: max. 1.5 mm2 (AWG 15)
Electrical Protection	Class III
Housing Material	Plastic (PBT)
Sealing	FKM, On request: FFKM, EPDM
Mass (head unit)	1.5 kg (3.3 lb)
EX-Approvals	ATEX (ia): II 1/2 G Ex ia IIB T6...T5 Ga/Gb ICEX (ia): EX ia IIB T6...T5 Ga/Gb
Approvals	CE, UKCA, RoHS

[1] Under reference conditions and stabilized temperature

[1] Under reference conditions and stabilized temperature

Probe specifications*

Probe type	Max. Measuring Range	Dead-zone[2]		Process Connection	ε_r min.
		Upper (t) / lower (b) ε_r = 80	Upper (t) / lower (b) ε_r = 2.4		
Mono cable Ø 4 mm (0.15 in.)	6 m (19.6 feet)	300 /20 mm (12 / 0.75 in.)	400 / 100 mm (16 / 4 in.)	1 in.	1.9
Mono rod Ø 8 mm (0.3 in.)	2 m (6.56 feet)	300 /20 mm (12 / 0.75 in.)	400 / 100 mm (16 / 4 in.)	1 in.	1.9

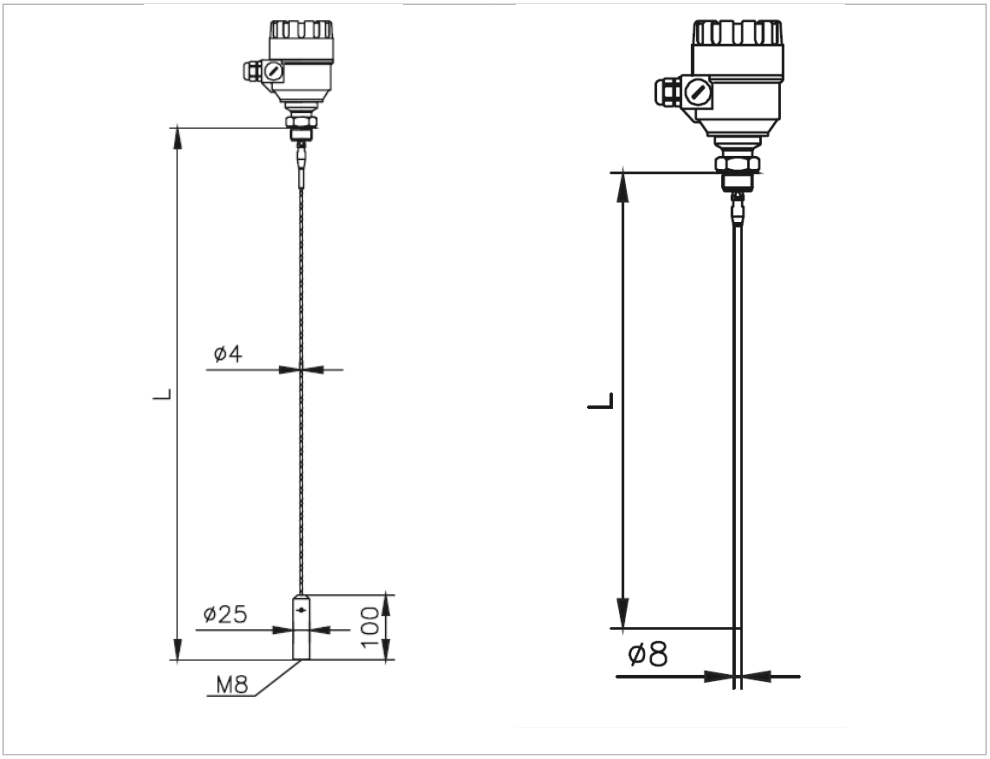
*The unmeasurable upper and lower part of the tank. The lower dead zone is extended by the length of the counterweight (cable versions only).

Technical data of the probes		
	Cable	Rod
Max. meas. dist.	24 m (80 feet)	3 m (10 feet)
Min. meas. Dist. (ε_r = 80 / ε_r = 2.4)	0.3 m / 0.4 m (1 feet / 1.3 feet)	
Minimal medium ε_r	1.9	
Sensing space around the probe	Ø 600 mm (2 feet)	
Process connection	1" BSP, 1" NPT	
Probe material	1.4401 (316)	1.4571 (316 Ti)
Probe nominal Ø	4 mm (0.15 inch)	8 mm (0.3 inch)
Mass	0.12 kg/m (0.08 lb/ft)	0.4 kg/m (0.25 lb/ft)
Counterweight dimensions	Ø 25x100 mm (1x4 inch)	
Counterweight material	1.4571 (316 Ti)	

* The unmeasurable upper and lower part of the tank. The lower dead zone is extended by the length of the counterweight (cable versions only).

[2] The unmeasurable upper and lower part of the tank, the lower dead-zone is extended with the length of the counterweight (cable version)

Dimensions

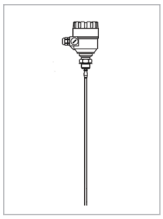


Type 2291 Cable Version
L = 6 m (19.69 ft)

Type 2291 Rod Version
L = 2 m (6.56 ft)

Ordering Information

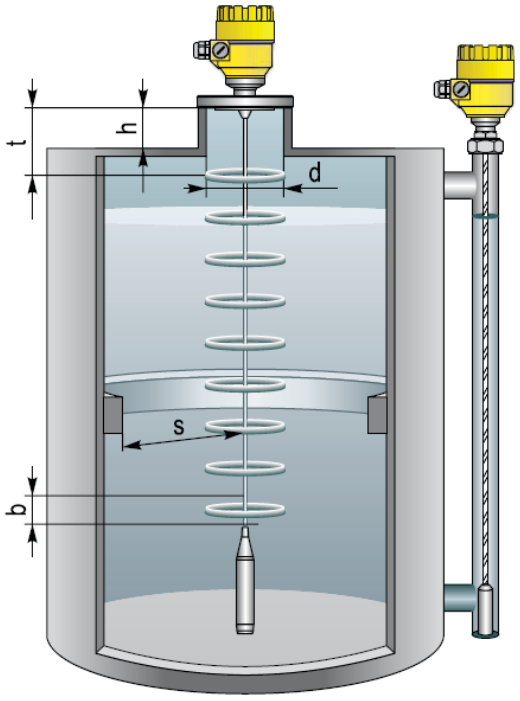
Mfr. Part No	Code	Description
2291-S-1DB1-6-R	159 300 190	LCD, PBT housing, 1" BSP, 6m cable Ø 4mm, SS316 Ti
2291-S-1DN1-6-R	159 300 191	LCD, PBT housing, 1" NPT, 6m cable Ø 4mm, SS316 Ti
2291-S-1DB1-2-D	159 300 192	LCD, PBT housing, 1" BSP, 2m rod Ø 8mm, SS316 Ti
2291-S-1DN1-2-D	159 300 193	LCD, PBT housing, 1" NPT, 2m rod Ø 8mm, SS316 Ti



Accessories

Mfr. Part No	Code	Description
	159 300 208	HART - USB Modem
3-8058-3	Special order	Wire-mount GF i-Go signal (4 to 20 mA /S³L) converter to connect 2290 to 9950 Smart Pro
3-8058-2	159 300 967	DIN rail mount GF i-Go (4 to 20 mA/S³L) converter to connect 2290 to 9950 SmartPro
3-9900-1P	159 001 695	9900 Transmitter - Panel Mount
3-9900-1	159 001 696	9900 Transmitter - Field Mount
3-9950-1	159 001 841	9950 Base Unit – Two Channel Multi-Parameter Inputs, Two 4 to 20 mA Outputs, Panel Mount, DC Power
3-9950-2	159 001 842	9950 Base Unit – Two Channel Multi-Parameter Inputs, Two 4 to 20 mA Outputs, Panel Mount, AC or DC Power

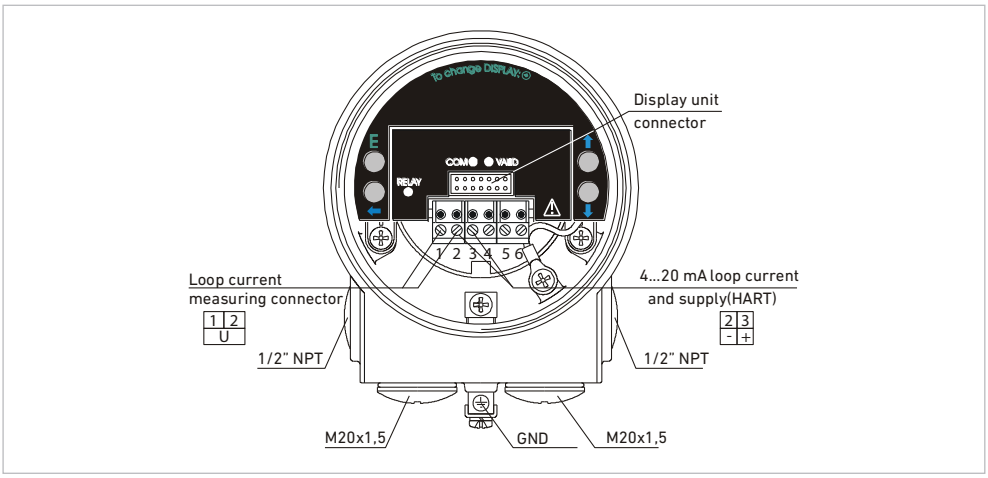
Installation



The probes can be removed from the head unit by the user.

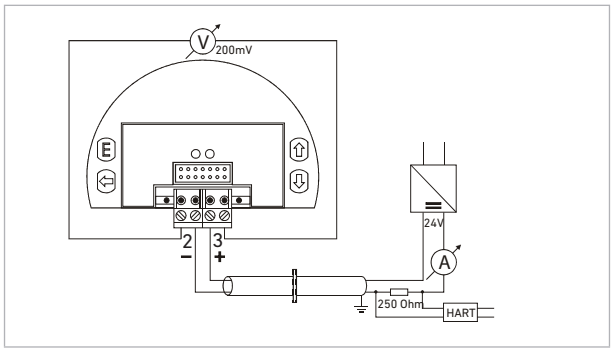
s = minimum distance from the internal disturbing objects. Objects that are parallel to the probe do not disturb the measurement. s > 300 mm (12 in.), h ≤ d, t

Wiring

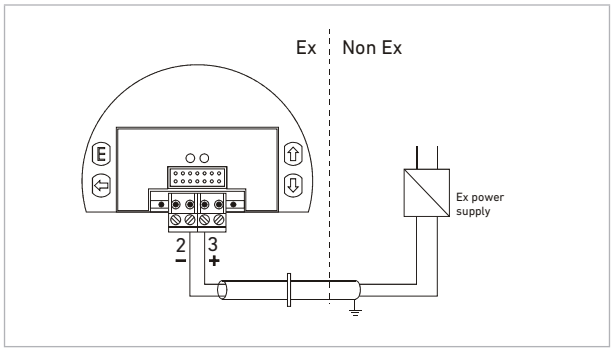


To Power Supply / HART Modem

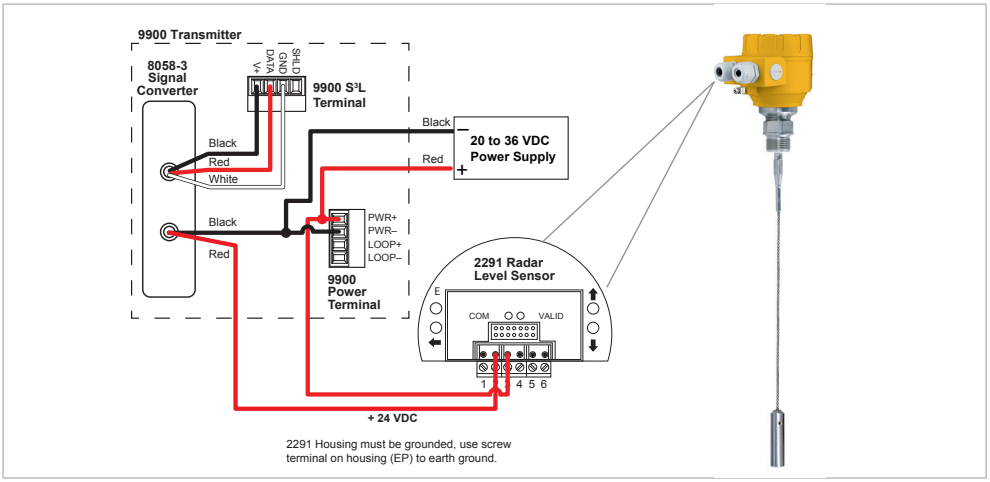
Standard wiring & connection of HART-Modem



Wiring in an EX-environment



To i-Go Converter - (S³L) / 4 to 20 mA



Pin No.	Assignment
1	mV Test, 10mV -> 1mA
2	4-20 mA current + supply (HART) any polarity
3	4-20 mA current + supply (HART) any polarity
4	Not Assigned
5	Not Assigned
6	Not Assigned

Type 2298 80 GHz Radar Level Transmitter



PP

Product description

The 80 GHz (W-band) 2298 Pulse Radars are the most progressive non-contact level transmitter technology for industrial processes. With an excellent accuracy, compact antennas and a user-friendly set-up the 2298 is an effective, simple, low cost choice for demanding level applications. GF's 80 GHz radar featuring ±2 mm (±0.079 in.) accuracy and short dead band excels with its full plastic housing. Its antenna range incorporates a stainless steel horn and enclosed plastic tube choices.

Local programming of type 2298 is aided by an on-board display module. The signal processing algorithm of the 2298 is based on years of experience with non-contact level measurement making it an excellent choice for applications simple and challenging alike.

Features

- 7° beam angle
- Measurement through a plastic tank roof
- Small dead zone
- High accuracy
- Fast response time
- Tank mapping function
- Large dot matrix LCD display
- Predefinded tank shapes
- Works with fumes, condensation, and light foam layers

Applications

- Bulk Storage Tanks
- Day Tanks
- Process vessels for Mixing and Batching
- Buffer Tanks
- Conditioning vessels
- Metal or Plastic

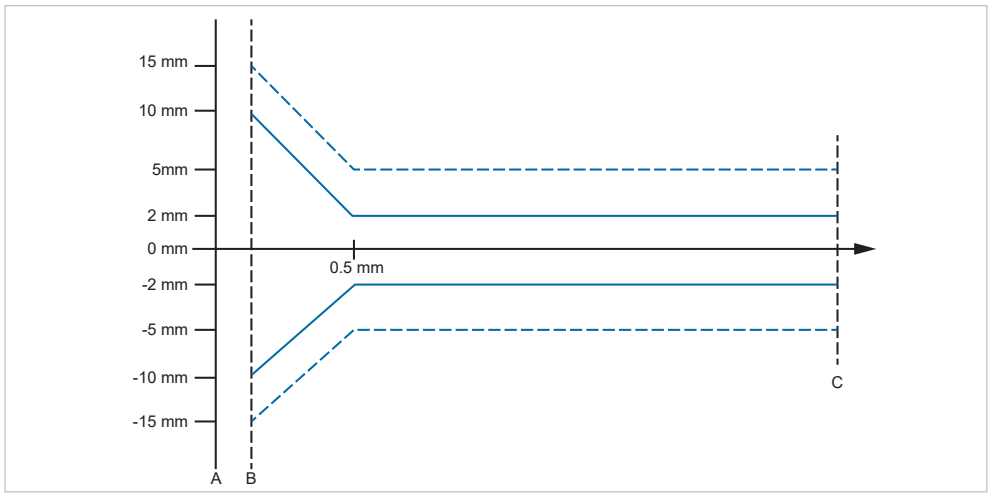
Specifications

Antenna type		Encapsulated Antenna				Stainless Steel Antenna*			
Antenna size		**⌀1" ***	**⌀1½"**		**⌀75 mm***	**⌀1" ***	**⌀1½" ***		
Dead zone (1)		0 m (0 ft)							
Max. measuring distance (2)		10 m (33 ft)*	10 m (33 ft)	20 m (66 ft)*	30 m (98.5 ft)*	10 m (33 ft)	10 m (33 ft)	20 m (66 ft)	
Antenna insertion length (3)		56 mm (2.2")	70 mm (2.76")		115 mm (4.53")	69 mm (2.72)	80 mm (3.15")		
Accuracy (4)		±5 mm (±0.2")	±5 mm (±0.2")	±2 mm (±0.079")	±2 mm (±0.079")	±5 mm (±0.2")	±5 mm (±0.2")	±2 mm (±0.079")	
Process pressure		–1...3 bar (–14.5...43.5 psi)				–1...25 bar (–14.5...362.6 psi)			
Beam angle (–3 dB)		12°	7°		4°	12°	7°		
Process connection		1" BSP / NPT	1½" BSP / NPT		flange	1" BSP / NPT	1½" BSP / NPT		
Materials	Antenna	PP, PVDF, PTFE*			PP/PVDF	1.4571 (316Ti) stainless steel			
	Housing	PBT							
	Seal	FPM (Viton®) (optionally: EPDM, FFKM Perfluoroelastomer (Kalrez® 6375))							
Wetted Parts	Horn Anntenna	PP, PVDF, PTFE, Stainless steel 316 Ti							
	Antenna enclosure	PTFE, PP, PVDF							
Measured Values		Level, Distance; Calculated values: Volume, Mass							
Frequency of the Measuring Signal		~80 GHz (W-band)							
Linearity Error (as per EN 61298-2)		See diagram							
Minimum dielectric constant εr of the Medium		1.9 (refer to diagram)							
Resolution		0.1 mm (0.0039")							
Power Supply Voltage		12...36 V DC							
Output Digital Communication		4...20 mA; (3.9...20.5 mA); RLmax = (US – 12 V) / 0.02 A + HART							
Output Display		64 x 128 Dot Matrix LCD Graphical display unit							
Measuring Frequency		~1/s							
Antenna Diameter		1" (25.4 mm); 1½" (38.1 mm)							
Medium Process Temperature		–40...+80 °C (–40...+176 °F), PP encapsulation: –30...+80 °C (–22...+176 °F)							
Ambient Temperature		–40...+70 °C (–40...+158 °F); with display unit: –20...+70 °C (–4...+158 °F)							
Protection class		IP66 / IP67							
Electrical Connection (5)		2× M20×1.5 cable gland + 2× internally threaded ½" NPT connection, cable outer diameter: Ø6...12 mm (Ø.24... Ø.47") (shielded cable is recommended), wire cross section: 0.5...1.5 mm2 (AWG20...AWG15)							
Electrical Protection		Class I overvoltage protection; (Class III [SELV])							
Communication Certifications		R&TTE, FCC							
Weight		PBT housing 0.6...0.8 kg (1.3...1.8 lb) SS housing 1.1...2 kg (2.4...4.4 lb)							
Standards and Approvals		Directive 2014/35/EU (LVD), Directive 2014/30/EU (EMC), Directive 2014/53/EU (RED), Directive 2015/863/EU (RoHS 3)							

* Available on request.

(1) From the tip of the antenna, if dielectric constant (ε_r) < 80.
(2) May be limited for media with low dielectric constants or non-vertical or non-planar surfaces.
(3) From process connection.
(4) With an ideal reflecting surface, according to IEC 62828-1, an accuracy of ±2 mm (±0.079») is not guaranteed for Region 3 and Region 4 settings.
(5) Operate only with galvanically isolated power supply!

Linearity error



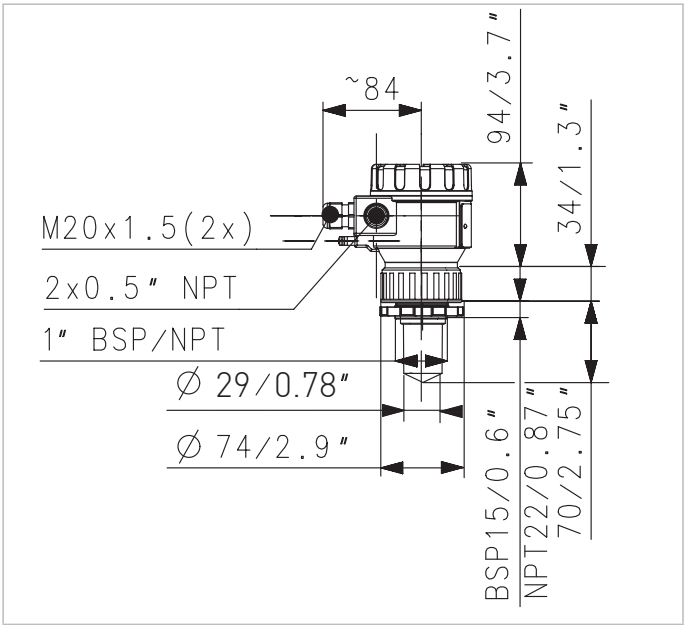
- - - Transmitters up to 10 m measuring range
——— Transmitters up to 20 m measuring range

A Process connection plane of the device

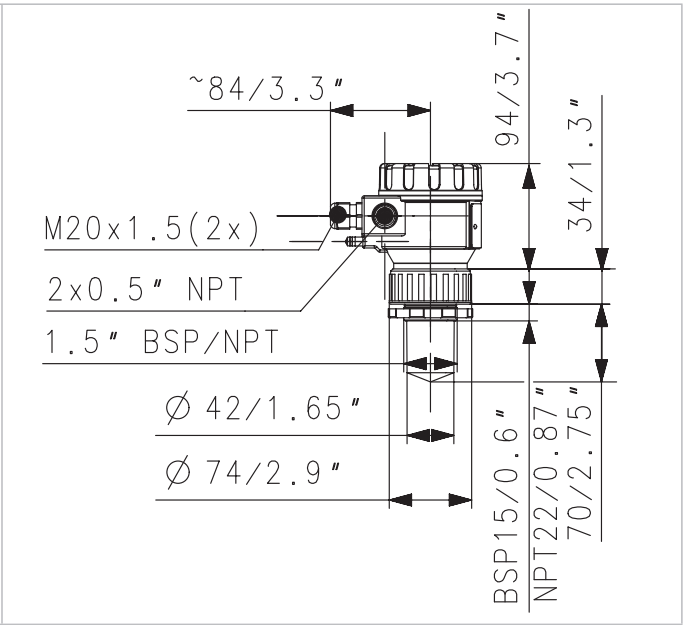
B The minimum measurement distance below which the radar cannot measure, due to the insertion length of the antenna (X_m)

C Maximum measurement distance (X_M)

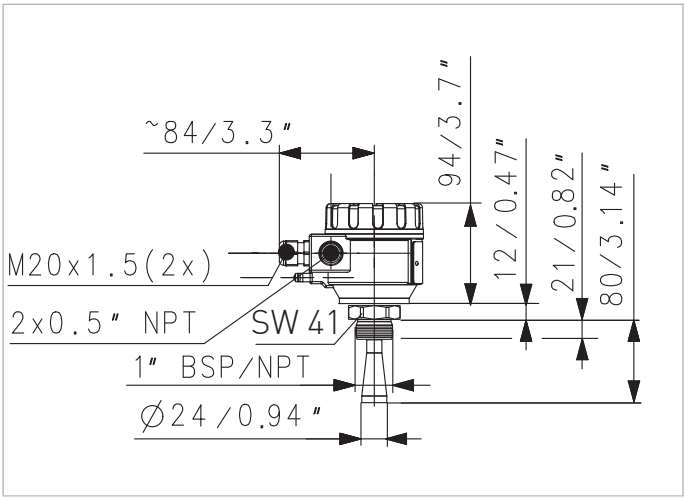
Dimensions



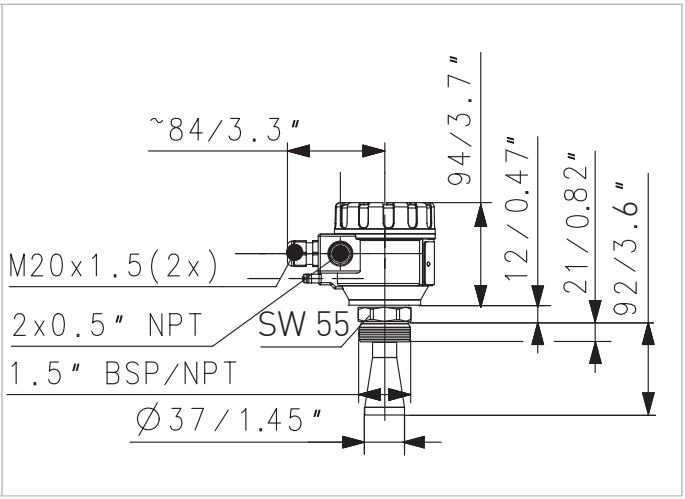
Encapsulated Antenna ⌀1"



Encapsulated Antenna ⌀1½"



Stainless Steel Antenna ⌀1"



Stainless Steel Antenna ⌀1½"

Ordering Information

Mfr. Part No	Description
159300452	2298 Radar Level Transmitter, 0-10m, LCD, PP/PBT housing, 1½“, 70 mm, BSP
159300453	2298 Radar Level Transmitter, 0-10m, LCD, PVDF/PBT housing, 1½“, 70 mm, BSP
159300455	2298 Radar Level Transmitter, 0-10m, LCD, PP/PBT housing, 1½“, 70 mm, NPT
159300456	2298 Radar Level Transmitter, 0-10m, LCD, PVDF/PBT housing, 1½“, 70 mm, NPT
159300426	2298 Radar Level Transmitter, 0-20m, LCD, PP/PBT housing, 1½“, 70 mm, BSP
159300427	2298 Radar Level Transmitter, 0-20m, LCD, PVDF/PBT housing, 1½“, 70 mm, BSP
159300430	2298 Radar Level Transmitter, 0-20m, LCD, PP/PBT housing, 1½“, 70 mm, NPT
159300431	2298 Radar Level Transmitter, 0-20m, LCD, PVDF/PBT housing, 1½“, 70 mm, NPT
*on request	2298 Radar Level Transmitter, 0-10m, LCD, PP/PBT housing, 1“, 56 mm, BSP
*on request	2298 Radar Level Transmitter, 0-10m, LCD, PVDF/PBT housing, 1“, 56 mm, BSP
*on request	2298 Radar Level Transmitter, 0-10m, LCD, PTFE/PBT housing, 1“, 56 mm, BSP
*on request	2298 Radar Level Transmitter, 0-10m, LCD, PP/PBT housing, 1“, 56 mm, NPT
*on request	2298 Radar Level Transmitter, 0-10m, LCD, PVDF/PBT housing, 1“, 56 mm, NPT
*on request	2298 Radar Level Transmitter, 0-10m, LCD, PTFE/PBT housing, 1“, 56 mm, NPT
*on request	2298 Radar Level Transmitter, 0-10m, LCD, PTFE/PBT housing, 1½“, 70 mm, BSP
*on request	2298 Radar Level Transmitter, 0-10m, LCD, PTFE/PBT housing, 1½“, 70 mm, NPT
*on request	2298 Radar Level Transmitter, 0-20m, LCD, PTFE/PBT housing, 1½“, 70 mm, BSP
*on request	2298 Radar Level Transmitter, 0-10m, LCD, PP/PVDF housing, 75 mm, 115 mm, Flange
*on request	2298 Radar Level Transmitter, 0-10m, LCD, stainless steel housing, 1“, 69 mm, BSP
*on request	2298 Radar Level Transmitter, 0-10m, LCD, stainless steel housing, 1“, 69 mm, NPT
*on request	2298 Radar Level Transmitter, 0-10m, LCD, stainless steel housing, 1½“, 80 mm, BSP
*on request	2298 Radar Level Transmitter, 0-10m, LCD, stainless steel housing, 1½“, 80 mm, NPT
*on request	2298 Radar Level Transmitter, 0-20m, LCD, stainless steel housing, 1½“, 80 mm, BSP
*on request	2298 Radar Level Transmitter, 0-20m, LCD, stainless steel housing, 1½“, 80 mm, NPT

Accessories

Mfr. Part No	Code	Description
	159 300 208	HART - USB Modem
3-8058-3	159 070 106	GF 3-8058-3 i-Go® Analog to S^3L Module, module mount, for use with GF 9900-1P transmitters only
3-8058-2	159 000 967	GF 3-8058-2 i-Go® Analog to S^3L Module, DIN-rail mount, dual 4 to 20 mA inputs to S^3L converter, for use with GF 9950-10/-11 transmitters only
3-8050	159 000 184	Universal Mount Kit
2-9900.396	159 001 701	Angle Adaptor
3-9900-1P	159 001 695	9900 Transmitter - Panel Mount
3-9900-1	159 001 696	9900 Transmitter - Field Mount
3-9950-1	159 001 841	9950 Base Unit – Two Channel Multi-Parameter Inputs, Two 4 to 20 mA Outputs, Panel Mount, DC Power
3-9950-2	159 001 842	9950 Base Unit – Two Channel Multi-Parameter Inputs, Two 4 to 20 mA Outputs, Panel Mount, AC or DC Power

Type 2298 80 GHz Radar Level Sensor



PP

Product description

The type 2298 is a rugged, high performance radar level measurement sensor, having transducer and processing electronics incorporated in one single housing.

For single and multiple tank applications 2-wire sensors are recommended using either HART protocol or 4 to 20 mA for the direct communication with a panel mount controller or a PLC.

Either for liquid level measurement in sumps or tanks, for tank volume measurement, or open channel flow measurement, the 2298 Level Sensors provide the answer. Sensing ranges up to 20 m (66 ft) are available. PP and PVDF sensor bodies provide best chemical resistance in applications where concentrated chemical shall be detected.

Features

- 2 wire compact sensor
- Compatible with 9900 Sensor (optional signal converter)
- Non-contact level measuring
- Narrow 7° beam angle
- Level, volume and open channel flow
- Compact housing
- Fully temperature compensated electronics
- Outstanding signal processing software providing highly accurate measuring results
- PP or PVDF sensor body provides best chemical resistance
- Secondary lightning protection
- 4 to 20 mA / HART interface

Applications

- Water Treatment
- Corrosive Industrial Waste Treatment
- Filling
- Batching
- Bulk Transfer
- Dirty Liquids

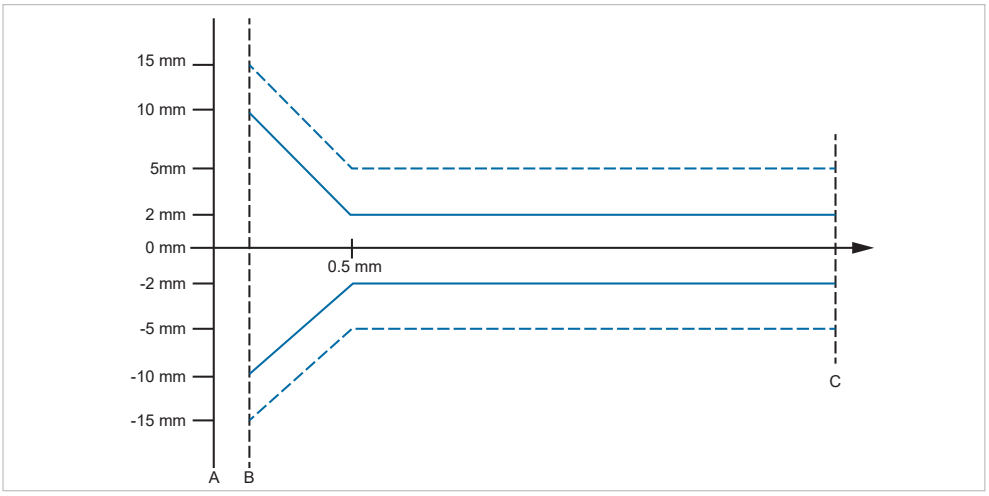
Specifications

Antenna type		Encapsulated Antenna		
Antenna size		**⌀1" ***	**⌀1½"**	
Dead zone [1]		0 m (0 ft)		
Max. measuring distance [2]		10 m (33 ft)	10 m (33 ft)	20 m (66 ft)
Antenna insertion length [3]		56 mm (2.2")	70 mm (2.76")	
Accuracy [4]		±5 mm (±0.2")	±5 mm (±0.2")	±2 mm (±0.079")
Process pressure		–1...3 bar (–14.5...43.5 psi)		
Beam angle (–3 dB)		12°	7°	
Process connection		1" BSP / NPT	1½" BSP / NPT	
Materials	Housing	PP, PVDF, PTFE*		
	Seal	EPDM		
	Cable	Cable sealing: EPDM, cable isolation: PVC		
Measured Values		Level, Distance; Calculated values: Volume, Mass		
Frequency of the Measuring Signal		~80 GHz (W-band)		
Linearity Error (as per EN 61298-2)		See diagram		
Minimum dielectric constant εr of the Medium		1.9 (refer to diagram)		
Resolution		0.1 mm (0.0039")		
Power Supply Voltage		12...36 V DC		
Output Digital Communication		4...20 mA; (3.9...20.5 mA); RLmax = (US – 12 V) / 0.02 A + HART		
Measuring Frequency		~1/s		
Antenna Diameter		1" (25.4 mm); 1½" (38.1 mm)		
Antenna Material		Horn: Stainless Steel; enclosure: PP / PVDF / PTFE		
Medium Process Temperature		PVDF: –40...+80 °C (–40...+176 °F) PP: –30...+80 °C (–34.4...+176 °F)		
Ambient Temperature		PVDF: –40...+80 °C (–40...+176 °F) PP: –30...+80 °C (–34.4...+176 °F)		
Upper process connection		1" BSP		
Protection class		IP66 / IP68		
Electrical Connection [5]		4 × 0.5 mm2 shielded Ø6 mm cable × 5 m (up to 30 m); (4 × 22 AWG shielded Ø0.24" cable × 16.4 ft [up to 98.5 ft]); For the relay option: 7 × 0.5 mm2 (22 AWG) shielded cable		
Electrical Protection		Class I overvoltage protection; (Class III [SELV])		
Communication Certifications		R&TTE, FCC		
Weight		~600 g (1.3 lb)		
Standards and Approvals		Directive 2014/35/EU (LVD), Directive 2014/30/EU (EMC), Directive 2014/53/EU (RED), Directive 2015/863/EU (RoHS 3)		

* Available on request.

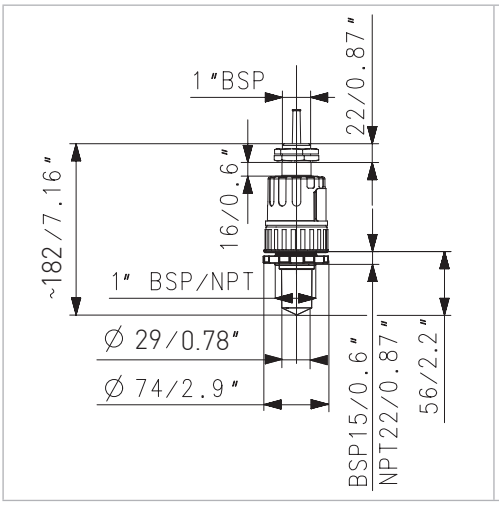
(1) From the tip of the antenna, if dielectric constant (ε_r) < 80.
(2) May be limited for media with low dielectric constants or non-vertical or non-planar surfaces.
(3) From process connection.
(4) With an ideal reflecting surface, according to IEC 62828-1, an accuracy of ±2 mm (±0.079») is not guaranteed for Region 3 and Region 4 settings.
(5) Operate only with galvanically isolated power supply!

Linearity error

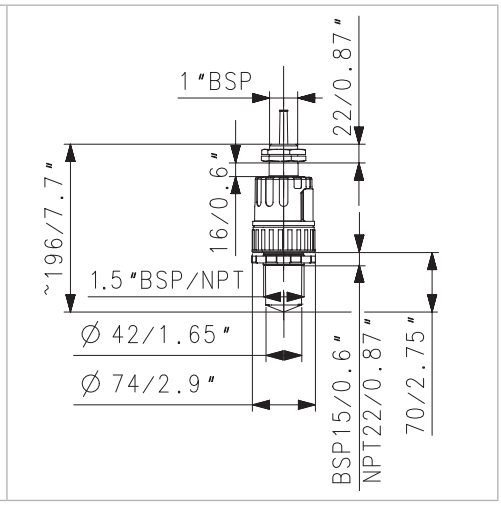


- - - Transmitters up to 10 m measuring range
— Transmitters up to 20 m measuring range
A Process connection plane of the device
B The minimum measurement distance below which the radar cannot measure, due to the insertion length of the antenna (X_m)
C Maximum measurement distance (X_M)

Dimensions



Encapsulated Antenna ⌀1"



Encapsulated Antenna ⌀1½"

Ordering Information

Mfr. Part No	Description
159300464	2298 Radar Level Sensor, 0-10m, PP housing, 1½", 70 mm, BSP
159300465	2298 Radar Level Sensor, 0-10m, PVDF housing, 1½", 70 mm, BSP
159300467	2298 Radar Level Sensor, 0-10m, PP housing, 1½", 70 mm, NPT
159300468	2298 Radar Level Sensor, 0-10m, PVDF housing, 1½", 70 mm, NPT
159300440	2298 Radar Level Sensor, 0-20m, PP housing, 1½", 70 mm, BSP
159300441	2298 Radar Level Sensor, 0-20m, PVDF housing, 1½", 70 mm, BSP
159300443	2298 Radar Level Sensor, 0-20m, PP housing, 1½", 70 mm, NPT
159300444	2298 Radar Level Sensor, 0-20m, PVDF housing, 1½", 70 mm, NPT
*on request	2298 Radar Level Sensor, 0-10m, PP housing, 1", 56 mm, BSP
*on request	2298 Radar Level Sensor, 0-10m, PVDF housing, 1", 56 mm, BSP
*on request	2298 Radar Level Sensor, 0-10m, PTFE housing, 1", 56 mm, BSP
*on request	2298 Radar Level Sensor, 0-10m, PP housing, 1", 56 mm, NPT
*on request	2298 Radar Level Sensor, 0-10m, PVDF housing, 1", 56 mm, NPT
*on request	2298 Radar Level Sensor, 0-10m, PTFE housing, 1", 56 mm, NPT
*on request	2298 Radar Level Sensor, 0-10m, PTFE housing, 1½", 70 mm, BSP
*on request	2298 Radar Level Sensor, 0-10m, PTFE housing, 1½", 70 mm, NPT
*on request	2298 Radar Level Sensor, 0-20m, PTFE housing, 1½", 70 mm, BSP
*on request	2298 Radar Level Sensor, 0-20m, PTFE housing, 1½", 70 mm, NPT

Accessories

Mfr. Part No	Code	Description
	159 300 208	HART - USB Modem
	159 300 182	HART - USB Modem, DIN Rail
3-8050	159 000 184	Universal Mount Kit
2-9900.396	159 001 701	Angle Adaptor

Type 2260 Ultrasonic Level Transmitters



Product description

The type 2260 is a rugged, high performance ultrasonic level measurement transmitter, having transducer and processing electronics and a display/programming unit incorporated in one single housing.

All type 2260 Level Transmitters are using established high end pulse echo transducers, which provide narrow beam angles and reliable measurement ranges up to a distance of 15 m (49.2 ft).

For small, stand alone tanks the transmitter provides a simple 2-wire 4 to 20 mA output, with additional power relay contacts. It can be programmed using push buttons and the large, graphic display. For large and/or multiple tank applications versions with HART interface are recommended, communicating directly with a panel mount controller or PLC. The HART protocol can easily be used for programming these versions.

Features

- 2-wire compact transmitters
- Non-contact level metering
- Narrow 5° beam angle
- Level, volume and open channel flow
- Fully temperature compensated electronics
- Outstanding signal processing software providing highly accurate measuring results
- PP or PVDF sensor body provides best chemical resistance
- Quick-set menu for efficient installation
- Plug-in keypad and display
- Switching relay for high / low alarm
- 4 to 20 mA / HART interface (Optional)
- Secondary lightning protection
- Intrinsically safe (Optional)
- 32-point linearization

CE UK CA

Applications

- Water Treatment
- Corrosive Industrial Waste Treatment
- Filling
- Batching
- Bulk Transfer
- Dirty Liquids

www.gfps.com/level

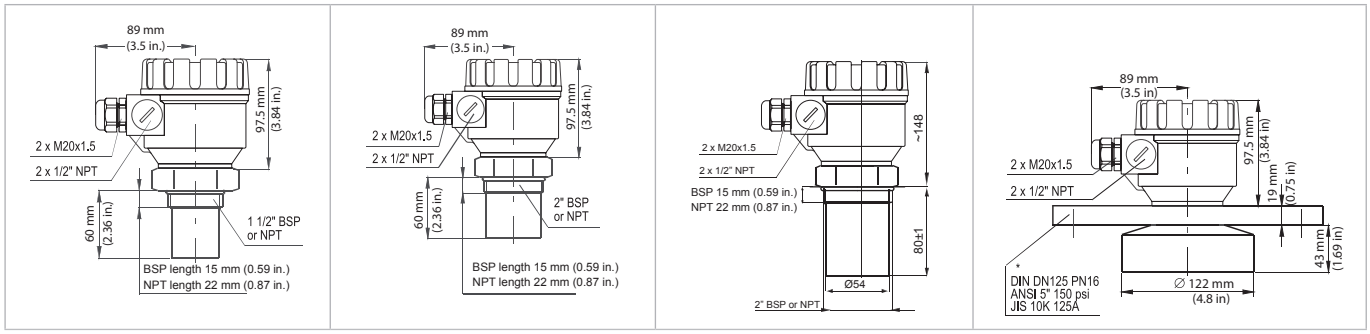
Specifications

General				
Type	2260-Y-YYY-4	2260-Y-YYY-6	2260-Y-YYY-8	2260-Y-YYY-15
Range	0.2 to 4 m / 0.65 to 13 ft	0.25 to 6 m / 0.82 to 20 ft	0.35 to 8 m / 1.1 to 26 ft	0.45 to 15 m / 1.5 to 49 ft
Measuring Frequency	80 kHz	80 kHz	50 kHz	40 kHz
Total Beam Angle	6°	5°	7°	5°
Accuracy *	± (0.2 % of measured distance plus 0.05 % of range)			
Resolution	<2 m (6.6 ft): 1 mm (0.04 in.) 2 to 5 m (6.6 to 16.4 ft): 2 mm (0.08 in.) 5 to 10 m (16.4 to 32.8 ft): 5 mm (0.2 in.) >10 m (32.8 ft): 10 mm (0.39 in.)			
Environmental				
Process Temperature	-30 °C to +90 °C (-22 °F to + 194 °F)			
Ambient Temperature	-25 °C to +70 °C (-13 °F to + 158 °F)			
Process Pressure (absolute)	0.03 to 0.3 MPa (0.3 to 3 bar) 4.35 psi - 43.5 psi			
Enclosure				
Enclosure Material				
Sensor Body	PP or PVDF			
Housing	PBT			
Ingress Protection				
Sensor	IP68 NEMA 6P Equivalent			
Housing	IP67 NEMA 6 Equivalent			
Process Connection	1 ½ in. BSP / NPT	2 in. BSP / NPT	2 in. BSP / NPT	DN125 / 5 in. flange
Sealing				
PP sensor	EPDM			
PVDF sensor	FKM			
Electrical				
Outputs	2-wire 4–20 mA , max. 600 Ohm; HART interface, Rt ≥ 250 Ω			
Relay	(SPDT) 250V AC, 3A AC1			
Power Supply	12 to 36 V DC / 44 to 800 mW			
Power Consumption	DC 3.6 W, AC 4 VA			
Connection	2 x M20x1.5 plastic cable gland: Cable: Ø6 ... 12 mm			
Standards and Approvals				
General Approvals	CE, UKCA, RoHS			

* Under optimal circumstances of reflection and stabilized transducer temperature

Dimensions (mm)

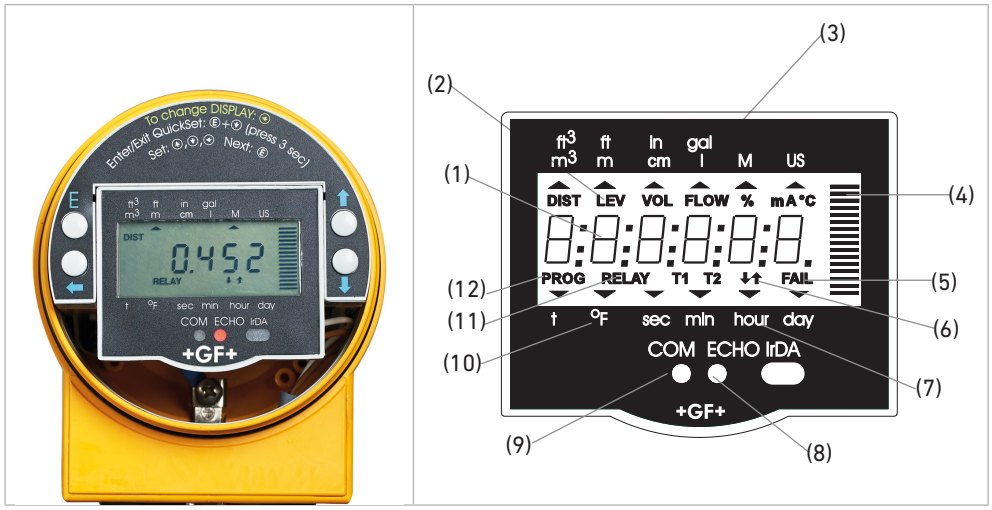
2-wire level transmitters



2260-Y-YYY-4 | 2260-Y-YYY-6 | 2260-Y-YYY-8 | 2260-Y-YYY-15

System Overview

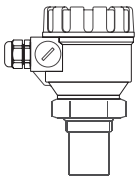
Display Unit



(1) Primary measured value
(2) Measurement mode
(3) Measurement unit / Standard
(4) Bar graph trend indication
(5) Measurement error indication
(6) Liquid movement direction
(7) Time unit
(8) Presence of valid echo
(9) HART communication
(10) Temperature unit
(11) Relay status indication
(12) Programming mode indication

Ordering Information

Mfr. Part No	Code	Description
2260-P-0DN-4	159 300 120	Range 4 m (13.1 ft), PP body, 4..20 mA 2-wire, NPT thread
2260-P-2DN-4	159 300 121	Range 4 m (13.1 ft), PP body, 4..20 mA 2-wire/relay/HART, NPT thread
2260-P-0DN-6	159 300 122	Range 6 m (19.7 ft), PP body, 4..20 mA 2-wire, NPT thread
2260-P-2DN-6	159 300 123	Range 6 m (19.7 ft), PP body, 4..20 mA 2-wire/relay/HART, NPT thread
2260-P-0DN-8	159 300 109	Range 8 m (26.2 ft), PP body, 4..20 mA 2-wire, NPT thread
2260-P-0DA-15	159 300 124	Range 15 m (49.2 ft), PP body, 4..20 mA 2-wire, ANSI Flange 5 inch
2260-P-2DA-15	159 300 125	Range 15 m (49.2 ft), PP body, 4..20 mA 2-wire/relay/HART, ANSI Flange 5 in.
2260-V-0DN-4	159 300 131	Range 4 m (13.1 ft), PVDF body, 4..20 mA 2-wire, NPT thread
2260-V-2DN-4	159 300 132	Range 4 m (13.1 ft), PVDF body, 4..20 mA 2-wire/relay/ HART, NPT thread
2260-V-0DN-6	159 300 133	Range 6 m (19.7 ft), PVDF body, 4..20 mA 2-wire, NPT thread
2260-V-2DN-6	159 300 134	Range 6 m (19.7 ft), PVDF body, 4..20 mA 2-wire/relay/ HART, NPT thread
2260-V-0DN-8	159 300 110	Range 8 m (26.2 ft), PVDF body, 4..20 mA 2-wire, NPT thread
2260-V-0DA-15	159 300 135	Range 15 m (49.2 ft), PVDF body, 4..20 mA 2-wire, ANSI Flange 5 inch
2260-V-2DA-15	159 300 136	Range 15 m (49.2 ft), PVDF body, 4..20 mA 2-wire/relay/ HART, ANSI Flange 5 in.
Versions with BSP thread / DIN flange		
2260-P-0DB-4	159 300 090	Range 4 m (13.1 ft), PP body, 4..20 mA 2-wire, BSP thread
2260-P-2DB-4	159 300 091	Range 4 m (13.1 ft), PP body, 4..20 mA 2-wire/relay/HART, BSP thread
2260-P-0DB-6	159 300 092	Range 6 m (19.7 ft), PP body, 4..20 mA 2-wire, BSP thread
2260-P-2DB-6	159 300 093	Range 6 m (19.7 ft), PP body, 4..20 mA 2-wire/relay/HART, BSP thread
2260-P-0DB-8	159 300 107	Range 8 m (26.2 ft), PP body, 4..20 mA 2-wire, BSP thread
2260-P-0DF-15	159 300 094	Range 15 m (49.2 ft), PP body, 4..20 mA 2-wire, DIN Flange DN125
2260-P-2DF-15	159 300 095	Range 15 m (49.2 ft), PP body, 4..20 mA 2-wire/relay/HART, DIN Flange DN125
2260-V-0DB-4	159 300 101	Range 4 m (13.1 ft), PVDF body, 4..20 mA 2-wire, BSP thread
2260-V-2DB-4	159 300 102	Range 4 m (13.1 ft), PVDF body, 4..20 mA 2-wire/relay / HART, BSP thread
2260-V-0DB-6	159 300 103	Range 6 m (19.7 ft), PVDF body, 4..20 mA 2-wire, BSP thread
2260-V-2DB-6	159 300 104	Range 6 m (19.7 ft), PVDF body, 4..20 mA 2-wire/relay / HART, BSP thread
2260-V-0DB-8	159 300 108	Range 8 m (26.2 ft), PVDF body, 4..20 mA 2-wire, BSP thread
2260-V-0DF-15	159 300 105	Range 15 m (49.2 ft), PVDF body, 4..20 mA 2-wire, DIN Flange DN125
2260-V-2DF-15	159 300 106	Range 15 m (49.2 ft), PVDF body, 4..20 mA 2-wire/relay/ HART, DIN Flange DN125

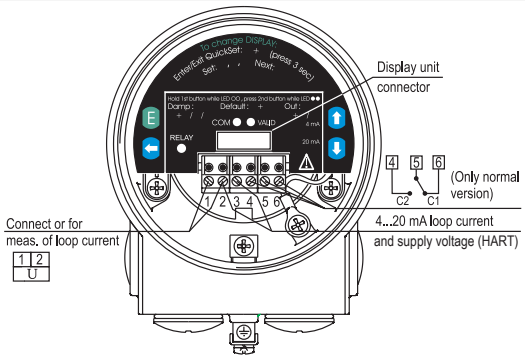


Accessories

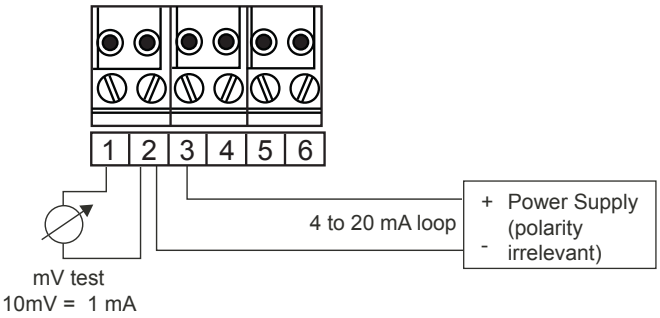
Code	Description
159 300 208	HART - USB Modem
159 300 182	HART - USB Modem, DIN Rail
159 300 180	Display unit for type 2260 Transmitter

Wiring

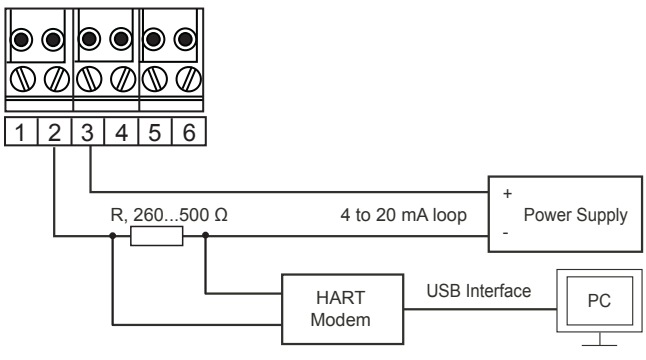
2260 Transmitter Terminals



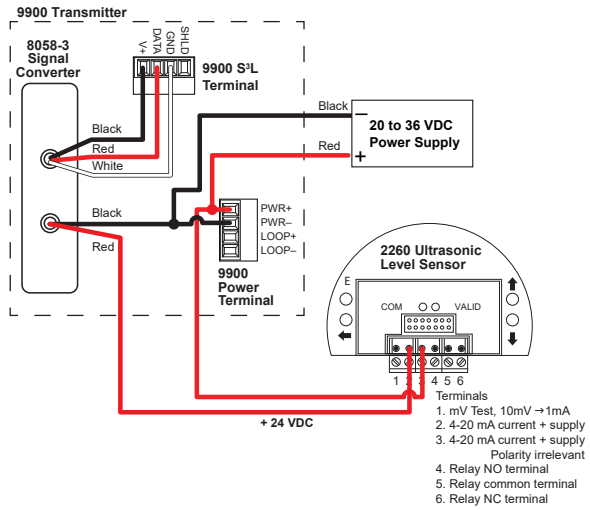
4 to 20 mA Loop Wiring



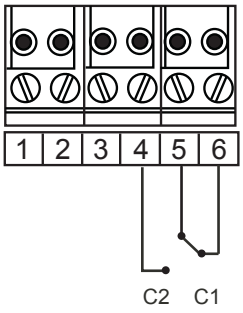
HART Interface Wiring



Wiring to 9900 Universal Transmitter



Relay Output Wiring



Type 2260 Ultrasonic Level Transmitters with ATEX Approval



Product description

The type 2260 is a rugged, high performance ultrasonic level measurement transmitter, having transducer and processing electronics and a display/programming unit incorporated in one single housing.

All type 2260 Level Transmitters are using established high end pulse echo transducers, which provide narrow beam angles and reliable measurement ranges up to a distance of 15 meters (49.2 ft).

For small, stand alone tanks the transmitter provides a simple 2-wire 4 to 20 mA output, with additional power relay contacts. It can be programmed using push buttons and the large, graphic display. For large and/or multiple tank applications versions with HART interface are recommended, communicating directly with a panel mount controller or PLC. The HART protocol can easily be used for programming these versions.

Features

- 2-wire compact transmitters
- Non-contact level metering
- Narrow 5° beam angle
- Level, volume and open channel flow
- Fully temperature compensated electronics
- Outstanding signal processing software providing highly accurate measuring results
- PP or PVDF sensor body provides best chemical resistance
- Quick-set menu for efficient installation
- Plug-in keypad and display
- 4 to 20 mA / HART interface (Optional)
- Secondary lightning protection
- Intrinsically safe (Option)
- 32-point linearization

Applications

- Hazardous Environments
- Water Treatment
- Corrosive Industrial Waste Treatment
- Filling
- Batching
- Bulk Transfer
- Dirty Liquids

www.gfps.com/level

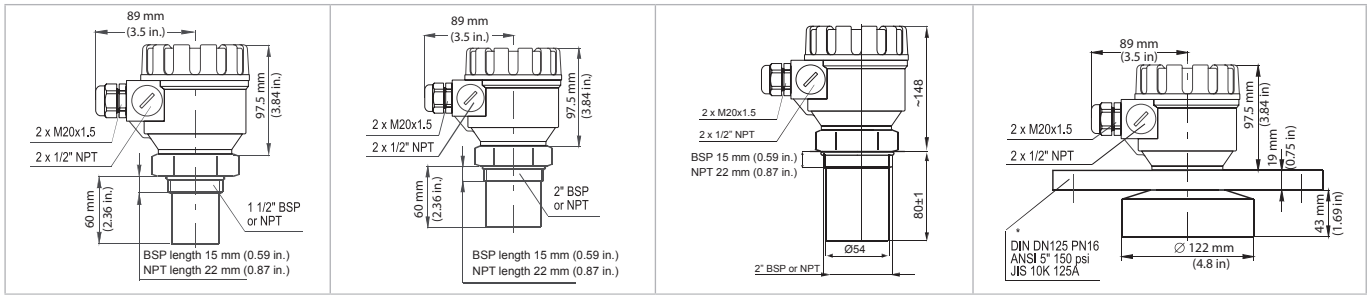
Specifications

General				
Type	2260-Y-YYYX-4	2260-Y-YYYX-6	2260-Y-YYY-8	2260-Y-YYYX-15
Range	0.2 to 4 m (0.65 to 13 ft)	0.25 to 6 m (0.82 to 20 ft)	0.35 to 8 m (1.1 to 26 ft)	0.45 to 15 m (1.5 to 49 ft)
Measuring Frequency	80 kHz	80 kHz	50 kHz	40 kHz
Total Beam Angle	6°	5°	7°	5°
Accuracy *	± (0.2 % of measured distance plus 0.05 % of range)			
Resolution	<2 m (6.6 ft): 1 mm (0.04 in.) 2 to 5 m (6.6 to 16.4 ft): 2 mm (0.08 in.) 5 to 10 m (16.4 to 32.8 ft): 5 mm (0.2 in.) >10 m (32.8 ft): 10 mm (0.39 in.)			
Environmental				
Process Temperature				
PP sensor	-20 °C to +70 °C (-4 °F to 158 °F)			
PVDF sensor	-20 °C to +80 °C (-4 °F to 176 °F)			
Ambient Temperature	-20 °C to +60 °C (-4 °F to 140 °F)			
Process Pressure (absolute)	0.03 to 0.3 MPa (0.3 to 3 bar) 4.35 psi - 43.5 psi			
Enclosure				
Enclosure Material				
Sensor Body	PP or PVDF			
Housing	PBT			
Ingress Protection				
Sensor	IP68, NEMA 6P Equivalent			
Housing	IP67, NEMA 6 Equivalent			
Process Connection	1½ in. BSP / NPT	2 in. BSP / NPT	2 in. BSP / NPT	DN125 / 5 in. Flange
Sealing				
PP sensor	EPDM			
PVDF sensor	FKM			
Electrical				
Outputs	2- wire 4–20 mA , HART interface, Rt ≥ 250 Ω			
Power Supply	12 to 30 V DC, Note: Ex-devices must be powered by EEx ia power supplies			
Power Supply Loading	U_o < 30 V, I_o < 140 mA, P_o < 1 W, Rt max = (Us - 12 V) / 0,02 A			
Intrinsically safety data	Ci ≤ 15 nF, Li ≤ 200 µH, Ui ≤ 30V, Ii ≤ 140 mA, Pi ≤ 1 W			
Connection	2 x M20x1,5 metal cable gland: Cable: Ø7 ... 13 mm			
Standards and Approvals				
General Approvals	CE, UKCA, RoHS			
ATEX Approval	ATEX II 1 G EEx ia IIB T6, IP68, NEMA 6P			

* Under optimal circumstances of reflection and stabilized transducer temperature

Dimensions (mm)

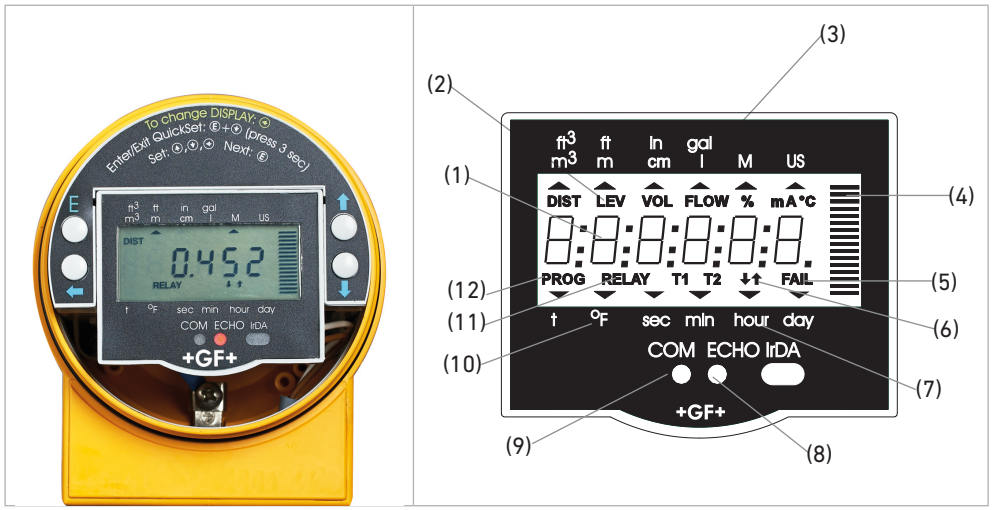
2-wire level transmitters



2260-Y-YYY-4 | 2260-Y-YYY-6 | 2260-Y-YYY-8 | 2260-Y-YYY-15

System Overview

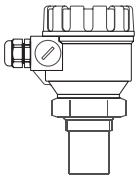
Display Unit



(1) Primary measured value
(2) Measurement mode
(3) Measurement unit / Standard
(4) Bar graph trend indication
(5) Measurement error indication
(6) Liquid movement direction
(7) Time unit
(8) Presence of valid echo
(9) HART communication
(10) Temperature unit
(11) Relay status indication
(12) Programming mode indication

Ordering Information

Mfr. Part No	Code	Description
Versions with NPT thread / ANSI flange		
2260-V-1DNX-4	159 300 142	Range 4 m (13.1 ft), PVDF body, 4..20 mA 2-wire/HART, ATEX, NPT thread
2260-V-1DNX-6	159 300 143	Range 6 m (19.7 ft), PVDF body, 4..20 mA 2-wire/HART, ATEX, NPT thread
2260-V-1DAX-15	159 300 144	Range 15 m (49.2 ft), PVDF body, 4..20 mA 2-wire/HART, ATEX, ANSI Flange 5 in.

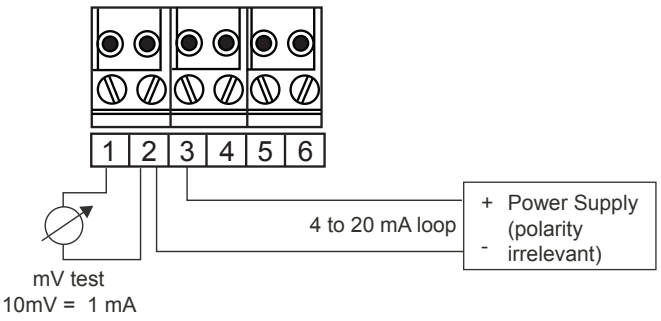


Accessories

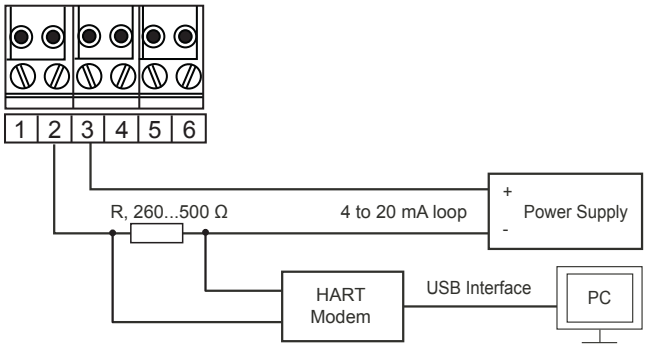
Code	Description
159 300 208	HART - USB Modem
159 300 182	HART - USB Modem, DIN Rail
159 300 183	HART - USB Modem, DIN Rail, ATEX
159 300 180	Display unit for type 2260 Transmitter

Wiring

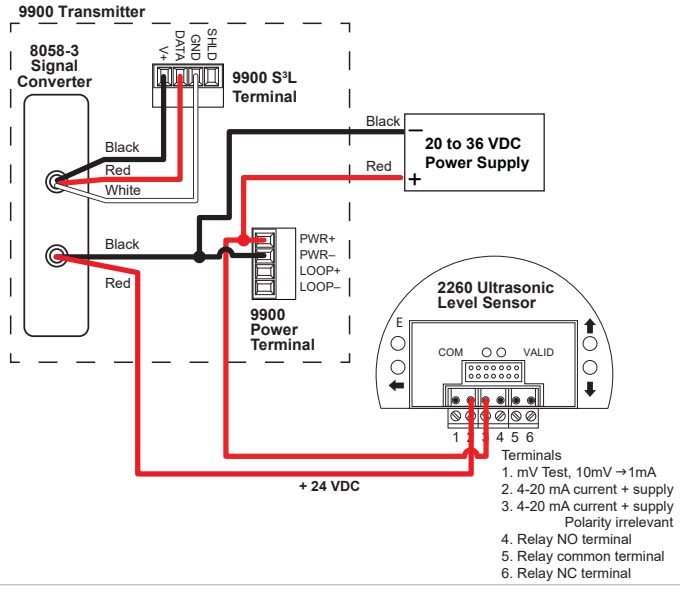
4 to 20 mA Loop Wiring



HART Interface Wiring



Wiring to 9900 Universal Transmitter



Type 2270 Ultrasonic Level Sensor



Product description

The type 2270 is a rugged, high performance ultrasonic level measurement sensor, having transducer and processing electronics incorporated in one single housing. It provides all the sophisticated echo detection features of the well accepted 2260 Ultrasonic Level Transmitters.

For single and multiple tank applications 2-wire sensors are recommended using either HART protocol or 4 to 20 mA for the direct communication with a panel mount controller or a PLC.

Either for liquid level measurement in sumps or tanks, for tank contents measurement, or open channel flow measurement, the 2270 Level Sensors provide the answer. Sensing ranges up to 8 m (26.2 ft) are available. PP and PVDF sensor bodies provide best chemical resistance in applications where concentrated chemical shall be detected.

Features

- 2 wire compact sensor
- Compatible with 9900 transmitter (optional signal converter)
- Non-contact level measuring
- Narrow 5° beam angle
- Level, volume and open channel flow
- Compact housing
- 32 points of linearization
- Fully temperature compensated electronics
- Outstanding signal processing software providing highly accurate measuring results
- PP or PVDF sensor body provides best chemical resistance
- Secondary lightning protection
- 4 to 20 mA / HART interface

CE UK CA

Applications

- Water Treatment
- Corrosive Industrial Waste Treatment
- Filling
- Batching
- Bulk Transfer
- Dirty Liquids

www.gfps.com/level

Specifications

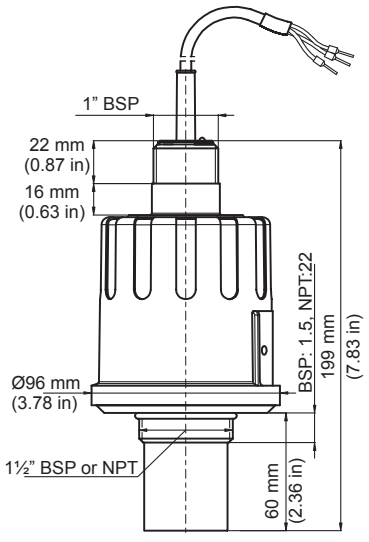
Type 2270-X-XX-4

General	
Range	0.2 to 4 m / 0.65 to 13 ft
Total Beam Angle	6°
Measuring Frequency	80 kHz
Accuracy *	± (0.2 % of measured distance plus 0.05 % of range)
Resolution	<2 m (6.6 ft): 1 mm (0.04 in.) 2 to 4 m (6.6 to 13.1 ft): 2 mm (0.08 in.)
Environmental	
Process Temperature	–30 °C to +90 °C (–22 °F to +194°F)
Ambient Temperature	–30 °C to +80 °C (–22 °F to +176°F)
Process Pressure (absolute)	0.05 to 0.3 MPa (0.5 to 3 bar) 7.25 psi to 43.5 psi
Enclosure	
Enclosure and Sensor Material	PP or PVDF
Cable Material	Cable sealing: EPDM, cable isolation: PVC
Ingress Protection	IP68 / NEMA 6P
Process Connection	1½" BSP / NPT
Sealing	
PP sensor	EPDM
PVDF sensor	FKM
Electrical	
Outputs	2-wire 4–20 mA , max. 600 Ohm; HART interface, Rt ≥ 250 Ohm
Power Supply	DC 12 to 36 V
Power Consumption	max. 720 mW, overload protected
Connecting	6 x 0,5 mm² shielded cable; Ø 6 mm x 5 m (30 m max.)
Electric shock protection	Class III, low voltage
Standard and Approvals	
General Approvals	CE, UKCA

* Under optimal circumstances of reflection and stabilized transducer temperature

* Under optimal circumstances of reflection and stabilized transducer temperature

Dimensions



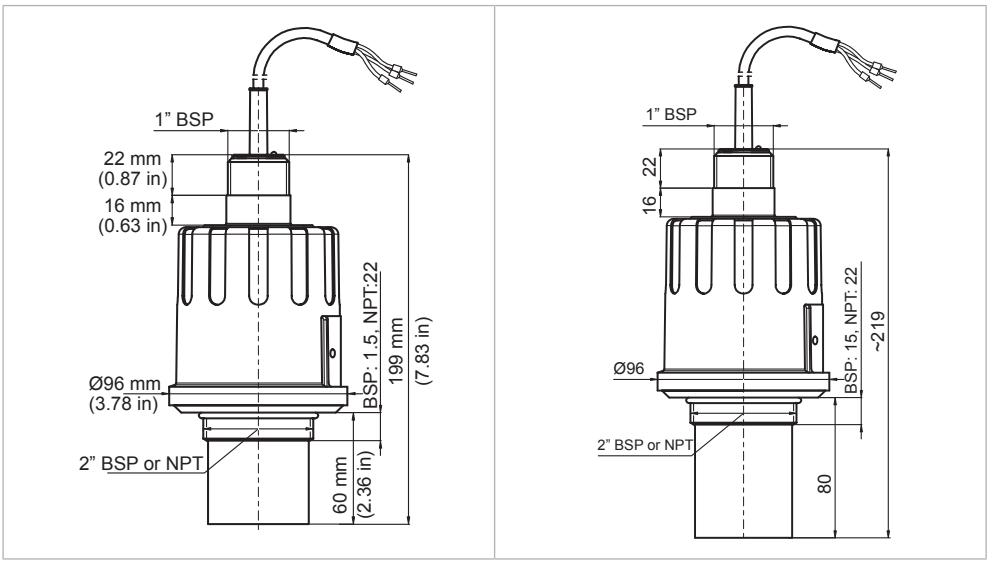
Type 2270-X-XX-6 / 2270-X-XX-8

General		
Type	2270-X-XX-6	2270-X-XX-8
Range	0.25 to 6 m / 0.82 to 20 ft	0.35 to 8 m
Total Beam Angle	5°	7°
Measuring Frequency	80 kHz	50 kHz
Accuracy *	± (0.2 % of measured distance plus 0.05 % of range)	
Resolution	<2 m (6.6 ft): 1 mm (0.04 in.) 2 to 5 m (6.6 to 16.4 ft): 2 mm (0.08 in.) 6 m (19.7): 5 mm (0.2 in.)	
Environmental		
Process Temperature	–30 °C to +90 °C (–22 °F to +194 °F)	
Ambient Temperature	–30 °C to +80 °C (–22 °F to +176 °F)	
Process Pressure (absolute)	0.05 to 0.3 MPa (0.5 to 3 bar) 7.25 psi to 43.5 psi	
Enclosure		
Enclosure and Sensor Material	PP or PVDF	
Cable Material	Cable sealing: EPDM, cable isolation: PVC	
Ingress Protection	IP68 / NEMA 6P	
Process Connection	2" BSP / NPT	
Sealing		
PP sensor	EPDM	
PVDF sensor	FKM	
Electrical		
Outputs	2-wire 4–20 mA , max. 600 Ohm; HART interface, Rt ≥ 250 Ohm	
Power Supply	DC 12 to 36 V	
Power Consumption	max. 720 mW, overload protected	
Connecting	6 x 0,5 mm2 shielded cable; Ø 6 mm x 5 m (30 m max.)	
Electric Shock Protection	Class III, low voltage	
Standard and Approvals		
General Approvals	CE, UKCA	

* Under optimal circumstances of reflection and stabilized transducer temperature

* Under optimal circumstances of reflection and stabilized transducer temperature

Dimensions



Ordering Information

Mfr. Part No.	Code	Description
Versions with NPT thread		
2270-P-1N-4	159 300 169	Range 4 m (13.1 ft), PP body, 4 to 20 mA 2-wire/HART, NPT thread
2270-P-1N-6	159 300 170	Range 6 m (19.7 ft), PP body, 4 to 20 mA 2-wire/HART, NPT thread
2270-P-1N-8	159 300 116	Range 8 m (26.2 ft), PP body, 4 to 20 mA 2-wire/HART, NPT thread
2270-V-1N-4	159 300 176	Range 4 m (13.1 ft), PVDF body, 4 to 20 mA 2-wire/HART, NPT thread
2270-V-1N-6	159 300 177	Range 6 m (19.7 ft), PVDF body, 4 to 20 mA 2-wire/HART, NPT thread
2270-V-1N-8	159 300 117	Range 8 m (26.2 ft), PVDF body, 4 to 20 mA 2-wire/HART, NPT thread
Versions with BSP thread		
2270-P-1B-4	159 300 155	Range 4 m (13.1 ft), PP body, 4 to 20 mA 2-wire/HART, BSP thread
2270-P-1B-6	159 300 156	Range 6 m (19.7 ft), PP body, 4 to 20 mA 2-wire/HART, BSP thread
2270-P-1B-8	159 300 111	Range 8 m (26.2 ft), PP body, 4 to 20 mA 2-wire/HART, BSP thread
2270-V-1B-4	159 300 162	Range 4 m (13.1 ft), PVDF body, 4 to 20 mA 2-wire/HART, BSP thread
2270-V-1B-6	159 300 163	Range 6 m (19.7 ft), PVDF body, 4 to 20 mA 2-wire/HART, BSP thread
2270-V-1B-8	159 300 115	Range 8 m (26.2 ft), PVDF body, 4 to 20 mA 2-wire/HART, BSP thread

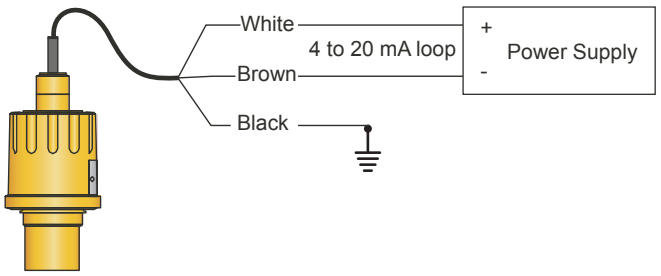


Accessories

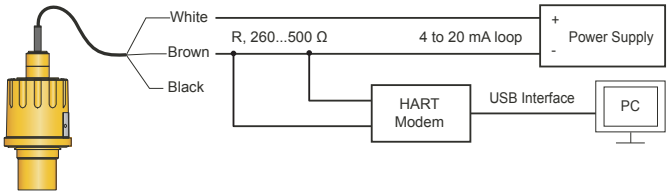
Code	Description
159 300 208	HART - USB Modem
159 300 182	HART - USB Modem, DIN Rail
159 300 183	HART - USB Modem, DIN Rail, ATEX

Wiring

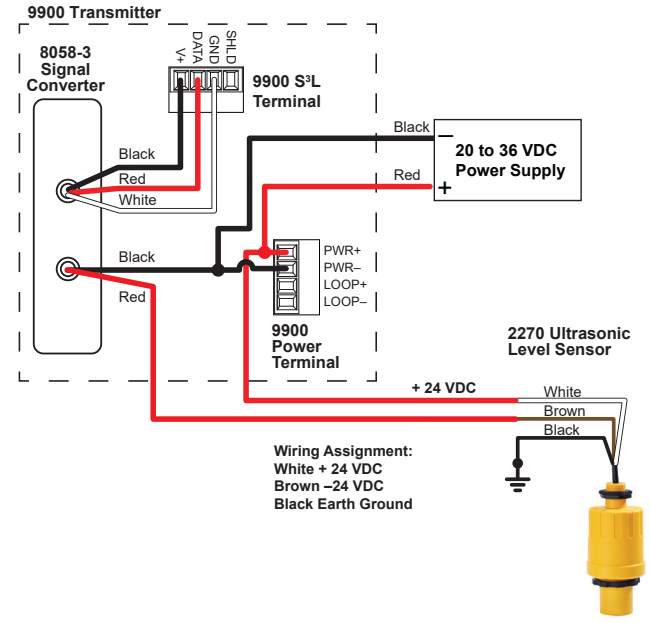
4 to 20 mA Loop Wiring



HART Interface Wiring



Wiring to 9900 Universal Transmitter



Type 2250 Submersible Hydrostatic Level Sensor



Blind Transmitter or Digital (S^3L) Sensor

Product description

The GF 2250 Hydrostatic Level Sensor for level and depth control has a one-piece injection molded PVDF body and ceramic diaphragm for superior compatibility in corrosive liquids. Utilizing hydrostatic pressure, the 2250 disregards false level signals from steam vapors, foam or any other debris on the liquid surface. Two pressure ranges allow for optimal resolution matched to your sensing needs. Solid state circuitry eliminates drift (no internal potentiometers).

These sensors are available with a proprietary digital (S^3L) output, or 4 to 20 mA output. The extended cable and capillary tubing with the union connection and a customer supplied conduit, allow submersion in process vessels.

Benefits/features

- Level and depth measurement
- 4 to 20 mA output or digital (S^3L) output
- Flush ceramic diaphragm
- Easy submersible installation
- Choice of two pressure ranges
- Standard union connection, extended cable and capillary tubing (10 m)

Applications

- Inventory management
- Storage tank monitoring
- Neutralization tanks
- Plating Lines
- Waste Sumps
- Clarifiers
- Overflow Protection

Technical data

Specification

General		
Output		Digital (S^3L) or 4 – 20 mA
Accuracy		±0.5% of full scale @ 25 °C
	-XU	0.001 psi
	-XL	0.01 psi
Response time		< 100 ms

Wetted Materials	
Union and Union Bushing	PVC-U
Sensor housing	PVDF
Diaphragm	Ceramic
Diaphragm seal	FKM

Electronics

Power supply

Digital (S^3L)	5 to 6.5 V DC < 1.5 mA (power supplied by 9900, 9950 and 0486)
4 to 20 mA	12 to 24 V DC ± 10 %, regulated
Cable length	10 m (32.8 ft)
Cable type	3 cond. plus shield, 22 AWG, PVC jacketed, Blk/Red/White/Shld with capillary tube
Digital (S^3L) output	Serial ASCII, TTL level 9'600 bps
	Reverse polarity and short circuit protected

4 – 20 mA output

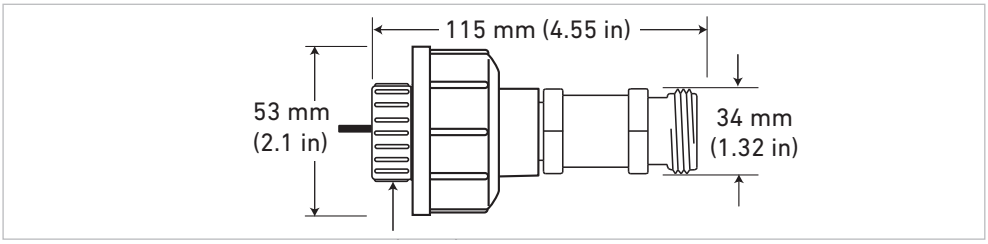
Accuracy	±32 µA
Resolution	< 5 µA
Range	4 to 20 mA, factory-calibrated operating ranges illustrated below
Max. loop impedance	100 Ω at 12 V
	325 Ω at 18 V
	600 Ω at 24 V

Max. temperature/pressure nominal value		
Operating temperature		-15 to +85 °C (5 °F to 185 °F)
Storage temperature		-20 to +100 °C (-4 °F to 212 °F)
Operating pressure	-XU	0 to 0.7 bar (0 to 10 psig)
	-XL	0 to 3.4 bar (0 to 50 psig)
Test pressure	-XU	1.4 bar (20 psig)
	-XL	5.2 bar (75 psig)

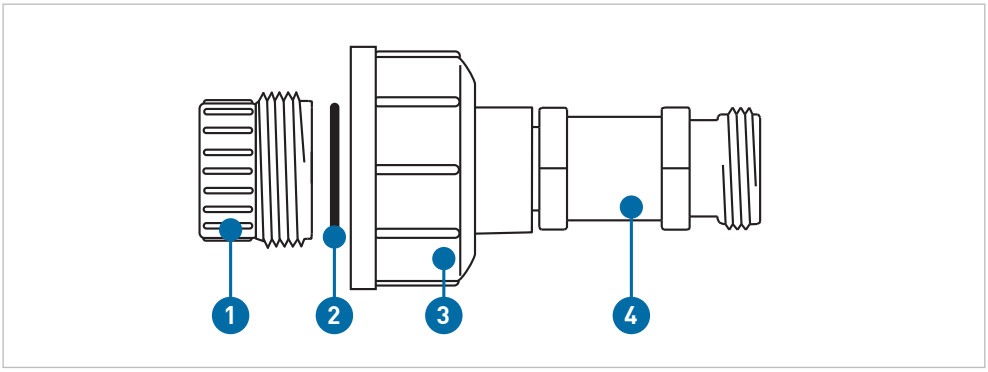
Shipping weight	
0.560 kg	1.23 lb

Standards and approvals
CE, UKCA, FCC
RoHS-compliant, China RoHS
Manufactured under ISO 9001, ISO 14001 and ISO 45001

Dimensions



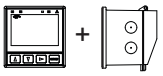
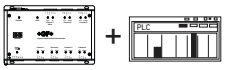
¾ inch (ANSI) or 25 mm (ISO) solvent cement socket connection



1 PVC-U union bushing
2 FKM o-ring
3 PVC-U Union Nut
4 Sensor with end connector

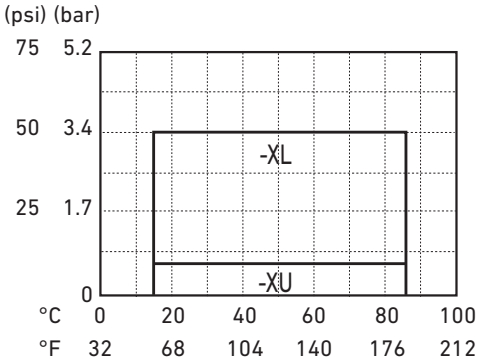
System overview

Submersible Installation

Panel, Wall Mount		4 to 20 mA Output	Automation System
9900 / 9950 Panel Mount 9900 Wall mount		- Customer Supplied Programmable Logic Controller, or - Programmable Automation Controller 	- 0486 Profibus Concentrator and Customer Supplied Programmable Logic Controller or - Programmable Automation Controller 
Customer supplied pipe extension or conduit with pipe assembly			
Type 2250 Submersible Hydrostatic Pressure Sensor with union connection, extended cable and capillary tubing (10 m)*			All sold separately

* Cable must be exposed to the atmosphere

Pressure-temperature diagrams



Please refer to Wiring, Installation, and Accessories sections for more information.

Ordering Information

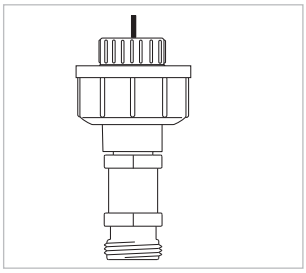
Ordering notes

1. Instrument is sold separately. The following instrument part numbers are compatible with the 2250: 9900 and 9950 transmitters and 0486 Profibus Concentrator.
2. Union mount installs into pipe w/end connector and union nut.

Pressure/fill ranges[1)]
3-2250-XU 0 to 10 psi = 0 to 7.03 m = 0 to 23.06 ft
3-2250-XL 0 to 50 psi = 0 to 35.15 m = 0 to 115.32 ft

[1)] Ranges calculated using specific gravity of water. Maximum range depends on the specific gravity.

Manufacturer's part no.	Code	Sensor output	Operating pressure	Level Range
Hydrostatic Level Sensor with ½ in. union connector and 10 m (32.8 ft) cable				
PVC-U Union Connection - ¾ in. Pipe Connection				
3-2250-11L	159 000 241	Digital (S^3L)	0 – 3.4 bar (0-50 psi)	35 m (115 ft)
3-2250-11U	159 001 242	Digital (S^3L)	0 – 0.7 bar (0-10 psi)	7 m (23 ft)
3-2250-21L	159 001 247	NPT, current loop (4 to 20 mA)	0 – 3.4 bar (0-50 psi)	35 m (115 ft)
3-2250-21U	159 001 248	NPT, current loop (4 to 20 mA)	0 – 0.7 bar (0-10 psi)	7 m (23 ft)
PVC-U Union Connection - Metric Pipe Connector				
3-2250-11U-1	159 001 478	ISO, digital (S^3L)	0 - 0.7 bar (0-10 psi)	7 m (23 ft)
3-2250-11L-1	159 001 479	ISO, digital (S^3L)	0 - 3.4 bar (0-50 psi)	35 m (115 ft)
3-2250-21U-1	159 001 482	ISO, current (4 to 20 mA)	0 - 0.7 bar (0-10 psi)	7 m (23 ft)
3-2250-21L-1	159 001 483	ISO, current (4 to 20 mA)	0 - 3.4 bar (0-50 psi)	35 m (115 ft)



Accessories and Replacement Parts

Manufacturer's part no.	Part no.	Description
3-8052	159 000 188	¾ in. Integral Mounting Kit
3-8052-1	159 000 755	¾ in. NPT mount junction box with one liquid tight connector and cap with junction terminals
3-8050	159 000 184	Universal Mount Kit
3-8050-1	159 000 753	Universal Mount Junction Box
3-9000.392-1	159 000 839	Liquid Tight Connector Kit, NPT (1 connector)
3-9000.392-2	159 000 841	Liquid Tight Connector Kit, PG 13.5 (1 connector)
3-0252	159 001 808	Configuration Tool

Pressure and Temperature

Content

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Temperature **511**

Planning Fundamentals

of Measurement and Control

Pressure

Content

Introduction 495
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Diaphragm Gauge Guard type Z500/Z501 507

Introduction

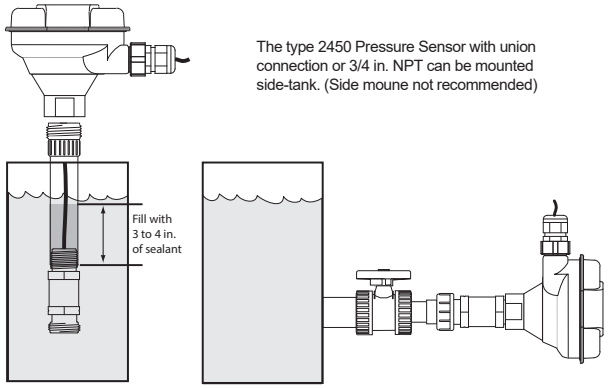
Pressure Sensors Specification Matrix

		2450
		
Output		Digital (S3L) or 4 to 20 mA
Pressure range		0 to 7 bar (0 to 10 psig)
		0 to 3.4 bar (0 to 50 psig)
		0 to 17 bar (0 to 250 psig)
Response Time, τ		< 100 ms
Repeatability		±0.5% of full scale @ 25 °C
Operating Temperature		-15 °C to 85 °C (5 °F to 185 °F)
Wetted Materials	Body	PVDF
	Diaphragm	Ceramic
	Diaphragm Seal and Union O-ring	FKM
Electrical connection		cable
Compatible GF Instruments		9900 using conductivity module 9950 using single or dual channel conductivity module
Applications Usage		Level or Depth Sensing, HVAC, Scrubber Systems, Pump Protection, Water Management, Irrigation Systems, Wastewater, Chemical Processing, Pressure Regulation/Monitoring
Standards and Approvals		RoHS compliant, China RoHS

Pressure Sensors Technical Basics

Submersible Installation

- Use the 2450 and 2250 sensors with 4.6 m (15 ft) cable and 10 m (32.8 ft).
- Mount the sensor to an extension pipe or watertight conduit using thread sealant.
- Use a cable gland at the top of the extension to prevent moisture accumulation inside the pipe.
- For 2450 sensors: DO NOT hermetically seal (i.e. applying silicone sealant or epoxy) the back of sensor. This may introduce measurement errors resulting from changes in atmospheric pressure and/or temperature. Instead, use a 2250 which has an extended atmospheric breather tube (same length of sensor cable). Do not to pinch breather tube.



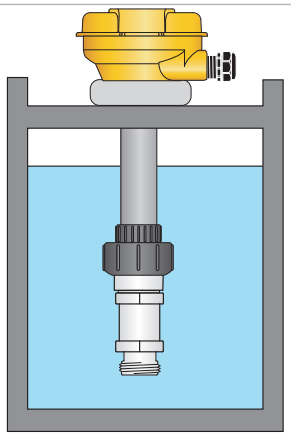
Type 2450 Pressure Sensor

In-Line Installation

- The 2450 can be mounted in a pipe-tee using the threads closest to the sensing end.
- The sensor can be mounted with or without an integral mount kit. This kit mounts a junction box or an instrument.
- See below for more information on instrument integral mount and junction box/remote mount examples.

Installation Tips

8050-1 and 8050-2 junction boxes can be useful for this installation option.



Type 2250 Hydrostatic Level Sensor

Integral Assembly

The 3-8052 Integral Kit connects the 8450 Pressure Transmitter directly onto the 2450 sensors.

- Use the 2450 sensor with 15.2 cm (6 in.) cable and digital (S^3L) output.
- Apply sealant or PTFE tape to the process connection threads, after inspecting threads to ensure integrity. Do not install a sensor with damaged threads.
- Tighten the sensor 1½ turns past finger tight into the process connection.

Remote Assembly

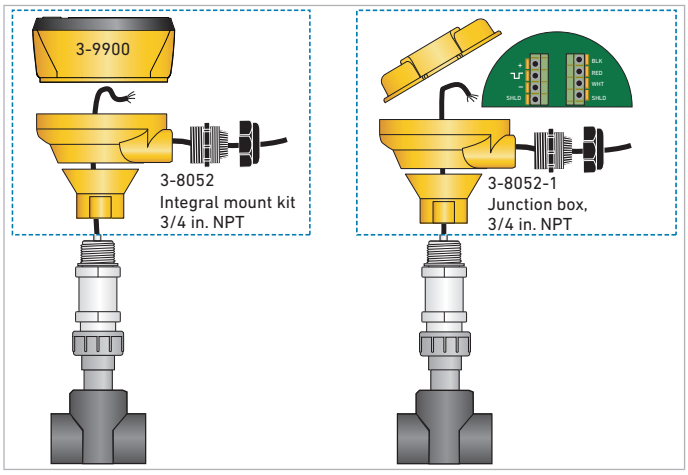
The optional 3-8052-1 Integral Kit with Junction Box and ¾ in. NPT sensor connection provides a convenient terminal point to extend the 2450 and 2250 cable over a distance.

The kit includes:

- ¾ in. NPT sensor connection
- Conduit base and cap with junction terminals
- 3-9000.392-1 liquid tight connector, ½ in. NPT

Installation Tips

Sensors can be mounted into any DN20 (¾ in) FNPT pipe tee (customer supplied)



The in-line 2450 pressure sensor with union connection can be mounted using GF parts. See below for list of GF Part Numbers.

Union Matrix for Pressure Sensor 3-2450 ½ in. (DN15) Union Connection

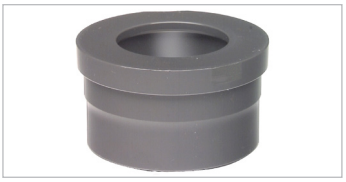
Nuts

Material	Part Number
PVC	721 690 006
PVC-C	723 690 006
PVDF	735 690 406
PP	727 690 406

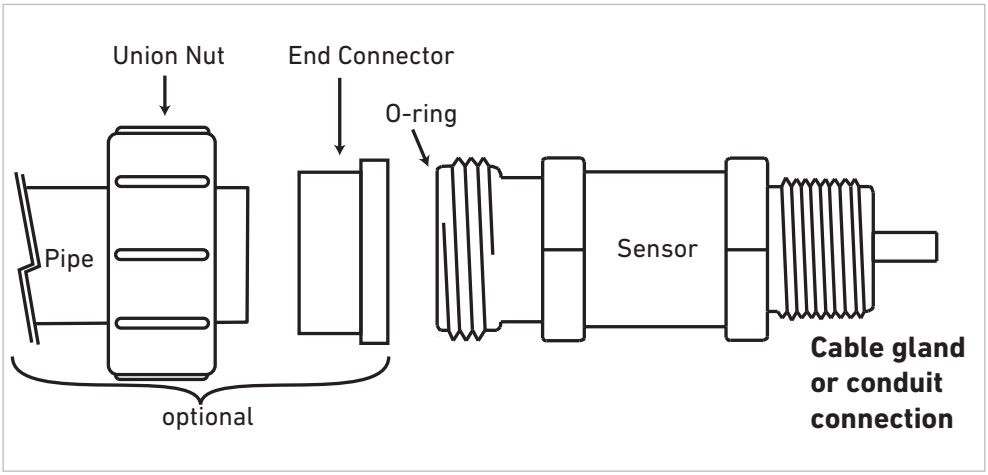


End Connector

Material	Part Number	Description
PVC	721 500 106	Union end metric socket
PVC	721 602 006	Union end IPS socket
PVC	721 602 656	Union end NPT thread
PVC-C	723 602 006	Union end socket
PP-H	727 508 506	Union end butt
PP-H	727 500 106	Union end socket
PP-H	157 203 603	Union end threaded NPT
PP-N	728 608 506	Union end butt
PVDF	735 608 606	Union end butt
PVDF	735 600 106	Union end socket
PVDF	198 203 611	Union end threaded







Type 2450 Pressure Sensor

1/2 in. union mount



Blind transmitter or digital (S^3L) sensor

Product description

The type 2450 Pressure Sensor has a one-piece injection molded PVDF body and ceramic diaphragm for superior compatibility in corrosive liquids. Three pressure versions allow for optimal resolution matched to your sensing needs. Solid state circuitry eliminates drift (no internal potentiometers).

These sensors are available with a proprietary digital (S3L) output, or field-scaleable 4 to 20 mA output.Dual-threaded ends allow submersion in process vessels or in-line installation with conduit connection, Integral adapters (sold separately) may be used to create a compact assembly with a field mount style of the GF 9900 Transmitter.

Features

- Test certificate included
- 4 to 20 mA or digital (S^3L) output
- ½ in. male union process connection
- One-piece injection molded PVDF body
- Flush ceramic diaphragm
- Easy installation
- Choice of three pressure ranges
- Pressure or level measurement
- NEMA 4X/IP65 rated when using the 3-8052-1

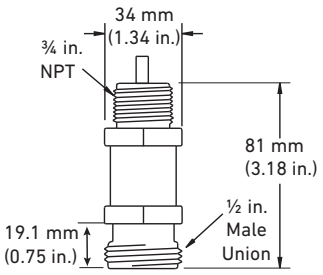
Applications

- HVAC
- Scrubber Systems
- Pump Protection
- Water Management
- Irrigation Systems
- Wastewater
- Chemical Processing
- Pressure Regulation/Monitoring

Technical Details

General		
Output	Digital (S^3L) or 4 to 20 mA	
Accuracy		
For all pressure ranges	±0.5% of full scale @ 25 °C	
Response time	< 100 ms	
Process connection	½ in. union male thread (requires end connector and union nut)	
	(See installation section for end connector and nut recommendation)	
Cable-end connection	¾ in. NPT male thread	
Wetted materials		
Sensor housing	PVDF	
Diaphragm	Ceramic	
Diaphragm seal and union O-ring	FKM	
Electrical		
Power requirements		
Digital (S^3L)	5 to 6.5 VDC < 1.5 mA	
4 to 20 mA	12 to 24 VDC ±10%, regulated	
Cable length	4.6 m	15 ft
Cable type	3 cond. + shield, 22 AWG, PVC jacketed, Blk/Red/White/Shld	
Digital (S^3L) output	Serial ASCII, TTL level 9600 bps.	
	Reverse polarity and short circuit protected.	
4 to 20 mA output		
Accuracy	±32 µA	
Resolution	< 5 µA	
Span	4 to 20 mA factory calibrated to operating ranges shown below	
Max. loop impedance	100 Ω @ 12 V	
	325 Ω @ 18 V	
	600 Ω @ 24 V	
Max. Temperature/Pressure rating		
Operating temperature	-15 °C to 85 °C	5 °F to 185 °F
Storage temperature	-20 °C to 100 °C	-4 °F to 212 °F
Operating pressure		
-XU	0 to 0.7 bar	0 to 10 psi
-XL	0 to 3.4 bar	0 to 50 psi
-XH	0 to 17 bar	0 to 250 psi
Vacuum range		
-XU	-0.1 to 0.7 bar	-1.5 to 10 psi
-XL	-0.41 to 3.4 bar	-6 to 50 psi
-XH	-0.96 to 17.2 bar	-14.6 to 250 psi
Proof pressure		
-XU	1.4 bar	20 psig
-XL	5.2 bar	75 psig
-XH	20.7 bar	300 psig
Shipping weight		
	0.150 kg	0.33 lb
Standards and Approvals		
CE, UKCA, FCC		
RoHS compliant, China RoHS		
Manufactured under ISO 9001, ISO 14001 and ISO 45001		

Dimensions

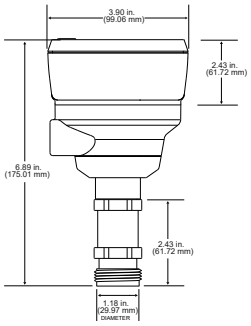


3-2450-3X, -7X

Pressure Instrument
Sold separately

3-8052
Integral
Mount Kit
Sold separately

3-2450-XX
Pressure
Sensor



Pressure Integral Systems with 9900 Transmitter

System Overview

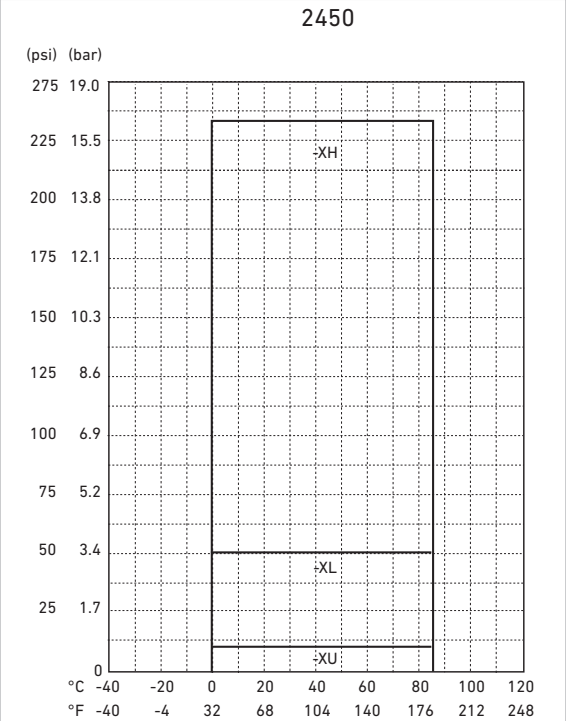
Panel Mount	Pipe, Tank, Wall Mount	Field Mount	4 to 20 mA Output	Automation System
GF Instruments - 9900 - 9950	GF Instruments* - 9900-1P with Rear Enclosure - 9900-1 with 3-8050 Universal Mount Kit*	GF Instruments with 3-8052 Integral Mount Kit - 9900	- Customer Supplied Chart Recorder, Programmable Logic Controller or - Programmable Automation Controller	- 0486 Profibus Concentrator and Customer Supplied Programmable Logic Controller or - Programmable Automation Controller
Type 2450 Pressure Sensor				
In-Line Installation - Fittings Customer Supplied				All sold separately

* The capillary tube located at the rear of the sensor must be exposed to the atmosphere.

Pressure-temperature diagram

Note

The pressure-temperature diagrams are specifically for the GF sensor. During system design the specifications of all components must be considered. In the case of a metal piping system, a plastic sensor will reduce the system specification. When using a PVDF sensor in a PVC piping system, the fitting will reduce the system specification.



Application Tips

- Keep sensor out of direct sunlight.
- To extend the cable, use a 3-conductor shielded cable & junction box.
- For submersible sensor mounting, always use the 3-2250 Submersible Hydrostatic Pressure Sensor.
- EPDM available contact special order.

Ordering Information

Mfr. Part No.	Code	Pressure range	Output	O-ring	Cable length
Pressure range 0 to 0.7 bar (0 to 10 psi)					
3-2450-3U	159 000 683	0 to 0.7 bar (0 to 10 psi)	Digital (S³L)	FPM	4.6 m (15 ft)
3-2450-7U	159 000 906	0 to 0.7 bar (0 to 10 psi)	Current (4 to 20 mA)	FPM	4.6 m (15 ft)
3-2450-7U-025	159 070 005	0 to 0.7 bar (0 to 10 psi)	Current (4 to 20 mA)	FPM	7.6 m (25 ft)
3-2450-7U-1	159 001 883	0 to 0.7 bar (0 to 10 psi)	Current (4 to 20 mA)	EPR (EPDM)	4.6 m (15 ft)
3-2450-7U-E-025	159 070 006	0 to 0.7 bar (0 to 10 psi)	Current (4 to 20 mA)	EPR (EPDM)	7.6 m (25 ft)
Pressure range 0 to 3.4 bar (0 to 50 psi)					
3-2450-3L	159 000 682	0 to 3.4 bar (0 to 50 psi)	Digital (S³L)	FPM	4.6 m (15 ft)
3-2450-7L	159 000 908	0 to 3.4 bar (0 to 50 psi)	Current (4 to 20 mA)	FPM	4.6 m (15 ft)
3-2450-7L-025	159 070 007	0 to 3.4 bar (0 to 50 psi)	Current (4 to 20 mA)	FPM	7.6 m (25 ft)
3-2450-7L-050	159 070 008	0 to 3.4 bar (0 to 50 psi)	Current (4 to 20 mA)	FPM	15.2 m (50 ft)
3-2450-7L-1	159 001 884	0 to 3.4 bar (0 to 50 psi)	Current (4 to 20 mA)	EPR (EPDM)	4.6 m (15 ft)
Pressure range 0 to 17 bar (0 to 250 psi)					
3-2450-3H	159 000 681	0 to 17 bar (0 to 250 psi)	Digital (S³L)	FPM	4.6 m (15 ft)
3-2450-7H	159 000 910	0 to 17 bar (0 to 250 psi)	Current (4 to 20 mA)	FPM	4.6 m (15 ft)
3-2450-7H-1	159 001 885	0 to 17 bar (0 to 250 psi)	Current (4 to 20 mA)	EPR (EPDM)	4.6 m (15 ft)







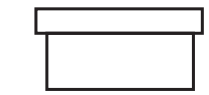
Additional ordering information

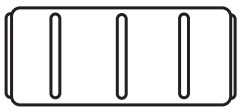
Additional possible configurations are listed below. For variants, combinations, and orders, please contact the local GF sales company.

Example Part Number **3-2450-7U-100**	**Pressure range**	**O-ring Material**	**Cable Length**
3-2450-7		**-**	
Pressure range			
0 to 0.7 bar (0 to 10 psi)	**U**		
0 to 3.4 bar (0 to 50 psi)	**L**		
0 to 17 bar (0 to 250 psi)	**H**		
O-ring Material			
FPM		**-**	
EPR (EPDM)		**1**	
Cable Length			
7.6 m (25 ft)			**025**
15.2 m (50 ft)			**050**
22.8 m (75 ft)			**075**
30.5 m (100 ft)			**100**

Union Matrix for Pressure Sensor 3-2450 ½ in. Union Connection

Material	Code	Description
End connector		
PVC	721 500 106	Union end metric socket
PVC	721 602 006	Union end IPS socket
PVC	721 602 656	Union end NPT thread
PVC-C	723 602 006	Union end socket
PP-H	727 508 506	Union end butt
PP-H	727 500 106	Union end socket
PP-H	157 203 603	Union end threaded NPT
PP-N	728 608 506	Union end butt
PVDF	735 608 606	Union end butt
PVDF	735 600 106	Union end socket
PVDF	198 203 611	Union end threaded
Nuts		
PVC	721 890 006	PVC nut
PVC-C	723 690 006	PVC-C nut
PVDF	735 690 406	PVDF nut
PP	727 890 406	Poly Pro nut





Accessories

Mfr. Part	Code	Description
5523-0322	159 000 761	Sensor cable (per ft), 3 cond. plus shield, 22 AWG
3-8052	159 000 188	¾ in. Integral mounting kit
3-8052-1	159 000 755	¾ in. NPT mount junction box with one liquid tight connector and cap with junction terminals (NEMA 4X/ IP65 rated)
3-9000.392-1	159 000 839	Liquid tight connector kit, NPT (1 connector)
3-9000.392-2	159 000 841	Liquid tight connector kit, PG 13.5 (1 connector)
3-9900.396	159 001 701	Angle Adjustment Adapter Kit (for Field Mounting)
3-0252	159 001 808	Configuration tool
3-2450-A		1/2 in. union to a 3/4 in. NPT adapter
3-2450-GG		Guage Guard with PVDF body and ½ in. union adapter. Must be used with the 3-2450-A

Pressure Integral Systems with type 9900 Transmitter

Member of the SmartPro® Family of Instruments



Product description

GF has combined the type 9900 SmartPro® Transmitter with the 2450 Pressure sensors to create integral systems for level applications that are easy to order and simple to install. Also available in conductivity, temperature, and flow configurations, each integral system features a 9900 Transmitter which provides a local and easy to read LCD display. The push button keypad makes it easy to navigate through the transmitter's menu.

The integral system offers a local display, a scalable 4 to 20 mA output and open collector for process control. A 2450 Pressure sensor with wetted material of ceramic and PVDF installs into a ½" union fitting. The 2450 Pressure sensor is offered in three pressure ranges.

Features

- Utilizes the 2450 sensor for pressure measurement
- Local integral display
- Provides 4 to 20 mA output
- "At a glance" visibility
- "Dial-type" digital bar graph
- NEMA 4X/IP65

Applications

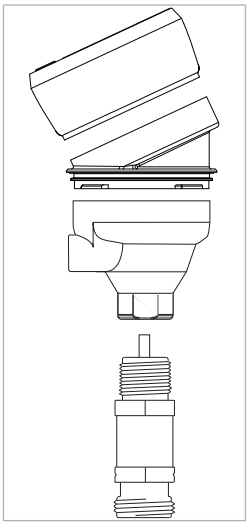
- Water Quality
- Filtration Systems
- Chemical Production
- Liquid Delivery Systems
- Media Filtration
- Reverse Osmosis Systems

Technical Details

See individual transmitter and sensor product pages for more information.

Sensor can be mounted through the side of a tank for hydrostatic level measurement. Tip: Add a ball valve to isolate the sensor from the tank to allow the removal of the sensor for service.

Pressure/Level Ranges*:	
3-2250-XU	0 to 10 psi = 0 to 7.03 meters = 0 to 23.06 ft
3-2250-XL	0 to 50 psi = 0 to 35.15 meters = 0 to 115.32 ft



3-9900
Instrument

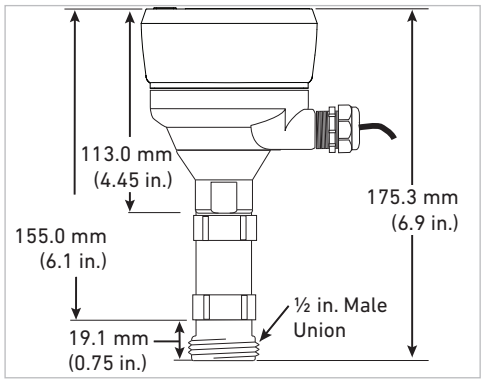
3-9900-396
Angle Adjustment Adapter Kit
(optional accessory)

3-8052
Integral Mount Kit

3-2450-3X
Pressure Sensor

Do not use the 2450 Pressure sensor mounted inside a tank. For all tank installations where the sensor is mounted inside a tank, use 3-2250 Hydrostatic Level sensor only.

Dimensions



System Overview

Integral Installation

Type 9900 Transmitter
with 3-8052 Integral Adapter Kit



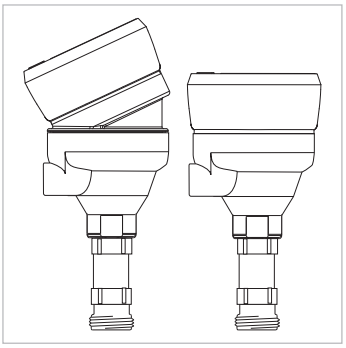
Type 2450
Pressure Sensor



Customer supplied standard ¾ in fittings

Ordering Information

Mfr. Part No./Code	Instrument + Sensor	Description
159 002 228	3-9900-1 + 3-2450-3U	Type 9900 transmitter + angle adjustment adapter kit + pressure sensor 0 - 0.7 bar (0 - 10 psi), ½ in. Union process connection
159 002 229	3-9900-1 + 3-2450-3L	Type 9900 transmitter + angle adjustment adapter kit + pressure sensor 0 - 3.4 bar (0 - 50 psi), ½ in. Union process connection
159 002 245	3-9900-1 + 3-2450-3H	Type 9900 transmitter + angle adjustment adapter kit + pressure sensor 0 - 17 bar (0 - 250 psi), ½ in. Union process connection
159 001 726*	3-9900-1 + 3-2450-3U	Type 9900 transmitter + angle adjustment adapter kit + pressure sensor 0 - 0.7 bar (0 - 10 psi), ½ in. Union process connection
159 001 727*	3-9900-1 + 3-2450-3L	Type 9900 transmitter + pressure sensor 0 - 3.4 bar (0 - 50 psi), ½ in. Union process connection
159 001 728*	3-9900-1 + 3-2450-3H	Type 9900 transmitter + pressure sensor 0 - 17 bar (0 - 250 psi), ½ in. Union process connection



*Only available in Europe.

Accessories

Mfr. Part	Code	Description
3-9900.396	159 001 701	Angle adjustment adapter kit

Diaphragm Gauge Guard type Z500/Z501



Type Z500
With manometer



Type Z501
Without manometer

Product description

The diaphragm-protected gauge guard Z500/Z501 is used when measuring the pressure of neutral and corrosive media.

Function

The manometer is separated from the medium by a TFM-coated EPDM-support diaphragm. The line pressure is transferred to the manometer via a buffer fluid.

The large area of the diaphragm and the low compressibility of the buffer fluid ensure an accurate display. The large number of possible materials makes for a wide range of areas of application.

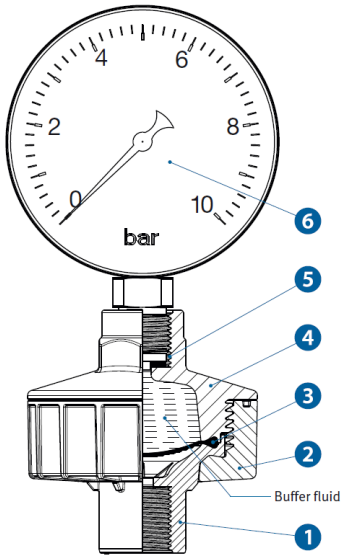
Applications

- Chemical Process Industry
- Food and beverages
- Water treatment
- Cooling
- Ship building

Benefits/features

- All parts which come into contact with the medium are made of highly resistant plastics
- The manometer does not come into contact with the medium
- The gauge guard is low-maintenance and can be installed in any position
- Large diaphragm surface ensures high accuracy
- The new construction of the diaphragm gauge guard makes turning the diaphragms impossible, which guarantees an extremely precise transfer of pressure
- The new design guarantees an even sealing force on the diaphragms
- Various pipe connections are possible by exchanging the lower part

Technical data



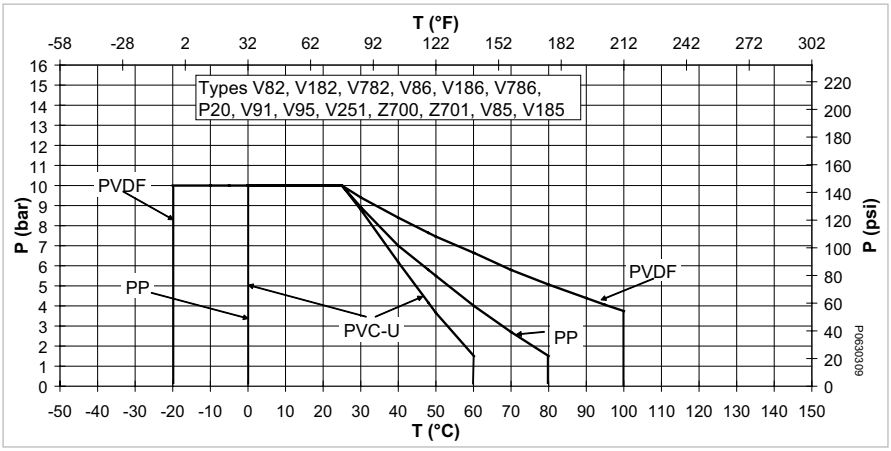
1 Lower part (PP, PVC and PVDF)
2 Coupling nut
3 Diaphragms EPDM/TFM
4 Upper part (PP GF)
5 Manometer gasket
6 Manometer

Specification	
Dimensions	d25/DN20 – d32/DN25, ¾" – 1"
Lower part materials	PVC-U, PP-H, PVDF
Upper part material	PP-GF30
Gasket materials	PTFE
Buffer fluid	Glysantin (DI water upon request)
Pressure level	PN10 (10 bar@ 20°C | 150 psi@ 68°F)
Manometer ranges	0 – 10 bar with R ¼" and with R ½"
	0 – 6 bar with R ¼" and with R ½"
Manometer connections	G ¼" for d25 with 63 mm diameter
	G ½" for d32 with 100 mm diameter
Connection spigots	d25 with manometer adaptor socket R ¼" with inner thread G ¼"
	d32 with manometer adaptor socket R ½" with inner thread G ½"
	Other connections on request

Pressure-temperature diagrams

PVC-U, PP-H, PVDF

The pressure-temperature diagrams are based on a lifetime of 25 years and water or similar media.



T Temperature (°C, °F)
P Permissible pressure (bar, psi)

Technical basics

Handling

Filling with buffer fluid

- Fill the upper part of the diaphragm gauge guard Z500/Z501 up to the lower edge of the thread, preferably with Glysantin or distilled water
- Slightly move the diaphragm from below using a blunt object until no more air bubbles appear.
- Screw in the manometer.
- If the manometer then already displays a low pressure, some buffer fluid must be removed until no pressure display can be be seen.

Installation notes

- Install the diaphragm gauge guard vertically with upstream threaded connection and shut-off valve. This guarantees that the manometer can also be moved into the desired reading position at a later stage and be exchanged without any problems (without turning off the system pressure).
- The diaphragm gauge guard may only be tightened using the hexagon on the housing or on the lower pipe socket using a strap wrench.
- In general, all commercially available manometers can be installed.

Maintenance notes

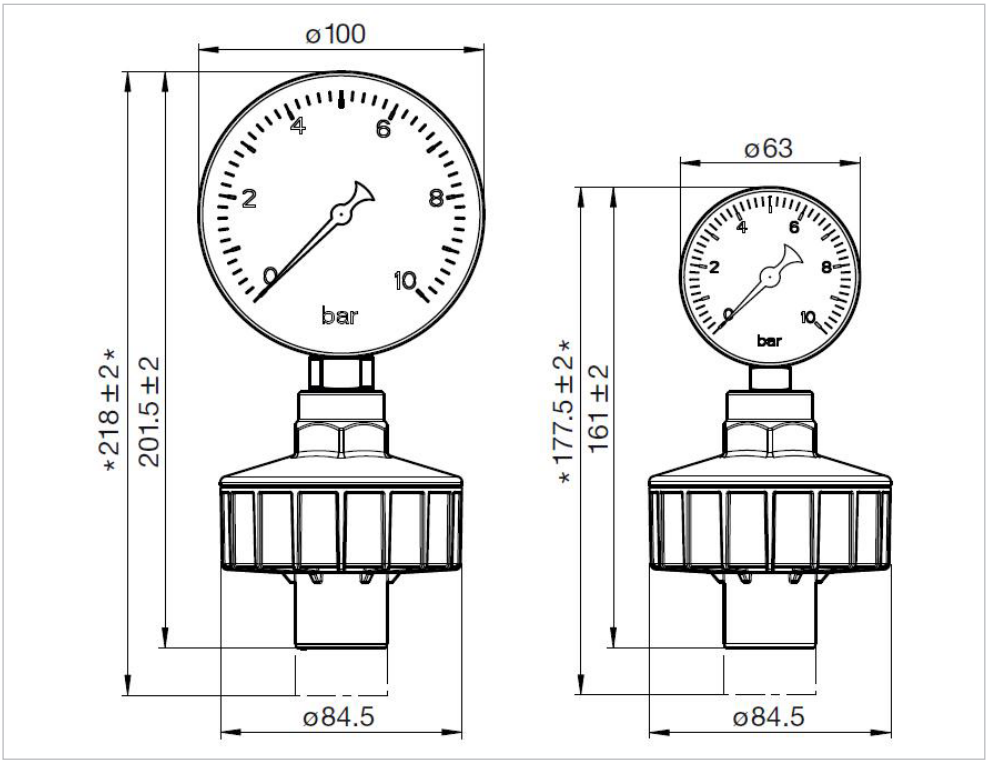
The diaphragm gauge guards are largely maintenance-free. It may be necessary to check whether a sufficient amount of buffer fluid is present.

⚠ Installation and maintenance must be performed in accordance with the corresponding installation manual. The installation manual is provided with the product, see also the online product catalogue at www.gfps.com.

Tips for installation

Distilled water in particular evaporates very easily at higher temperature, and therefore the buffer fluid may evaporate after years in service. If this happens, top up the buffer fluid.

Dimensions



Planning Fundamentals

of Measurement and Control

Temperature

Content

Introduction 512
Type 2350 Temperature Sensor 514
Temperature Integral System with type 9900 Transmitter 519

Introduction

Temperature Sensors Specification Matrix

	2350
	
Output	Digital (S3L) or 4 to 20 mA
Operating Temperature	-10 °C to 100 °C (14 °F to 212 °F)
Accuracy	±0.5 °C (±0.9 °F)
Response Time, τ	10 seconds
Repeatability	±0.1 °C (±0.2 °F)
Resolution	0.01 °C (0.02 °F)
Wetted Materials (Body)	PVDF
Electrical connection	cable
Compatible GF Instruments	9900 using conductivity module 9950 using single or dual channel conductivity module
Applications Usage	Plating Bath Temperature Control, Heat Exchange Monito, R.O. and D.I. System Monitor, Hot/Cold Mixing System Monitor, Data Acquisition, Cooling Loops, Effluent Monitoring, HVAC, Chemical Processing
Standards and Approvals	RoHS compliant, China RoHS

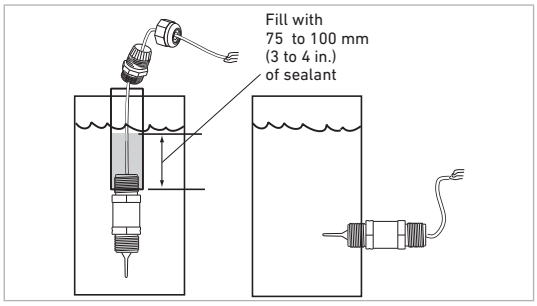
Temperature Sensors Technical Basics

Submersible Installation

- Use the 2350 sensor with 4.6 m (15 ft) cable.
- Mount the sensor to an extension pipe or watertight conduit using thread sealant.
- Use a cable gland at the top of the extension to prevent moisture intrusion/accumulation inside the pipe.
- For additional defense against possible accumulation of condensation at the back seal area of the sensor, fill the lower 75-100 mm (3-4 inches) of conduit or extension pipe with a flexible sealant such as silicone.

Installation Tips

8050-1 and 8052-1 junction boxes can be useful for this installation option.



In-Line Installation

- The 2350 can be mounted in a pipe-tee using the threads closest to the sensing end.
- The sensor can be mounted with or without an integral kit. This kit mounts a junction box to an instrument.
- See below for more information on instrument integral mount and junction box/remote mount examples.

Integral Assembly

- The 3-8052 Integral Kit connects the 9900 Temperature Transmitter directly onto the 2350 sensor.
- Apply sealant or PTFE tape to the process connection threads, after inspecting threads to ensure integrity. Do not install a sensor with damaged threads.
- Tighten the sensor 1½ turns past finger tight into the process connection.

Remote Assembly

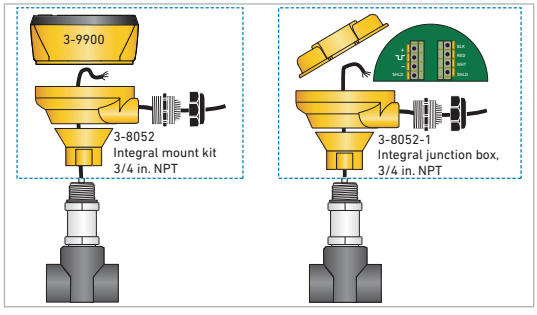
- The optional 3-8052-1 Integral Junction Box with ¾ in. process connection offers a convenient terminal point to extend the 2350 cable over a distance.

The kit includes:

- ¾ in. NPT process connection
- Conduit base and cap with junction terminals
- 3-9000.392-1 liquid tight connector, ½ in. NPT
- Apply sealant or PTFE tape to the process connection threads, after inspecting threads to ensure integrity. Do not install a sensor with damaged threads.
- Tighten the sensor 1½ turns past finger tight into the process connection.

Installation Tips

Sensors can be mounted into any DN20 (¾ in.) FNPT pipe tee (customer supplied)



Type 2350 Temperature Sensor

Blind Transmitter or Digital (S^3L) Sensor



Product description

The type 2350 Temperature Sensor has a one piece injection molded PVDF body that is ideal for use in high purity applications. It also outlasts metal sensors in aggressive liquids and eliminates the need for costly custom thermowells. These sensors are available with a proprietary digital (S^3L) output or field-scaleable 4 to 20 mA output.

Dual threaded ends (¾ in. NPT) allow submersion in process vessels, or in-line installation with conduit connection. An integral adapter kit (sold separately) may be used to create a compact assembly with field mount versions of the type 9900 Transmitter.

Features

- 4 to 20 mA or digital (S3L) output
- Standard ¾ in. NPT process connection
- One-piece injection molded PVDF body
- Pt1000 platinum RTD in extended tip for quick response
- Easy installation
- Threaded for in-line or submersible installation

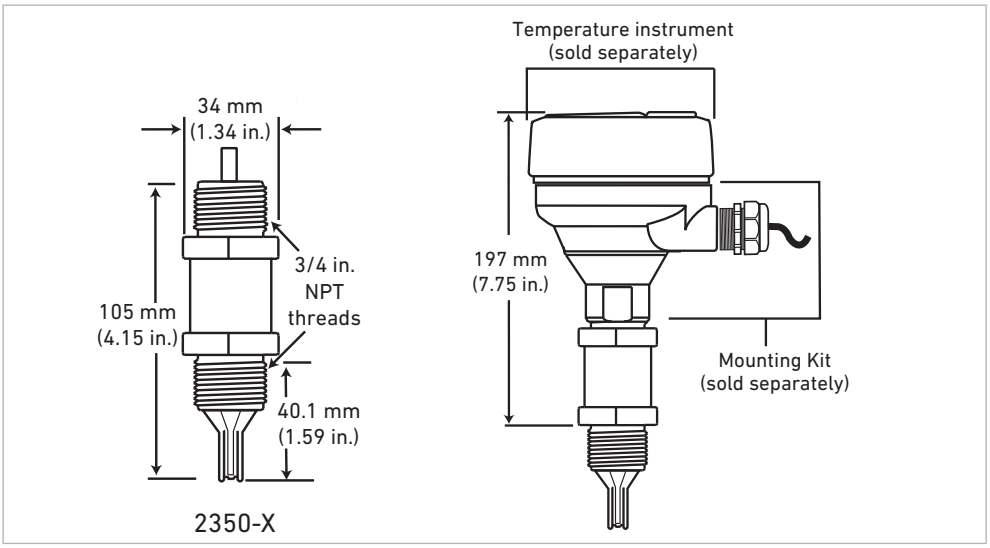
Applications

- Plating Bath Temperature Control
- Heat Exchange Monitor
- R.O. and D.I. System Monitor
- Hot/Cold Mixing System Monitor
- Data Acquisition
- Cooling Loops
- Effluent Monitoring
- HVAC
- Chemical Processing

Technical Details

General		
Output	Digital (S^3L) output or 4 to 20 mA	
Accuracy	±0.5 °C (±0.9 °F)	
Response Time	10 seconds	
Repeatability	±0.1 °C (±0.2 °F)	
Resolution	0.01 °C (0.02 °F)	
Sensing-End Connection	¾ in. NPT male thread	
Cable-End Connection	¾ in. NPT male thread	
Wetted Materials		
Sensor Housing	PVDF	
Electrical		
Power Requirements		
Digital (S^3L)	5 to 6.5 VDC ±10 %, <1.5 mA	
4 to 20 mA	12 to 24 VDC ±10 %, regulated	
Cable Length	4.6 m (15 ft) cable length can also be extended up to 121 m (400 ft)	
Digital (S^3L) Output	Serial ASCII, TTL Level 9600 bps.	
	Reverse polarity and short circuit protected.	
4 to 20 mA Output		
Accuracy	±32 µA	
Resolution	<5 µA	
Span	4 to 20 mA factory calibrated 0 °C to 100 °C (32 °F to 212 °F)	
Max. Loop Impedance	50 Ω @ 12 V	
	325 Ω @ 18 V	
	600 Ω @ 24 V	
Update Rate	<100 ms	
Max. Temperature/Pressure Rating		
Operating Temperature		
In-line Mounting	-10 °C @ 16 bar to 100 °C @ 7.5 bar	14 °F @ 232 psi to 212 °F @ 108 psi
Submersible Mounting	-10 °C @ 16 bar to 100 °C @ 7.5 bar	14 °F @ 232 psi to 185 °F @ 108 psi
Storage Temperature	-55 °C to 100 °C	-67 °F to 212 °F
Relative Humidity	0 to 95% non-condensing	
Shipping Weight		
	0.22 kg	0.5 lb
Standards and Approvals		
CE, UKCA, FCC		
RoHS compliant, China RoHS		
Manufactured under ISO 9001, ISO 14001, and ISO 45001		

Dimensions



System Overview

In-Line Installation

Panel Mount	Pipe, Tank, Wall Mount	Field Mount	4 to 20 mA Output	Automation System
GF Instruments - 9900 - 9950	GF Instruments* - 9900-1P with Rear Enclosure - 9900-1 with 3-8050 Universal Mount Kit*	GF Instruments with 3-8052 Integral Mount Kit - 9900	- Customer Supplied Chart Recorder, Programmable Logic Controller or - Programmable Automation Controller	- 0486 Profibus Concentrator and Customer Supplied Programmable Logic Controller or - Programmable Automation Controller
Type 2350 Temperature Sensor				
In-Line Installation - Fittings Customer Supplied				All sold separately

Submersible Installation

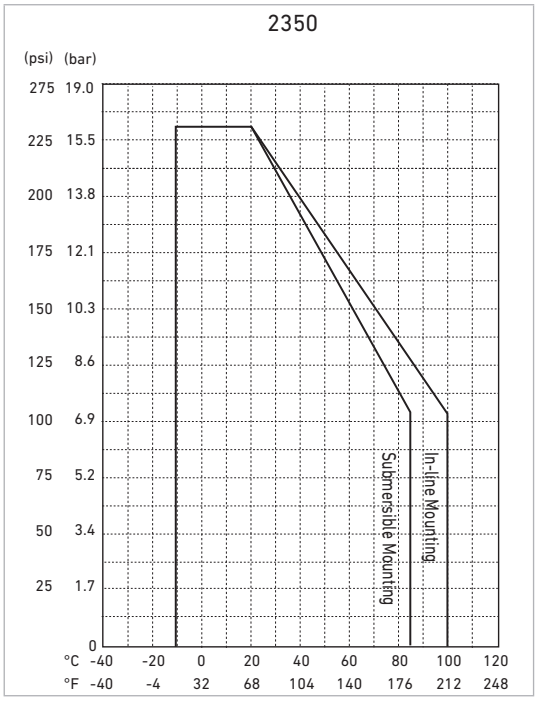
Panel Mount	Pipe, Tank, Wall Mount		4 to 20 mA Output	Automation System
GF Instruments - 9900 - 9950	GF Instruments* - 9900-1P with Rear Enclosure - 9900-1 with 3-8050 Universal Mount Kit or 3-8052 Integral Mount Kit and Pipe Extension or Conduit with 3/4 in. FNPT Threads**		- Customer Supplied Chart Recorder Programmable Logic Controller or - Programmable Automation Controller	- 0486 Profibus Concentrator and Customer Supplied Programmable Logic Controller or - Programmable Automation Controller
Type 2350 Temperature Sensor				All sold separately

*For tank or wall mount installations, user must use the Universal Adapter Kit (3-8050)
**Refer to the GF Submersion Kit brochure (3-0000.707) located on our website for installation suggestions and options.

Pressure-temperature diagram

Note

The pressure-temperature diagrams are specifically for the GF sensor. During system design the specifications of all components must be considered. In the case of a metal piping system, a plastic sensor will reduce the system specification. When using a PVDF sensor in a PVC piping system, the fitting will reduce the system specification.

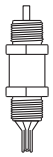


Application Tips

- For submersible sensor mounting, always use a water tight conduit and a cable gland to prevent moisture intrusion.
- To extend the cable, use a 3-conductor shielded cable and junction box.
- Sensors with extended cables available, contact Special Order products.

Ordering Information

Mfr. Part No.	Code	Output	Process connection	Cable length
3-2350-1	159 000 021	Digital (S³L)	¾ in. NPT	4.6 m (15 ft)
3-2350-3	159 000 920	Current (4 to 20 mA)	¾ in. NPT	4.6 m (15 ft)
3-2350-3-025	159070002	Current (4 to 20 mA)	¾ in. NPT	7.6 m (25 ft)
3-2350-3-050	159070003	Current (4 to 20 mA)	¾ in. NPT	15.2 m (50 ft)
3-2350-3U-025	159070004	Current (4 to 20 mA)	½ in. Union	7.6 m (25 ft)



Additional ordering information

Additional possible configurations are listed below. For variants, combinations, and orders, please contact the local GF sales company.

Example Part Number
3-2350-3-075

	Output		Process Connection		Cable Length
3-2350-		**-**		**-**	
Output					
Digital (S³L)	**1**				
Current 4 to 20 mA	**3**				
Process Connection					
¾ in. NPT			**-**		
½ in. Union			**U**		
Cable Length					
7.6 m (25 ft)					**025**
15.2 m (50 ft)					**050**
22.8 m (75 ft)					**075**
30.5 m (100 ft)					**100**

Accessories

Mfr. Part	Code	Description
5523-0322	159 000 761	Sensor cable (per ft), 3 cond. plus shield, 22 AWG
3-8052	159 000 188	¾ in. Integral mounting kit
3-8052-1	159 000 755	¾ in. NPT mount junction box with one liquid tight connector and cap with junction terminals (NEMA 4X/ IP65 rated)
3-9000.392-1	159 000 839	Liquid tight connector kit, NPT (1 connector)
3-9000.392-2	159 000 841	Liquid tight connector kit, PG 13.5 (1 connector)
3-0252	159 001 808	Configuration tool
Universal Sensor Adapter	150 300 300	For in-line applications requiring extra insertion depth for conductivity, temperature, and pressure process measurements.



150 300 300
Universal
Sensor Adapter

Temperature Integral System with type 9900 Transmitter

Member of the SmartPro® Family of Instruments



Product description

GF has combined the 9900 SmartPro® Transmitter with the type 2350 Temperature sensors to create integral systems that are easy to order and simple to install.

Each integral system features a 9900 Transmitter which provides a local and easy to read LCD display. The push button keypad makes it easy to navigate through the transmitter's menu. The DC-powered 9900 features a scalable 4 to 20 mA output and open collector for process control.

The integral system is offered with a type 2350 Temperature sensor and is available in a range of -10 °C to 100 °C (14 °F to 212 °F). Sensor installation is achieved via the ¾ inch sensor threaded NPT process connection. The sensor is available with PVDF wetted materials.

Features

- Local integral display
- Provides 4 to 20 mA output
- "At a glance" visibility
- "Dial-type" digital bar graph
- NEMA 4X/IP65

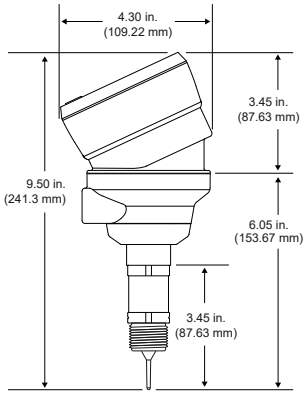
Applications

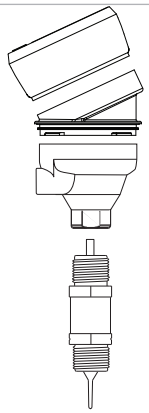
- Cooling Tower Control
- Plating Baths
- Chemical Production
- Semiconductor Water Production
- Aquariums
- Aquatic Monitoring
- Heat Exchangers
- Galvanic Plating

Technical Details

See individual transmitter and sensor product pages for more information.

Dimensions





3-9900
Instrument

3-9900-396
Angle Adjustment Adapter Kit

3-8052
Integral
Mount Kit

3-2350-1
Temperature Sensor

System Overview

Integral Installation

Type 9900 Transmitter
with 3-8052 Integral Adapter Kit



3-8052

Type 2350
Temperature Sensor

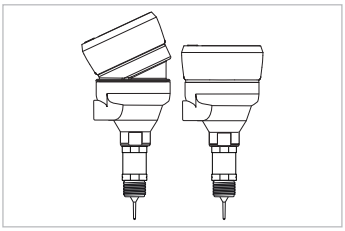


Customer supplied standard ¾ in fittings

Ordering Information

Mfr. Part No.	Instrument + Sensor	Description
159 002 246	3-9900-1 + 3-2350-1	4 to 20 mA and one open collector + angle adjustment adapter kit + digital (S^3L) temperature sensor.
159 001 745*	3-9900-1 + 3-2350-1	4 to 20 mA and one open collector + digital (S^3L) temperature sensor

*Only available in Europe.



Accessoires

Mfr. Part	Code	Description
3-9900.396	159 001 701	Angle adjustment adapter kit

Installation Fittings

Content

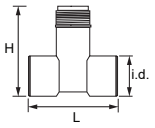
Installation Fittings 523
Fitting Insert Reference 555

Installation Fittings

PVC-U Tees SCH 80 - Fitting Only

Part No.	Code No.	Size [in.]	Sensor Type	L [in.]	H [in.]	i.d. [in.]
MPV8T005F	159 001 614	0.50	Flow -X0, pH -XX	3.75	3.50	0.85
MPV8T007F	159 001 615	0.75	Flow -X0, pH -XX	3.75	3.70	1.06
MPV8T010F	159 001 616	1.00	Flow -X0, pH -XX	4.30	4.00	1.33
MPV8T012F	159 001 617	1.25	Flow -X0, pH -XX	4.40	4.30	1.67
MPV8T015F	159 001 618	1.50	Flow -X0, pH -XX	5.00	4.60	1.91
MPV8T020F	159 001 619	2.00	Flow -X0, pH -XX	5.50	5.00	2.40



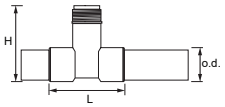


- For use with Flow: P51530-X0, 3-2536-X0, 3-8510-X0, 3-8512-X0, 3-2537-XC-X0, 3-2551-X0-X0-XX
- For use with pH/ORP: 3-272X-XX, 3-273X-XX
- NSF.

PVC-U Tees SCH 80 - with Pipe[1]

Part No.	Code No.	Size [in.]	Sensor Type	L [in.]	H [in.]	o.d. [in.]
MPV8T005	159 001 623	0.50	Flow -X0, pH -XX	14	3.5	0.84
MPV8T007	159 001 624	0.75	Flow -X0, pH -XX	14	3.7	1.05
MPV8T010	159 001 625	1.00	Flow -X0, pH -XX	17	4	1.32
MPV8T012	159 001 626	1.25	Flow -X0, pH -XX	20	4.3	1.66
MPV8T015	159 001 627	1.50	Flow -X0, pH -XX	24	4.6	1.9
MPV8T020	159 001 628	2.00	Flow -X0, pH -XX	26.5	5.02	2.38





- For use with Flow: P51530-X0, 3-2536-X0, 3-8510-X0, 3-8512-X0, 3-2537-XC-X0, 3-2551-X0-X0-XX
- For use with pH/ORP: 3-272X-XX, 3-273X-XX.

[1]Pipe lengths included with these fittings do not satisfy straight-run requirements for all installation configurations.

PVC-U Tees SCH 80 - with Pipe[1]

Part No.	Code No.	Size [in.]	Sensor Type	L [in.]	H [in.]	o.d. [in.]
PV8T025	198 801 573	2.50	Flow -X0, pH -XX	24	5.4	0.85
PV8T030	198 801 416	3.00	Flow -X0, pH -XX	24	6.0	1.06
PV8T040	198 801 436	4.00	Flow -X0, pH -XX	24	7.0	1.33



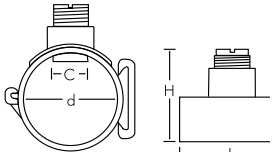
- For use with Flow: P51530-X0, 3-2536-X0, 3-8510-X0, 3-8512-X0, 3-2537-XC-X0, 3-2551-X0-X0-XX
- For use with pH/ORP: 3-272X-XX, 3-273X-XX

[1] Pipe lengths included with these fittings do not satisfy straight-run requirements for all installation configurations.

PVC-U Clamp-on Saddles SCH 80

Part No.	Code No.	Size [in.]	Sensor Type	L [in.]	H [in.]	d [in.]	C [in.]
PV8S020	159 000 637	2.00	Flow -X0, pH -XX	4.00	5.0	2.375	1.43
PV8S025	159 000 638	2.50	Flow -X0, pH -XX	4.75	5.4	2.875	1.43
PV8S030	198 150 577	3.00	Flow -X0, pH -XX	5.00	6.0	3.500	1.43
PV8S040	198 150 578	4.00	Flow -X0	5.00	7.1	4.500	1.43
PV8S060	198 150 579	6.00	Flow -X1	5.00	10.0	6.625	2.25
PV8S080	159 000 639	8.00	Flow -X1	5.00	11.5	8.625	2.25



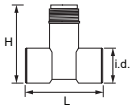


- For use with Flow: P51530-X0/-X1, 3-2536-X0/-X1, 3-8510-X0/-X1, 3-8512-X0/-X1, 3-2537-XC-X0/-X1, 3-2551-X0-XX/-X1-XX
- For use with pH/ORP: 3-272X-XX, 3-273X-XX
- Mounts on PVC pipe
- C - Clearance dimension
- EPR (EPDM) O-ring
- NSF

PVC-C Tees SCH 80 - Fitting Only

Part No.	Code No.	Size [in.]	Sensor Type	L [in.]	H [in.]	i.d. [in.]
MCPV8T005F	159 001 632	0.50	Flow -X0, pH -XX	3.75	3.50	0.85
MCPV8T007F	159 001 633	0.75	Flow -X0, pH -XX	3.75	3.70	1.06
MCPV8T010F	159 001 634	1.00	Flow -X0, pH -XX	4.30	4.00	1.33
MCPV8T012F	159 001 635	1.25	Flow -X0, pH -XX	4.40	4.30	1.67
MCPV8T015F	159 001 636	1.50	Flow -X0, pH -XX	5.00	4.60	1.91
MCPV8T020F	159 001 637	2.00	Flow -X0, pH -XX	5.50	5.00	2.40



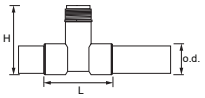


- For use with Flow: P51530-X0, 3-2536-X0, 3-8510-X0, 3-8512-X0, 3-2537-XC-X0, 3-2551-X0-X0-XX
- For use with pH/ORP: 3-272X-XX, 3-273X-XX

PVC-C Tees SCH 80 - with Pipe[1]

Sensor Type	Code No.	Size [in.]	Sensor Type	L [in.]	H [in.]	o.d. [in.]
MCPV8T005	159 001 641	0.50	Flow -X0, pH -XX	14	3.50	0.84
MCPV8T007	159 001 642	0.75	Flow -X0, pH -XX	14	3.70	1.05
MCPV8T010	159 001 643	1.00	Flow -X0, pH -XX	17	4.00	1.32
MCPV8T012	159 001 644	1.25	Flow -X0, pH -XX	20	4.30	1.66
MCPV8T015	159 001 645	1.50	Flow -X0, pH -XX	24	4.60	1.90
MCPV8T020	159 001 646	2.00	Flow -X0, pH -XX	26.5	5.02	2.38





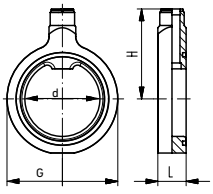
- For use with Flow: P51530-X0, 3-2536-X0, 3-8510-X0, 3-8512-X0, 3-2537-XC-X0, 3-2551-X0-X0-XX
- For use with pH/ORP: 3-272X-XX, 3-273X-XX

[1]Pipe lengths included with these fittings do not satisfy straight-run requirements for all installation configurations.

PP-H, Wafer Fitting, Metric and Inch (EPR/EPDM gaskets)

Part No.	EPDM Code No.	d [in.]	DN [mm]	Sensor Type	PN [bar]	d [mm]	D [mm]	H [mm]	L [mm]	L1 [mm]
PPMTE025	727 311 012	2.50	65	Flow -X1	10	75	88	133	48	61
PPMTE030	727 311 013	3.00	80	Flow -X1	10	90	102	140	48	69
PPMTE040	727 311 014	4.00	100	Flow -X1	10	110	132	149	48	79
PPMTE060	727 311 017	6.00	150	Flow -X1	10	160	182	156	48	106



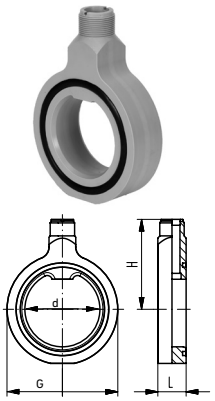


- For use with Flow: P51530-X1/-X2, 3-2536-X1/-X2, 3-8510-X1, 3-8512-X1, 3-2537-XC-X1, 3-2551-X1-XX/X2-XX
- Threaded outlet 1¼ inch NPSM
- Sensor length depends on installation fitting
- Suitable for backing flanges metric and inch
- Suitable for SDR 11 - SDR 17.6.
- Delivered with profile O-ring.
- Wafer can be used with other pipe materials.

PP-H, Wafer Fitting, Metric and Inch (FKM gaskets)

Part No.	FKM Code No.	d [in.]	DN [mm]	Sensor Type	PN [bar]	d [mm]	D [mm]	H [mm]	L [mm]	L1 [mm]
PPMTF040	727 311 044	4.00	100	Flow -X1	10	110	132	145	48	79

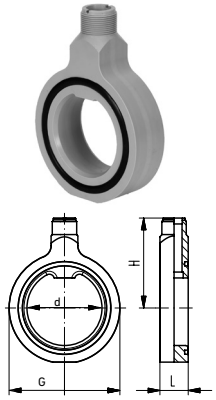
- For use with Flow: P51530-X1/-X2, 3-2536-X1/-X2, 3-8510-X1, 3-8512-X1, 3-2537-XC-X1, 3-2551-X1-XX/X2-XX
- Threaded outlet 1¼ inch NPSM
- Sensor length depends on installation fitting
- Suitable for backing flanges metric and inch.
- Suitable for SDR 11 - SDR 17.6.
- Delivered with profile O-ring.
- Wafer can be used with other pipe materials.



SYGEF Standard, Metric and Inch (FKM gaskets)

Part No.	FKM Code No.	d [in.]	d [mm]	Sensor Type	PN [bar]	DN [mm]	H [mm]	D [mm]	L [mm]	L1 [mm]
SFMTF030	735 311 043	3.00	90	Flow -X1	10/16	80	141	102	48	69

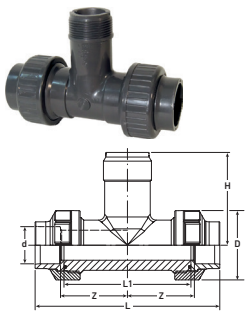
- For use with Flow: P51530-X1, 3-2536-X1, 3-8510-X1, 3-8512-X1, 3-2537-XC-X1, 3-2551-X1-XX
- Threaded outlet 1¼ inch NPSM
- Sensor length depends on installation fitting
- Suitable for backing flanges metric and inch.
- Delivered with profile O-ring.
- Wafer can be used with other pipe materials.



310 PVC-U For socket systems Inch BS

Part No.	FKM Code No.	EPDM Code No.	d [in.]	DN [mm]	Sensor Type	PN [bar]	D [mm]	z [mm]	L [mm]	L1 [mm]	H [mm]
PVAT007	721 310 337	721 310 307	¾	20	Flow -X0, pH -XX	15	51	53	147	100	78
PVAT010	721 310 338	721 310 308	1	25	Flow -X0, pH -XX	15	58	58	164	110	81
PVAT012	721 310 339	721 310 309	1¼	32	Flow -X0, pH -XX	15	72	58	171	110	85
PVAT015	721 310 340	721 310 310	1½	40	Flow -X0, pH -XX	15	83	63	188	120	89
PVAT020	721 310 341	721 310 311	2	50	Flow -X0, pH -XX	15	100	68	211	130	95

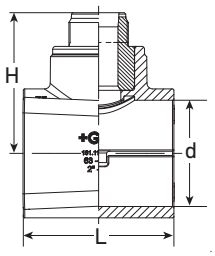
- For use with Flow: P51530-X0, 3-2536-X0, 3-8510-X0, 3-8512-X0, 3-2537-XC-X0, 3-2551-X0-XX
- For use with pH/ORP: 3-272X-XX, 3-273X-XX
- BSP - British Standard Pipe.
- Threaded outlet 1¼ inch NPSM.
- Sensor length depends on installation fitting.



BSP PVC-U, Clamp-on Saddle, BS Inch

Part No.	Code No.	d [in.]	DN [mm]	Sensor Type	d [mm]	PN [bar]	D [mm]	H [mm]	H1 [mm]	L [mm]
PVAS030	198 150 550	3	80	Flow -X0, pH -XX	90	15	39	105	225	105
PVAS040	198 150 551	4	100	Flow -X0, pH -XX	110	15	39	114	264	105
PVAS060	198 150 554	6	150	Flow -X1	160	15	39	156	339	120





- For use with Flow: P51530-X0/-X1, 3-2536-X0/-X1, 3-8510-X0/-X1, 3-8512-X0/-X1, 3-2537-XC-X0/-X1, 3-2551-X0-XX/-X1-XX
- For use with pH/ORP: 3-272X-XX, 3-273X-XX

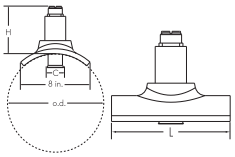
- Sensor length depends on installation fitting.
- BSP - British Standard Pipe.
- Threaded outlet 1¼ inch NPSM.
- Sensor length depends on installation fitting.
- EPR (EPDM) Gasket.

Alternative solution can be a PP saddle or wafer. Pipe size, pressure rating and chemical resistance need to be evaluated.

PVC-U Glue-on Saddle Fitting SCH 80

Part No.	Code No.	Size [in.]	Sensor Type	L [in]	H [in]	o.d. [in.]	C [in]
PV8S100	159 000 695	10	Flow -X2	9	5.43	10.75	2.25
PV8S120	159 000 696	12	Flow -X2	9	5.15	12.75	2.25
PV8S140	159 070 070	14	Flow -X2	9	4.96	14.00	2.25
PV8S160	159 070 071	16	Flow -X2	9	4.96	16.00	2.25

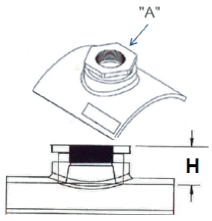




- For use with Flow: P51530-X2, 3-2536-X2, 3-2551-X2-XX

Glue-on Saddle Fitting for 3719-XX Wet-tap

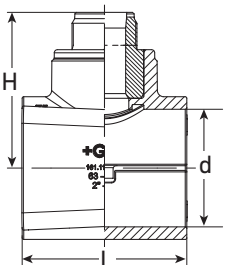
Part No.	Code No.	Size [in.]	Sensor Type	L [in]	H [in]	A
PV8S100-2 NPT	159 070 065	10	Flow -X2	9.0	2.0	2“ NPT
PV8S120-2 NPT	159 070 069	12	Flow -X2	9.0	2.0	2“ NPT
PV8S140-2 NPT	159 070 066	14	Flow -X2	9.0	2.0	2“ NPT
PV8S160-2 NPT	159 070 067	16	Flow -X2	9.0	2.0	2“ NPT
PV8S180-2 NPT	159 070 068	18	Flow -X2	9.0	2.0	2“ NPT



PVC-U Clamp-on Saddle, Metric

Part No.	Code No.	d [in.]	DN [mm]	Sensor Type	PN [bar]	H [mm]	L [mm]
PVMS025	198 150 538	75	65	Flow -X0, pH -XX	16	99	105
PVMS030	198 150 539	90	80	Flow -X0, pH -XX	16	105	105
PVMS040	198 150 540	110	100	Flow -X0, pH -XX	16	114	105
PVMS060	198 150 543	160	150	Flow -X1	16	156	120
PVMS080	198 150 545	225	200	Flow -X1	16	184	120



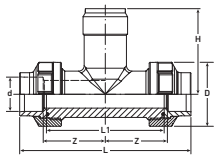


- For use with Flow: P51530-X0/-X1, 3-2536-X0/-X1, 3-8510-X0/-X1, 3-8512-X0/-X1, 3-2537-XC-X0/-X1, 3-2551-X0-XX/-X1-XX
- For use with pH/ORP: 3-272X-XX, 3-273X-XX
- Sensor length depends on installation fitting.
- Threaded outlet 1¼ inch NPSM.
- Top saddle for solvent cement bonding.
- Seal: Lip seal of EPDM.
- pH sensors can only be used up to 4 in. or DN100 pipe.

PVC-U for Socket Systems, Metric

Part No.	FKM Code No.	EPDM Code No.	d [in.]	DN [mm]	Sensor Type	PN [bar]	D [mm]	z [mm]	L [mm]	L1 [mm]	H [mm]
PVMT005	721 310 036	721 310 006	20	15	Flow -X0, pH -XX	16	43	48	128	90	76
PVMT007	721 310 037	721 310 007	25	20	Flow -X0, pH -XX	16	51	53	144	100	78
PVMT010	721 310 038	721 310 008	32	25	Flow -X0, pH -XX	16	58	58	160	110	81
PVMT012	721 310 039	721 310 009	40	32	Flow -X0, pH -XX	16	72	58	168	110	85
PVMT015	721 310 040	721 310 010	50	40	Flow -X0, pH -XX	16	83	63	188	120	89
PVMT020	721 310 041	721 310 011	63	50	Flow -X0, pH -XX	16	100	68	212	130	95



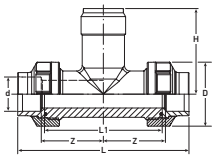


- For use with Flow: P51530-X0, 3-2536-X0, 3-8510-X0, 3-8512-X0, 3-2537-XC-X0, 3-2551-X0-XX
- For use with pH/ORP: 3-272X-XX, 3-273X-XX
- To install this installation fitting in PVC-C, PP-R and PE pipes; replace the original union ends with PVC-C, PP-R and PE union ends.
- Threaded outlet 1¼ inch NPSM
- Sensor length depends on installation fitting

PP-H for Socket Fusion, Metric (PROGEF Standard)

Part No.	FKM Code No.	EPDM Code No.	d [in.]	DN [mm]	Sensor Type	PN [bar]	D [mm]	z [mm]	L [mm]	L1 [mm]	H [mm]
PPMT005	727 310 036	727 310 006	20	15	Flow -X0, pH -XX	10	48	50	128	90	76
PPMT007	727 310 037	727 310 007	25	20	Flow -X0, pH -XX	10	58	55	142	100	78
PPMT010	727 310 038	727 310 008	32	25	Flow -X0, pH -XX	10	65	60	156	110	81
PPMT012	727 310 039	727 310 009	40	32	Flow -X0, pH -XX	10	79	60	160	110	85
PPMT015	727 310 040	727 310 010	50	40	Flow -X0, pH -XX	10	91	65	176	120	89
PPMT020	727 310 041	727 310 011	63	50	Flow -X0, pH -XX	10	105	70	194	130	95



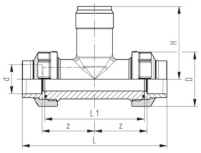


- For use with Flow: P51530-X0, 3-2536-X0, 3-8510-X0, 3-8512-X0, 3-2537-XC-X0, 3-2551-X0-XX
- For use with pH/ORP: 3-272X-XX, 3-273X-XX
- To install this installation fitting in PVC-C, PP-R and PE pipes; replace the original union ends with PVC-C, PP-R and PE union ends.
- Threaded outlet 1¼ inch NPSM.
- Union end with fusion socket PP-H.

PVDF for Socket Fusion, Metric, type 310 (SYGEF Standard)

Part No.	FKM Code No.	d [mm]	Sensor Type	PN [bar]	D [mm]	H [mm]	L [mm]	L1 [mm]	z [mm]
SFMT005	735 310 036	20	Flow -X0, pH -XX	16	45	76	128	90	50
SFMT007	735 310 037	25	Flow -X0, pH -XX	16	55	78	142	100	55
SFMT010	735 310 038	32	Flow -X0, pH -XX	16	62	81	156	110	60
SFMT012	735 310 039	40	Flow -X0, pH -XX	16	75	85	160	110	60
SFMT015	735 310 040	50	Flow -X0, pH -XX	16	84	89	176	120	65
SFMT020	735 310 041	63	Flow -X0, pH -XX	16	101	95	194	130	70



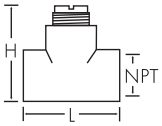


- For use with Flow: P51530-X0, 3-2536-X0, 3-8510-X0, 3-8512-X0, 3-2537-XC-X0, 3-2551-X0-XX
- For use with pH/ORP: 3-272X-XX, 3-273X-XX
- To install this installation fitting in PVC-C, PP-R and PE pipes; replace the original union ends with PVC-C, PP-R and PE union ends
- Socket fusion equipment is required to install PVDF union tees.
- FKM O-rings.
- Sensor length depends on installation fitting.
- Threaded outlet 1¼ inch NPSM.

Carbon Steel Threaded Tees with NPT Threads

Part No.	Code No.	Size [in.]	Sensor Type	L [in.]	H [in.]
CS4T005-CPVC	159 002 112	0.5	Flow -X0, pH -XX	3.6	4.0
CS4T007-CPVC	159 002 113	0.75	Flow -X0, pH -XX	3.6	4.2
CS4T010-CPVC	159 002 114	1	Flow -X0, pH -XX	3.6	4.2
CS4T012-CPVC	159 002 115	1.25	Flow -X0, pH -XX	3.8	4.5
CS4T015-CPVC	159 002 116	1.5	Flow -X0, pH -XX	4.1	4.8
CS4T020-CPVC	159 002 117	2	Flow -X0, pH -XX	4.9	5.3



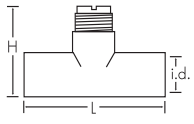


- For use with Flow: P51530-X0, 3-2536-X0, 3-8510-X0, 3-8512-X0, 3-2537-XC-X0, 3-2551-X0-XX,
- For use with pH/ORP: 3-272X-XX, 3-273X-XX
- PVDF insert - all sizes.
- For use with SCH 40 metal pipe (ASTM).
- PTFE wetted material. Contact factory for available options.

Copper Sweat-on Tee with PVDF Insert

Part No.	Code No.	Size [in.]	Sensor Type	L [in.]	H [in.]	i.d. [in.]
CUKT005	198 801 687	0.5	Flow -X0, pH -XX	3.15	3.3	0.62
CUKT007	198 801 688	0.75	Flow -X0, pH -XX	2.96	3.52	0.87
CUKT010	198 801 689	1	Flow -X0, pH -XX	3	3.8	1.12
CUKT012-CPVC	159 002 118	1.25	Flow -X0, pH -XX	4.16	4.12	1.38
CUKT015-CPVC	159 002 119	1.5	Flow -X0, pH -XX	4.5	4.34	1.63
CUKT020-CPVC	159 002 120	2	Flow -X0, pH -XX	5.5	4.86	2.11





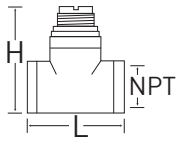
- For use with Flow: P51530-X0, 3-2536-X0, 3-8510-X0, 3-8512-X0, 3-2537-XC-X0, 3-2551-X0-XX
- For use with pH/ORP: 3-272X-XX, 3-273X-XX
- No insert up to 1 in., over 1 in. - PVDF insert.
- For use with copper pipe (SCH K).
- PTFE wetted material. Contact factory for available options.

Galvanized Iron Threaded Tee with NPT Threads and PVDF Insert

Part No.	Code No.	Size [in.]	Sensor Type	NPT	L [in.]	H [in.]
IR4T010-CPVC	159 002 121	1	Flow -X0, pH -XX	1	3.4	4.1
IR4T012-CPVC	159 002 122	1.25	Flow -X0, pH -XX	1.25	3.56	4.34
IR4T015-CPVC	159 002 123	1.5	Flow -X0, pH -XX	1.5	3.75	4.67
IR4T020-CPVC	159 002 124	2	Flow -X0, pH -XX	2	3.9	5.05

- For use with Flow: P51530-X0, 3-2536-X0, 3-8510-X0, 3-8512-X0, 3-2537-XC-X0, 3-2551-X0-XX
- For use with pH/ORP: 3-272X-XX, 3-273X-XX
- PVDF insert - all sizes.
- For use with SCH 40 metal pipe (ASTM).
- PTFE wetted material. Contact factory for available options.





316 SS (1.4401) Threaded Tees with NPT Threads with PVDF Insert

Part No.	Code No.	Size [in.]	Sensor Type	L [in.]	H [in.]
CR4T005-CPVC	159 002 084	0.5	Flow -X0, pH -XX	3.6	4
CR4T007-CPVC	159 002 085	0.75	Flow -X0, pH -XX	3.6	4.2
CR4T010-CPVC	159 002 086	1	Flow -X0, pH -XX	3.6	4.2
CR4T012-CPVC	159 002 087	1.25	Flow -X0, pH -XX	3.8	4.5
CR4T015-CPVC	159 002 088	1.5	Flow -X0, pH -XX	4.1	4.8
CR4T020-CPVC	159 002 089	2	Flow -X0, pH -XX	4.9	5.3

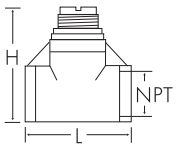
- For use with Flow: P51530-X0, 3-2536-X0, 3-8510-X0, 3-8512-X0, 3-2537-XC-X0, 3-2551-X0-XX
- For use with pH/ORP: 3-272X-XX, 3-273X-XX
- PVDF insert - all sizes.
- For use with SCH 40 metal pipe (ASTM).
- PTFE wetted material. Contact factory for available options.



0.50"- 1.00"



1.25" - 2.00"

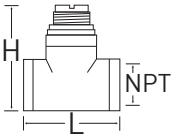


Brass Threaded Tee with NPT Threads and PVDF Insert

Part No.	Code No.	Size [in.]	Sensor Type	NPT [in.]	L [in.]	H [in.]
BR4T010-CPVC	159 002 108	1	Flow -X0, pH -XX	1	3.36	4.09
BR4T012-CPVC	159 002 109	1.25	Flow -X0, pH -XX	1.25	3.42	4.42
BR4T015-CPVC	159 002 110	1.5	Flow -X0, pH -XX	1.5	3.46	4.7
BR4T020-CPVC	159 002 111	2	Flow -X0, pH -XX	2	3.68	5.19

- For use with Flow: P51530-X0, 3-2536-X0, 3-8510-X0, 3-8512-X0, 3-2537-XC-X0, 3-2551-X0-XX
- For use with pH/ORP: 3-272X-XX, 3-273X-XX
- PVDF insert - all sizes.
- For use with SCH 40 metal pipe (ASTM).
- PTFE wetted material. Contact factory for available options.





Carbon Steel Weld-on Weldolets for use with SCH 40 Metal Pipe (ASTM)

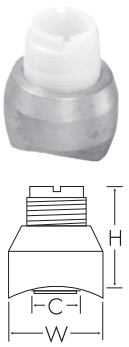
Part No.	Code No.	Size [in.]	Sensor Type	W [in.]	H [in.]	C [in.]
CS4W025-CPVC	159 002 096	2.5	Flow -X0, pH -XX	2.6	2.48	1.31
CS4W030-CPVC	159 002 097	3	Flow -X0, pH -XX	2.6	2.47	1.31
CS4W040-CPVC	159 002 098	4	Flow -X0, pH -XX	2.6	2.45	1.31
CS4W050-CPVC	159 002 099	5	Flow -X1	3.5	3.24	2.1
CS4W060-CPVC	159 002 100	6	Flow -X1	3.5	3.11	2.1
CS4W080-CPVC	159 002 101	8	Flow -X1	3.5	2.88	2.1
CS4W100*	198 801 575	10	Flow -X2	3.5	5.63	2.1
CS4W120*	198 801 576	12	Flow -X2	3.5	5.4	2.1
CS4W140*	159 070 039	10	Flow -X2	3.5	5.63	2.1
CS4W160*	159 070 040	12	Flow -X2	3.5	5.4	2.1
CS4W180*	159 070 041	14	Flow -X2	3.5	5.17	2.1
CS4W200*	159 070 042	16	Flow -X2	3.5	4.95	2.1
CS4W240*	159 070 043	18	Flow -X2	3.5	4.71	2.1
		20	Flow -X2	3.5	4.48	2.1
		24	Flow -X2	3.5	4.25	2.1



- For use with Flow: P51530-X0/-X1/-X2, 3-2536-X0/-X1/-X2, 3-8510-X0/-X1, 3-8512-X0/-X1, 3-2537-XC-X0/-X1, 3-2551-X0-XX/-X1-XX/-X2-XX
- For use with pH/ORP: 3-272X-XX, 3-273X-XX
- For use with Flow: P51530-X0/-X1/-X2, 3-2536-X0/-X1/-X2, 3-8510-X0/-X1, 3-8512-X0/-X1, 3-2537-XC-X0/-X1, 3-2551-X0-XX/-X1-XX/-X2-XX
- For use with pH/ORP: 3-272X-XX, 3-273X-XX
- C - Clearance dimension.
- Up to 8 in. - PVDF insert, over 8 in. - PVC insert.
- PTFE wetted material. Contact factory for available options.

Brass Brazolet with PVDF Insert for use with Copper Pipe (SCH 40 ASTM)

Part No.	Code No.	Size [in.]	Sensor Type	W [in.]	H [in.]	C [in.]
BR4B025-CPVC	159 002 102	2.5	Flow -X0, pH -XX	2.5	2.48	1.31
BR4B030-CPVC	159 002 103	3	Flow -X0, pH -XX	2.5	2.47	1.31
BR4B040-CPVC	159 002 104	4	Flow -X0, pH -XX	2.5	2.45	1.31
BR4B050-CPVC	159 002 105	5	Flow -X1	3.5	3.24	2.1
BR4B060-CPVC	159 002 106	6	Flow -X1	3.5	3.11	2.1
BR4B080-CPVC	159 002 107	8	Flow -X1	3.5	2.88	2.1
BR4B100*	198 801 800	10	Flow -X2	3.5	5.63	2.1
BR4B120*	198 801 801	12	Flow -X2	3.5	5.4	2.1

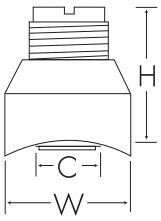


- For use with Flow: P51530-X0/-X1/-X2, 3-2536-X0/-X1/-X2, 3-8510-X0/-X1, 3-8512-X0/-X1, 3-2537-XC-X0/-X1, 3-2551-X0-XX/-X1-XX/-X2-XX
- For use with pH/ORP: 3-272X-XX, 3-273X-XX
- C - Clearance dimension.
- Up to 8 in. - PVDF insert, over 8 in. - PVC insert.
- PTFE wetted material. Contact factory for available options.

316 SS (1.4401) Weldolets with PVDF Insert for use with SCH 40 Metal Pipe (ASTM)

Part No.	Code No.	Size [in.]	Sensor Type	W [in.]	H [in.]	C [in.]
CR4W025-CPVC	159 002 090	2.5	Flow -X0, pH -XX	2.5	2.48	1.31
CR4W030-CPVC	159 002 091	3	Flow -X0, pH -XX	2.5	2.47	1.31
CR4W040-CPVC	159 002 092	4	Flow -X0, pH -XX	2.5	2.45	1.31
CR4W050-CPVC	159 002 093	5	Flow -X1	3.5	3.24	2.1
CR4W060-CPVC	159 002 094	6	Flow -X1	3.5	3.11	2.1
CR4W080-CPVC	159 002 095	8	Flow -X1	3.5	2.88	2.1
CR4W100*	198 801 792	10	Flow -X2	3.5	5.63	2.1
CR4W120*	198 801 793	12	Flow -X2	3.5	5.4	2.1





- For use with Flow: P51530-X0/-X1/-X2, 3-2536-X0/-X1/-X2, 3-8510-X0/-X1, 3-8512-X0/-X1, 3-2537-XC-X0/-X1, 3-2551-X0-XX/-X1-XX/-X2-XX
- For use with pH/ORP: 3-272X-XX, 3-273X-XX
- Up to 8 in. - PVDF insert, over 8 in. - PVC insert.
- C - Clearance dimension.
- PTFE wetted material. Contact factory for available options.

Stainless steel Weldolet for 2552

Part No.	Code No.	Size [in.]	Sensor Type	o.d min [in.]	o.d max [in.]	Process connector
CR4020-A	159 070 044	2 to 2.5	3-2552-2X	2	2.5	1 1/4"
CR4060-A	159 070 045	6	3-2552-2X	6	-	1 1/4"
CR4090-A	159 070 046	8 to 10	3-2552-2X	8	10	1 1/4"
CR4012-018-A	159 070 047	12 to 18	3-2552-2X	12	18	1 1/4"
CR4200-360-A	159 070 048	20 to 36	3-2552-2X	20	36	1 1/4"
CR4380-A	159 070 049	38+	3-2552-2X	38	-	1 1/4"
CR4060-B	159 070 050	6	3-2552-2X	6	-	1 1/2"
CR4090-B	159 070 051	8 to 10	3-2552-2X	8	10	1 1/2"
CR4012-018-B	159 070 052	12 to 18	3-2552-2X	12	18	1 1/2"
CR4200-360-B	159 070 053	20 to 36	3-2552-2X	20	36	1 1/2"
CR4380-B	159 070 054	38+	3-2552-2X	38	-	1 1/2"



- For use with the 3-2552 insertion Magmeter

Carbon steel Weldolet for 2552

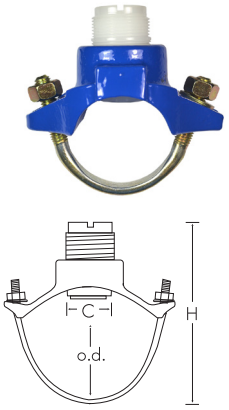
Part No.	Code No.	Size [in.]	Sensor Type	o.d min [in.]	o.d max [in.]	Process connector
2129-9204	159 821 020	4 to 5	3-2552-2X	4	5	1 1/4"
2129-9291	159 070 055	6	3-2552-2X	6	-	1 1/4"
2129-9292	159 070 056	8 to 10	3-2552-2X	8	10	1 1/4"
2129-9294	159 070 057	12 to 18	3-2552-2X	12	18	1 1/4"
2129-9295	159 070 058	20 to 36	3-2552-2X	20	36	1 1/4"
2129-9296	159 070 059	38+	3-2552-2X	38	+	1 1/4"
2129-9091	159 070 060	6	3-2552-2X	6	-	1 1/2"
2129-9092	159 070 061	8 to 10	3-2552-2X	8	10	1 1/2"
2129-9094	159 070 062	12 to 18	3-2552-2X	12	18	1 1/2"
2129-9095	159 070 063	20 to 36	3-2552-2X	20	36	1 1/2"
2129-9096	159 070 064	38+	3-2552-2X	38	+	1 1/2"



- For use with the 3-2552 insertion Magmeter

Iron Strap-on Saddle for use with SCH 80 Metal Pipe (ASTM)

Part No.	Code No.	Size [in.]	Sensor Type	H [in.]	o.d. min [in.]	o.d. max [in.]	C [in.]
IR8S020-CPVC	159 002 077	2	Flow -X0, pH -XX	5.5	2.35	2.56	1.44
IR8S025-CPVC	159 002 078	2.5	Flow -X0, pH -XX	5.5	2.44	2.91	1.44
IR8S030-CPVC	159 002 079	3	Flow -X0, pH -XX	6.5	2.97	3.54	1.44
IR8S040-CPVC	159 002 080	4	Flow -X0, pH -XX	7.5	4.4	4.55	1.44
IR8S050-CPVC	159 002 081	5	Flow -X1	9	5	5.63	2.25
IR8S060-CPVC	159 002 082	6	Flow -X1	10.5	5.94	6.7	2.25
IR8S080-CPVC	159 002 083	8	Flow -X1	12	7.69	8.72	2.25
IR8S100*	198 801 432	10	Flow -X2	18	10.64	12.12	2.25
IR8S120*	198 801 433	12	Flow -X2	20	12.62	14.32	2.25
IR8S140*	159 070 034	14	Flow -X2		12.62	14.32	2.25
IR8S160*	159 070 035	16	Flow -X2		15.95	17.25	2.25
IR8S180*	159 070 036	18	Flow -X2		17.40	18.00	2.25
IR8S200*	159 070 037	20	Flow -X2		19.25	20.00	2.25
IR8S240*	159 070 038	24	Flow -X2		23.75	24.50	2.25

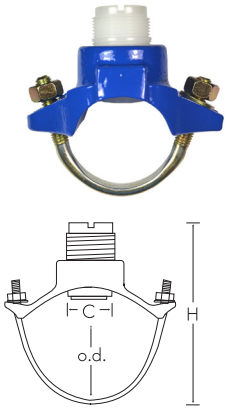


*PVC inserts

- For use with Flow: P51530-X0/-X1/-X2, 3-2536-X0/-X1/-X2, 3-8510-X0/-X1, 3-8512-X0/-X1, 3-2537-XC-X0/-X1, 3-2551-X0-XX/-X1-XX/-X2-XX
- For use with pH/ORP: 3-272X-XX, 3-273X-XX
- C - Clearance dimension.
- Up to 8 in. - PVDF insert, over 8 in. - PVC insert.
- Buna O-ring.
- Larger sizes may be available as well as PTFE wetted material. Contact factory.

IR5D Ductile iron pipe saddles SCH 52

Part No.	Code No.	Size [in.]	Sensor Type	H [in.]	o.d. min [in.]	o.d. max [in.]	C [in.]
IR5D035	159 070 022	3.5	Flow -X0, pH -XX	5.5	3.74	4.13	1.44
IR5D040	159 070 023	4	Flow -X0, pH -XX	5.5	4.7	5.14	1.44
IR5D070	159 070 024	6	Flow -X0, pH -XX	6.5	6.84	7.60	1.44
IR5D080	159 070 025	8	Flow -X1	7.5	8.54	10.10	1.44
IR5D100	159 070 026	10	Flow -X2	9	10.64	12.12	2.25
IR5D120	159 070 027	12	Flow -X2	10.5	12.62	14.32	2.25
IR5D140	159 070 028	14	Flow -X2	12	14.73	15.65	2.25
IR5D160	159 070 029	16	Flow -X2	18	17.25	17.80	2.25
IR5D180	159 070 030	18	Flow -X2	20	19.38	19.68	2.25
IR5D210	159 070 031	20	Flow -X2	22	21.55	21.65	2.25
IR5D240	159 070 032	24	Flow -X2	26	25.75	25.85	2.25
IR5D300	159 070 033	30	Flow -X2	32	31.75	32.50	2.25



- For use with Flow: P51530-X0/-X1/-X2, 3-2536-X0/-X1/-X2, 3-8510-X0/-X1, 3-8512-X0/-X1, 3-2537-XC-X0/-X1, 3-2551-X0-XX/-X1-XX/-X2-XX
- For use with pH/ORP: 3-272X-XX, 3-273X-XX
- C - Clearance dimension.
- Up to 8 in. - PVDF insert, over 8 in. - PVC insert.
- Buna O-ring.
- Larger sizes may be available as well as PTFE wetted material. Contact factory.

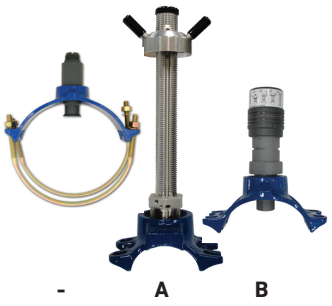
Ductile Iron Pipe Service Saddles

The GF Strap-on Iron Saddles are especially recommended where large taps are required. The GF Strap-on Iron Saddles have a ductile iron body per ASTM A536. The saddles have an outlet for the service connection that allows the NPT thread of the 2552 Magmeter or 3719 pH/ORP Wet-Tap assembly to be tapped into it. The gasket is made of Nitrile (Buna) and NSF 61 listed and has a temperature range of -29°C to 82°C (-20°F to +180°F).

Type SCH 52 for ductile iron pipes, with insert for flow sensor

Example Part Number
IR5D-120-A

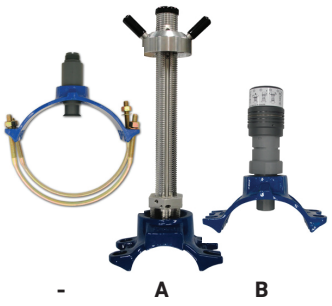
	Pipe Size		Inlet Size
IR5D-		**-**	
Pipe Size - saddle and size/OD/Wall thickness			
3 ½ in. saddle, 3.74 to 4.13 in./ OD = 3.96 in./0.25 in.	**035**		
4 in. saddle, 4.74 to 5.14 in./ OD = 4.80 in./0.29 in.	**040**		
6 in. saddle, 6.84 to 7.6 in./ OD = 6.9 in./0.31 in.	**060**		
8 in. saddle, 8.54 to 10.10 in./ OD = 9.05 in./0.33 in.	**080**		
10 in. saddle, 10.64 to 12.12 in./ OD = 11.10 in./ 0.35 in.	**100**		
12 in. saddle, 12.62 to 14.32 in./ OD = 13.20 in./0.37 in.	**120**		
14 in. saddle, 14.73 to 15.65 in./ OD = 15.30 in./0.39 in.	**140**		
16 in. saddle, 17.25 to 17.80 in./ OD = 17.40 in./0.40 in.	**160**		
18 in. saddle, 19.38 to 19.68 in./ OD = 19.50 in./0.41 in.	**180**		
20 in. saddle, 21.55 to 21.65 in./ OD = 21.60 in./0.42 in.	**200**		
24 in. saddle, 25.75 to 25.85 in./ OD = 25.80 in./0.44 in.	**240**		
30 in. saddle, 31.75 to 32.50 in./ OD = 32.00 in./0.47 in.	**300**		
Inlet Size			
with insert for flow sensor			**-**
1¼ in. NPT - use with 3-2552-2X or 3519			**A**
1½ in. NPT - use with 3-2552-3X or 3519			**B**



Type SCH 40 and SCH 80 for ductile iron pipes, with insert for flow sensor

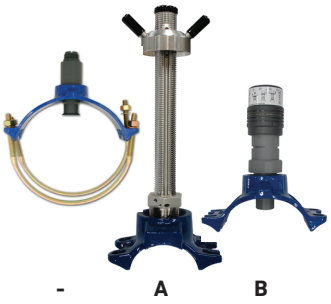
Example Part Number
IR4S180A

	Pipe Schedule	Pipe Size	Inlet Size
IR			
Pipe Schedule - Iron Service Saddle			
Schedule 40 pipe	**4S**		
Schedule 80	**8S**		
Pipe Size - OD/Wall thickness			
2 in. Pipe (OD = 2.35 in. to 2.56 in./59.69 to 65.0 mm)		**020**	
2.5 in. Pipe (OD = 2.44 in. to 2.91 in./62 to 74 mm)		**025**	
3 in. Pipe (OD = 2.97 in. to 3.54 in./75.4 to 90.0 mm)		**030**	
4 in. Pipe (OD = 4.40 in. to 4.80 in./111.76 to 121.9 mm)		**040**	
5 in. Pipe (OD = 5.00 in. to 5.63 in./127 to 143 mm)		**050**	
6 in. Pipe (OD = 5.94 in. to 6.70 in./151 to 170 mm)		**060**	
8 in. Pipe (OD = 7.96 in. to 8.72 in./202.2 to 221 mm)		**080**	
10 in. Pipe (OD = 10.64 in. to 12.12 in./270.2 to 308 mm)		**100**	
12 in. Pipe (OD = 12.62 in. to 14.32 in./320.5 to 363.7 mm)		**120**	
14 in. Pipe (OD = 12.62 in. to 14.32 in./320 to 363 mm)		**140**	
16 in. Pipe (OD = 15.95 in. to 17.25 in./405 to 438 mm)		**160**	
18 in. Pipe (OD = 17.40 in. to 18.00 in./442 to 478.5 mm)		**180**	
20 in. Pipe (OD = 19.25 in. to 20.00 in./489 to 508 mm)		**200**	
24 in. Pipe (OD = 23.75 in. to 24.50 in./603 to 622 mm)		**240**	
Inlet Size			
with insert for flow sensor			**-**
1¼ in. NPT - use with 3-2552-2X or 3519			**A**
1½ in. NPT - use with 3-2552-3X or 3519			**B**



Metric (K9 type) for ductile iron pipes, with insert for flow sensor

Example Part Number IR5MD-125-A		Pipe Size		Inlet Size
	IR5MD-		-	
Pipe Size - saddle and size/OD/Wall thickness				
K-9 saddle, DN40/ OD = 56 mm (2.205 in.)/ 6 mm (0.236 in.)		040		
K-9 saddle, DN50/ OD = 66 mm (2.598 in.)/ 6 mm (0.236 in.)		050		
K-9 saddle, DN60/ OD = 77 mm (3.03 in.)/ 6 mm (0.236 in.)		060		
K-9 saddle, DN65/ OD = 82 mm (3.23 in.)/ 6 mm (0.236 in.)		065		
K-9 saddle, DN80/ OD = 98 mm (3.86 in.)/ 6 mm (0.236 in.)		080		
K-9 saddle, DN100/ OD = 118 mm (4.65 in.)/ 6 mm (0.236 in.)		100		
K-9 saddle, DN125/ OD = 144 mm (5.67 in.)/ 6 mm (0.236 in.)		125		
K-9 saddle, DN150/ OD = 170 mm (6.69 in.)/ 6 mm (0.236 in.)		150		
K-9 saddle, DN200/ OD = 222 mm (8.74 in.)/ 6.3 mm (0.248 in.)		200		
K-9 saddle, DN250/ OD = 274 mm (10.8 in.)/ 6.8 mm (0.268 in.)		250		
K-9 saddle, DN300/ OD = 326 mm (12.84 in.)/ 7.2 mm (0.283 in.)		300		
K-9 saddle, DN350/ OD = 378 mm (14.88 in.)/ 7.7 mm (0.303 in.)		350		
K-9 saddle, DN400/ OD = 429 mm (16.89 in.)/ 8.1 mm (0.319 in.)		400		
Inlet Size				
with insert for flow sensor				-
1¼ in. NPT - use with 3-2552-2X or 3519				A
1½ in. NPT - use with 3-2552-3X or 3519				B



Weld-on Weldolet

The A and B versions of the Weld-on Weldolet allow easy installation of the 3-2552 and 3-3719 pH/ORP Wet-Tap assembly into metal piping systems. Smaller Weld-on Weldolet sizes and metric size pipes are available.

Type SCH 40 Weldolet, with insert for flow sensor

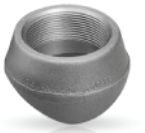
Example Part Number CS4W140A	Threadolet Material	Pipe Size	Inlet Size
Threadolet Material			
Carbon Steel, Schedule 40	CS4		
Stainless Steel, Schedule 40	CR4		
Pipe Size			
14 in. Pipe		W140	
16 in. Pipe		W160	
18 in. Pipe		W180	
20 in. Pipe		W200	
24 in. Pipe		W240	
Inlet Size			
with insert for flow sensor			-
1¼ in. NPT - use with 3-2552-2X or 3519			A
1½ in. NPT - use with 3-2552-3X or 3519			B

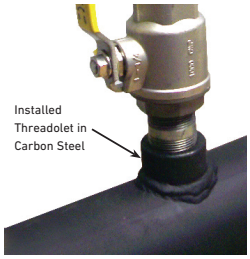




Weldolet for 3-2552 und 3-3719-11

Example Part Number 2129-9091	Threadolet Material			Pipe Size
	21	29	-	9	
Threadolet Material				
Carbon Steel		29		
Pipe Size - use with 2552-21				
2 in. Threadolet, 1 ¼ in. NPT connection				202
4 to 5 in. Threadolet, 1 ¼ in. NPT connection				204
6 in. (153 mm) weldolet, 1 ¼ in. NPT connection				291
8 to 10 in. (203 to 254 mm) weldolet, 1 ¼ in. NPT connection				292
12 to 18 in. (305 to 457 mm) weldolet, 1 ¼ in. NPT connection				294
20 to 36 in. (508 to 915 mm) weldolet, 1 ¼ in. NPT connection				295
38 in. (965 mm) weldolet, 1 ¼ in. NPT connection				296
Pipe Size - use with 2552-33 or 3-3719-11				
6 in. (153 mm) weldolet, 1 ½ in. NPT connection				091
8 to 10 in. (203 to 254 mm) weldolet, 1 ½ in. NPT connection				092
12 to 18 in. (305 to 457 mm) weldolet, 1 ½ in. NPT connection				094
20 to 36 in. (508 to 915 mm) weldolet, 1 ½ in. NPT connection				095
38 in. (965 mm) weldolet, 1 ½ in. NPT connection				096

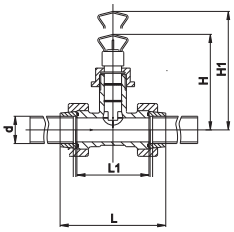




JIS PVC-U Tee Fittings

EPDM Code No.	FKM Code No.	DN [mm]	Sensor Type	d [mm]	H [mm]	H1 [mm]	L [mm]	L1 [mm]
200 072 063	200 070 933	15	Flow -X0, pH -XX	22	145	225	128	90
200 072 064	200 070 934	20	Flow -X0, pH -XX	26	148	228	144	100
200 072 065	200 070 935	25	Flow -X0, pH -XX	32	151	231	160	110
200 072 066	200 070 936	32	Flow -X0, pH -XX	38	155	235	168	110
200 072 067	200 070 937	40	Flow -X0, pH -XX	48	159	239	188	120
200 072 068	200 070 902	50	Flow -X0, pH -XX	60	164	244	212	130





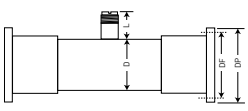
- For use with Flow: P51530-X0, 3-2536-X0, 3-8510-X0, 3-8512-X0, 3-2537-XC-X0, 3-2551-X0-XX,
- For use with pH/ORP: 3-272X-XX, 3-273X-XX

- These fittings are only available from the GF sales office in Japan.
- Choice FKM or EPR (EPDM) O-ring.
- Appearance varies in DN15 mm.

JIS PVC-U Tee Fittings (Flange type)

Code No.	DN [mm]	Sensor Type	D [mm]	DF	DP	L [mm]
200 070 892	65	Flow -X0, pH -XX	76	175	140	57.2
200 070 893	80	Flow -X0, pH -XX	89	185	150	56.8
200 070 894	100	Flow -X0, pH -X1	114	210	175	56.9
200 070 895	125	Flow -X1	140	250	210	82
200 070 896	150	Flow -X1	165	280	240	77.8
200 070 897	200	Flow -X1	216	330	290	71.6



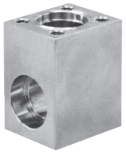


- For use with Flow: with P51530-X0/-X1, 3-2536-X0/-X1, 3-8510-X0/-X1, 3-8512-X0/-X1, 3-2537-XC-X0/-X1, 3-2551-X0-XX/-X1-XX
- For use with pH/ORP: 3-272X-XX, 3-273X-XX

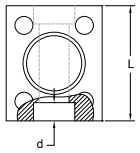
- These fittings are only available from the GF sales office in Japan.
- Choice FKM or EPR (EPDM) O-ring.
- Appearance varies in DN15 mm.

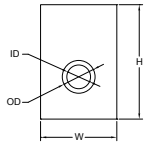
Metalex Socket Weld Mini-Tap (1.4401)

Part No.	Code No.	DN [mm]	Size [in.]	Sensor Type	o.d. [mm]	d [mm]	i.d. [mm]	o.d. [in.]	d [in.]	i.d. [in.]	L [in.]	W [in.]	H [in.]
P526-2005	198 840 501	15	0.50	P525-1, -1S	21.8	9.7	15.8	0.85	0.38	0.622	2.4	2.0	3.0
P526-2007	198 840 502	20	0.75	P525-1, -1S	27.2	12.7	20.9	1.06	0.50	0.824	2.4	2.0	3.0
P526-2010	198 840 503	25	1.00	P525-1, -1S	33.8	12.7	26.7	1.33	0.50	1.05	2.4	2.0	3.0



- For use with P525-1 and P525-1S only
- For use with SS pipe



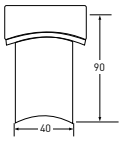


SS Weld-On Fittings (1.4401)

Code No.	DN [mm]	Inch
198 150 346	40 - 800	1.50 - 30



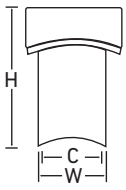
- For use with P525-2 and P525-2S



Metalex Weld-on Mini-Tap (1.4401)

Part No.	Code No.	Size [in.]	Sensor type - Flow	W [in.]	H [in.]	C [in.]
P526-2012	159 000 494	1.25	P525-2, -2S	1.66	2.25	1.26
P526-2015	198 840 506	1.50	P525-2, -2S	1.66	2.20	1.26
P526-2020	159 000 495	2.00	P525-2, -2S	1.66	2.17	1.26
P526-2025	159 000 496	2.50	P525-2, -2S	1.66	2.10	1.26
P526-2030	159 000 497	3.00	P525-2, -2S	1.66	2.00	1.26
P526-2040	159 000 498	4.00	P525-2, -2S	1.66	1.95	1.26
P526-2050	159 000 499	5.00	P525-2, -2S	1.66	1.83	1.26
P526-2060	159 000 500	6.00	P525-2, -2S	1.66	1.75	1.26
P526-2080	159 000 501	8.00	P525-2, -2S	1.66	1.56	1.26
P526-2100	159 000 502	10.00	P525-2, -2S	1.66	1.35	1.26
P526-2120	159 000 503	12.00	P525-2, -2S	1.66	1.15	1.26





- For use with P525-2 and P525-2S only
- For use with SS pipe
- Gasket Klinger C4401 Thermoseal

Electrofusion for PE pipes: Transition Saddles with Stainless 1¼ Inch Outlet

Code No.	Size [in.]	Sensor Type	L [in.]	H [in.]	d [in.]
10004673	2.0	2552-2	3.6	3.18	N/A
10004686	3.0	2552-2	4.6	3.18	N/A
10004700	4.0	2552-2	6.26	3.8	N/A
10004717	6.0	2552-2	8.68	4.96	N/A
10007761	8.0	2552-2	5.92	2.96	N/A
Special request	10.0	2552-2	Call	Call	N/A
Special request	12.0	2552-2	Call	Call	N/A



- Transition saddle with 1¼ FNPT branch/outlet
- Transition saddle with 1½ FNPT branch/outlet
- These fittings are only available from your local GF sales office

Electrofusion for PE pipes: Transition Saddles with Stainless 1½ Inch Outlet

Code No.	Size [in.]	Sensor Type	L [in.]	H [in.]	d [in.]
10004676	2.0	2552-3, 2540-XX, 3719-11	3.6	3.18	N/A
10004689	3.0	2552-3, 2540-XX, 3719-11	4.6	3.18	N/A
10004703	4.0	2552-3, 2540-XX, 3719-11	6.26	3.8	N/A
10004720	6.0	2552-3, 2540-XX, 3719-11	8.68	4.96	N/A
10004743	8.0	2552-3, 2540-XX, 3719-11	5.92	2.96	N/A
Special request	10.0	2552-3, 2540-XX, 3719-11	Call	Call	N/A
Special request	12.0	2552-3, 2540-XX, 3719-11	Call	Call	N/A

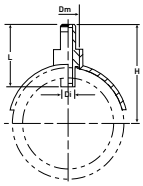


- Transition saddle with 1¼ FNPT branch/outlet
- Transition saddle with 1½ FNPT branch/outlet
- These fittings are only available from your local GF sales office

Type 312 PE Electrofusion System

Code No.	d [mm]	PN [bar]	Sensor Type	Di [mm]	H [mm]	L [mm]	Dm [mm]
753 312 012	75	16	Flow -X1	38	123	102	63
753 312 013	90	16	Flow -X1	38	130	102	63
753 312 014	110	16	Flow -X1	38	142	102	63
753 312 015	125	16	Flow -X1	38	141	102	63
753 312 016	140	16	Flow -X1	38	146	102	63
753 312 017	160	16	Flow -X1	38	153	102	63
753 312 018	180	16	Flow -X2	38	235	178	63
753 312 019	200	16	Flow -X2	38	244	178	63
753 312 020	225	16	Flow -X2	38	250	178	63
753 312 021	250	16	Flow -X2	38	258	178	63
753 312 022	280	16	Flow -X2	38	268	178	63
753 312 023	315	16	Flow -X2	38	279	178	63
753 312 024	355	16	Flow -X2	38	293	178	63
753 312 025	400	16	Flow -X2	38	307	178	63

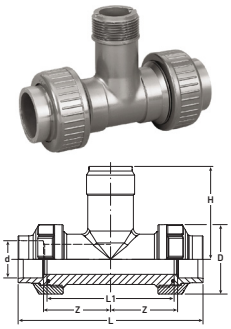




- For use with Flow: P51530-X1/-X2, 3-2536-X1/-X2, 3-8510-X1, 3-8512-X1, 3-2537-XC-X1, 3-2551-X1-XX
- Sensor length depends on installation fitting
- Threaded outlet 1¼ inch NPSM.
- Material: Polyethylene.

Type 310, PVC-U for Socket Systems, Metric

EPDM Code No.	FKM Code No.	d [mm]	DN [mm]	PN [bar]	Sensor Type	D [mm]	L [mm]	L1 [mm]	H [mm]	z [mm]
721 310 006	721 310 036	20	15	16	Flow -X0, pH -XX	43	128	90	76	48
721 310 007	721 310 037	25	20	16	Flow -X0, pH -XX	51	144	100	78	53
721 310 008	721 310 038	32	25	16	Flow -X0, pH -XX	58	160	110	81	58
721 310 009	721 310 039	40	32	16	Flow -X0, pH -XX	72	168	110	85	58
721 310 010	721 310 040	50	40	16	Flow -X0, pH -XX	83	188	120	89	63
721 310 011	721 310 041	63	50	16	Flow -X0, pH -XX	100	212	130	95	68

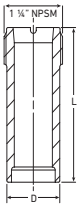


- For use with Flow: P51530-X0, 3-2536-X0, 3-8510-X0, 3-8512-X0, 3-2537-XC-X0, 3-2551-X0-XX
- For use with pH/ORP: 3-272X-XX, 3-273X-XX
- Sensor length depends on installation fitting
- Threaded outlet 1¼ inch NPSM.
- To install this installation fitting in PVC-C, PP-R and PE pipes; replace the original union ends with PVC-C, PP-R and PE union ends.

Type 314, PVC-U, Weldolet, Metric

Code No.	d [mm]	DN [mm]	Sensor Type	D [mm]	L [mm]
721 314 000	75 - 180	65 - 150	Flow -X0, pH - XX	38	68
721 314 001	200 - 355	200 - 350	Flow -X1	38	102
721 314 002	400 - 630	350 - 600	Flow -X2	38	178



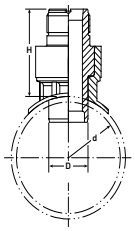


- For use with Flow: P51530-X0/-X1/-X2, 3-2536-X0/-X1/-X2, 3-8510-X0/-X1, 3-8512-X0/-X1, 3-2537-XC-X0/-X1, 3-2551-X0-XX/-X1-XX/-X2-XX
- For use with pH/ORP: 272X-XX, 3-273X-XX
- Sensor length depends on installation fitting.
- Threaded outlet 1¼ inch NPSM.
- Please consult the instruction manual.
- For conventional hot gas back welding according to DVS 2207 part 3.
- Your maximum allowable pressure may be determined by the pressure rating of the pipe material, quality of weld and/or installed sensor.
- pH sensors can also be used for dimensions above d180/DN150 and below d75/DN65 with 721 314 000 the length might have to be adjusted.

Type 312, PVC-U, Glue-on Saddle, Metric

Code No.	d [mm]	DN [mm]	PN [bar]	Sensor Type	D [mm]	L [mm]
721 312 012	75	65	10	Flow -X1	38	89
721 312 013	90	80	10	Flow -X1	38	89
721 312 014	110	100	10	Flow -X1	38	89
721 312 015	125	100	10	Flow -X1	38	81
721 312 016	140	125	10	Flow -X1	38	79
721 312 017	160	150	10	Flow -X1	38	76
721 312 019	200	200	10	Flow -X1	38	69
721 312 020	225	200	10	Flow -X2	38	141
721 312 021	250	250	10	Flow -X2	38	137
721 312 023	315	300	10	Flow -X2	38	127



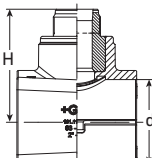


- For use with Flow: P51530-X1/-X2, 3-2536-X1/-X2, 3-8510-X1, 3-8512-X1, 3-2537-XC-X1, 3-2551-X1-XX
- Sensor length depends on installation fitting.
- Threaded outlet 1¼ inch NPSM.
- Top saddle for solvent cement bonding.

Type 312, PVC-U Clamp-on Saddle, Metric

Code No.	d [mm]	DN [mm]	PN [bar]	Sensor Type	H [mm]	L [mm]
198 150 538	75	65	16	Flow -X0, pH-XX	99	105
198 150 539	90	80	16	Flow -X0, pH-XX	105	105
198 150 540	110	100	16	Flow -X0, pH-XX	114	105
198 150 543	160	150	16	Flow -X1	157	120
198 150 545	225	200	16	Flow -X1	184	120





- For use with Flow: P51530-X0/-X1, 3-2536-X0/-X1, 3-8510-X0/-X1, 3-8512-X0/-X1, 3-2537-XC-X0/-X1, 3-2551-X0-XX/-X1-XX

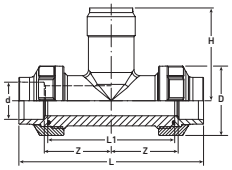
For use with pH/ORP: 3-272X-XX, 3-273X-XX

- Sensor length depends on installation fitting.
- Threaded outlet 1¼ inch NPSM.
- Top saddle for solvent cement bonding.
- Seal: Lip seal of EPDM.
- pH sensors can only be used up to 4 in. or DN100 pipe.

Type 310, BSP PVC-U for Socket Fusion, BS Inch

EPDM Code No.	FKM Code No.	d [in.]	PN [bar]	Sensor Type	D [mm]	z [mm]	L [mm]	L1 [mm]	H [mm]
721 310 306	721 310 336	½	15	Flow -X0, pH -XX	43	48	131	90	76
721 310 307	721 310 337	¾	15	Flow -X0, pH -XX	51	53	147	100	78
721 310 308	721 310 338	1	15	Flow -X0, pH -XX	58	58	164	110	81
721 310 309	721 310 339	1¼	15	Flow -X0, pH -XX	72	58	171	110	85
721 310 310	721 310 340	1½	15	Flow -X0, pH -XX	83	63	188	120	89
721 310 311	721 310 341	2	15	Flow -X0, pH -XX	100	68	211	130	95



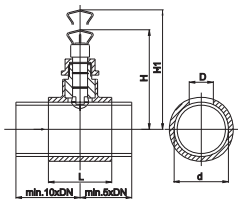


- For use with Flow: P51530-X0, 3-2536-X0, 3-8510-X0, 3-8512-X0, 3-2537-XC-X0, 3-2551-X0-XX
- For use with pH/ORP: 3-272X-XX, 3-273X-XX
- Sensor length depends on installation fitting.
- BSP - British Standard Pipe.
- Threaded outlet 1¼ inch NPSM.

Type 312, BSP PVC-U, Clamp-on Saddle, BS Inch

Code No.	d [mm]	d [in.]	DN [mm]	PN [bar]	Sensor Type	D [mm]	H [mm]	H1 [mm]	L [mm]
198 150 550	90	3	80	15	Flow -X0, pH -XX	39	105	225	105
198 150 551	110	4	100	15	Flow -X0, pH -XX	39	114	264	105
198 150 554	160	6	150	15	Flow -X1	39	156	339	120



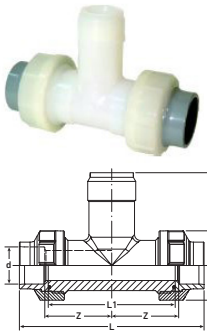


- For use with Flow: P51530-X0/-X1, 3-2536-X0/-X1, 3-8510-X0/-X1, 3-8512-X0/-X1, 3-2537-XC-X0/-X1, 3-2551-X0-XX/-X1-XX
- For use with pH/ORP: 3-272X-XX, 3-273X-XX
- Sensor length depends on installation fitting.
- BSP - British Standard Pipe.
- Threaded outlet 1¼ inch NPSM.
- Lip seal EPDM.

Alternative solution can be a PP saddle or wafer pipe size, pressure rating and chemical resistance need to be evaluated.

Type 310, PVC-C for Socket Systems, Metric

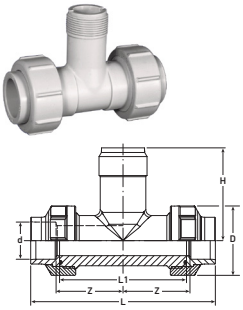
EPDM Code No.	FKM Code No.	d [mm]	DN [mm]	PN [bar]	Sensor Type	D [mm]	z [mm]	L [mm]	L1 [mm]	H [mm]
723 310 006	723 310 036	20	15	16	Flow -X0, pH -XX	45	49	132	90	76
723 310 007	723 310 037	25	20	16	Flow -X0, pH -XX	55	53	148	100	78
723 310 008	723 310 038	32	25	16	Flow -X0, pH -XX	62	58	164	110	81
723 310 009	723 310 039	40	32	16	Flow -X0, pH -XX	75	58	172	110	85
723 310 010	723 310 040	50	40	16	Flow -X0, pH -XX	84	63	188	120	89
723 310 011	723 310 041	63	50	16	Flow -X0, pH -XX	101	68	212	130	95



- For use with Flow: P51530-X0, 3-2536-X0, 3-8510-X0, 3-8512-X0, 3-2537-XC-X0, 3-2551-X0-X0-XX
- For use with pH/ORP: 3-272X-XX, 3-273X-XX
- Sensor length depends on installation fitting.
- Threaded outlet 1¼ inch NPSM.
- Body and union nut PVDF.
- Union end with solvent cement socket PVC-C.

Type 310, PROGEF Standard, PP-H for Socket Fusion, Metric

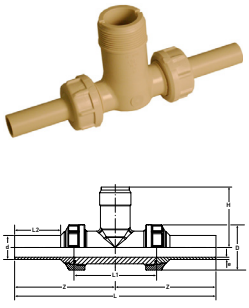
EPDM Code No.	FKM Code No.	d [mm]	DN [mm]	PN [bar]	Sensor Type	D [mm]	z [mm]	L [mm]	L1 [mm]	H [mm]
727 310 006	727 310 036	20	15	10	Flow -X0, pH -XX	48	50	128	90	76
727 310 007	727 310 037	25	20	10	Flow -X0, pH -XX	58	55	142	100	78
727 310 008	727 310 038	32	25	10	Flow -X0, pH -XX	65	60	156	110	81
727 310 009	727 310 039	40	32	10	Flow -X0, pH -XX	79	60	160	110	85
727 310 010	727 310 040	50	40	10	Flow -X0, pH -XX	91	65	176	120	89
727 310 011	727 310 041	63	50	10	Flow -X0, pH -XX	105	70	194	130	95



- For use with Flow: P51530-X0, 3-2536-X0, 3-8510-X0, 3-8512-X0, 3-2537-XC-X0,3-2551-X0-XX
- For use with pH/ORP: 3-272X-XX, 3-273X-XX
- To install this installation fitting in PVC-C, PP-R and PE pipes; replace the original union ends with PVC-C, PP-R and PE union ends.
- Threaded outlet 1¼ inch NPSM.
- Union end with socket fusion PP-H.

Type 318, PROGEF Standard, PP-H for Butt Fusion, Metric

EPDM Code No.	FKM Code No.	d [mm]	DN [mm]	PN [bar]	Sensor Type	D [mm]	L [mm]	L1 [mm]	L2 [mm]	H [mm]	Z [mm]	e
727 318 006	727 318 036	20	15	10	Flow -X0, pH -XX	48	224	90	52	76	112	1.9
727 318 007	727 318 037	25	20	10	Flow -X0, pH -XX	58	242	100	53	78	121	2.3
727 318 008	727 318 038	32	25	10	Flow -X0, pH -XX	65	256	110	55	81	128	2.9
727 318 009	727 318 039	40	32	10	Flow -X0, pH -XX	79	272	110	60	85	136	3.7
727 318 010	727 318 040	50	40	10	Flow -X0, pH -XX	91	294	120	66	89	147	4.6
727 318 011	727 318 041	63	50	10	Flow -X0, pH -XX	105	316	130	70	95	158	5.8

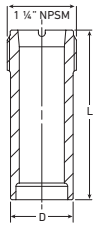


- For use with Flow: P51530-X0, 3-2536-X0, 3-8510-X0, 3-8512-X0, 3-2537-X0, 3-2551-X0
- For use with pH/ORP: 3-272X-XX, 3-273X-XX
- Also available for PROGEF Natural Systems with union ends in PP-R and body in PP-H (Code No.: 728318106...) or with body in PVDF (Code No.: 728318006...)
- To install this installation fitting in PVC-C, PP-R and PE pipes; replace the original union ends with PVC-C, PP-R and PE union ends.
- Threaded outlet 1¼ inch NPSM.
- Union end with butt fusion spigot PP-H.

Type 314, PROGEF Standard, PP-H, Metric

Code No.	d [mm]	DN [mm]	Sensor Type	D [mm]	L [mm]
727 314 000	75 - 180	65 - 150	Flow -X0, pH -XX	37.5	68
727 314 001	200 - 355	200 - 350	Flow -X1	37.5	102
727 314 002	400 - 630	350 - 600	Flow -X2	37.5	178



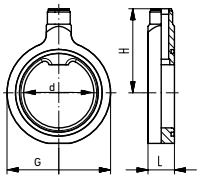


- For use with Flow: P51530-X0/-X1/-X2, 3-2536-X0/-X1/-X2, 3-8510-X0/-X1, 3-8512-X0/-X1, 3-2537-XC-X0/-X1, 3-2551-X0-XX/-X1-XX/-X2-XX
- For use with pH/ORP: 272X-XX, 3-273X-XX
- Threaded outlet 1¼ inch NPSM
- For conventional hot gas back welding according to DVS 2207 part 3
- Please consult the instruction manual.
- Sensor length depends on installation fitting.
- Your maximum allowable pressure may be determined by the pressure rating of the pipe material, quality of weld and/or installed sensor.
- pH sensors can also be used for dimensions above d180/DN150 and below d75/DN65 with 727 314 000; the length might have to be adjusted.

Type 311, PROGEF Standard, PP-H, Wafer fitting, Metric/Inch

EPDM Code No.	FKM Code No.	d [mm]	d [in.]	DN [mm]	PN [bar]	Sensor Type	D [mm]	H [mm]	L [mm]	L1[mm]
727 311 012	727 311 042	75	2 ½	65	10	Flow -X1	88	133	48	61
727 311 013	727 311 043	90	3	80	10	Flow -X1	102	140	48	69
727 311 014	727 311 044	110	4	100	10	Flow -X1	132	145	48	79
727 311 015	727 311 045	125		100	10	Flow -X1	132	144	48	79
727 311 016	727 311 046	140	5	125	10	Flow -X1	157	149	48	94
727 311 017	727 311 047	160	6	150	10	Flow -X1	182	156	48	106
727 311 018	727 311 048	180		150	10	Flow -X1	182	163	48	106
727 311 019	727 311 049	200	8	200	10	Flow -X1	236	170	48	134
727 311 020	727 311 050	225	8	200	10	Flow -X1	236	178	48	134
727 311 021	727 311 051	250	10	250	10	Flow -X2	289	263	48	160
727 311 022	727 311 052	280	10	250	10	Flow -X2	289	273	48	160
727 311 023	727 311 053	315	12	300	10	Flow -X2	329	285	48	185

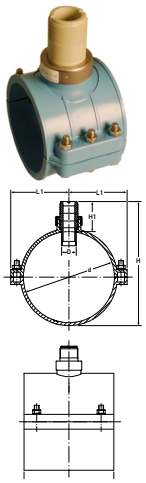




- For use with Flow: P51530-X1/-X2, 3-2536-X1/-X2, 3-8510-X1, 3-8512-X1, 3-2537-XC-X1, 3-2551-X1-XX
- Threaded outlet 1¼ inch NPSM.
- Suitable for backing flanges metric and inch.
- Suitable for SDR 11 - SDR 17.6.
- Delivered with profile O-ring.
- Wafer can be used with other pipe materials.
- Sensor length depends on installation fitting.

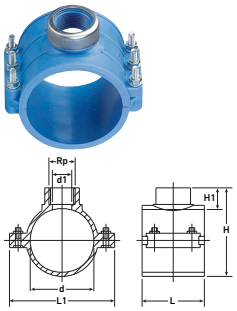
Type 312, PP-H, Screw-on, Metric

Code No.	d [mm]	DN [mm]	PN [bar]	Sensor Type	D [mm]	L [mm]	L1 [mm]	H [mm]	H1 [mm]
727 312 072	75	65	8	Flow -X1	34	78	62	172	88
727 312 073	90	80	8	Flow -X1	34	86	69	186	87
727 312 074	110	100	8	Flow -X1	34	98	79	206	86
727 312 075	125	100	8	Flow -X1	34	101	85	212	78
727 312 076	140	125	6	Flow -X1	34	114	104	227	75
727 312 077	160	150	6	Flow -X1	34	114	114	243	72
727 312 078	180	150	6	Flow -X2	34	168	134	348	144
727 312 079	200	200	6	Flow -X2	34	168	132	357	142
727 312 080	225	200	5	Flow -X2	34	174	146	375	136
727 312 081	250	250	5	Flow -X2	34	179	159	397	131
727 312 082	280	250	5	Flow -X2	34	179	167	426	127
727 312 083	315	300	5	Flow -X2	34	248	202	450	120



- For use with Flow: P51530-X1/-X2, 3-2536-X1/-X2, 3-8510-X1, 3-8512-X1, 3-2537-XC-X1, 3-2551-X1-XX
- Threaded outlet 1¼ inch NPSM.
- Sensor length depends on installation fitting.
- Top saddle with EPDM gasket.
- Stainless steel bolts and nuts.
- Saddle can be used with other pipe materials.

Poly16 Plus Clamp Saddle

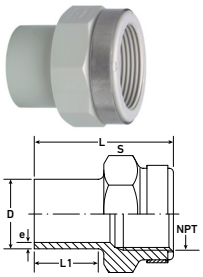


Code No.	d [mm]	Rp [in.]	PN [bar]	Sensor Type	d1 [mm]	H [mm]	H1 [mm]	L [mm]	L1
727 627 012	25	¾	16	pH/ORP 2724-X-1, 2726-X-1, 2774-ISO, 2777-ISO, Conductivity 2839-1D, 2842-1D	13	58	15	49	79
727 627 022	32	¾	16	pH/ORP 2724-X-1, 2726-X-1, 2774-ISO, 2777-ISO, Conductivity 2839-1D, 2842-1D	14	62	20	49	79
727 627 032	40	¾	16	pH/ORP 2724-X-1, 2726-X-1, 2774-ISO, 2777-ISO, Conductivity 2839-1D, 2842-1D	21	71	20	62	86
727 627 042	50	¾	16	pH/ORP 2724-X-1, 2726-X-1, 2774-ISO, 2777-ISO, Conductivity 2839-1D, 2842-1D	21	82	20	62	86
727 627 044	50	1¼	16	Flow 2552-X2	21	82	20	62	86
727 627 052	63	¾	16	pH/ORP 2724-X-1, 2726-X-1, 2774-ISO, 2777-ISO, Conductivity 2839-1D, 2842-1D	24	96	21	62	101
727 627 054	63	1¼	16	Flow 2552-X2	31	96	21	62	101
727 627 055	63	1½	16	pH/ORP 3719-2, Flow 2540-21-4, 2552-X4	31	96	21	62	101
727 627 062	75	¾	16	pH/ORP 2724-X-1, 2726-X-1, 2774-ISO, 2777-ISO, Conductivity 2839-1D, 2842-1D	21	104	16	79	123
727 627 064	75	1¼	16	Flow 2552-X2	35	109	21	79	123
727 627 065	75	1½	16	pH/ORP 3719-2, Flow 2540-21-4, 2552-X4	42	109	21	79	123
727 627 072	90	¾	16	pH/ORP 2724-X-1, 2726-X-1, 2774-ISO, 2777-ISO, Conductivity 2839-1D, 2842-1D	21	118	16	87	138
727 627 074	90	1¼	16	Flow 2552-X2	35	123	21	87	138
727 627 075	90	1½	16	pH/ORP 3719-2, Flow 2540-21-4, 2552-X4	42	123	21	87	138
727 627 082	110	¾	16	pH/ORP 2724-X-1, 2726-X-1, 2774-ISO, 2777-ISO, Conductivity 2839-1D, 2842-1D	20	150	23	99	152
727 627 084	110	1¼	16	Flow 2552-X2	35	150	23	99	152
727 627 085	110	1½	16	pH/ORP 3719-2, Flow 2540-21-4, 2552-X4	41	150	23	99	152
727 627 092	125	¾	16	pH/ORP 2724-X-1, 2726-X-1, 2774-ISO, 2777-ISO, Conductivity 2839-1D, 2842-1D	20	169	24	101	166
727 627 094	125	1¼	16	Flow 2552-X2	35	168	23	101	166
727 627 095	125	1½	16	pH/ORP 3719-2, Flow 2540-21-4, 2552-X4	41	168	23	101	166
727 627 102	140	¾	16	pH/ORP 2724-X-1, 2726-X-1, 2774-ISO, 2777-ISO, Conductivity 2839-1D, 2842-1D	24	191	25	114	207
727 627 104	140	1¼	16	Flow 2552-X2	38	191	25	114	207
727 627 105	140	1½	16	pH/ORP 3719-2, Flow 2540-21-4, 2552-X4	45	191	24	114	207
727 627 112	160	¾	16	pH/ORP 2724-X-1, 2726-X-1, 2774-ISO, 2777-ISO, Conductivity 2839-1D, 2842-1D	24	215	24	114	226
727 627 114	160	1¼	16	Flow 2552-X2	37	215	24	114	226
727 627 115	160	1½	16	pH/ORP 3719-2, Flow 2540-21-4, 2552-X4	45	215	24	114	226
727 627 124	180	1¼	10	Flow 2552-X2	36	265	38	169	262
727 627 125	180	1½	10	pH/ORP 3719-2, Flow 2540-21-4, 2552-X4	42	265	38	169	262
727 627 145	225	1½	10	pH/ORP 3719-2, Flow 2540-21-4, 2552-X4	45	287	26	174	287

- Stainless steel bolts.
- Saddle can be used with other pipe materials.
- Check H1 value vs. sensor length regarding minimum insertion depth.

Adapter Socket, PP-H, ANSI - NPT

Code No.	d [mm]	NPT [in.]	PN [bar]	Sensor Type	D [mm]	L [mm]	L1 [mm]	s [mm]	e [mm]
727 914 357	25	¾	10	2724-2726, 2774-2777, 2819-2842, 2350, 2450	25	51	23	36	2.3
727 914 358	32	1	10	2764-2767	32	54	23	46	2.9
727 914 359	40	1¼	10	2552-X1	40	56	23	55	3.7
727 914 360	50	1½	10	3719-11, 2540-1/-3, 2552-X3	50	60	23	65	4.6
727 914 361	63	2	10	3719-21	63	62	23	80	5.8

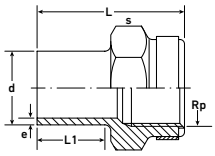


- "d" is for pipe dimension .
- Connection via Butt or IR fusion.
- Check L1 value vs. sensor length regarding minimum insertion depth.

Adapter Socket, PP-H, Metric - Rp

Code No.	d [mm]	Rp [in.]	PN [bar]	Sensor Type	L [mm]	L1 [mm]	s [mm]	e [mm]
727 910 267	25	¾	10	2724-X1, 2726-X1, 2774-ISO, 2777-ISO, 2839-1D-2842-1D	50	23	36	2.3
727 910 269	40	1¼	10	2552-X2	56	23	55	3.7
727 910 270	50	1½	10	3719-12, 2540-2/-4, 2552-X4	60	23	65	4.6
727 910 271	63	2	10	3719-22	62	23	80	5.8



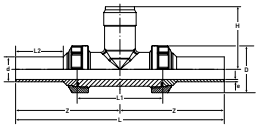


- "d" is for pipe dimension
- Connection via Butt or IR fusion
- Check L1 value vs. sensor length regarding minimum insertion depth.

Type 318, ecoFIT PE100 SDR 11 for Butt Fusion System, Metric

EPDM Code No.	FKM Code No.	d [mm]	DN [mm]	PN [bar]	Sensor Type	D [mm]	L [mm]	L1 [mm]	L2 [mm]	H [mm]	z
753 318 006	753 318 036	20	15	10	Flow -X0, pH -XX	48	224	90	52	76	112
753 318 007	753 318 037	25	20	10	Flow -X0, pH -XX	58	242	100	53	78	121
753 318 008	753 318 038	32	25	10	Flow -X0, pH -XX	65	256	110	55	81	128
753 318 009	753 318 039	40	32	10	Flow -X0, pH -XX	79	272	110	60	85	136
753 318 010	753 318 040	50	40	10	Flow -X0, pH -XX	91	294	120	66	89	147
753 318 011	753 318 041	63	50	10	Flow -X0, pH -XX	105	316	130	70	95	158



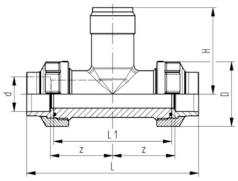


- For use with Flow: P51530-X0, 3-2536-X0, 3-8510-X0, 3-8512-X0, 3-2537-XC-X0, 3-2551-X0-XX,
- For use with pH/ORP: 3-272X-XX, 3-273X-XX
- Sensor length depends on installation fitting.
- Threaded outlet 1¼ inch NPSM.
- Union end with butt fusion spigot PE100.
- Body and union nut PP-H.

Type 310, ecoFIT PP-H/PE80 for Socket Systems, Metric

EPDM Code No.	FKM Code No.	d [mm]	DN [mm]	Sensor Type	D [mm]	L [mm]	L1 [mm]	H [mm]	z
733 310 006	733 310 036	20	15	Flow -X0, pH -XX	48	128	90	76	50
733 310 007	733 310 037	25	20	Flow -X0, pH -XX	58	421	100	78	55
733 310 008	733 310 038	32	25	Flow -X0, pH -XX	65	156	110	81	60
733 310 009	733 310 039	40	32	Flow -X0, pH -XX	79	160	110	85	60
733 310 010	733 310 040	50	40	Flow -X0, pH -XX	91	176	120	89	65
733 310 011	733 310 041	63	50	Flow -X0, pH -XX	105	194	130	95	70



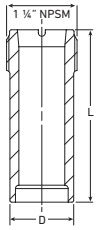


- For use with Flow: P51530-X0, 3-2536-X0, 3-8510-X0, 3-8512-X0, 3-2537-XC-X0, 3-2551-X0-XX,
- For use with pH/ORP: 3-272X-XX, 3-273X-XX
- Sensor length depends on installation fitting.
- Threaded outlet 1¼ inch NPSM.
- Union end with fusion socket PE80.
- Body and union nut PP-H.

Type 314, ecoFIT PE weldolet, Metric and Inch

Code No.	d [mm]	DN [mm]	Sensor Type	D [mm]	L [mm]
753 314 000	75 - 180	65 - 150	Flow -X0, pH -XX	38	68
753 314 001	200 - 355	200 - 350	Flow -X1	38	102
753 314 002	400 - 630	350 - 600	Flow -X2	38	178



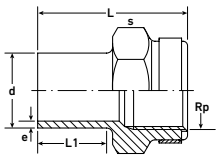


- For use with Flow: P51530-X0/-X1/-X2, 3-2536-X0/-X1/-X2, 3-8510-X0/-X1, 3-8512-X0/-X1, 3-2537-XC-X0/-X1, 3-2551-X0-XX/-X1-XX/-X2-XX,
- For use with pH/ORP: 3-272X-XX, 3-273X-XX
- Threaded outlet 1¼ inch NPSM.
- Sensor length depends on installation fitting.
- For conventional hot gas back welding according to DVS 2207 part 3.
- Your maximum allowable pressure may be determined by the pressure rating of the pipe material, quality of weld and/or installed sensor.
- pH sensors can also be used for dimensions above d180/DN150 and below d75/DN65 with 753 314 000; the length might have to be adjusted.

Adapter Socket, ecoFIT PE100, SDR11 Metric - Rp

Code No.	d [mm]	Rp [in.]	PN bar]	Sensor Type	D [mm]	L [mm]	L1 [mm]	s [mm]	e [mm]
753 910 267	25	¾	10	272X, 277X-ISO, 2839-1D - 2842-1D	25	51	23	36	2.3
753 910 269	40	1¼	10	2552-X2	40	57	23	55	3.7
753 910 270	50	1½	10	3719-12, 2540-2/-4, 2552-X4	50	60	23	64	4.6





- Threaded outlet 1¼ inch NPSM.
- Sensor length depends on installation fitting.
- Connection via socket fusion.
- Small "d" is for pipe diameter.

Transition Adapter PE/brass (CW617N) ISO female thread, Metric

Code No.	d [mm]	PN [bar]	Rp [in.]	Sensor Type	L [mm]	z [mm]
720 920 231	63	16	1¼	2552-X2	85	47
720 920 241	63	16	1½	3719, 2540, 2552-X4	85	47



- 16 bar water.
- For electrofusion saddle (193 131 XXX and 193 135 159).

PE Adapter ISO female thread, Metric

Code No.	d [mm]	PN [bar]	Rp [in.]	Sensor Type	L [mm]
173 281 925	63	12.5	1½	3719, 2540, 2552-X4	54

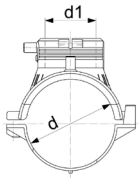


- Reinforcing ring stainless (A2).
- For electrofusion saddle (193 131 XXX and 193 135 159).

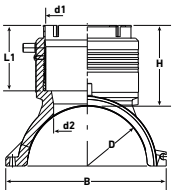
ELGEF Plus, Electrofusion Saddle, PE100, SDR 11

Code No.	d [mm]	d1 [mm]	L [mm]
193 131 037	63	63	165
193 131 047	75	63	165
193 131 057	90	63	165
193 131 067	110	63	165
193 131 077	125	63	165
193 131 087	140	63	165
193 131 097	160	63	165
193 131 107	180	63	165
193 131 117	200	63	165
193 131 127	225	63	165
193 131 147	280	63	165
193 131 157	315-355	63	165





L = length / Länge



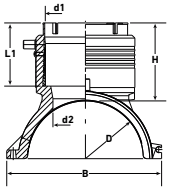
- Connection with transition adapter PE/Brass or PE adapter.

ELGEF Plus Branch Fitting

Code No.	d [mm]	d1 [mm]	H [mm]	L [mm]	L1 [mm]	B [mm]	d2 [mm]
193 135 159	500 - 630	90	102	260	82	263	65



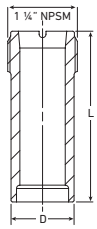
- Can be used with reduction d90 - d63 (753 908 906)
- Connection via socket fusion with transition adapter PE/brass or PE adapter.



Type 314, SYGEF Standard, PVDF, Metric/Inch

Code No.	d [mm]	DN [mm]	Sensor Type	D [mm]	L [mm]
735 314 000	75 - 180	65 - 150	Flow -X0, pH -XX	37.5	68
735 314 001	200 - 355	200 - 350	Flow -X1	37.5	102
735 314 002	400 - 630	350 - 600	Flow -X2	37.5	178



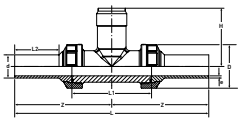


- For use with Flow: P51530-X0/-X1/-X2, 3-2536-X0/-X1/-X2, 3-8510-X0/-X1, 3-8512-X0/-X1, 3-2537-XC-X0/-X1, 3-2551-X0-XX/-X1-XX/-X2-XX
- For use with pH/ORP: 3-272X-XX, 3-273X-XX
- Threaded outlet 1¼ inch NPSM
- Sensor length depends on installation fitting
- Please consult the instruction manual
- Installation only by trained and certified welder
- For conventional hot gas back welding according to DVS 2207 part 3
- Your maximum allowable pressure may be determined by the pressure rating of the pipe material, quality of weld and/or installed sensor
- pH sensors can also be used for dimensions above d180/DN150 and below d75/DN65 with 735 314 000; the length might have to be adjusted

Type 318, SYGEF Standard, PVDF for Butt Fusion, Metric

Code No.	d [mm]	DN [mm]	PN [bar]	Sensor Type	D [mm]	L [mm]	L1 [mm]	L2 [mm]	H [mm]	e [mm]
735 318 036	20	15	16	Flow -X0, pH -XX	45	196	90	37	76	1.9
735 318 037	25	20	16	Flow -X0, pH -XX	55	212	100	37	78	1.9
735 318 038	32	25	16	Flow -X0, pH -XX	62	228	110	40	81	2.4
735 318 039	40	32	16	Flow -X0, pH -XX	75	234	110	40	85	2.4
735 318 040	50	40	16	Flow -X0, pH -XX	84	250	120	43	89	3.0
735 318 041	63	50	16	Flow -X0, pH -XX	101	266	130	43	95	3.0



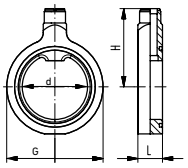


- For use with Flow: P51530-X0, 3-2536-X0, 3-8510-X0, 3-8512-X0, 3-2537-XC-X0, 3-2551-X0-XX
- For use with pH/ORP: 3-272X-XX, 3-273X-XX
- Threaded outlet 1¼ inch NPSM
- Sensor length depends on installation fitting
- Union end with butt fusion spigot PVDF.
- To install this installation fitting in PVC-C, PP-R and PE pipes; replace the original union ends with PVC-C, PP-R and PE union ends.

Type 311, SYGEF Standard, PVDF, Metric and Inch

FKM Code No.	d [mm]	d [in.]	DN [mm]	PN [bar]	Sensor Type	H [mm]	D [mm]	L [mm]	L1 [mm]
735 311 042	75	2½	65	16	Flow -X1	129	88	48	61
735 311 043	90	3	80	16	Flow -X1	141	102	48	69
735 311 044	110	4	100	16	Flow -X1	149	132	48	79
735 311 045	125		100	16	Flow -X1	147	132	48	79
735 311 046	140	5	125	16	Flow -X1	153	157	48	94
735 311 047	160	6	150	16	Flow -X1	161	182	48	106
735 311 049	200	8	200	16	Flow -X1	175	236	48	134
735 311 050	225	8	200	16	Flow -X1	185	236	48	134





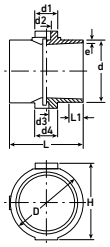
- For use with Flow: P51530-X1, 3-2536-X1, 3-8510-X1, 3-8512-X1, 3-2537-XC-X1, 3-2551-X1-XX
- Sensor length depends on installation fitting.
- Threaded outlet 1¼ inch NPSM.
- Suitable for backing flanges metric and inch.
- Delivered with profile O-ring.
- Wafer can be used with other pipe materials.

SYGEF Plus, PVDF HP Installation Fitting, SDR33/PN10

Code no.	d [mm]	Rp/NPT [in.]	PN [bar]	FM	D [mm]	e [mm]	d1 [mm]	d2 [mm]	d3 [mm]	d4 [mm]	H [mm]	L [mm]	L1 [mm]
735 918 716	140	¼-1	10	IR	171	4.3	63	17	10	50	171	155	40
735 918 717	160	¼-1	10	IR	189	4.9	63	17	10	50	191	155	40
735 918 720	225	¼-1	10	IR	248	6.9	63	17	10	50	256	155	40

- For all 1/4 to 1 inch threaded sensors.
- Compatible with all GF sensors (except flow sensors).
- Thread needs to be milled, handheld drilling must not be done.



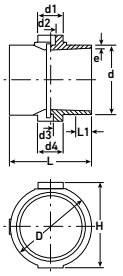


SYGEF Plus, PVDF HP Installation Fitting, PN16

Code no.	d [mm]	Rp/NPT [in.]	PN [bar]	FM	D [mm]	e [mm]	d1 [mm]	d2 [mm]	d3 [mm]	d4 [mm]	H [mm]	L [mm]	L1 [mm]
735 918 811	63	¼-¾	16	BCF, IR	85	3.0	40	17	10	32	89	120	25
735 918 812	75	¼-¾	16	BCF, IR	96	3.6	40	17	10	40	101	130	25
735 918 813	90	¼-¾	16	BCF, IR	110	4.3	40	17	10	40	116	130	25
735 918 814	110	¼-¾	16	BCF, IR	127	5.3	40	17	10	40	136	130	25
735 918 816	140	¼-1	16	IR	171	6.7	63	17	10	50	171	155	40
735 918 817	160	¼-1	16	IR	189	7.7	63	17	10	50	191	155	40
735 918 820	225	¼-1	16	IR	248	10.8	63	17	10	50	256	155	40

- For all 1/4 to 1 inch threaded sensors.
- Compatible with all GF sensors (except flow sensors).
- Thread needs to be milled, handheld drilling must not be done.



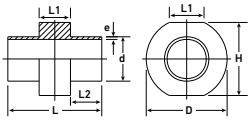


SYGEF Plus, PVDF HP Installation Fitting, PN16

Code no.	d [mm]	DN [mm]	Rp/NPT [in.]	PN [bar]	FM	D [mm]	H [mm]	L [mm]	L1 [mm]	L2 [mm]	e [mm]
735 918 615	125	100	1/8 - ¾	16	IR	162	157	100	40	27	6.0
735 918 616	140	125	1/8 - ¾	16	IR	176	171	110	40	32	6.7
735 918 617	160	150	1/8 - ¾	16	IR	194	190	110	40	32	7.7
735 918 619	200	200	1/8 - ¾	16	IR	231	228	110	40	32	9.6
735 918 620	225	200	1/8 - ¾	16	IR	254	251	110	40	32	10.8
735 918 621	250	250	1/8 - ¾	16	IR	277	274	160	40	60	11.9
735 918 622	280	250	1/8 - ¾	16	IR	304	307	160	40	60	13.4
735 918 623	315	300	1/8 - ¾	16	IR	336	334	160	40	60	15.0

- For all 1/8 to 3/4 inch threaded sensors.
- Compatible with all GF sensors (except flow sensors).
- Thread needs to be milled, handheld drilling must not be done.

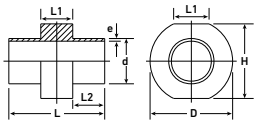




SYGEF Plus, PVDF HP Installation Fitting, PN10

Code no.	d [mm]	DN [mm]	Rp/NPT [in.]	PN [bar]	FM	D [mm]	H [mm]	L [mm]	L1 [mm]	L2 [mm]	e [mm]
735 918 565	125	100	1/8 - ¾	10	IR	162	157	100	40	27	3.9
735 918 566	140	125	1/8 - ¾	10	IR	176	171	110	40	32	4.4
735 918 567	160	150	1/8 - ¾	10	IR	194	190	110	40	32	4.9
735 918 569	200	200	1/8 - ¾	10	IR	231	228	110	40	32	6.2
735 918 570	225	200	1/8 - ¾	10	IR	254	251	110	40	32	7.0

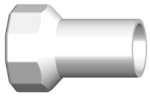


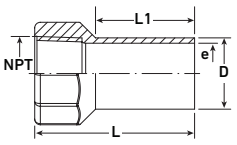


- For all 1/8 to 3/4 inch threaded sensors.
- Compatible with all GF sensors (except flow sensors).
- Thread needs to be milled, handheld drilling must not be done.

SYGEF Standard, PVDF, ANSI - NPT Female Thread, PN16

Code no.	d [mm]	NPT [in.]	PN [bar]	FM	Sensor Type	D [mm]	L [mm]	sw	L1 [mm]	e [mm]
735 914 587	25	¾	16	BCF, IR	272X, 277X, 2819-2842, 2350, 2450	58	25	38	30	1.9
735 914 588	32	1	16	BCF, IR	276X	63	32	48	30	2.4
735 914 589	40	1¼	16	BCF, IR	2552-X1	67	40	58	30	2.4
735 914 590	50	1½	16	BCF, IR	3719-11, 2540-1/-3, 2552-X3	67	50	65	30	3.0
735 914 591	63	2	16	BCF, IR	3719-21	73	63	80	30	3.0

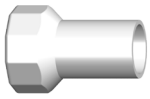


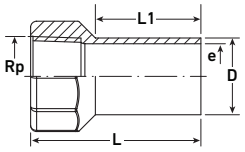


- Check L1 value vs. sensor length regarding minimum insertion depth.
- Also available in SYGEF Plus (PVDF-HP) in all dimensions: Code No. 735 914 787 etc.).
- Connection via BCF or IR fusion.
- Small “d” is for pipe dimension.

SYGEF Standard, PVDF for ISO Rp Female Thread, PN16

Code no.	d [mm]	Rp [in.]	PN [bar]	FM	Sensor Type	D [mm]	L [mm]	sw	L1 [mm]	e [mm]
735 910 587	25	¾	16	BCF, IR	272X, 277X-ISO, 2839-1D-2842-1D	25	57	38	30	1.9
735 910 289	40	1¼	16	BCF, IR	2552-X2	40	66	58	30	2.4
735 910 290	50	1½	16	BCF, IR	3719-12, 2540-2/-4, 2552-X4	50	66	65	30	3.0
735 910 590	63	2	16	BCF, IR	3719-22	63	73	80	30	3.0
735 910 591	63	2	16	BCF, IR	3719-21	73	63	80	30	3.0



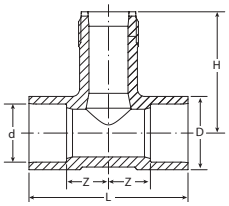


- Check L1 value vs. sensor length regarding minimum insertion depth.
- Also available in SYGEF Plus (PVDF-HP) in all dimensions: Code No. 735 914 787 etc.).
- Connection via BCF or IR fusion.
- Small “d” is for pipe dimension.

Type 310, ABS, Metric

Code no.	d [mm]	DN [mm]	PN [bar]	Sensor Type	D [mm]	L [mm]	H [mm]	z [mm]	closest [in.]
729 310 007	25	20	10	Flow -X0, pH -XX	35	100	78	32	¾
729 310 008	32	25	10	Flow -X0, pH -XX	44	110	81	33	1
729 310 009	40	32	10	Flow -X0, pH -XX	51	110	84	29	1¼
729 310 010	50	40	10	Flow -X0, pH -XX	63	120	88	29	1½
729 310 011	63	50	10	Flow -X0, pH -XX	78	130	94	28	2



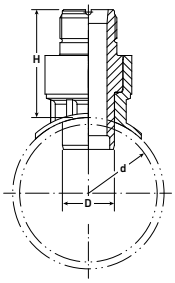


- For use with Flow: P51530-X0, 3-2536-X0, 3-8510-X0, 3-8512-X0, 3-2537-XC-X0, 3-2551-X0-XX,
- For use with pH/ORP: 3-272X-XX, 3-273X-XX
- Threaded outlet 1¼ inch NPSM.
- Sensor length depends on installation fitting.
- With solvent cement socket metric.

Type 312, ABS Glue-on Saddle, Metric

Code no.	d [mm]	DN [mm]	PN [bar]	Sensor Type	D [mm]	H [mm]	closest [in.]
729 312 012	75	65	10	Flow -X1	38	91	2½
729 312 013	90	80	10	Flow -X1	38	91	3
729 312 014	110	100	10	Flow -X1	38	91	4
729 312 016	140	125	10	Flow -X1	38	81	5
729 312 017	160	150	10	Flow -X1	38	77	6
729 312 019	200	200	10	Flow -X1	38	71	8
729 312 020	225	200	10	Flow -X1	38	67	8





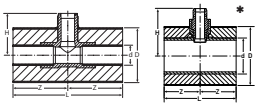
- For use with Flow: P51530-X1, 3-2536-X1, 3-8510-X1, 3-8512-X1, 3-2537-XC-X1, 3-2551-X1-XX
- Threaded outlet 1¼ inch NPSM.
- Sensor length depends on installation fitting.
- Top saddle for solvent cement bonding.

Type 313, COOL-FIT, pre-insulated, Metric

Type	Code no.	d [mm]	Rp [in.]	DN [mm]	PN [bar]	Required nipple	D [mm]	L [mm]	H [mm]	z [mm]	closest [in.]
A	738 313 007	25	½	20	10	738 901 107	90	160	102	80	¾
A	738 313 008	32	½	25	10	738 901 108	90	160	102	80	1
A	738 313 009	40	½	32	10	738 901 109	110	180	112	90	1¼
A	738 313 010	50	½	40	10	738 901 110	110	180	112	90	1½
A	738 313 011	63	½	50	10	738 901 111	125	200	122	100	2
A	738 313 012	* 75	½	65	10	738 901 112	140	250	153	125	2½
A	738 313 013	* 90	½	80	10	738 901 113	160	280	168	140	3
B	738 313 114	* 110	½	100	10	738 901 114	180	220	119	110	4
B	738 313 116	* 140	½	125	10	738 901 116	225	220	134	110	5
B	738 313 117	* 160	½	150	10	738 901 117	250	220	145	110	6
B	738 313 119	* 200	½	200	10	738 901 119	280	250	165	125	8
B	738 313 120	* 225	½	200	10	738 901 120	315	280	178	140	8

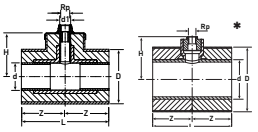
Type A





Type B





Type A
- Threaded outlet ½ Rp.
- Insulation made from PUR.
- Outer jacket impact resistant. Color: black.

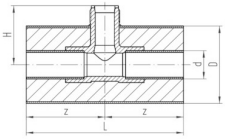
Type B
- With ½ inch Rp threaded branch for sensors (i.e. pressure).
- Insulation made from PUR.
- Outer jacket impact resistant. Color: black.

Type 310, COOL-FIT, pre-insulated, Metric

Type	Code no.	d [mm]	D [mm]	PN [bar]	Required nipple	Sensor Type	H [mm]	L [mm]	z [mm]	closest [in.]
A	738 310 107	25	90	10	738 901 107	Flow -X0, pH -XX	78	220	110	¾
A	738 310 108	32	90	10	738 901 108	Flow -X0, pH -XX	81	220	110	1
A	738 310 109	40	110	10	738 901 109	Flow -X0, pH -XX	84	220	110	1
A	738 310 110	50	110	10	738 901 110	Flow -X0, pH -XX	88	220	110	1½
A	738 310 111	63	125	10	738 901 111	Flow -X0, pH -XX	94	220	110	2
B	738 310 112	75	140	10	738 901 112	Flow -X1	161	220	110	2½
B	738 310 113	90	160	10	738 901 113	Flow -X1	171	220	110	3
B	738 310 114	110	180	10	738 901 114	Flow -X1	181	220	110	4
B	738 310 116	140	225	10	738 901 116	Flow -X1	193	220	110	5
B	738 310 117	160	250	10	738 901 117	Flow -X1	202	220	110	6
B	738 310 119	200	280	10	738 901 119	Flow -X1	211	250	125	8
B	738 310 120	225	315	10	738 901 120	Flow -X1	225	280	140	8

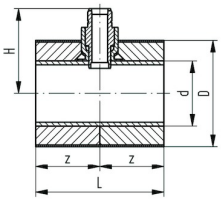
Type A





Type B





Type A and B

- For use with Flow: P51530-X0/-X1, 3-2536-X0/-X1, 3-8510-X0/-X1, 3-8512-X0/-X1, 3-2537-XC-X0/-X1, 3-2551-X0-XX/-X1-XX
- For use with pH/ORP: 3-272X-XX, 3-273X-XX
- Threaded outlet 1¼ NPSM.
- Insulation made from PUR.
- Outer jacket impact resistant. Color: black.

Type B

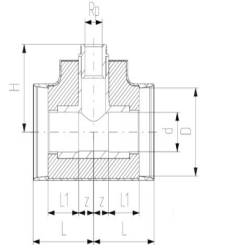
- With ½ inch Rp threaded branch for sensors (i.e. pressure).
- Insulation made from PUR.
- Outer jacket impact resistant. Color: black.

Type 313, COOL-FIT 2.0, Pre-insulated, Metric

Type	Code no.	d [mm]	D [mm]	PN [bar]	Rp [in.]	L [mm]	L1 [mm]	H [mm]	z [mm]	closest [in.]
A	738 313 408	32	75	16	½	73	36	75	16	1
A	738 313 409	40	90	16	½	81	40	85	21	1¼
A	738 313 459	40	90	16	¾	81	40	88	21	1¼
A	738 313 410	50	90	16	½	88	44	94	24	1½
A	738 313 460	50	90	16	¾	88	44	97	24	1½
A	738 313 411	63	110	16	½	97	48	113	29	2
A	738 313 461	63	110	16	¾	97	48	116	29	2
A	738 313 412	75	125	16	½	110	55	99	35	2½
A	738 313 462	75	125	16	¾	110	55	102	35	2½
A	738 313 413	90	140	16	½	123	62	113	42	3
A	738 313 463	90	140	16	¾	123	62	116	42	3
A	738 313 414	110	160	16	½	148	72	128	56	4
A	738 313 464	110	160	16	¾	148	72	131	56	4
B	738 313 416	140	200	16	½	224	84	110	447	5
B	738 313 466	140	200	16	¾	224	84	113	447	5

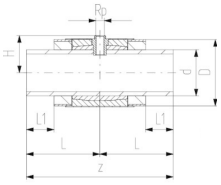
Type A





Type B





Type A

- Pre-insulated PE100 SDR11, metric.
- Insulation made from GF HE foam.
- Impact resistant. Color: black.
- With threaded branch for sensors (i.e. temperature, pressure).
- Electrofusion Fitting with integrated sealing lip, for a moisture-proof and vapor tight sealing.

Type B

- Pre-insulated PE100 SDR11, metric.
- Insulation made from GF HE foam.
- Impact resistant. Color: black.
- With threaded branch for sensors (i.e. temperature, pressure).
- Spigot Fitting with free end (separate electrofusion fitting needed for joining).

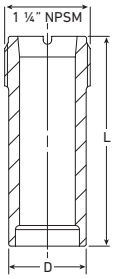
Type 314, Stainless Steel, Metric

Code no.	d [mm]	DN [mm]	Sensor Type	D [mm]	L [mm]
724 314 000	63 - 180	50 - 150	Flow -X0/ pH -XX	38	68
724 314 001	200 - 355	200 - 350	Flow -X1	38	102
724 314 002	400 - 630	350 - 600	Flow -X2	38	178



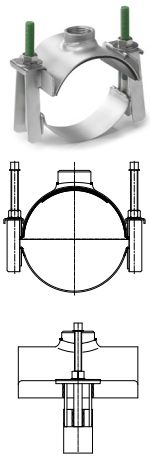
- For use with Flow: P51530-X0/-X1/-X2, 3-2536-X0/-X1/-X2, 3-8510-X0/-X1, 3-8512-X0/-X1, 3-2537-XC-X0/-X1, 3-2551-X0-XX/-X1-XX/-X2-XX
- For use with pH/ORP: 3-272X-XX, 3-273X-XX

- Threaded outlet 1¼ inch NPSM .
- pH sensors can also be used for dimensions above d180/DN150 and below d63/DN50 with 724 314 000; the length might have to be adjusted.



Multi/Clamp Saddle Studs Threaded Outlet ¾ Inch

Code no.	Range [mm]	PN Water [bar]	Sensor Type
724 201 062	68 - 78	16	2350, 2450, 272X, 273X, 277X
724 201 074	88 - 110	16	2350, 2450, 272X, 273X, 277X
724 201 098	108 - 134	16	2350, 2450, 272X, 273X, 277X
724 201 134	133 - 155	16	2450
724 201 170	159 - 181	16	2450, 277X
724 201 194	168 - 190	16	2450*, 277X
724 201 206	190 - 212	16	2450, 277X
724 201 218	216 - 238	16	2450, 277X
724 201 242	238 - 260	16	2450, 277X
724 201 254	267 - 289	16	2450, 277X



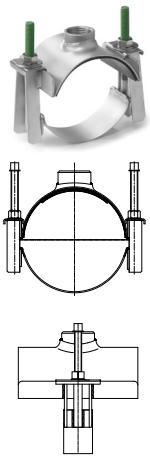
- Saddle with threaded outlet.
- The rubber gasket is available in NBR (EPDM on request).

- Lower shell half is without gasket (available on request).

* Must use 3-2450-A

Multi/Clamp Saddle Studs Threaded Outlet 1¼ Inch

Code no.	Range [mm]	PN Water [bar]	Sensor Type
724 201 076	88 - 110	16	2552-2x
724 201 100	108 - 134	16	2552-2x
724 201 136	133 - 155	16	2552-2x
724 201 172	159 - 181	16	2552-2x
724 201 196	168 - 190	16	2552-2x
724 201 208	190 - 212	16	2552-2x
724 201 220	216 - 238	16	2552-2x
724 201 244	238 - 260	16	2552-2x
724 201 256	267 - 289	16	2552-2x



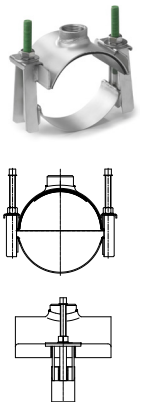
- Saddle with threaded outlet.
- The rubber gasket is available in NBR (EPDM on request).

- Lower shell half is without gasket (available on request).

Multi/Clamp Saddle Studs Threaded Outlet 1½ Inch

Code no.	Range [mm]	PN Water [bar]	Sensor Type
724 201 101	108 - 134	16	2552-3x, 2540, 3719-1
724 201 137	133 - 155	16	2552-3x, 2540, 3719-1
724 201 173	159 - 181	16	2552-3x, 2540, 3719-1
724 201 197	168 - 190	16	2552-3x, 2540, 3719-1
724 201 209	190 - 212	16	2552-3x, 2540, 3719-1
724 201 221	216 - 238	16	2552-3x, 2540, 3719-1
724 201 245	238 - 260	16	2552-3x, 2540, 3719-1
724 201 257	267 - 289	16	2552-3x, 2540, 3719-1

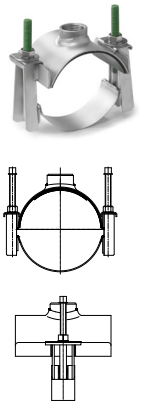
- For use with Flow: 2552, 2540
- For use with pH/ORP: 3719
- Saddle with threaded outlet
- The rubber gasket is available in NBR (EPDM on request).
- Lower shell half is without gasket (available on request).



Multi/Clamp Saddle Studs Threaded Outlet 2 Inch

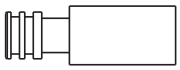
Code no.	Range [mm]	PN Water [bar]	Sensor Type
724 201 102	108 - 134	16	3719-2x
724 201 138	133 - 155	16	3719-2x
724 201 174	159 - 181	16	3719-2x
724 201 198	168 - 190	16	3719-2x
724 201 210	190 - 212	16	3719-2x
724 201 222	216 - 238	16	3719-2x
724 201 246	238 - 260	16	3719-2x
724 201 258	267 - 289	16	3719-2x

- Saddle with threaded outlet.
- The rubber gasket is available in NBR (EPDM on request).
- Lower shell half is without gasket (available on request).

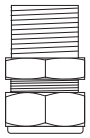


Miscellaneous

Mfr. Part No.	Code no.	Description	Compatibility
3-2842.390	159 000 925	2842 Replacement Insulator	2842
3-2820.392	198 840 222	½ in. NPT Fitting, 316 SS	2820-1, 2821-1
3-2820.390	198 840 223	¾ in. NPT Fitting, 316 SS	2822-1, 2823-1
3-2820.391	198 840 221	¾ in. NPT Fitting, Polypro	2819-1, 2820-1, 2821-1
3-2870.390	159 002 007	¾ in. NPT fitting, polypropylene replacement	2870, 2872, 2873
3-2870.391	159 002 008	¾ in. NPT fitting, 316L stainless steel	2870, 2872, 2873
3-2870.392	159 002 016	¾ in. NPT extended fitting polypro-pylene	2870, 2872, 2873
6205-0002	159 000 858	DIN Rail (1-m Length)	8058, 8059, 7310
6250-0003	159 000 859	End Clips for DIN Rail	8058, 8059, 7310
5523-0222	159 000 392	Cable (per foot), 2 cond. w/shield, 22 AWG (Red/Black)	8058, 8059, 7310
3-8050-2	159 000 754	Universal Mount Junction Box with EasyCal	2751

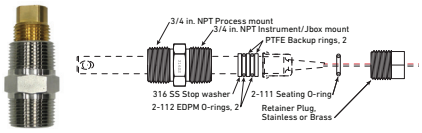


2842 Replacement Insulator



NPT Fitting

Mfr. Part No.	Code no.	Description	Compatibility
3-2819.606-S 316L Stainless Steel	On request	The 3-2819.606-X dual NPT adapter to adapt the 3-2819-1, 3-2820-1 or the 3-2821-1 Conductivity sensor to the 3-2850-5X electronics.	2819-1, 2820-1, 2821-1
3-2819.606-T Titanium	On request		



Mfr. Part No.	Code no.	Description	Compatibility
3-2450-A	On request	Use the 3-2450-A PVC adapter to install a 3-2450-X ½ in. union pressure sensor into a ¾ inch NPT female pipe nipple.	2450
3-2450-GG	On request	The 2450-GG Guage Guard has a PVDF body and ½ in. union adapter. A PTFE membrane separates the pressure sensor from the chemi-cal. This allows the 3-2450-X pressure sensor to be used in difficult applications that can attack the ceramic diaphragm or FPM O-ring. Must be used with the 3-2450-A, sold separately.	2450



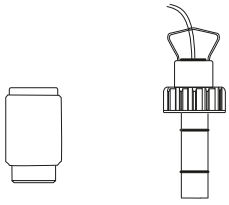
Fill the upper chamber with a compatible liquid of the same density.



Fitting Insert Reference

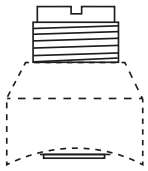
The following inserts can be used to replace inserts in GF fittings.

Fitting Accessories	Insert Part Code no.	Description
P31515-0C200	159 500 333	Pipe Adapter Insert, CPVC
P31515-0P200	159 000 630	Pipe Adapter Insert, PVC
P31671-1C	159 002 142	Pipe Adapter Insert, CPVC
P31520-1C	159 002 141	Pipe Adapter Insert, CPVC
P31520-2P	159 000 461	Pipe Adapter Insert, PVC
P31536	198 840 201	Sensor Plug, Polypro

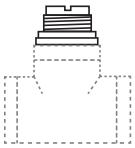


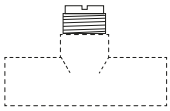
Sensor Plug

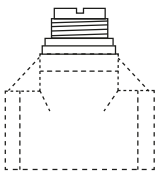
Brazolet Fitting	Insert Part Code no.	Description
BR4B025 -CPVC	P31515-0V200	Brazolet, Brass
BR4B030 -CPVC	P31515-0V200	Brazolet, Brass
BR4B040 -CPVC	P31515-0V200	Brazolet, Brass
BR4B050 -CPVC	P31520-1V	Brazolet, Brass
BR4B060 -CPVC	P31520-1V	Brazolet, Brass
BR4B080 -CPVC	P31520-1V	Brazolet, Brass
BR4B100	P31520-2P	Brazolet, Brass
BR4B120	P31520-2P	Brazolet, Brass

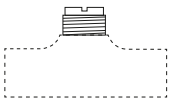


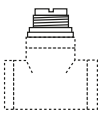
Tee Fitting	Insert Part Code no.	Description
BR4T010-CPVC	P31515-0V200	Brazolet, Brass
BR4T012-CPVC	P31515-0V200	Brazolet, Brass
BR4T015-CPVC	P31515-0V200	Brazolet, Brass
BR4T020-CPVC	P31515-0V200	Brazolet, Brass
CUKT005	Not applicable	Tee, Copper
CUKT007	Not applicable	Tee, Copper
CUKT010	Not applicable	Tee, Copper
CUKT012 -CPVC	P31515-0C200	Tee, Copper
CUKT015 -CPVC	P31627	Tee, Copper
CUKT020 -CPVC	P31531-1C3	Tee, Copper
CR4T005 -CPVC	P31515-0C200	Tee, SS
CR4T007 -CPVC	P31515-0C200	Tee, SS
CR4T010 -CPVC	P31515-0C200	Tee, SS
CR4T012 -CPVC	P31515-0C200	Tee, SS
CR4T015 -CPVC	P31627C	Tee, SS
CR4T020 -CPVC	P31531-1C3	Tee, SS
CS4T005 -CPVC	P31515-0C200	Tee, Carbon Steel
CS4T007 -CPVC	P31515-0C200	Tee, Carbon Steel
CS4T010 -CPVC	P31515-0C200	Tee, Carbon Steel
CS4T012 -CPVC	P31515-0C200	Tee, Carbon Steel
CS4T015 -CPVC	P31515-0C200	Tee, Carbon Steel
CS4T020 -CPVC	P31515-0C200	Tee, Carbon Steel
IR4T010-CPVC	P31515-0C200	Tee, Iron
IR4T012-CPVC	P31515-0C200	Tee, Iron
IR4T015-CPVC	P31515-0C200	Tee, Iron
IR4T020-CPVC	P31515-0C200	Tee, Iron



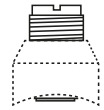


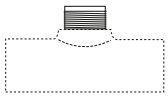


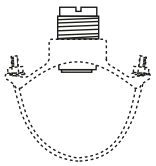


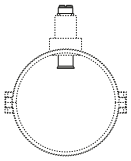


Weldolet Fitting	Insert Part Code no.	Description
CR4W025-CPVC	P31515-0C200	Weldolet, SS
CR4W030-CPVC	P31515-0C200	Weldolet, SS
CR4W040-CPVC	P31515-0C200	Weldolet, SS
CR4W050-CPVC	P31520-1C1	Weldolet, SS
CR4W060-CPVC	P31520-1C1	Weldolet, SS
CR4W080-CPVC	P31520-1C1	Weldolet, SS
CR4W100	P31520-2P	Weldolet, SS
CR4W120	P31520-2P	Weldolet, SS
CS4W025-CPVC	P31515-0C200	Weldolet, Carbon Steel
CS4W030-CPVC	P31515-0C200	Weldolet, Carbon Steel
CS4W040-CPVC	P31515-0C200	Weldolet, Carbon Steel
CS4W050-CPVC	P31531-1C1	Weldolet, Carbon Steel
CS4W060-CPVC	P31531-1C1	Weldolet, Carbon Steel
CS4W080-CPVC	P31531-1C2	Weldolet, Carbon Steel
CS4W100	P31520-2P	Weldolet, Carbon Steel
CS4W120	P31520-2P	Weldolet, Carbon Steel
CS4W140	P31520-2P	Weldolet, Carbon Steel
CS4W160	P31520-2P	Weldolet, Carbon Steel
CS4W180	P31520-2P	Weldolet, Carbon Steel
CS4W200	P31520-2P	Weldolet, Carbon Steel
CS4W240	P31520-2P	Weldolet, Carbon Steel









Saddle Fitting	Insert Part Code no.	Description
IR8S020-CPVC	P31515-0V200	Saddle, Iron
IR8S025-CPVC	P31515-0V200	Saddle, Iron
IR8S030-CPVC	P31515-0V200	Saddle, Iron
IR8S040-CPVC	P31515-0V200	Saddle, Iron
IR8S050-CPVC	P31520-1V	Saddle, Iron
IR8S060-CPVC	P31520-1V	Saddle, Iron
IR8S080-CPVC	P31520-1V	Saddle, Iron
IR8S100	P31520-2P	Saddle, Iron
IR8S120	P31520-2P	Saddle, Iron
IR8S140	P31520-2P	Saddle, Iron
IR8S160	P31520-2P	Saddle, Iron
IR8S180	P31520-2P	Saddle, Iron
IR8S200	P31520-2P	Saddle, Iron
IR8S240	P31520-2P	Saddle, Iron

Note: Always confirm the chemical compatibility and the maximum pressure/temperature specifications for fitting and sensor selection prior to purchase. Failure to do so may result in property damage and/or serious personal injury.

Ordering Notes:

1. If insert is intended for use with GF installation fittings, specify fitting part number at the time of purchase.
2. If insert is not for use with GF installation fittings, specify the following at the time of purchase:
   - Outside diameter (o.d.) of pipe
   - Thickness of pipe
   - Dimension from top of pipe to top of installation fitting when installed.

Accessories and Replacement Parts

Content

Submersion Kit 559
Universal In-line Sensor Adapter 567
Type 0252 Configuration Tool 569
Type 8059 External Relay Module 572
Type 7310 Switching Power Supplies 575
Type 0486 Profibus Concentrator 580
Type 2850 Conductivity/Resistivity Tool 588
Accessories for Chlorine 591
Type 2759 pH/ORP System Tester 592
pH/ORP Buffer Solutions 594
Accessories and Replacement Parts for pH/ORP 598
Accessories and Replacement Parts for Flow Sensors 599

Submersion Kit

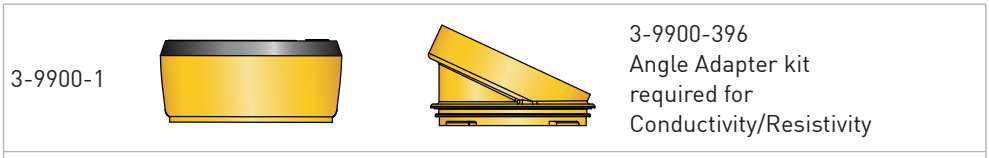
Use this step-by-step ordering guide to assemble your Submersion Kit. The cost effective Submersion Kits are easily built by selecting a GF instrument/junction box, pipe segments, adapter and sensor. Various pipe sizes and materials (PVC-U, PVC-C, PP and PVDF) are also available to suit your needs.

Installation Tips

Use the universal mount junction box to adapt any mounting bracket. Standpipe must be filled with water proof epoxy resin to seal against condensation build-up.

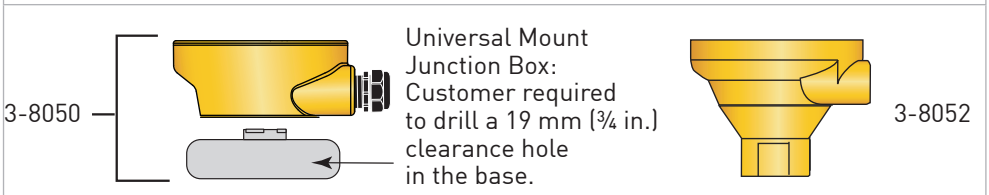
Step 1:

Choose a transmitter



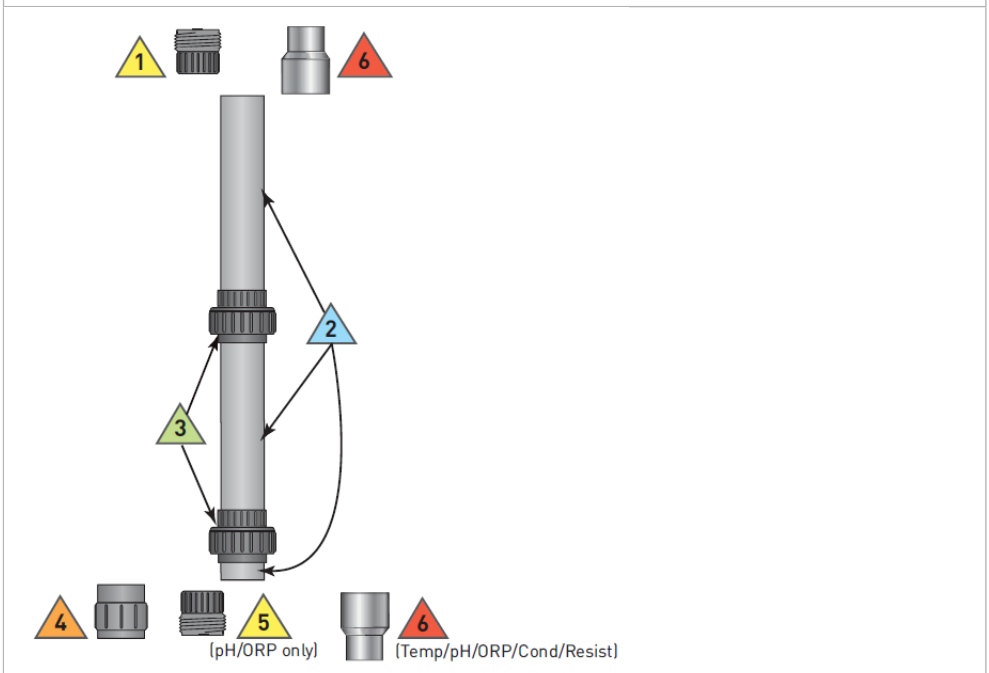
Step 2:

Choose a wiring junction box



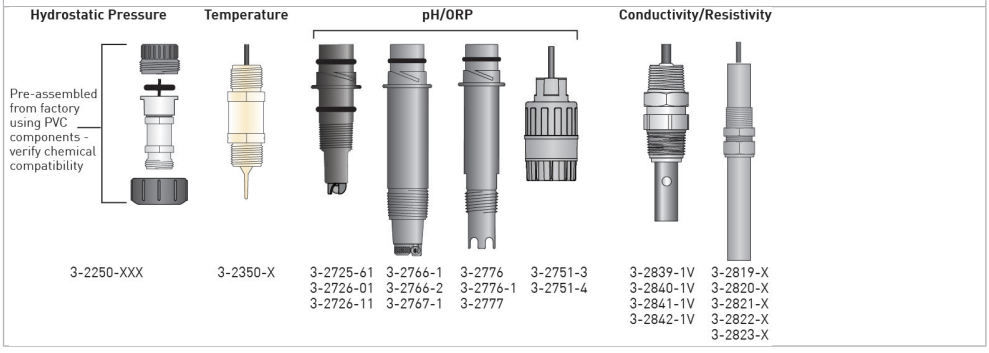
Step 3:

Choose the pipe material



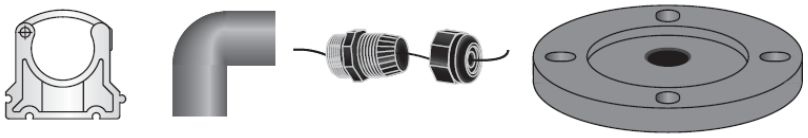
Step 4:

Choose a sensor



Step 5:

Optional Accessories



5.1 # 5.2 # 5.3 # 5.4

Step 1: Choose a transmitter

If required

Mfr. Part No.	Code	Component	Description

3-9900-1	159 001 696	Single channel transmitter	• 10.8 to 35.2 VDC
			• 4 to 20 mA output
			• Open collector output
			• 9900 Accessories (Optional)
			  • HART Module
			  • Conductivity Module with angle adapter
			  • 4 to 20 mA Output Module

If no transmitter required: Go to Step 2

Step 2: Choose a wiring junction box*

*Note: More than one item can be used.

Transmitter

Mfr. Part No.	Code	Component	Description
3-8050	159 000 184	The Universal Mount Kit mounts a 9900 field mount instrument onto a wall, pipe, or tank. Includes: transmitter base, universal mounting plate and bracket.	• Use to mount transmitter, 3-9900-1
3-8050-1	159 000 753	The Universal Mount Junction Box contains two terminal blocks that enable cable extensions for pH, ORP, flow, temperature, pressure, and conductivity sensors/electrodes. This kit mounts on a wall, pipe, or tank. Includes: top cover, transmitter base,universal mounting plate and bracket, liquid tight connector kit.	• Use if sensor wiring needs to be extended. Cable for sensor should never exceed 30 m (100 ft)
3-8052	159 001 188	3/4 in. Integral mount kit is designed to mount a ProcessPro field mount instrument directly on top of a conductivity/ resistivity, temperature, pressure or level sensor. Includes: transmitter base, sensor adapter.	• Use to mount transmitter, 3-9900
3-9900.396	159 001 701	Angle Adjustment Adapter Kit	• Adjusts the mounting angle of the 3-9900 Transmitter and adds additional wiring clearance

ph/ORP

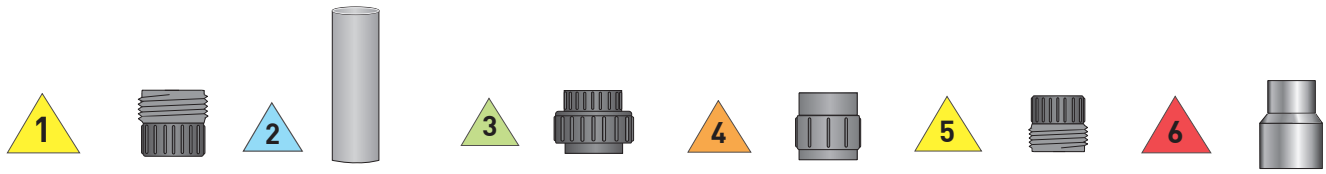
Mfr. Part No.	Code	Component	Description
3-8052-1	159 000 755	The universal mount junction box contains two terminal blocks that enable cable extensions for pH, ORP electronics or 2751. This kit mounts on a wall, pipe or tank.	• Use if sensor wiring needs to be extended. Refer to manual for maximum cable lengths.
3-8050-2 (pH/ORP)	159 000 754	The pH/ORP universal mount junction box contains two terminal blocks that enable cable extension of pH or ORP sensors. It features an EasyCal board for simple, push-button pH or ORP calibration. This kit mounts on a wall, pipe, or tank. Includes: top cover, transmitter base, universal mounting plate and bracket, liquid tight connector kit.	• Built-in EasyCal electronics • Digital (S^3L) signal output to remote 3-9900 Transmitter • 4 to 20 mA signal output to PLC • Used with the 3-2751-3 or 3-2751-4 submersible sensor electronics

Conductivity/Resistivity

Mfr. Part No.	Code	Component	Description
3-2850-61 (Conductivity/ Resistivity)	159 001 400	Universal mount junction box with sensor electronics, (S^3L)	• Digital (S^3L) signal output to remote 3-9900 Transmitter • Built-in EasyCal electronics
3-2850-62 (Conductivity/ Resistivity)	159 001 401	Universal mount junction box with sensor electronics, 4 to 20 mA	• 4 to 20 mA signal output to PLC • Built-in EasyCal electronics
NONE	Go to Step 5.3 - Cable Gland + Reducer + Elbow		

Step 3: Choose the correct pipe material based on Chemical Compatibility

- Verify the length of the assembly and add a union adapter (3) every 2 meters
- Recommended pipe size d25 ≤ 2m/d50 > 2m
- If union/FKM component is not suitable, contact factory



Hydrostatic Level

Pipe Material	Adapter Nipple NPT Male ¾" (+Reductions)		Pipe PN16	Union/ FKM	Reduction to d25
	Item 1	6 *	Item 2	Item 3	Item 4
PVC-U					
d25/DN20	721 910 557		161 017 107	721 510 132	
d50/DN40	721 910 557 721 900 354	*	161 017 110	721 510 135	721 900 354
PVC-C					
d25/DN20	723 910 557		163 017 132	723 510 132	
d50/DN40	723 910 557 723 900 354	*	163 017 135	723 510 135	723 900 354
PP					
d25/DN20	727 914 557		167 480 712	727 520 157	
d50/DN40	727 914 557 727 910 354	*	167 480 715	727 520 160	727 910 354
PVDF					
d25/DN20	735 914 557		175 480 204	735 528 607	
d50/DN40	735 914 557 735 908 654	*	175 480 207	735 528 610	735 908 654

* Reducer required for d50/DN40 pipes to 3/4 inch nipple

Temperature

Pipe Material	Adapter Nipple NPT Male ¾" (+Reductions)		Pipe PN16	Union/ FKM	Adapter Nipple NPT Female 3/4" (+Reductions)	
	Item 1	6 *	Item 2	Item 3	Item 4	6 *
PVC-U						
d25/DN20	721 910 557		161 017 107	721 510 132	721 914 207	
d50/DN40	721 910 557 721 900 354	*	161 017 110	721 510 135	721 910 441 721 900 354	*
PVC-C						
d25/DN20	723 910 557		163 017 132	723 510 132	723 910 207	
d50/DN40	723 910 557 723 900 354	*	163 017 135	723 510 135	723 910 441 723 900 354	*
PP						
d25/DN20	727 914 557		167 480 712	727 520 157	727 914 267	
d50/DN40	727 914 557 727 910 354	*	167 480 715	727 520 160	727 910 354	*
PVDF						
d25/DN20	735 914 557		175 480 204	735 528 607	735 914 267	
d50/DN40	735 914 557 735 908 654	*	175 480 207	735 528 610	735 914 267 735 908 654	*

* Reducer required for d50/DN40 pipes to 3/4 inch nipple

pH/ORP

Pipe Material	Adapter Nipple NPT Male ¾" (+Reductions)		Pipe PN16	Union/ FKM	Adapter Nipple NPT Male 3/4" (+Reductions)	
	Item 1	6 *	Item 2	Item 3	Item 4	6 *
PVC-U						
d25/DN20	721 910 557		161 017 107	721 510 132	721 910 557	
d50/DN40	721 910 557 721 900 354	*	161 017 110	721 510 135	721 910 557 721 900 354	*
PVC-C						
d25/DN20	723 910 557		163 017 132	723 510 132	723 910 557	
d50/DN40	723 910 557 723 900 354	*	163 017 135	723 510 135	723 910 557 723 900 354	*
PP						
d25/DN20	727 914 557		167 480 712	727 520 157	727 910 507	
d50/DN40	727 914 557 727 910 354	*	167 480 715	727 520 160	727 910 507 737 910 354	*
PVDF						
d25/DN20	735 914 557		175 480 204	735 528 607	735 910 557	
d50/DN40	735 914 557 735 908 654	*	175 480 207	735 528 610	735 910 557 735 908 654	*

* Reducer required for d50/DN40 pipes to 3/4 inch nipple

Conductivity/Resistivity

Pipe Material	Adapter Nipple NPT Male ¾" (+Reductions)		Pipe PN16	Union/ FKM	Adapter Nipple NPT Female 3/4" (+Reductions)	
	Item 1	6 *	Item 2	Item 3	Item 4	6 *
PVC-U						
d25/DN20	721 910 557		161 017 107	721 510 132	721 914 207	
d50/DN40	721 910 557 721 900 354	*	161 017 110	721 510 135	721 910 441 721 900 354	*
PVC-C						
d25/DN20	723 910 557		163 017 132	723 510 132	723 910 207	
d50/DN40	723 910 557 723 900 354	*	163 017 135	723 510 135	723 910 441 723 900 354	*
PP						
d25/DN20	727 914 557		167 480 712	727 520 157	727 914 267	
d50/DN40	727 914 557 727 910 354	*	167 480 715	727 520 160	727 910 354	*
PVDF						
d25/DN20	735 914 557		175 480 204	735 528 607	735 914 267	
d50/DN40	735 914 557 735 908 654	*	175 480 207	735 528 610	735 914 267 735 908 654	*

* Reducer required for d50/DN40 pipes to 3/4 inch nipple

Step 4: Choose the correct sensor or electrode

Hydrostatic Level

Choose the correct sensor by verifying the correct chemical compatibility, temperature, fluid density and requested output sign.

Mfr. Part No.	Code	Component	Description
3-2250-11U-1	159 001 478	Hydrostatic level 0-700 mbar	Digital (S^3L) output signal. Use with the 3-9900-1 Transmitter
3-2250-21U-1	159 001 482	Hydrostatic level 0-700 mbar	4 to 20 mA output (Blind)

Temperature

Choose the correct sensor by verifying the correct application temperature and requested output signal.

Mfr. Part No.	Code	Component	Description
3-2350-1	159 000 021	Temperature sensor	Digital (S^3L) output signal. Use with the 3-9900-1 Transmitter
3-2350-3	159 000 920	Temperature sensor	4 to 20 mA output (Blind)

pH/ORP

Choose the correct preamplifier based on sensor selection and the use of a transmitter. Bulb type electrodes are recommended for submersible application.

Mfr. Part No.	Code	Component	Description
3-2751-3	159 001 806	Sensor Electronics for 3-9900 and 3-9950 Transmitter	Sensor Electronics ¾ inch ISO
3-2751-4	159 001 807	Sensor Electronics for 3-9900 and 3-9950 Transmitter	Sensor Electronics ¾ inch ISO

Choose the correct sensor by verifying the correct chemical compatibility, conductivity level, temperature and sensor glass (bulb or flat)

3-2724-01	159 001 546	pH Electrode, flat PT1000	Use with the 3-2751 Smart sensor electronics
3-2725-61	159 001 562	ORP electrode, flat	Use with all preamplifiers and electronics
3-2726-01	159 001 554	pH electrode, bulb, PT1000	Use with the 3-2751 Smart sensor electronics
3-2734-00	159 001 774	pH Electrode, flat, PT1000	Use with the 3-2751 Smart sensor electronics
3-2734-01	159 001 775	pH Electrode, flat, PT1000	Use with the 3-2751 Smart sensor electronics
3-2734-HF-00	159 001 776	pH Electrode, flat, HF resistant	Use with the 3-2751 Smart sensor electronics
3-2734-HF-01	159 001 777	pH Electrode, flat, HF resistant	Use with the 3-2751 Smart sensor electronics
3-2736-00	159 001 778	pH electrode, bulb, PT1000	Use with the 3-2751 Smart sensor electronics
3-2736-01	159 001 779	pH electrode, bulb, PT1000	Use with the 3-2751 Smart sensor electronics
3-2736-HF-00	159 001 780	pH electrode, bulb, HF resistant	Use with the 3-2751 Smart sensor electronics
3-2736-HF-01	159 001 781	pH electrode, bulb, HF resistant	Use with the 3-2751 Smart sensor electronics
3-2735-60	159 001 782	ORP electrode, flat, 10K	Use with all preamplifiers and electronics
3-2735-61	159 001 783	ORP electrode, flat, 10K	Use with all preamplifiers and electronics
3-2766-2	159 000 950	pH electrode, bulb, PT1000	Use with the 3-2751 Smart sensor electronics
3-2767-1	159 000 952	ORP electrode, bulb	Use with all preamplifier and electronics
3-2774-HT-C	159 001 795	pH electrode, flat, 3KΩ	Use with the 3-2751 Smart sensor electronics
3-2776-1	159 000 960	pH electrode, bulb, PT1000	Use with the 3-2751 Smart sensor electronics
3-2777	159 000 961	ORP electrode, bulb	Use with all preamplifiers and electronics

Applications requiring high temperature above 85 °C, please contact factory.

Conductivity/Resistivity

Choose the correct preamplifier based on sensor selection and the use of a transmitter.

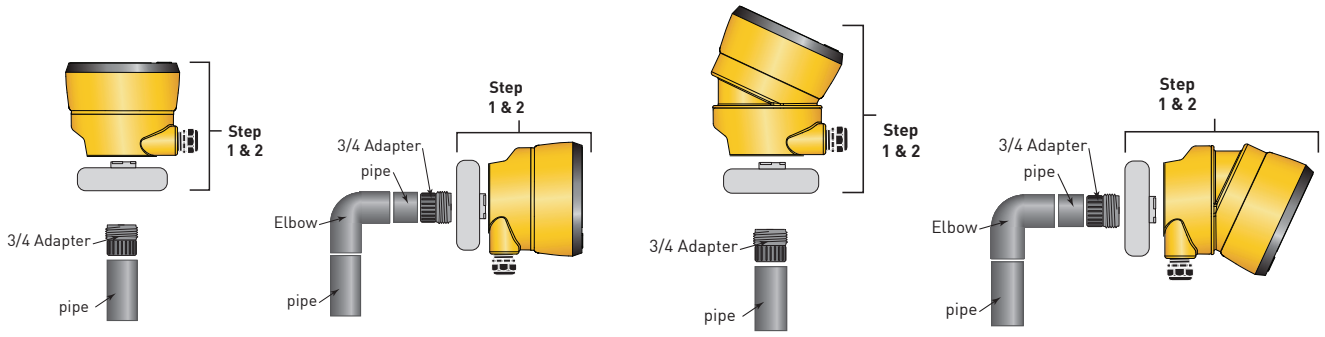
Mfr. Part No.	Code	Component	Description
* 3-2850-61	159 001 400	Sensor Electronics	Sends a digital (S^3L) signal to 3-9900-1 Transmitter
* 3-2850-62	159 001 401	Sensor Electronics	4 to 20 mA output (Blind)

Choose the correct sensor by verifying the correct chemical compatibility (if SS is not suitable, Hastelloy-C, Titanium, Monel - Contact factory or email GF-specialproducts@georgfischer.com, conductivity level and temperature

3-2839-1V	159 001 810	Conductivity sensor, 0.01 cell	Application with conductivity levels 18.2 MΩ to 100 µS
3-2839-1VD	159 001 811	Conductivity sensor, 0.01 cell	Application with conductivity levels 18.2 MΩ to 100 µS
3-2840-1V	159 001 812	Conductivity sensor, 0.1 cell	Application with conductivity levels 1.0 µS to 1000 µS
3-2840-1VD	159 001 813	Conductivity sensor, 0.1 cell	Application with conductivity levels 1.0 µS to 1000 µS
3-2841-1V	159 001 814	Conductivity sensor, 1.0 cell	Application with conductivity levels 10 µS to 10,000 µS
3-2841-1VD	159 001 815	Conductivity sensor, 1.0 cell	Application with conductivity levels 10 µS to 10,000 µS
3-2842-1V	159 001 816	Conductivity sensor, 10 cell	Application with conductivity levels 100 µS to 200 mS
3-2842-1VD	159 001 817	Conductivity sensor, 10 cell	Application with conductivity levels 100 µS to 200 mS
3-2823-1	198 844 003	Conductivity sensor, 20 cell	Application with conductivity levels 200 µS to 400 mS

* Maximum sensor cable length 4.6 m (15 ft) when using the 3-2850-XX electronics.

Step 5: Optional accessories



Examples of mounting options. Customize to your specific needs.

Item 5.1 - Pipe Clips

Pipe Clips	Code
d25/DN20	167 061 037
d50/DN40	167 061 040

Item 5.2 - Elbow

Elbow	PVC-U	PVC-C	PP	PVDF
d25/DN20	721 100 107	723 100 107	727 100 107	735 018 107
d25/DN40	721 100 110	723 100 110	727 100 110	735 018 110

Item 5.3 - Gland + Elbow (+Reductions)

Cable Gland + Elbow + Reductions	PVC-U	PVC-C	PP	PVDF
d25/DN20	721 914 206 159 000 618 721 100 107 721 910 911	723 910 437 159 000 618 723 100 107 -	727 914 266 159 000 618 727 100 107 727 910 337	735 914 266 159 000 618 735 018 707 735 908 637
d25/DN40	721 914 206 159 000 618 721 910 915 721 900 352 721 100 110	723 910 437 159 000 618 723 900 354 723 100 110 -	727 914 266 159 000 618 727 100 110 727 910 355 727 910 906	735 914 266 159 000 618 735 908 654 735 908 637 735 018 710

Universal In-line Sensor Adapter



Product description

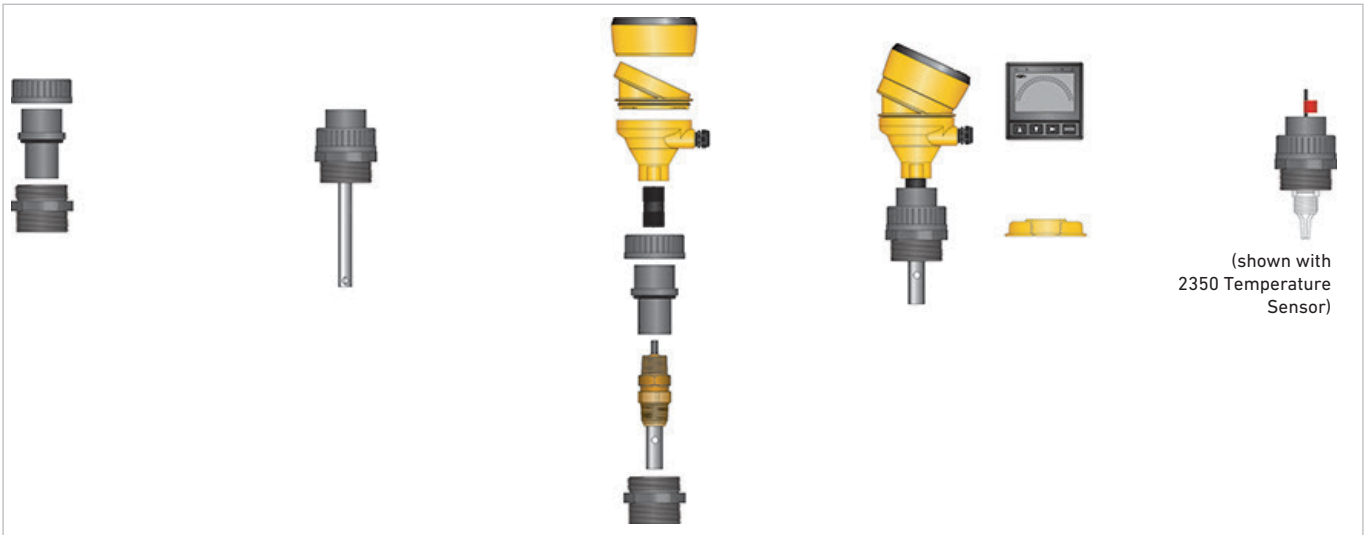
For in-line applications requiring extra insertion depth for conductivity, temperature, and pressure process measurements.

The 2 in. x ¾ in. Universal Sensor adapter with union style connection allows the user more flexibility when installing the sensor in larger size lines. By utilizing the ¾ back end connection, the sensor can be extended further into the process stream, proving adequate exposure to the fluid, thus ensuring proper measurement.

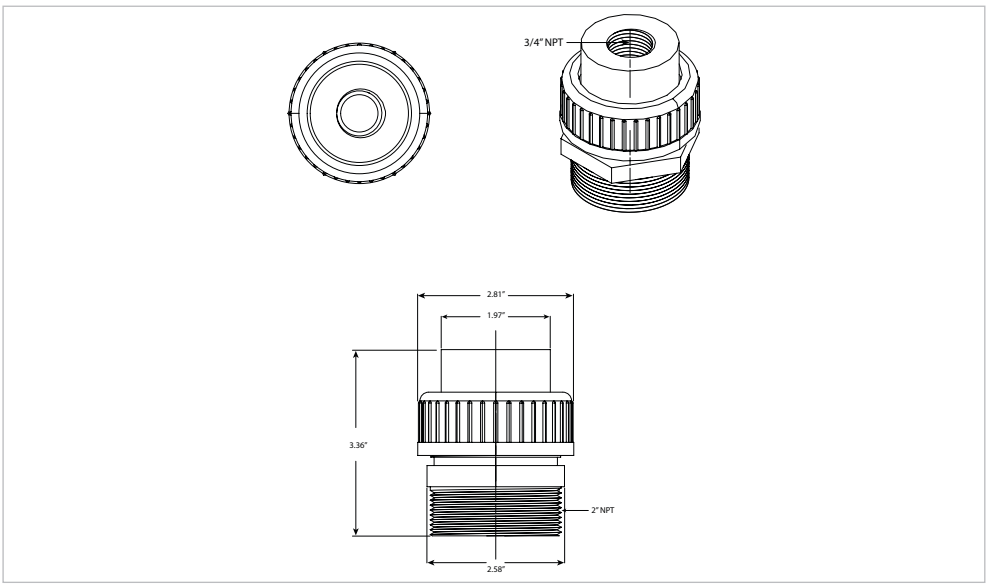
Wetted materials are CPVC/FKM, with a pressure rating of up to 150 psi, for better performance in a wide variety of applications.

Features

- Size 2 in. x ¾ in.
- Material CPVC/FKM
- Extended sensor insertion, use with:
  - Conductivity
  - Temperature
  - Pressure

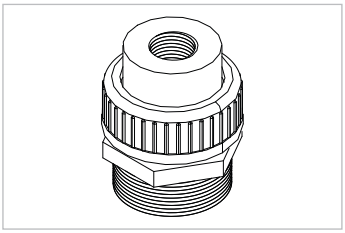


Dimensions



Ordering Information

Code	Description
150 300 300	Universal Adapter



Type 0252 Configuration Tool



Product description

The type 0252 Configuration Tool interfaces with GF SmartPro® Transmitters and blind sensors, allowing fast and easy configuration using a PC. The configuration information can be saved to a file and stored on a PC to be used later on a replacement sensor or for another sensor in a similar application.

The saved configuration file can be downloaded to the sensor or the SmartPro Transmitters in mere seconds.

The save and load features allow you to back up all of your settings and transfer them to future devices. You can also e-mail the files to share with other users of the 0252 software.

The 0252 will graph and data log sensors in real time for trend and troubleshooting analysis. Export data logs in coma-separated value (CSV) format for review and reporting in many popular spreadsheet and database applications.

The software is supported in the following languages: Chinese, English, French, German, Italian, Portuguese and Spanish.

Features

- Back up and restore SmartPro® Transmitters and blind sensors configurations to a computer file
- User-friendly interface
- Configure settings such as instrument type, units, scale 4 to 20 current loops and modify labels from the computer
- Use a single file to clone multiple SmartPro® Transmitters and blind sensors
- Red and blue LED indicators for power and data

Compatibility

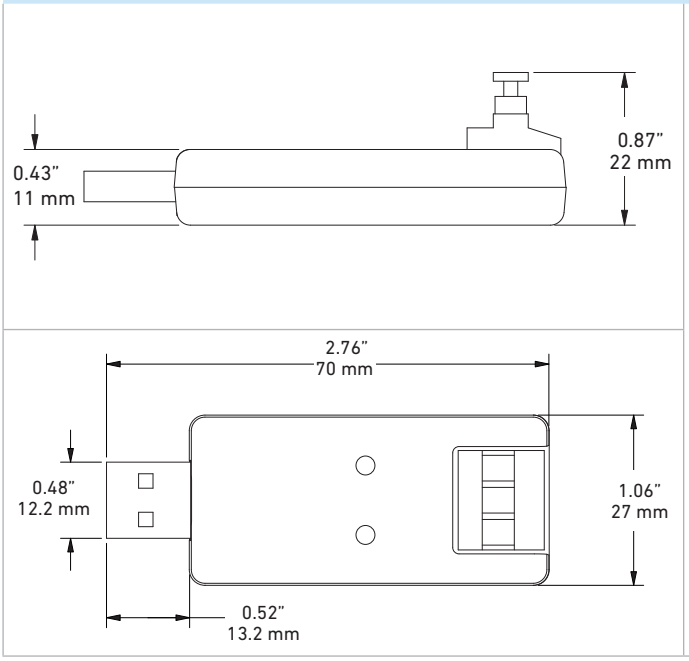
- 9900 Transmitter
- 2250 Level Sensor
- 2350 Temperature Sensor
- 2450 Pressure Sensor
- 2551 Magmeter Flow Sensor
- 2552 Metal Magmeter Flow Sensor
- 258X FlowtraMag Meter
- 2610-51 Dissolved Oxygen
- 2751 pH/ORP Smart Sensor Electronics
- Windows 7 (32 and 64-bit versions)
- Windows 8 and Windows 8.1 (32 and 64-bit versions)
- Windows 10 (32 and 64-bit versions)

Specifications

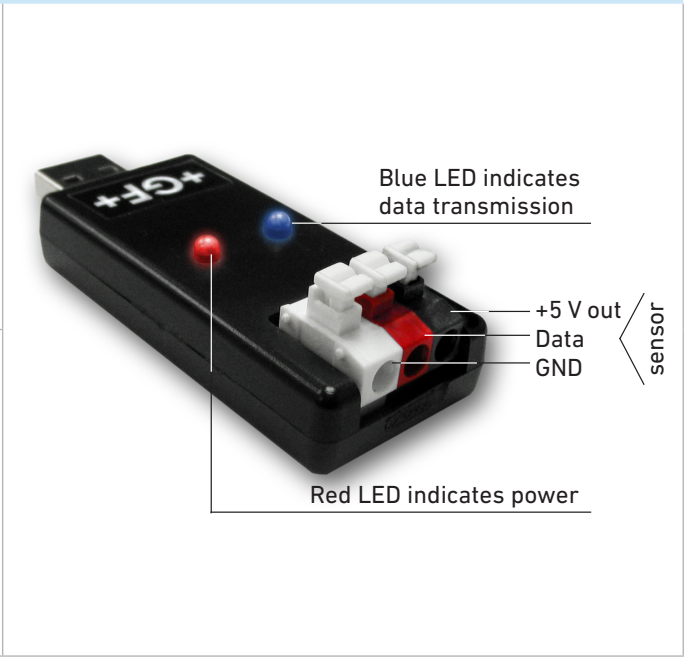
General		
Materials	ABS body	
Power Requirements	Supplied by USB Interface	
System Requirements	Windows XP, Windows Vista, Windows 7 (32 and 64 bit), Windows 8, 8.1, Windows 10 (32 and 64 bit) and Windows 11, USB port, administrator account for installation	
Inputs	3-wire (S³L) input	
Output Specifications	USB 1.0 or greater	
Shipping Weight		
	0.220 kg	0.48 lb
Standards and Approvals		
	CE, UKCA, FCC	
	RoHS compliant, China RoHS	

Dimensions

Dimensions



Overview



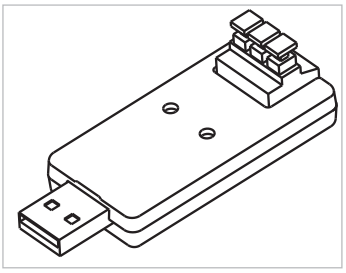
System Overview

Modifiable Parameters (dependent on SmartPro Instrument type or sensor to be configured)

- Instrument type
- Units of measure
- Customer configurable tag (label)
- 4 to 20 mA span
- 4 to 20 mA error value
- Relay and open collector modes
- Bar graph span
- Back light control
- LCD contrast
- Password
- and other instrument and sensor specific settings
- Relay Modes (dependent on Instrument type)
  - Low set point
  - High set point
  - Window In
  - Window Out
  - PWM
  - Proportional Pulse
  - Cycle Low
  - Cycle High
  - Volumetric Pulse
  - Totalizer
  - Error
- Includes 2 m (6 ft) USB extension cable and 1 m (3 ft) Smart-Pro (9900) interface cable

Ordering Information

Mfr. Part No	Code	Description
3-0252	159 001 808	Configuration tool



Accessories and Replacement Parts

Mfr. Part No	Code	Description
6682-3004	159 001 725	Replacement terminal block plug (9900 only)

Type 8059 External Relay Module



Product description

The Type 8059 External Relay Module supplement the output capabilities of certain host instruments such as the type 9950-10/11 Six-Channel Transmitter or 0486 Profibus Concentrator. AC-powered versions accept universal line voltage, and also provide 24 VDC output that can be used to power 4-20mA passive loops.

The host instrument controls relay operation by way of a single digital (S³L) connection. The compact plastic housing is DIN rail mountable and includes LED annunciators for each relay, plus one each for power-on and data transfer or test mode.

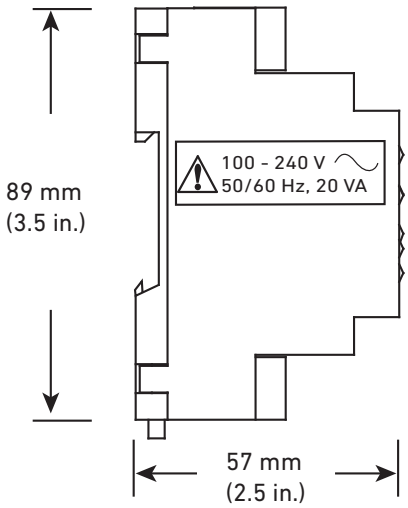
Features

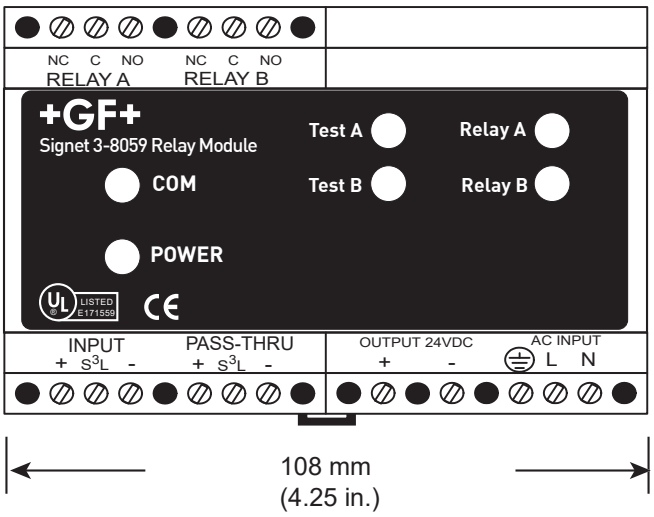
- External relays controlled by host instrument
- AC and DC powered versions
- DC power output (AC versions)
- DC power pass-through (DC versions) to simplify wiring
- Digital (S³L) pass-through to simplify sensor wiring
- Red LED annunciators for each relay
- Green LED indicators for power and digital (S³L) data transfer
- Relay can be tested locally, and also via the host instrument

Specifications

General		
Input	Digital (S^3L) via host instrument	
Type	DIN rail mountable	
Terminals	Standard screw-type	
Material		
Enclosure	PC/ABS UL 94 V-0	
Electrical		
Power Requirements		
8059-4 AC	100-240 VAC ±10% regulated, 50/60 Hz, 20 VA	
8059-4	12 to 24 VDC ±10% regulated	
DC Output		
8059-4 AC	24 VDC regulated, 300 mA	
Isolation	> 5,000 Vrms	
Relays		
Type	SPDT 250 VAC/30 VDC/5 A	
Resolution	2 ms (in pulse mode)	
Response Time	< 100 ms	
Annunciators	Red LED, 1 per relay	
Environmental		
Operating Temperature	-10 °C to 55 °C	14 °F to 131 °F
Storage Temperature	-20 °C to 85 °C	-4 °F to 185 °F
Relative Humidity	0 to 90% (non-condensing)	
Maximum Altitude	2,000 m (6,561 ft)	
Shipping Weight		
	0.37 kg	0.8 lb
Standards and Approvals		
	CE, UKCA, FCC, UL, CUL	
	China RoHS	
	Manufactured under ISO 9001, and ISO 45001	

Dimensions





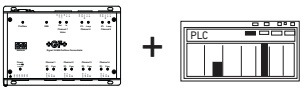
System Overview

Automation System

- 9950-10/-11 Six-Channel Transmitter



- 0486 Profibus Concentrator and
  Customer Supplied Programmable Logic Controller or
- Programmable Automation Controller



Type 8059
External Relay Module



All sold separately

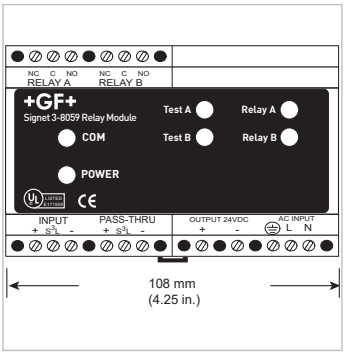
Ordering Notes

1) Use an RC filter kit to protect relays from voltage spikes.

2) DIN railing and clips are available for mounting a relay module.

Ordering Information

Mfr. Part No	Code	Description
External Relay Module		
4 Relay Module		
3-8059-4	**159 000 772**	12 to 24 VDC ±10% regulated with pass-through DC output (minus 0.7 volts)
3-8059-4AC	**159 000 773**	100 to 240 VAC with 24 VDC output ±10% regulated



Accessories and Replacement Parts

Mfr. Part No	Code	Description
3-8050.396	**159 000 617**	RC Filter Kit for relay use (2 per kit)
6205-0002	**159 000 858**	DIN Rail, 1 meter
6205-0003	**159 000 859**	End Clip, DIN rail

Type 7310 Switching Power Supplies



Product description

Type 7310 Switching Power Supplies provide regulated output voltage in compact and lightweight plastic housings for DIN Rail mounting. The series includes five different output capacities from 0.42A to 4A (10W to 96W), all of which accept universal AC line voltage input and meet worldwide standards for performance and safety. These units meet the power requirements for a single system, multiple GF instruments or other devices requiring 24 VDC operation.

Features

- Universal AC input/Full range
- Protections: Short circuit/Overload/Over voltage
- Cooling by free air convection
- Install on DIN rail TS-35/7.5 or 15
- NEC class 2/LPS compliant
- Built in DC OK active signal
- LED indicator for power on
- No load power consumption < 1W for
- 7310-7024 and < 0.75W for others
- 100% full load burn-in test

Compatibility

- GF Instruments
- Electromagnetic Flow Sensors
- Suitable for Electric Actuated Valves, including Solenoid
- Suitable for powering passive outputs and relays

Specifications

	7310-1024	7310-2024	7310-4024	7310-6024	7310-7024
Output					
DC Voltage	24V				
Rated Current	0.42A	1.0A	1.7A	2.5A	4.0A
Current Range	0 ~ 0.42A	0 ~ 1A	0 ~ 1.7A	0 ~ 2.5A	0 ~ 4A
Rated Power	10W	24W	40.8W	60W	96W
Ripple & Noise (max.) Note.2	150mVp-p				
Voltage Adj. Range	N/A	21.6 ~ 26.4V		24 ~ 30V	
Voltage Tolerance Note.3	±2.0%			±1.0%	
Line Regulation	±1.0%				
Load Regulation	±2.0%	±1.0%			
Setup, Rise Time Note.5	500ms, 30ms/230VAC, 1000ms, 30ms/115VAC at full load		500ms, 30ms/230VAC 500ms, 30ms/115VAC at full load		3000ms, 50ms/ 230VAC 3000ms, 50ms/115VAC at full load
Hold Up Time (Typ.)	120ms/230VAC, 25ms/115VAC at full load	50ms/230VAC 20ms/115VAC at full load			
Input					
Voltage Range	85 ~ 264VAC, 120 ~ 370VDC				
Frequency Range	47 ~ 63Hz				
Efficiency (Typ.)	84%		88%	88%	86%
AC Current (Typ.)	0.33A/115VAC 0.21A/230VAC	0.55A/115VAC 0.35A/230VAC	1.1A/115VAC 0.7A/230VAC	1.8A/115VAC 1A/230VAC	1.3A/115VAC 0.8A/230VAC
Inrush Current (Typ.)	Cold Start 35A/115VAC 70A/230VAC	Cold Start 20A/115VAC 40A/230VAC	Cold Start 30A/115VAC 60A/230VAC		
Leakage Current	<1mA / 240VAC				
Protection					
Overload	Above 105% rated output power	105 ~ 160% rated output power	105 ~ 150% rated output power		
Protection type	Hiccup mode, recovers automatically after fault condition is removed	Constant current limiting, recovers automatically after fault condition is removed			
Over Voltage	27.6 ~ 32.4V	27.6 ~ 32.4V		31.2 ~ 36V	
Protection type	Shut down o/p voltage, repower on to recover				
Function					
DC OK Active Signal (max.)	18 ~ 27V / 20mA	18 ~ 27V / 20mA	Relay contact rating(max.): 30V/1A resistive		
Environment					
Working Temperature	-20 ~ +70 °C (Refer to output load Derating Curve)				10 ~ 60 °C (Refer to output load Derating Curve)
Working Humidity	20 ~ 90% RH non-condensing				
Storage Temp., Humidity	-40 ~ +85 °C, 10 ~ 95% RH				
Temp. Coefficient	±0.03%/ °C (0~50 °C)				
Vibration	Component:10 ~ 500Hz, 2G 10min./1cycle, 60min. each along X, Y, Z axes; Mounting: Compliance to IEC60068-2-6				
Safety and EMC (Note 4)					
Safety Standards	UL508, TUV EN60950-1 approved, NEC class 2 / LPS compliant		UL508, UL60950-1, TUV EN60950-1 approved		UL508, TUV EN60950-1 approved

	7310-1024	7310-2024	7310-4024	7310-6024	7310-7024
Withstand Voltage	I/P-O/P:3KVAC I/P-FG:1.5KVAC O/P-FG:0.5KVAC		I/P-O/P:3KVAC I/P-FG:2KVAC O/P-FG:0.5KVAC		I/P-O/P:3KVAC I/P-FG:1.5KVAC O/P-FG:0.5KVAC
Isolation Resistance	I/P-O/P, I/P-FG, O/P-FG:100MΩ 500VDC / 25 °C / 70% RH	I/P-O/P, I/P-FG, O/P-FG:100MΩ /500VDC / 70% RH	I/P-O/P, I/P-FG, O/P-FG:>100MΩ / 500VDC / 25 °C / 70% RH	I/P-O/P, I/P-FG, O/P-FG:>100MΩ / 500VDC / 25 °C / 70% RH	I/P-O/P, I/P-FG, O/P-FG:>100Ω / 500VDC / 25 °C / 70% RH
EMC Emission	Compliance to EN55011, EN55022 (CISPR22), EN61204-3 Class B, EN61000-3-2,-3				
EMC Immunity	Compliance to EN61000-4-2, 3, 4, 5, 6, 8, 11, EN55024, EN61000-6-1, EN61204-3, light industry level, criteria A				
Others					
MTBF	584K hrs min MIL-HDBK-217F (25 °C)	236.9K hrs min MIL-HDBK-217F (25 °C)	301.7K hrs min MIL-HDBK-217F (25 °C)	299.2K hrs min MIL-HDBK-217F (25 °C)	346K hrs min MIL-HDBK-217F (25 °C)
Dimension	22.5*90*100mm (W*H*D)	22.5*90*100mm (W*H*D)	40*90*100mm (W*H*D)		55*90*100mm (W*H*D)
Packing	0.17Kg; 72pcs/ 13.2Kg/.0.91CUFT	0.19Kg; 72pcs/ 14.7Kg /0.91CUFT	0.3Kg; 42pcs/ 13.6Kg/0.82CUFT	0.33Kg; 42pcs/ 14.8Kg/0.82CUFT	0.42Kg; 30pcs/ 13.6Kg/0.82CUFT

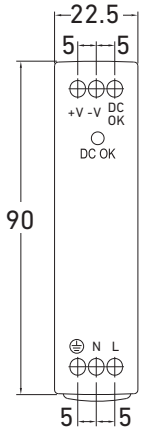
Note

1. All parameters NOT specially mentioned are measured at 230VAC input, rated load and 25 °C of ambient temperature.
2. Ripple & noise are measured at 20MHz of bandwidth by using a 12" twisted pair-wire terminated with a 0.1uf & 47uf parallel capacitor.
3. Tolerance : includes set up tolerance, line regulation and load regulation.
4. The power supply is considered a component which will be installed into a final equipment. The final equipment must be re-confirmed that it still meets EMC directives.
5. Length of set up time is measured at cold first start. Turning ON/OFF the power supply may lead to increase of the set up time.

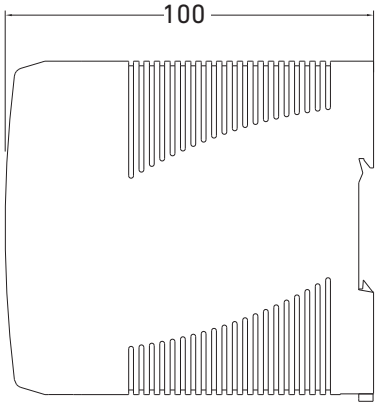
Dimensions

7310-1024
7310-2024

Front view

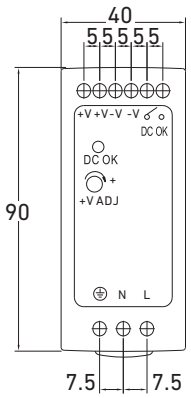


Side View

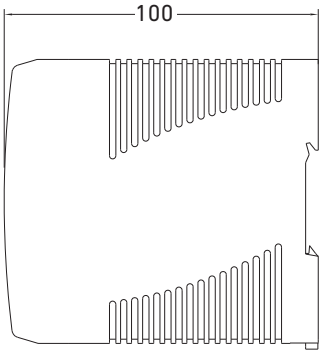


7310-4024
7310-6024

Front view

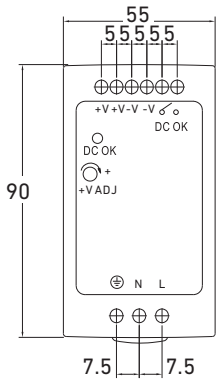


Side View

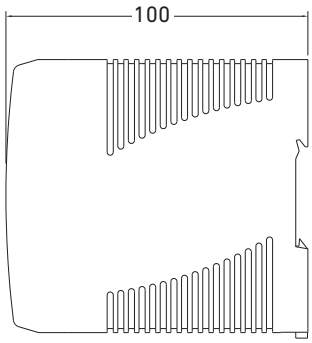


7310-7024

Front view

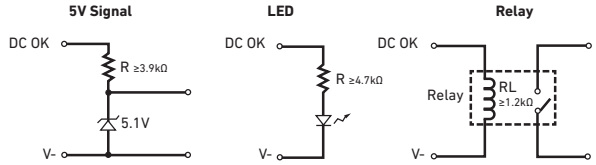


Side View



Application of DC OK Active Signal
7310-1024, 7310-2024

Application of DC OK active signal

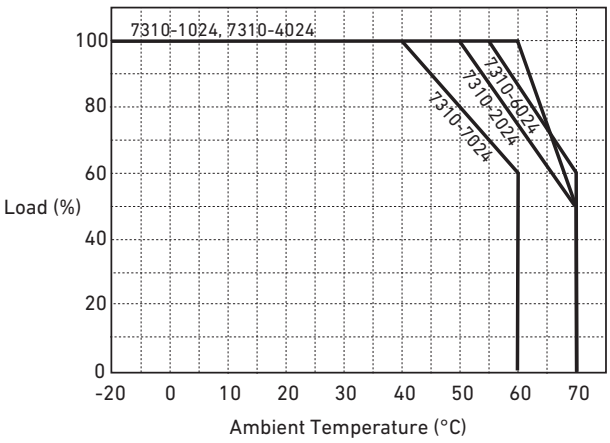


DC OK Relay Contact
7310-4024, 7310-6024, 7310-7024

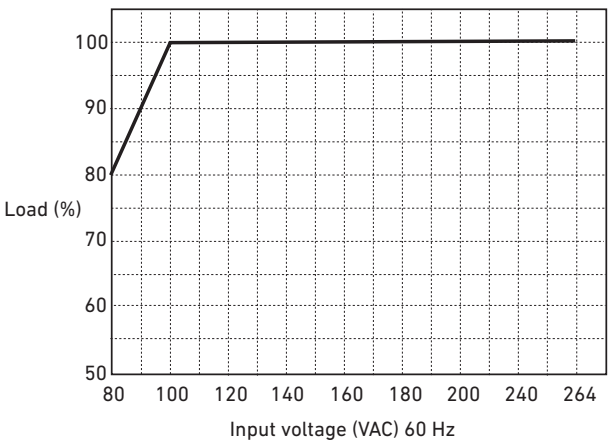
Contact close	PSU turns on/DC okay
Contact open	PSU turns off/DC fail
Contact ratings (max.)	30V/1A resistive load

Curves

Derating Curve

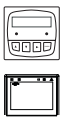


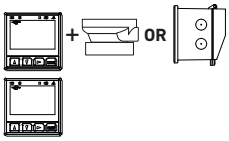
Output Derating Vs. Input Voltage



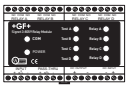
System Overview

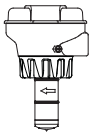
Panel Mount	Pipe, Tank, Wall Mount	Field (Integral) Mount	External Relay	Electromagnetic Sensor
GF Instruments - 9900 - 9900-1BC - 9950	GF Instruments - 9900 - 9900-1BC with Rear Enclosure - 9950	GF Instruments with 3-8051 or 3-8052 Integral Mount Kit - 9900	GF 8059 External Relay Modules	GF Sensors - 2551 - 2552



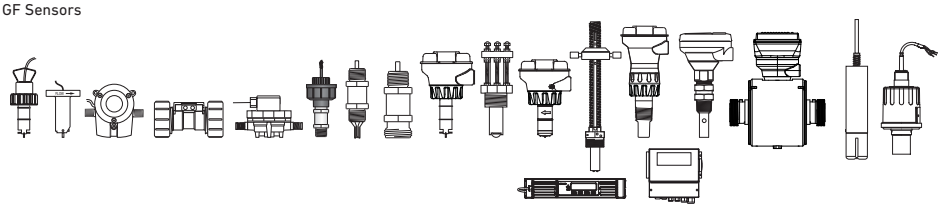








GF Sensors

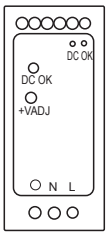


7310 Switching Power Supplies



Ordering Information

Mfr. Part No	Code	Description
7310-1024	**159 873 004**	24 VDC Power Supply, 10W , 0.42 A
7310-2024	**159 873 005**	24 VDC Power Supply, 24W, 1.0 A
7310-4024	**159 873 006**	24 VDC Power Supply, 40W, 1.7 A
7310-6024	**159 873 007**	24 VDC Power Supply, 60W, 2.5 A
7310-7024	**159 873 008**	24 VDC Power Supply, 96W, 4.0 A

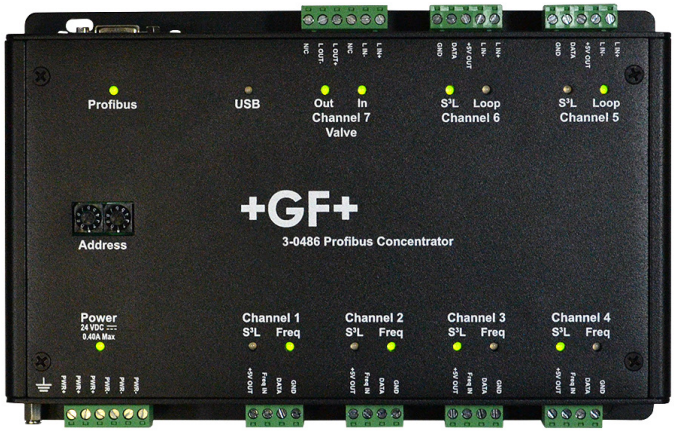


Accessories and Replacement Parts

DIN rail in one meter (1000 mm) lengths, and DIN rail clips are available. The standard packaging of these power supplies are to be fastened to DIN rails, and accessory clips will keep the supplies from sliding if the rail itself is mounted vertically, for example. Contact the factory for more details.

Mfr. Part No	Code	Description
6205-0002	**159 000 858**	1-meter length DIN Rail
6205-0003	**159 000 859**	End Clip for DIN Rail

Type 0486 Profibus Concentrator



Product description

The type 0486 Profibus Concentrator allows for simplified connection of GF sensors to a PROFIBUS network. The 0486 supports six sensor interfaces and a 4 to 20 mA current loop proportional valve interface. The 0486 supports PROFIBUS DPV1 and is available with either DB9 or M12 network connectors.

The 0486 sensor interfaces are multifunctional. All six inputs are compatible with GF digital (S^3L) sensors, four inputs are compatible with frequency output flow sensors, and two inputs are compatible with 4 to 20 mA current loops. The 0486 PLC interface allows for complete control of the GF sensors. The programmer is able to configure the sensor for the specific needs of their application, read measurements in engineering units, and gather diagnostic data to ensure accuracy and correctness of readings.

In addition to interfacing to GF sensors the six (S^3L) inputs will also support the 8059 four channel relay module allowing for on/off control of GF valves or other devices. Up to six 8059 can be connected to a single 0486 giving the user the ability to control 24 on/off devices.

The proportional valve interface is designed to interface with Georg Fischer electric and pneumatic actuators offering proportional valve positioning control or other 4 to 20 mA current loop devices. The interface will send a 4 to 20 mA current loop to the proportional interface, and read back a
4 to 20 mA current loop signal from the valve to ensure proper valve positioning.

Fail-safe control of valves is built into the 0486. The programmer is able to configure the state of each individual relay, off or on, and the current level of the proportional valve interface in case of communications disruption. This will ensure that the system will fail in a safe, known state.

The 0486 supports diagnostic messaging for the sensors; the programmer can read the state of each sensor to ensure control is based on accurate readings. Mis-wiring, probe failure, or other events will be reported back to the PLC for proper handling and alerting.

Features

- Interface six GF sensor or relay modules and a proportional valve to a PROFIBUS network with a single service
- Four channels support (S³L) or flow frequency devices
- Two channels support (S³L) or 4 to 20 mA current loops
- One channel for dedicated 4 to 20 mA current loop input and output. Ideal for proportional valve control or other current loop uses.
- Support for PROFIBUS DP V1 and DP V0
  - Supports 9.6K to 12M bits/second network speeds
  - System and sensor diagnostic support (DP V1)
  - Fail-safe for 8059 Relay Modules and proportional valve outputs on communication failure
- Simplifies the programming of sensors, saving programming time and reducing errors.
- Convenient DIN Rail or surface mountable enclosure

Applications

- Automation Upgrades
- Filter and RO Skids
- Neutralization Systems
- Water and Wastewater Treatment
- Pool and Spa Control
- Aquatic Animal Life Support Systems and Aquaculture

Specifications

General	
Channels	**4 channels digital (S³L) or frequency input (open collector or sinusoidal)**
	2 channels digital (S³L) or 4 to 20 mA current loop
	1 channel 4 to 20 mA current loop input/output for valve positioning or current loop uses
Accuracy	**Frequency, accuracy ± 0.5% of reading max error @ 25 °C, resolution 1 uS**
	4 to 20 mA current loop input, accuracy ± 32 uA @ 25 °C, resolution 16 uA
	4 to 20 mA current loop output, accuracy ± 32 uA @ 25 °C, resolution 6 uA
Terminal Plug type	**Pluggable screw types, 24 to 12 AWG**
Enclosure	
Material	**Aluminum 6063 T3 and 5052 H32 powder coated**
Mounting	**Surface (not included)**
	35 mm DIN rail mounts (included)
Input Power	
DC	**24 VDC ±10% @ 10 W max., 0.40 A max. External Surge Protection is Required, 2KV Common Mode, 1KV Differential Mode.**
Input Specifications	
Digital (S³L)	**Channels 1, 2, 3, 4, 5 and 6**
Output Power	**5 VDC regulated @ 20 mA**
Overcurrent Protected	Each channel independently protected
	A short on a channel will not impair the other channels
Frequency	**Channels 1, 2, 3 and 4**
Range	**1 to 1'300 Hz**

4 to 20 mA Current Loop Input	Channels 5, 6 and 7
Maximum Voltage	40 VDC
Maximum Current	40 mA
Maximum Voltage Drop	5 VDC
Minimum Update Rate	100 mS
Reverse Voltage and Over Current Protected	

Output Specifications

4 to 20 mA Current Loop Input	Channel 7
Maximum Excitation Voltage	24 VDC
Minimum Excitation Voltage	12 VDC
Maximum Resistance	250 Ω @ 12 VDC
	500 Ω @ 18 VDC
	750 Ω @ 24 VDC
Minimum Update Rate	100 mS

Environmental

Operating Temperature	-10 °C to 70 °C	14 °F to 158 °F
Storage Temperature	-20 °C to 85 °C	-4 °F to 185 °F
Relative Humidity	5 to 95% non-condensing	

Profibus

Output Signal	Profibus-DP V1 according to IEC 61158-2
DP Function	Slave
Transfer Rates	9.6 kbps to 12 Mbps
Signal Coding	NRZ Code
Physical Layer	RS 485
Connection 3-0486-D	9-pin D-sub female connector
Connection 3-0486-M	M12 connector (Special Order)

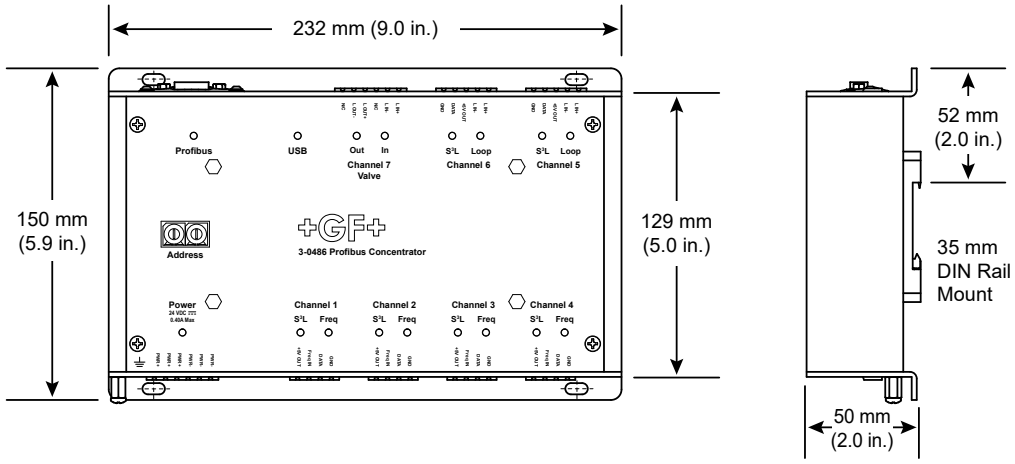
Shipping Weight

	1.4 kg	3.0 lb

Standard and Approvals

CE, UKCA, RoHS compliant, China RoHS
Profibus Certified
Manufactured under ISO 9001 for Quality
Safety: UL 61010-1, CAN/CAS-C22.2 No. 61010-1, IEC 61010-1:2010
EMC: EN 61000-6-3:2007+A1, IEC 61000-6-3:2006+A1, FCC 15.107 Class B, FCC 15.109 Class B, FCC 15.109(g) Class B, EN 61000-6-2

Dimensions

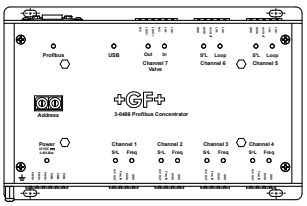


Support

- 2250 Hydrostatic Level
- 2350 Temperature
- 2450 Pressure or Hydrostatic Level
- 515, 525, 2536, 2540, 2000, 2100, 2507, 2551 or 2552 Flow
- 2610-51 Dissolved Oxygen
- 2751 pH/ORP Smart Sensor Electronics
- 2850 Conductivity
- 8058 iGo Signal Converter
- 2581 FlowtraMag
- 8059 Relay Module
- PPA04-80, PA30-90 Pneumatic Actuators with Pilot Valve
- 5-Series DIASTAR Pneumatically Actuated Diaphragm Valves On/Off Control (requires 8059)
- EA15, 25, 45, 120 or 250 Electric Actuator On/Off Control and type 104 Electrically Actuated Ball Valves (requires 8059)
- Electropneumatic positioner type SPC/RPC

Ordering Information

Mfr. Part No	Code	Description
3-0486-D	159 001 839	DB9 Profibus Concentrator
Special Order Options - Please consult the factory		
3-0486-M		Profibus Concentrator with M12 connector

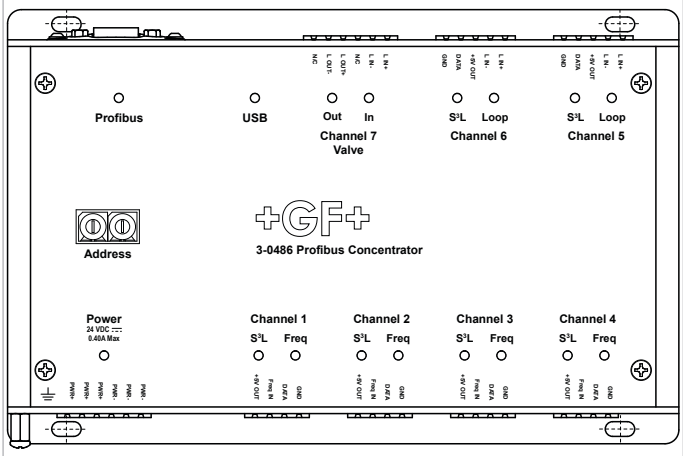


Accessories and Replacement Parts

Mfr. Part No	Code	Description
6682-1104	159 001 712	Loop power plug, 4-pos, right angle
6682-0051	159 866 089	Terminal block plug, 5-pos
6682-0061	159 866 090	Terminal block plug, 6-pos
3-0486.390	159 310 266	Profibus DIN mount kit (two DIN mount plates and six screws)

Wiring information

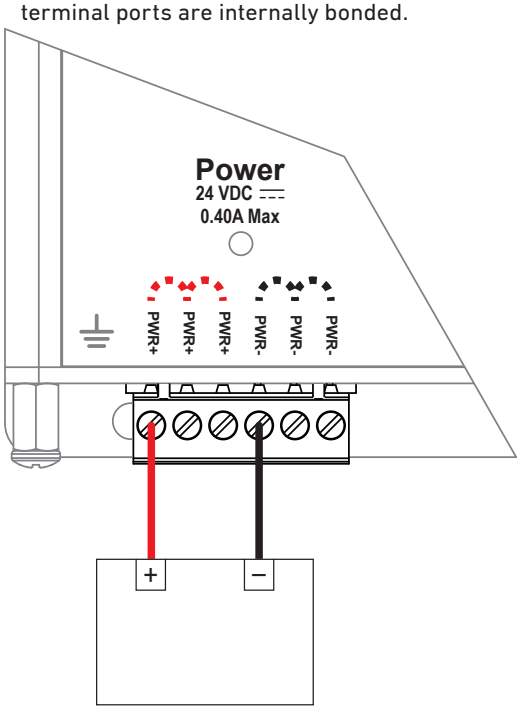
0486 Profibus Concentrator



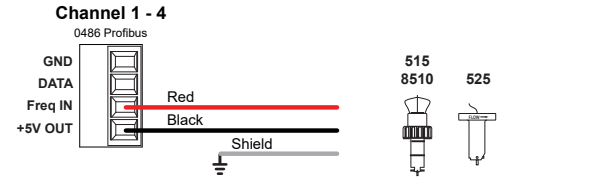
Power - 24 VDC ±10% Regulated

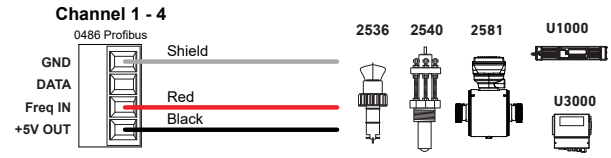
PWR - terminal ports are internally bonded.

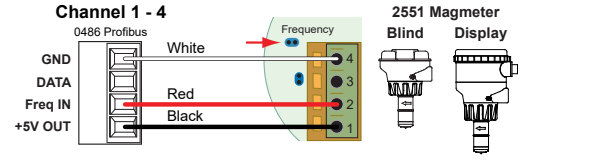
PWR + terminal ports are internally bonded.

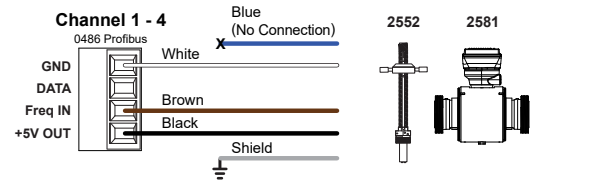


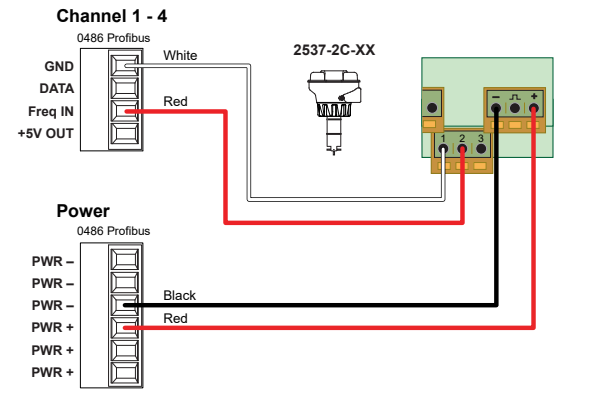
Frequency Flow Sensors (Channels 1, 2, 3, and 4)

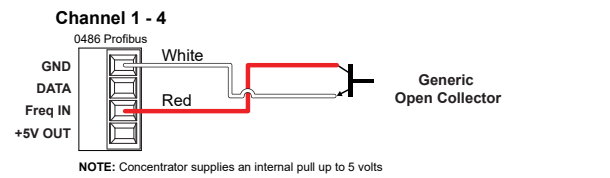










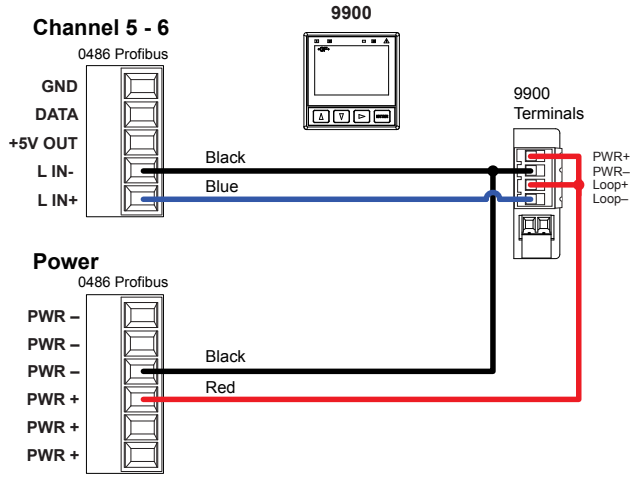


NOTE: Concentrator supplies an internal pull up to 5 volts

Current Loop Input (Channels 5 and 6)

Compatible Devices	4 to 20 mA versions of GF sensors, other Current Loop devices
NOTE: For 4 to 20 mA versions of GF sensors, refer to the appropriate manual for wiring instructions.	
Channel	5, 6

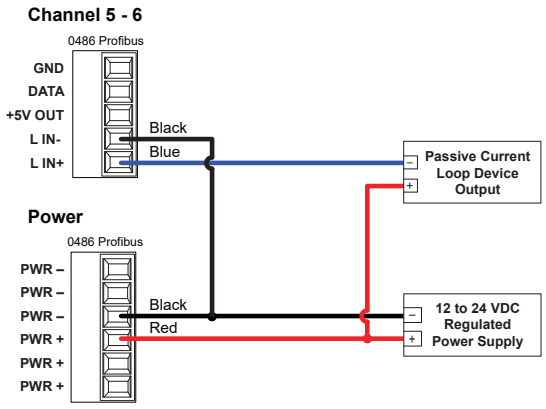
Passive 4 to 20 mA Current Loop Input



Generic Active 4 to 20 mA Current Loop Input



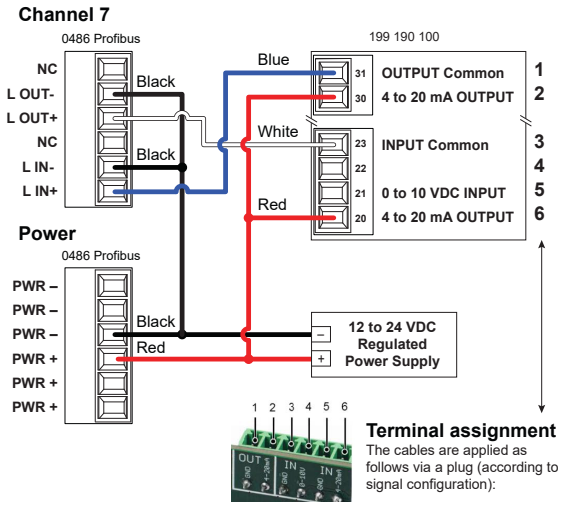
Generic Passive 4 to 20 mA Current Loop Input



Current Loop Input & Output (Channel 7)

Compatible Devices	PE-25 (EA21, EA31, EA42), Current Loop Input and Output Devices
Channel	7

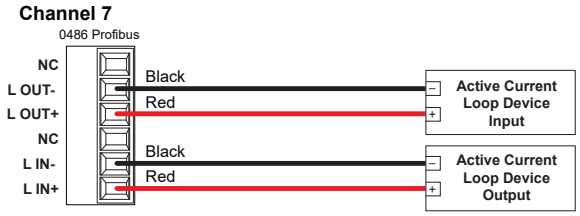
Passive PE 25 Valve Positioner Wiring



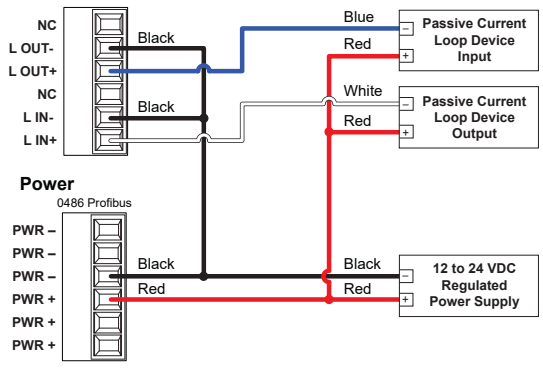
Terminal assignment
The cables are applied as follows via a plug (according to signal configuration):

Terminal 1	Terminal 2	Terminal 3	Terminal 4	Terminal 5	Terminal 6
Ground	4 to 20 mA	Ground	0-10 V	Ground	4 to 20 mA
OUT		IN			

Generic Active Current Loop Input & Output Wiring



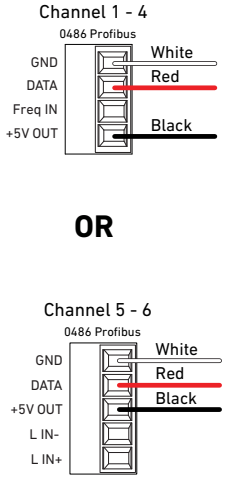
Generic Passive Current Loop Input & Output Wiring



(S³L) Devices (Channels 1, 2, 3, 4, 5, and 6)

Compatible Sensors:

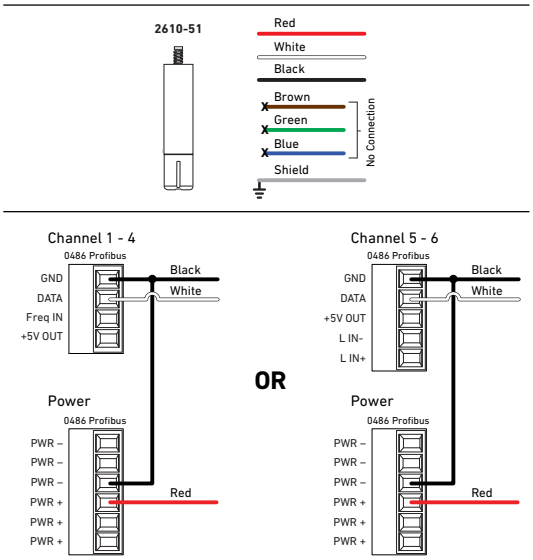
2250, 2350, 2450, 2551, 2552, 2751, 2850, and 8058



2581 wiring to 0486 Profibus Concentrator

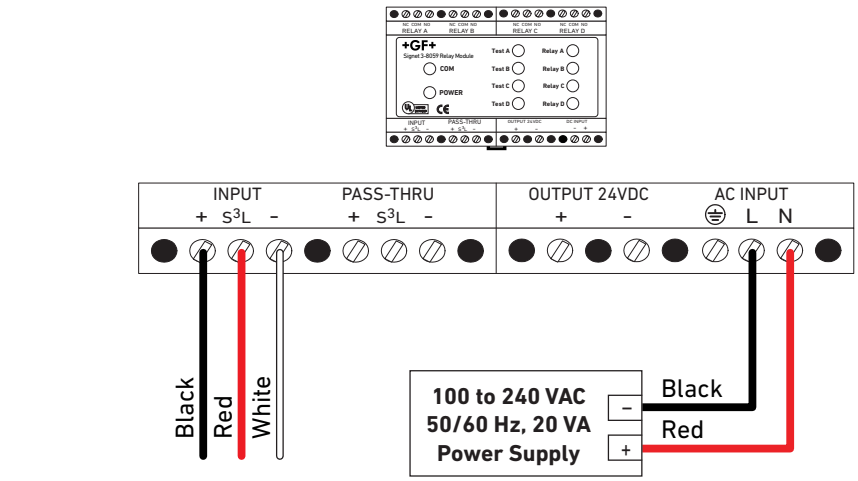
Refer to the 0486 Profibus Concentrator manual for Frequency wiring and programing instructions.

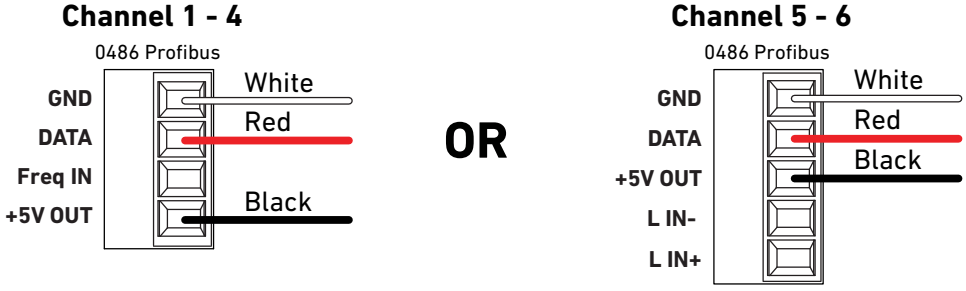
2610-51 Dissolved Oxygen Sensor



Compatible Sensor: 8059

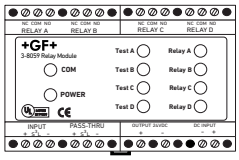
8059-4AC

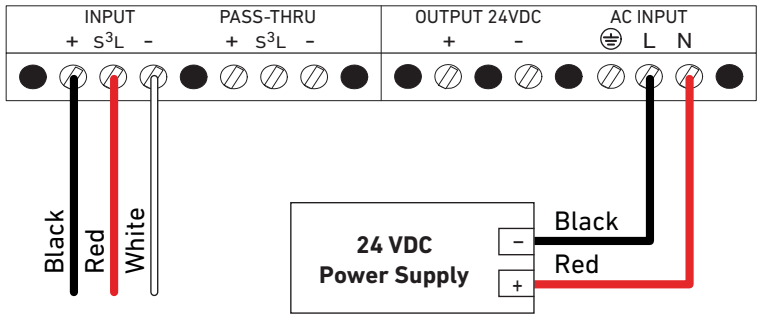




Compatible Sensor: 8059

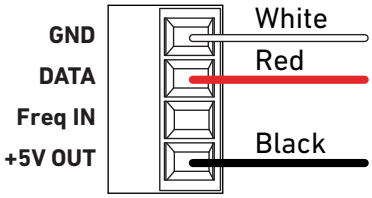
8059-4





Channel 1 - 4

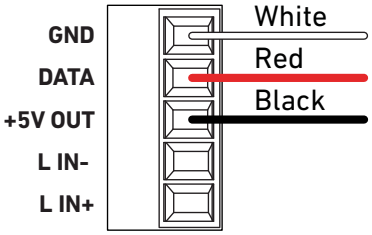
0486 Profibus



OR

Channel 5 - 6

0486 Profibus



Type 2850 Conductivity/Resistivity Tool



2850.101-X

Product description

The type 2850 Conductivity/Resistivity tool is available for certification or validation of electronics that are independent of the electrode. Because there are no available liquid standards for calibration in low conductivity and resistivity applications, the tool is ideal for various installations. The tool is built to conform to the ASTM D 1125-95 Standard (Standard Test Methods for Electrical Conductivity and Resistivity of Water), which is also commonly used for USP 24 applications.

The Conductivity/Resistivity tool simulates within ±0.1% precision (accuracy), various values:
1.0 µS, 2.5 µS, 10.0 µS, 10.0 MΩ, 18.2 MΩ. The tool enables the user to accurately validate or certify the electronics.

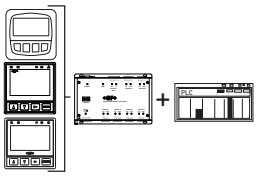
The type 2850.101-X simulators are used with the type 9900 and type 2850 electronics by simply plugging into the same terminals as the sensor cables.

Features

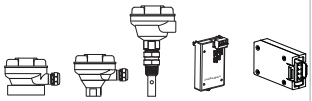
- Available in five different values
- Compatible with 3-2850 electronics when used with the 9900 or 9950 Transmitter or as a stand-alone 4 to 20 mA output
- Verifies electronics independent of electrode
- NIST traceable units
- Temperature compensated to 25 °C
- All units delivered with NIST traceable certificates

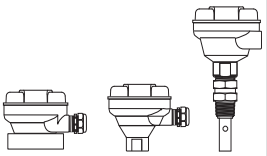
System Overview

S³L Input	4 to 20 mA Output
Instrument with 0486 Profibus and Customer Supplied Programmable Logic Controller or Programmable Automation Controller - 9900 - 9950	Customer Supplied Chart Recorder, Programmable Logic Controller, or Programmable Automation Controll
Sensor Electronics - 2850-51 - 2850-61 - 2850-63 - 9900.394 (9900 only) - 9950.394-1 - 3-9950.394-2	Sensor Electronics - 2850-52 - 2850-62









GF 2850.101-X
Certification Tool



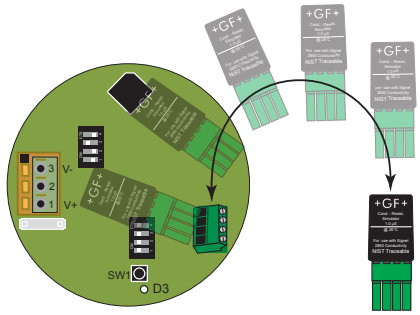
All sold separately

Ordering Information

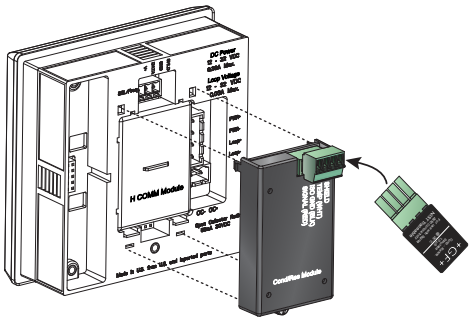
Mfr. Part No	Code	Description
3-2850.101-1	**159 001 392**	Plug-in NIST Traceable Tool, 1.0 µS simulated
3-2850.101-2	**159 001 393**	Plug-in NIST Traceable Tool, 2.5 µS simulated
3-2850.101-3	**159 001 394**	Plug-in NIST Traceable Tool, 10.0 µS simulated
3-2850.101-4	**159 001 395**	Plug-in NIST Traceable Tool, 18.2 MΩ simulated
3-2850.101-5	**159 001 396**	Plug-in NIST Traceable Tool, 10.0 MΩ simulated

Anschluss

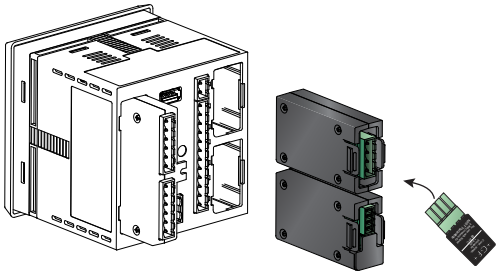
3-2850.101-X



3-9900



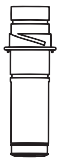
3-9950



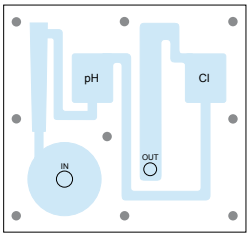
Accessories for Chlorine

Note: Not all accessories shown pictorially.

Mfr. Part No.	Code no.	Description
3-2630-1	159 001 746	Free Chlorine Sensor, 0.02 to 2 ppm (mg/l)
3-2630-2	159 001 662	Free Chlorine Sensor, 0.05 to 5 ppm (mg/l)
3-2630-3	159 001 747	Free Chlorine Sensor, 0.1 to 20 ppm (mg/l)
3-2632-1	159 001 767	Chlorine Dioxide Electrode, 0.02 to 2 ppm (mg/l)
3-2724-00	159 001 545	pH Sensor, Flat Glass, Pt1000 Temp Element, ¾ in. MNPT
3-2650-7	159 001 670	Chlorine - In-line Amperometric Electronics, Digital (S3L), 4.6 m (15 ft) Cable
3-2751-7	159 001 957	pH - In-line Electronics, Digital (S3L), 4.6 m (15 ft) Cable
3-9950-3	159 001 954	9500 Base Unit - DC Powered, 2 Channel Input, 2 Passive 4 to 20 mA Output, 2 Active 4 to 20 mA Output (Module) 2 Mechanical Relays, 4 Binary Inputs
3-9950-4	159 001 955	9950 Base Unit - AC Powered, 2 Channel Input, 2 Passive 4 to 20 mA Output, 2 Active 4 to 20 mA Output (Module), 2 Mechanical Relays, 4 Binary Input
3-4630.390	159 001 688	Rebuild Kit, O-rings, Boots, Screws, 1 Filter Screen
3-4630.391	159 001 689	Pressure Regulator with 1 Spare Filter Screen
3-4630.392	159 001 690	Acrylic Flow Cell complete with all components and connections
3-2630.391	159 001 674	Electrolyte Kit, 30 ml Bottle with Syringe and Needle
3-2630.394	159 310 164	Free Chlorine and Chlorine Dioxide Replacement PTFE membrane (1)
3-2630.396	159 001 676	Electrolyte Replacement Kit - 30 ml Electrolyte Bottles (2), Needles (2) and Membranes (2) with Syringe
3-2632.391	159 310 160	Chlorine Dioxide electrolyte, 30 mL (2) bottles
3-2632.398	159 310 165	Chlorine Dioxide maintenance kit - (2) electrolyte, (2) PTFE membranes, (2) Silicone Bands, and Polishing Paper
3-0700.390	198 864 403	pH Buffer Kit (1 each 4, 7, 10 pH Buffer in Powder Form, makes 50 ml of each)
3822-7004	159 001 581	pH 4.01 Buffer Solution, 1 pint (473 ml) Bottle
3822-7007	159 001 582	pH 7.00 Buffer Solution, 1 pint (473 ml) Bottle
3822-7010	159 001 583	pH 10.00 Buffer Solution, 1 pint (473 ml) Bottle
3-2700.395	159 001 605	Calibration Kit: included 3 polypropylene cups, box used as cup stand,1 pint pH 4.01, 1 pint pH 7.00



Chlorine Sensor
3-263X-X



Acrylic Flow Cell
3-4630.392

Type 2759 pH/ORP System Tester



Product description

The type 2759 pH/ORP Simulator is a battery-powered millivolt generator that simulates pH values of 4, 7 and 10, plus ORP values of ±700 mV. This device is useful as a troubleshooting aid and for general verification of system operation. It is not a substitute for periodic system calibration with pH buffers or test solutions.

Accessory adapter cable (sold separately) enables the 2759 to connect directly to 2751 pH/ORP Smart Sensor Electronics. The adapters include a selector switch for pH or ORP simulation. The switch triggers automatic sensor-recognition software in GF pH/ORP instrumentation.

Features

- Battery powered millivolt generator
- Simulates pH and ORP values
- High impedance test signal
- Verifies system functionality
- Compatible with 2751
- Connects to all GF instruments
- Verifies sensor electronics

System Overview

GF Instruments	Automation System
2751 Smart Sensor Electronics with - 9900 and Rear Enclosure - 9950	2751 Smart Sensor Electronics with - 0486 Profibus Concentrator and Customer Supplied Programmable Logic Controller or - Programmable Automation Controller
Type 2759.391 Adapter Cable	
Type 2759 pH/ORP System Tester	

All sold separately

Overview

A) **Power OFF button**

B) **Output simulation buttons and indicators**
Simulate pH and ORP output at fixed values: pH 4,
pH 7, pH 10, -700 mV and +700 mV. Pressing any one of these buttons turns the 2759 on.

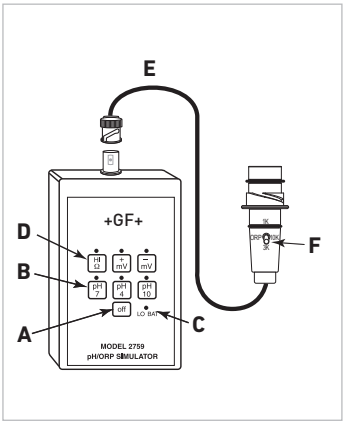
C) **Low battery indicator**

D) **High Ω switch**
Adds 1000 MΩ resistance in series with output. Simulates high impedance of pH electrodes. Used to verify proper preamplifier operation.

E) **Adapter cable**
Use PN 3-2759.391 for use with the 2751.

F) **Mode selector switch**
Trigger automatic sensor recognition software in GF pH/ORP instrumentation. The three-way toggle switch positions are:

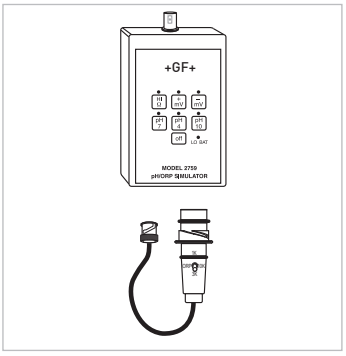
- Top = 1K for a type 9900/9950 instrument or 2751 Smart Sensor Electronics. Compatible with Pt1000 or 3KΩ temperature element.
- Middle = 10K for ORP simulation.
- Bottom = 3K for older GF instruments.



Ordering Information

Mfr. Part No	Code	Description
3-2759	**159 000 762**	pH/ORP System Tester Kit for all pH Instruments
3-2759.391	**159 000 764**	Adapter Cable for use with 2751*

* required for use with the 3-2759 to test and evaluate 3-2751 preamplifiers



pH/ORP Buffer Solutions



pH/ORP Buffer Solutions

Product description

The GF pH buffers are ideal for many calibration requirements. The liquid solutions are conveniently packaged in one pint bottles; the powder pillows are packaged in low weight, single-use containers which can be mixed with water. All pH buffers are color coded for easy identification; 4.01 pH is red, 7.00 pH is yellow, and 10.00 pH is blue.
The pH buffers are traceable to NIST standards and certificates are available upon request. They are accurate to within ±0.01 pH units @ 25 °C and have long term stability.

These solutions are temperature sensitive and are provided with temperature correction values for the most accurate calibration. For applications that require ORP calibration, the pH 4 and pH 7 buffers can be mixed with quinhydrone powder for the correct measurement values of +264 mV and +87 mV respectively.

Features

- NIST traceable
- Easily identifiable color coded buffer solutions
- Liquid or powder versions
- Temperature compensated values
- Kits for easy use

Calibration Tips

1. The pH and ORP solutions can be used for calibrating more than one sensor within a day. However, the solutions must remain free of debris and must not be diluted by rinse water from previous calibrations.
2. ORP solutions made with quinhydrone are very unstable and may not read properly once exposed to air for a prolonged time. These solutions must be disposed of within an hour.
3. All other calibration solutions must be disposed of at the end of one day. Proper disposal is simply done by running tap water while pouring the used solutions slowly down the drain or per local requirements.
4. Use tap or deionized water to rinse the solutions off of the sensors.

System Overview

Panel, Pipe, Tank, Wall Mount	4 to 20 mA Output	Automation System
GF Instruments with 2751 Smart Sensor Electronics - 9900 - 9950	2751 Smart Sensor Electronics with - Customer Supplied Chart Recorder Programmable Logic Controller or - Programmable Automation Controller	2751 Smart Sensor Electronics with - 0486 Profibus Concentrator and Customer Supplied Programmable Logic Controller or - Programmable Automation Controller
GF Electrodes and Sensors - 2724-2726 - 2734-2736 - 2744-2746 - 2756-2757 - 2774-2776		

GF pH/ORP Buffer Solutions


Buffer Kit


Buffer Solution


Quinhydrone

All sold separately

Ordering Information

Mfr. Part No.	Code	Description
3-2700.395	159 001 605	Calibration Kit; includes 3 polypropylene cups, box used as cup stand, 1 pint pH 4.01, 1 pint pH 7.00
3822-7115	159 001 606	20 gram Bottle Quinhydrone for ORP Calibration
3822-7004	159 001 581	*pH 4.01 Buffer Solution, 1 pint (473 ml) bottle
3822-7007	159 001 582	*pH 7.00 Buffer Solution, 1 pint (473 ml) bottle
3822-7010	159 001 583	*pH 10.00 Buffer Solution, 1 pint (473 ml) bottle
3-0700.390	198 864 403	*pH Buffer Kit (1 each 4, 7, 10 pH buffer in powder form, makes 50 ml of each)
Special Request		NIST Traceable Certificate (liquids only)

* Safety Data Sheets (SDS) are available online at www.gfps.com

Technical basics

Understanding pH and ORP Calibration

Why do electrodes need to be calibrated?

Calibration ensures the pH or ORP electrode continues to function properly and accurately. pH and ORP electrode readings vary over time due to changes in reference voltage or aging of the pH glass. pH electrode output decreases with age, coating, elevated temperatures and pH glass erosion (by abrasion, and strong sodium hydroxide (NaOH), potassium hydroxide (KOH) or hydrofluoric acid (HF) solutions).

Calibration helps to identify when the electrode is worn out and needs to be replaced.

How often should an electrode be calibrated?

- New applications: Weekly calibration is recommended for a new process where a pH or ORP electrode has never been installed. If the electrode calibrates within acceptable limits* over the next few weeks, change the calibration schedule to once every two weeks and continue to extend the schedule to meet your needs.
- Existing applications: It is recommended the electrode be calibrated at least every month to ensure proper function* of the electrode.
- Critical applications: In locations where measurement accuracy is extremely critical, the electrode should be calibrated as frequently as required for proper performance*.
- Dirty applications: In applications where the electrode needs frequent cleaning, the electrode should be calibrated after each cleaning to ensure proper functionality*.

Why do some electrodes need frequent calibration while others need calibration every month?

If a process plant has a variety of processes within the facility, a calibration schedule needs to be determined for sensors placed in each type of process liquid.

- Clean applications, like drinking water, are rarely a problem for pH or ORP measurements and calibration is typically required every month.
- If the process solution contains high concentrations of chemicals, elevated temperature and/or pressure, or has many suspended solids, it is common to calibrate once every one or two weeks.
- For dirty process liquid applications, an electrode should be cleaned before calibrating.

What calibration solutions should be used?

pH calibration:

- Two pH buffer solutions should be used and need to be at least 3 pH units apart.
- Use pH 7.00 and pH 4.01 solutions if the normal measurement value is less than 7 pH.
- Use pH 10 and pH 7 if the normal measurement value is greater than 7 pH.

ORP two point calibration:

- ORP calibrations are performed similar to pH calibrations using one or two solutions at different values.
- A pH 4 buffer solution saturated with quinhydrone will generate +264 mV while a pH 7 buffer saturated with quinhydrone will generate +87 mV.

Note: Quinhydrone solutions will last only for a short time (one hour or less). Also note that GF EasyCal function only works with these two values.

* Sensors are good when a new electrode reads very close to the theoretical value (±0.25 pH). A used pH electrode may read as far off as ±0.84 pH before it needs to be replaced. If the pH readings in all buffers have shifted greater than 0.84 pH units (for example, electrode is reading 4.85 in a 4 buffer and 7.85 in a 7 buffer) or if the millivolt offset for pH/ORP sensors is extreme (outside of ±50 mV) in both pH/ORP solutions), a problem with the reference electrode is indicated and the electrode should be replaced.

Accessories and Replacement Parts for pH/ORP

pH/ORP Electrode Mounting

Note: Not all accessories shown pictorially.

Mfr. Part No.	Code no.	Description	Compatibility
P31515-0P200	159 000 630	PVC Pipe Adapter, 1¼ in. o.d.	272X, 273X
P31515-0C200	159 000 631	CPVC Pipe Adapter, 1¼ in. o.d.	272X, 273X



Pipe Adapter, 1¼ in. OD.

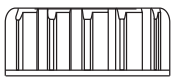
Wet-Tap Replacement Parts

Mfr. Part No.	Code no.	Description	Compatibility
1220-0114	159 000 854	3719 O-ring, FKM (spare part)	3719 Wet-Tap
3-3719.390	159 000 855	3719 Locking Shroud (spare part)	3719 Wet-Tap
1220-9458	159 000 927	3719 O-ring, FKM	3719 Wet-Tap

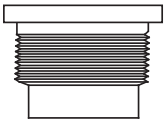
pH/ORP Miscellaneous

Note: Not all accessories shown pictorially.

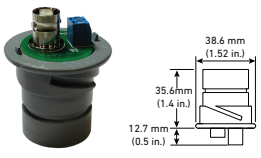
Mfr. Part No.	Code no.	Description	Compatibility
1220-0021	198 801 000	O-ring, FKM	272X, 273X
1224-0021	198 820 006	O-ring, EPR (EPDM)	272X, 273X
1228-0021	198 820 007	O-ring, FFKM	272X, 273X
3800-4340	159 001 948	Replacement Salt Bridge	2744 - 2747
3-2759	159 000 762	pH/ORP System Tester	2751, 2760
3-2759.391	159 000 764	2759 DryLoc Adapter Cable	2751, 2760
3864-0002	159 001 008	Replacement Reference Electrolyte Solution 500 ml	2764-2767
2120-0015	159 001 009	CPVC Adapter, 1½ in. MNPT to 1 in. FNPT	2764-2767
2122-0015	159 001 010	316 SS (1.4401) Adapter, 1½ in. MNPT to 1 in. FNPT	2764-2767
3822-7004	159 001 581	pH 4.01 Buffer Solution, 1 pint (473 ml) Bottle	
3822-7007	159 001 582	pH 7.00 Buffer Solution, 1 pint (473 ml) Bottle	
3822-7010	159 001 583	pH 10.00 Buffer Solution, 1 pint (473 ml) Bottle	
3-0700.390	198 864 403	pH Buffer Kit	
3-2700.395	159 001 605	Calibration kit	
3822-7115	159 001 606	20 gm Bottle Quinhydrone for ORP Calibration	
3-8050.390-1	159 001 702	Retaining Nut, Valox	
3-2722	159 070 088	The 2722 BNC DryLoc adapter is used to connect the GF 277X high temperature pH and ORP electrodes used in submersible applications to the 2750/2760 electronics	



Sensor Cap



Pipe Adapter, 1½ in. to 1 in. FNPT



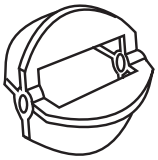
2722 BNC DryLoc adapter

Accessories and Replacement Parts for Flow Sensors

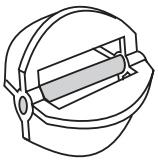
Rotors and Rotor Kits

Note: Not all accessories shown pictorially.

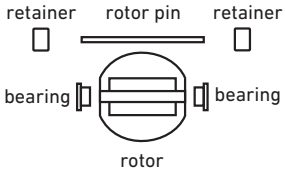
Mfr. Part No.	Code no.	Description	Compatibility
M1538-2	198 801 181	Rotor only, PVDF Black	515
M1538-4	198 820 018	Rotor, ETFE	515
P51550-3	198 820 043	Rotor and Pin, PVDF Natural	515
3-0515.322-1	198 820 059	Sleeved Rotor, PVDF Black	515
3-0515.322-2	198 820 060	Sleeved Rotor, PVDF Natural	515
3-0515.322-3	198 820 017	Sleeved Rotor, ETFE	515
3-2000.390	159 000 248	Replacement Rotor Kit	2000
3-2507.080-2	198 801 550	Rotor	2507
P52509	198 801 501	Rotor Kit (rotor, stainless steel pin, bearings, retainers)	525
P52509-2	159 000 480	Rotor Kit (rotor, tungsten carbide pin, bearings, retainers)	525
3-2540.320	198 820 040	Rotor Kit, 2540 PEEK® Bearing (old version)	2540
3-2540.321	159 000 623	Rotor Kit, 2540 Tungsten Carbide Pin (new version since 1.1.2000)	2540
3-2536.320-1	198 820 052	Rotor, PVDF Black	2536, 2537
3-2536.320-2	159 000 272	Rotor, PVDF Natural	2536, 2537
3-2536.320-3	159 000 273	Rotor, ETFE	2536, 2537
3-2536.321	198 820 054	PVDF Natural, Rotor Kit	2536, 2537
3-2536.322-1	198 820 056	Sleeved Rotor, PVDF Black	2536, 2537
3-2536.322-2	198 820 057	Sleeved Rotor, PVDF Natural	2536, 2537
3-2536.322-3	198 820 058	Sleeved Rotor, ETFE	2536, 2537



Rotor
(pin not included)



Sleeved Rotor
(pin not included)



Rotor Kit (P52509)

Rotors Pins

Mfr. Part No.	Code no.	Description	Compatibility
M1546-1	198 801 182	Pin, Titanium	515, 2536, 2537
M1546-2	198 801 183	Pin, Hastelloy-C	515, 2536, 2537
M1546-3	198 820 014	Pin, Tantalum	515, 2536, 2537
M1546-4	198 820 015	Pin, Stainless Steel	515, 2536, 2537
P51545	198 820 016	Pin, Ceramic	515, 2536, 2537



Rotor Pin

Rotors Shafts

Mfr. Part No.	Code no.	Description	Compatibility
P52504-1	198 801 500	Rotor Shaft, Stainless steel 316 (optional)	525
P52504-2	198 820 023	Rotor Shaft, Tungsten Carbide (standard)	525

Bearings

Mfr. Part No.	Code no.	Description	Compatibility
P52503	198 820 013	Carbon Fiber Reinforced PTFE	525, 2540

In-line Rotors

Mfr. Part No.	Code no.	Description	Compatibility
3-2507.081-2	198 801 502	2 mm Insert	2507
3-2507.081-3	198 801 503	3 mm Insert	2507
3-2507.081-4	198 801 558	4 mm Insert	2507
3-2507.080-5	198 801 508	DIN Connector	2507

Magmeter Flow Sensor Accessories

Mfr. Part No.	Code no.	Description	Compatibility
Replacement Transducers			
3-2551-P0	159 001 211	PP/316L SS, DN15 to DN100 (½ to 4 in.) pipe	2551
3-2551-P1	159 001 212	PP/316L SS, DN125 to DN200 (5 to 8 in.) pipe	2551
3-2551-P2	159 001 444	PP/316L SS, DN250 to DN300 (10 to 12 in.) pipe	2551
3-2551-T0	159 001 213	PVDF/Titanium, DN15 to DN100 (½ to 4 in.) pipe	2551
3-2551-T1	159 001 214	PVDF/Titanium, DN125 to DN200 (5 to 8 in.) pipe	2551
3-2551-T2	159 001 445	PVDF/Titanium, DN250 to DN300 (10 to 12 in.) pipe	2551
3-2551-V0	159 001 376	PVDF/Hastelloy-C, DN15 to DN100 (½ to 4 in.) pipe	2551
3-2551-V1	159 001 377	PVDF/Hastelloy-C, DN125 to DN200 (5 to 8 in.) pipe	2551
3-2551-V2	159 000 446	PVDF/Hastelloy-C, DN250 to DN300 (10 to 12 in.) pipe	2551
Replacement Electronics Module			
3-2551-11	159 001 215	Magmeter Electronics, Frequency or Digital (S3L) Output	2551
3-2551-12	159 001 216	Magmeter Electronics, 4 to 20 mA Output	2551
3-2551-21	159 001 372	Magmeter Display Electronics, Frequency or Digital (S3L) Output, w/ Relays	2551
3-2551-22	159 001 373	Magmeter Display Electronics, 4 to 20 mA Output w/Relays	2551
3-2551-41	159 001 374	Magmeter Display Electronics, Frequency or Digital (S3L) Output	2551
3-2551-42	159 001 375	Magmeter Display Electronics, 4 to 20 mA Output	2551
Other			
3-8551.521	159 001 378	Clear Plastic Cap for Display	2551
2120-1512	159 001 425	1½ in. x 1¼ in. NPT Adapter	2552
2120-2012	159 001 426	2 in. x 1¼ in. NPT Adapter	2552
4301-2125	159 001 533	1¼ in. NPT Full Port Ball Valve, Brass	2552
4301-3125	159 001 387	1¼ in. NPT, Female to Female Full Port Ball valve, 316 SS	2552
5541-4184	159 001 388	Cable, 4 cond., 22 AWG, 4 m (13 ft)	2552
5541-4186	159 001 389	Cable, 4 cond., 22 AWG, 6 m (19.5 ft)	2552
3-2551.395	159 310 096	Display Cap Magmeter w/relays and LED	2551
3-2551.395-1	159 310 097	Display Cap Magmeter NO LED	2551
3-2552.392	159 001 530	1¼ in. NPT, Full Port SS Ball Valve and Nipple Kit	2552
3-2552.393	159 001 531	1¼ in. NPT, Full Port Brass Ball Valve and Nipple Kit	2552
3-2552.394	159 001 532	1½ in. NPT, Conduit Adapter, Aluminum	2552
3-2552.397	on request	Cable connector, 4-pin, watertight, unassembled, male	2552
3-2552.398	on request	Cable connector, 4-pin, watertight, unassembled, female	2552

O-rings and Gaskets

Mfr. Part No.	Code no.	Description	Compatibility
1220-0018	159 000 019	O-rings FKM (2 required per sensor)	2100
1220-0021	198 801 000	O-ring, FKM (2 per sensor)	515, 2536, 2537
1220-0029	198 820 049	Cover O-ring	2000
1220-0121	159 000 852	O-ring, FKM (2 required per sensor)	2540
1224-0018	159 000 020	O-rings EPR (EPDM) (2 required per sensor)	2100
1224-0021	198 820 006	O-ring, EPR (EPDM) (2 required per sensor)	515, 2536, 2537, 2540
1228-0021	198 820 007	O-ring, FFKM (2 required per sensor)	515, 2536, 2537, 2540
3-2507.080-3	198 801 547	Quad Ring	2507
P52618	159 000 493	Gasket	525
1222-0042	159 001 379	O-ring for Clear Plastic Cap, EPR (EPDM)	2551
1223-0151	159 000 236	Cap O-ring for Yellow Field Mount Housing	9900, ProcessPro yellow body

Miscellaneous

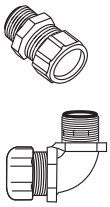
Mfr. Part No.	Code no.	Description	Compatibility
3-1500.663	198 820 008	Hot-Tap Installation Tool (See Installation for more information)	2540
P31520-2P	159 000 461	Pipe Adapter Insert, PVC	5 in. to 8 in. pipe fittings
P31536	198 840 201	Sensor Plug, Polypro	515, 2536, 2537
P31542	198 801 630	Sensor Cap, Red	515
P31542-3	159 000 464	Sensor Cap, Blue	2536
P31934	159 000 466	Conduit Cap	515, 2536, 2540
2450-0620	198 820 051	Cover Screw	2000
3-2541.260-1	159 000 849	Standard Replacement Electronics Module	2540
3-2541.260-2	159 000 850	Hot-Tap Replacement Electronics Module	2540
P52527	159 000 481	Retainers, SS (1.4401)	525, 2540
P52628	159 000 504	Fitting Cap Kit (cap and gasket)	525
P51589	159 000 476	Conduit Adapter Kit	515, 525, 2536, 2540
5523-0222	159 000 392	Cable (per foot), 2 cond., w/shield, 22 AWG	515, 2507, 2000, 2540
5523-0322	159 000 761	Cable (per foot), 3 cond., w/shield, 22 AWG	8058, 2751, 2850, 2250, 2350, 2450
5523-3222	159 000 393	Cable (per foot), 2 cond., w/shield 22 AWG	525



Sensor Plug



Sensor Cap



Conduit Adapter Kit

Technical Reference

Content

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Flow Application Assistance 613
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Standards and Approvals

CE Mark

CE Marking on a product is a legal requirement for selling in the EU stating the conformity with specific European Union (EU) directives. It is a self-declaration that a product complies with the essential requirements of the relevant European health, safety and environmental protection legislation. For our products the relevant directives are “Low Voltage” and “Electromagnetic Conformity (“EMC”).

Low Voltage Directive

This directive refers to products that require voltage ranges from 50 to 1000 volts for AC (alternating current) and 75 to 1500 volts for DC (direct current).

EMC Directive

This directive defines the minimum requirements for immunity and maximum emissions with related tests for electronic equipment. These tests are only relevant for “active” circuitry, which refers to products that contain semiconductors that can be affected by electromagnetic interference (EMI) or generate themselves EMI. Products that do not contain such active circuits (like 515, 525 or pH sensors) are exempt from the requirements from this directive, thus do not require the CE marking.

UL Listing

Underwriters Laboratory (UL) is recognized as a Nationally Recognized Testing Laboratory (NRTL). UL is required for products intended to be connected to voltage levels that may cause "Hazardous Live" conditions. For all practical purposes this means the connection of 120V or 240V AC to either an AC power supply or the contacts of relays. Furthermore we list products equipped with certain types of batteries that may cause specific safety concerns (e.g. explosion) other than the voltage rating. Manufacturers submit products to UL for testing and safety certification on a voluntary basis and therefore UL is not required by law. Products with the UL mark can assure customers that they are buying products that have been tested to a standard that will help prevent danger or accidents in case of hazardous conditions. All products that have mechanical relays such the ProcessPro, ProPoint, Multi-Parameter, Display Magmeter with relays, and 2537, all qualify for the UL listing because of the relay ratings which are typically 240 VAC max and 5A max. Products that contain a battery, such as the 8150, also require UL to safety test the current discharge amount that can cause a fire/explosion. Canada also has the UL Listing, however, the products in Canada will be listed under CUL.

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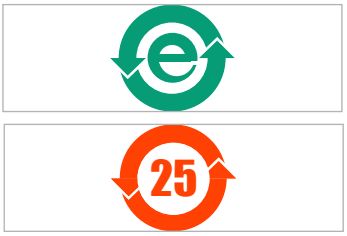
ETL

Intertek (ETL) is also recognized as a Nationally Recognized Testing Laboratory (NRTL). ETL provides product safety testing and certification, and is equally recognized and accepted as UL. ETL evaluates products using UL, CSA, and other harmonized standards. It is also voluntary.

China RoHS

(Restriction of Hazardous Substances), officially known as Administrative Measure on the Control of Pollution Caused by Electronic Information Products, is a Chinese government regulation to control six EU RoHS substances and other hazardous substances which have not been defined. All items shipped to China now have to be marked whether the items contained in the box are compliant or non-compliant. The Electronic Information Products (EIP) logo is used to mark parts and assemblies where these identified materials are within acceptable limits, and are environmentally safe. Units that do contain hazardous substances are marked with the EIP logo including an Environment Friendly Use Period (EFUP) value in years.

RoHS and WEEE



The Restriction of Hazardous Substances Directive 2002/95/EC (RoHS Directive) and the Waste Electrical and Electronic Equipment Directive 2002/96/EC (WEEE Directive) were adopted in February 2003 by the European Union. RoHS Directive bans the placing on the EU market of new electrical and electronic equipment containing more than agreed levels of lead, cadmium, mercury, hexavalent chromium, polybrominated biphenyl (PBB) and polybrominated diphenyl ether (PBDE) flame retardants. It is closely linked with the WEEE Directive which sets collection, recycling and recovery targets for electrical goods and is part of a legislative initiative to solve the problem of huge amounts of toxic e-waste. For disassembly instructions, please refer to our website.

On June 8, 2011, RoHS Recast Directive 2011/65/EU (revision to the RoHS Directive 2002/95/EC) was adopted and published in the Official Journal of the European Union on July 1, 2011. It repeals the original RoHS Directive, 2002/95/EC. The 2011/65/EU directive specifies its scope of coverage in Annex 1, Categories 1-11. In addition, Article 4, Paragraph 3, states that the directive shall apply to industrial monitoring and control instruments which are placed on the market from 22 July 2017.

The Recast codifies documentation, marking, and manufacturer, importer and distributor responsibilities under the Directive, including product CE marking and manufacturer Declaration of Conformity.

It is important to understand that GF products will remain compliant although RoHS logo and declaration statements will change. All relevant literature and products (product labels, data sheets, manuals, catalogs, etc.) will be updated by July 22, 2017.

Starting January 2013 we will begin removing the EU Lead Free RoHS logo [] from all relevant published literature and products. A conformity declaration will be available on our website and in the local language of the European Union (EU) market as they become available.

ISO 9001 / 14001 and ISO 45001

- ISO 9001 provides the requirements for quality management systems, is now firmly established as the globally implemented standard for providing assurance about the ability to satisfy quality requirements and to enhance customer satisfaction in supplier-customer relationships.
- ISO 14001 provides the requirements for environmental management systems, confirms its global relevance for organizations wishing to operate in an environmentally sustainable manner.
- ISO 45001 provided the occupational health and safety activities and associated supporting processes associated with the design, production and service of flow and analytical sensors, transmitters, controllers, indicators, instruments and accessories of their products and services.

The people of Georg Fischer LLC are dedicated to the design, manufacture and support of products that meet or exceed the requirements of our customers. We pledge to do this by developing safe processes and procedures which continuously improve our systems, products and the environment.

We target appropriate goals in our business environment, being mindful of legal requirements, regulations, customer requests and the prevention of pollution. We are committed to enhancing our employees health and safety.

This policy was developed by the executive management of the company. We train all employees in the requirements of this policy, and we document, audit, review, and revise our business systems regularly to ensure that it remains appropriate and effective to achieve our goals.

FCC

Federal Communications Commission (FCC) is an independent U.S. Federal Government agency responsible for the management of the radio spectrum in the US. The FCC regulates interstate and international communications by radio, television, wire, satellite and cable in all 50 states, the District of Columbia and U.S. territories.

Electrical and electronic products may interfere by producing radio spectrum noise. As electric current moves around inside an electrical product, the current will produce electromagnetic field waves that will travel through space. Those waves may affect other electrical currents in other products, and cause unwanted interference.

We ensure our products have been tested and are compliant with the radio pollution limits and equipment authorization procedures.

NSF/ANSI 61 and NSF/ANSI 372

NSF International is an accredited, independent third-party certification body that tests and certifies products to verify they meet these public health and safety standards. Products that meet these standards bear the NSF mark.

Georg Fischer LLC has received certification under NSF/ANSI 61: Drinking Water System Components - Health Effects, for its Polypropylene Flow sensors, PVC-U Tee Fittings, and PVC-U Clamp-on Saddles in February of 2015.

Products are also certified to NSF/ANSI 372: Drinking Water System Components - Lead Content and conform to the lead content requirements for “lead free” plumbing as defined by California, Vermont, Maryland, and Louisiana state laws and the U.S. Safe Drinking Water Act.

The water contact temperature listed in the certification is CLD 23, which is 23 degrees Celsius, or 73 degrees Fahrenheit, or ambient temperature.

GF products bearing the NSF mark means the product complies with NSF/ANSI 61 and NSF/ANSI 372 requirements. NSF conducts periodic unannounced inspections and product testing to verify that the product continues to comply with the applicable standards.

The mark also provides:

Knowledge that an impartial review against established criteria or guidelines has been conducted. Evidence that product labeling and claims have been objectively reviewed by a trusted third party. Backing by a team of professionals dedicated to public health and safety operating in more than 150 countries.

Lloyd’s Register type Approval

Lloyd’s Register Group Limited (LR) is a technical and business services organization and a maritime classification society.

A type Approval from Lloyd’s Register demonstrates that the product conforms to recognized industry quality standards, International Conventions and/or the LR Rules, through a process of independent design review, sample testing and verification of production controls.

ATEX

The ATEX Directives, 99/92/EC and 94/9/EC, applies to equipment intended to be used where an explosive atmosphere is present, when they are first placed on the European Union Market. Products that comply with the ATEX Directive bear the CE and the ATEX marks.

The ATEX Directive defines procedures that manufacturers have to apply before placing a product on the market. The procedures are intended to demonstrate the due diligence of the manufacturers of the equipment and, in some cases, involves Notified Bodies.

PROFIBUS and PROFINET International (PI):

PROFIBUS and PROFINET International (PI) is an independent organization responsible for the PROFIBUS and PROFINET protocols. PROFIBUS is standardized by the International Electrotechnical Commission (IEC) as IEC 61158. PI, through its regional associations, competence centers, training centers and test labs ensure high quality products and devices that implement the PROFIBUS standards. GF products that implement the PROFIBUS protocol are tested and certified by PROFIBUS and PROFINET International and the PI Test Labs.

HART®

HART is a bi-directional communication protocol that provides data access between intelligent field instruments and host systems. A host can be any software application from a technician's hand-held device or laptop to a plant's process control, asset management, safety or other system using any control platform.

All devices that use the HART Protocol as a basis for communications are tested according to the standards contained in HART Protocol Specification 7.2 (HCF_TEST-1 through HCF_TEST-4) to ensure full compliance with all Protocol requirements prior to being listed in the Foundation's Supplier Product Catalog.

HART is a registered trademark of the HART Communication Foundation.

Bluetooth

The Bluetooth SIG is a global community of over 34,000 companies serving to unify, harmonize and drive innovation in the vast range of connected devices all around us.

Through collective creation and shared technical standards, Bluetooth simplifies, secures and enriches the technology experience of users worldwide.

The Bluetooth® word mark and logos are registered trademarks owned by Bluetooth SIG,Inc. and any use of such marks by Georg Fischer is under license. Other trademarks and trade names are those of their respective owners.

Conversion Factors

Volume						
To Convert	**Into**	**Multiply by**		**To Convert**	**Into**	**Multiply by**
Gallons (U.S.)	fl. oz. (U.S.)	128		Liters	fl. oz. (U.S.)	33.81
Gallons (U.S.)	Cubic in. (in3)	231		Liters	Cubic in. (in3)	61.02
Gallons (U.S.)	Cubic ft. (ft3)	0.1336		Liters	Cubic ft (ft3)	0.0353
Gallons (U.S.)	Liters	3.785		Liters	Gallons (U.S.)	0.2642
Gallons (U.S.)	Cubic meter (m3)	0.00379		Cubic meter (m3)	Cubic ft (ft3)	35.31
Gallons (U.S.)	Pounds	8.33		Cubic meter (m3)	Gallon (UK)	219.97
Gallons (U.S.)	Cubic centimeter (cm3 or cc)	3785.41		Cubic meter (m3)	Gallons (U.S.)	264.17
Gallons (U.S.)	Gallon (UK)	0.833		1 Acre foot	Gallons (U.S.)	325,853
Gallons (U.S.)	Milliliter (mL)	3785.41		Cubic ft. (ft3)	Gallon (UK)	6.23
Cubic ft. (ft3)	Liters	28.32		Cubic ft. (ft3)	Gallons (U.S.)	7.48
Cubic ft. (ft3)	Cubic meter (m3)	0.028317				

Pressure						
To Convert	**Into**	**Multiply by**		**To Convert**	**Into**	**Multiply by**
psi	bar	0.069		bar	psi	14.5
psi	kPa	6.89		bar	kPa	100
psi	atmosphere	0.068		bar	atmosphere	0.987
psi	mm of Hg	51.71		bar	mm of Hg	750.06
atmosphere	bar	1.013		kPa	bar	0.01
atmosphere	psi	14.696		kPa	psi	0.145
atmosphere	kPa	101.325		kPa	atmosphere	0.00987
atmosphere	mm of Hg	760		kPa	mm of Hg	7.5

Temperature						
To Convert	**Into**	**Multiply by**		**To Convert**	**Into**	**Multiply by**
Deg F	Deg C	(F-32)*0.5555		Deg C	Deg F	C*1 .8+32

Length						
To Convert	**Into**	**Multiply by**		**To Convert**	**Into**	**Multiply by**
inch	meter (m)	0.0254		foot	centimeter (cm)	30.48
inch	millimeter (mm)	25.4		cm	foot (ft)	0.0328
inch	centimeter (cm)	2.54		cm	inch (in.)	0.3938
foot	meter (m)	0.3048		m	foot (ft)	3.28
foot	millimeter (mm)	304.8		m	inch (in.)	39.37

Flow rate						
To Convert	**Into**	**Multiply by**		**To Convert**	**Into**	**Multiply by**
gallon (US)/min	m3/h	0.227		m3/h	l/s	0.2778
gallon (US)/min	l/s	0.063		m3/h	ft3/min	0.589
gallon (US)/min	ft3/min	0.134		m3/h	gallon (US)/min	4.4
ft3/min	m3/h	1.699		l/s	m3/h	3.6
ft3/min	l/s	0.472		l/s	ft3/min	2.12
ft3/min	gallon (US)/min	7.48		l/s	gallon (US)/min	15.85

Weight						
To Convert	**Into**	**Multiply by**		**To Convert**	**Into**	**Multiply by**
ounce(Av.)	grams (g)	28.35		grams (g)	ounce(Av.)	0.035274
pound(Av.)	grams (g)	453.59		grams (g)	pound(Av.)	0.0022046
pound(Av.)	ounce (Av.)	16				

Area						
To Convert	**Into**	**Multiply by**		**To Convert**	**Into**	**Multiply by**
Acre	Hectare	0.4047		square meter (m2)	Hectare	0.0001
Acre	square ft (ft2)	43559.66		square meter (m2)	square ft (ft2)	10.764
Acre	square meter (m2)	4046.82		square centimeter (cm2)	square ft (ft2)	0.00108
Acre	square kilometer (km2)	0.004047		square inch (in2)	square centimeter (cm2)	0.155

Equations

Flow

To convert fluid velocity into a volumetric flow rate.

GPM = (ID2 x Feet/sec)/0.4084967 (To calculate GPM enter ID in inches.) LPM = 0.0471189 x ID2 x m/s (To calculate LPM enter ID in millimeters.)

To convert volumetric flow rate into fluid velocity.

Feet/sec = (GPM x 0.4084967)/ID2 (To calculate Feet/sec enter ID in inches.)

m/s = (LPM x 21 .22291)/ID2(To calculate m/s enter ID in millimeters.)

Conductivity

Conductivity = 1/Resistivity

1/Ohm = 1 Siemen = 1 mho

Measured conductivity = [(solution conductivity) x (electrode sectional area)]/electrode separation

Measured conductivity = Siemen/cm

Nominal Pipe Sizes

Below are the NPS (Nominal Pipe Sizes) inch names and their metric equivalents called DN or “diameter nominal”. The metric designations conform to International Standards Organization (ISO).

Metric DN (mm)	NPS (inch)
6	⅛
8	¼
10	⅜
15	½
20	¾
25	1
32	1¼
40	1½
50	2
65	2½
80	3
100	4
125	5
150	6
200	8
250	10
300	12
350	14
400	16
450	18
500	20
550	22
600	24
650	26
700	28
750	30
800	32
900	36
1000	40
1100	42
1200	48
1400	54
1500	60
1600	64
1800	72
2000	80
2200	88

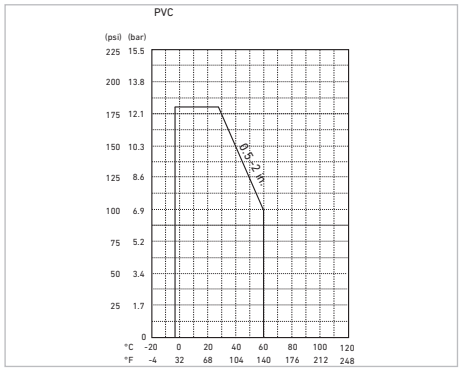
Operating Temperature/Pressure Graphs for Tees, Saddles and Fittings

Note

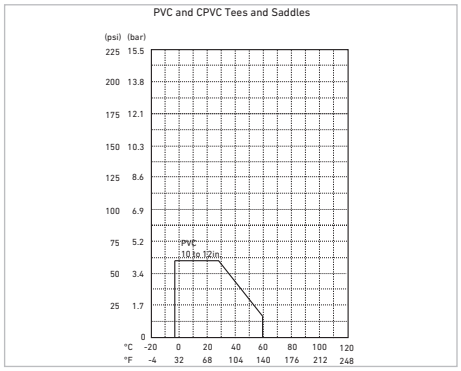
The pressure-temperature diagrams are specifically for the stated type. During system design the specifications of all components must be considered. In the case of a metal piping system, a plastic sensor will reduce the system specification. When using a PVDF sensor in a PVC piping system, the fitting will reduce the system specification.

Pressure-temperature diagrams

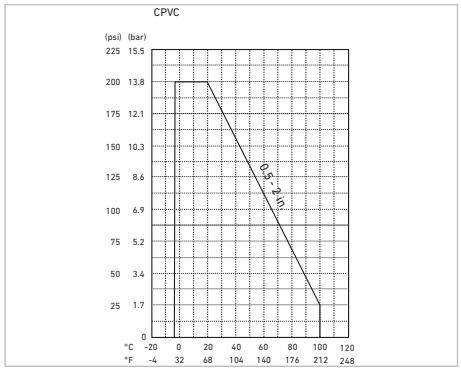
PVC Tees



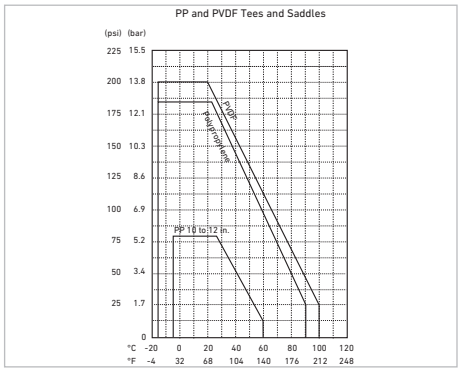
PVC Saddle



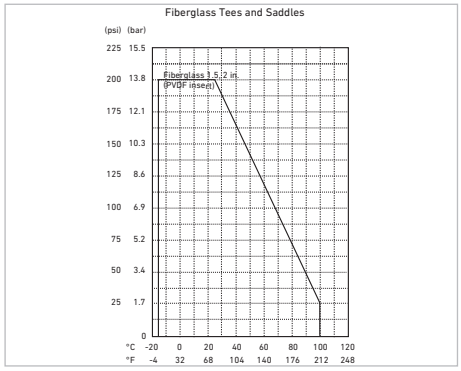
CPVC Tees



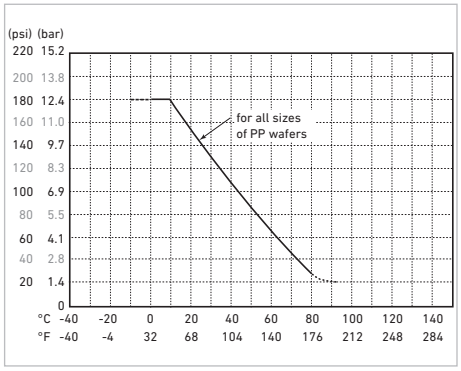
PP and PVDF Tees and Saddles



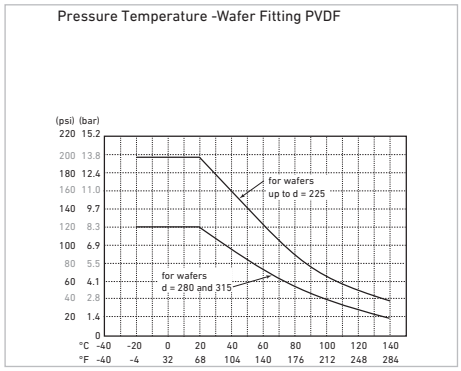
Fiberglass Tees



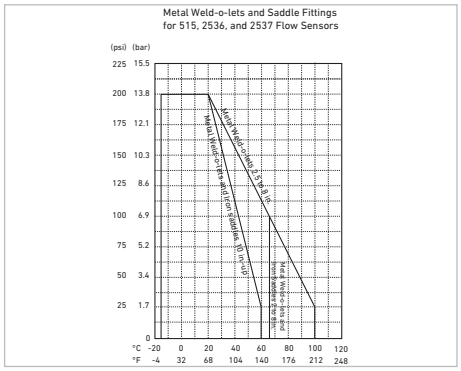
PP Wafer Fittings



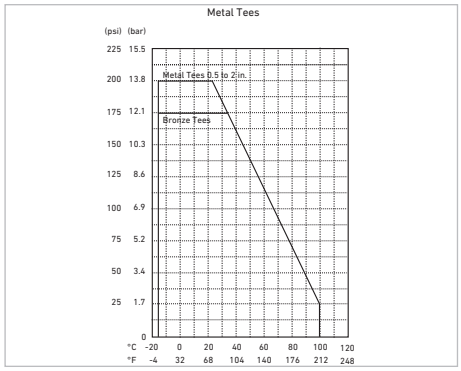
PVDF Wafer Fittings



Metal Weldolets and Saddle Fittings



Metal Tees

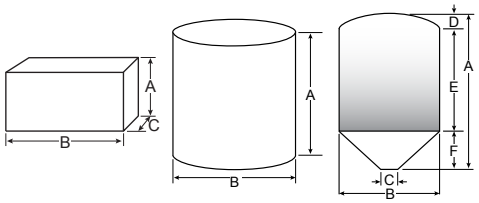


Level Application Assistance

Please provide as much detail as possible for prompt assistance. Send the completed form to Technical Support at your local GF sales office.

Date:	Company:	Contact:
Address:	City:	Zip/Postal Code:
Country:	State:	
Phone:	Ext:	Email:
Name of project:		
GF Distributor:	Contact:	Tel:
Description of application (use separate sheet if necessary):		

Tank shape:	☐ Round	☐ Square	☐ Rectangle	Other:	
Orientation:	☐ Vertical	☐ Horizontal	**Location:**	☐ Indoor	☐ Outdoor
Features:	☐ Open Top	☐ Flat Top	☐ Dome Top	☐ Flat Bottom	☐ Conical Bottom
Tank volume:	(gallons)	**Tank material:**		**Tank liner:**	
Fill rate:	(gpm)				

Dimensions (inch)	A:	B:	C:	
	D:	E:	F:	

*Please attach a sketch of any qualities or specifications unique to your tank application

Sensor Requirement	☐ Multipoint switch	**Sensor Install**	**Fill Location**
☐ Radar (guided)	☐ Vibration fork	☐ Tank adapter	☐ Top
☐ Radar (unguided)	☐ Ultrasonic gap	☐ Standpipe	☐ Side
☐ Ultrasonic	☐ Float (guided)	☐ Side Mount	☐ Bottom
☐ Hydrostatic (pressure)	☐ Float (unguided)	☐ Other:	

Submerged items in tank (ladder, heater, mixer, plumbing, etc):					
Fluid to be measured:			(%)	**Fluid Dielectric Constant:**	
Fluid Temperature: (°F):			Min	Max	
Vessel Pressure: (psi):			Min	Max	
Vapors/Condensation:	☐ Y	☐ N	**Foaming:**	☐ Y ☐ N	(describe):
Agitation:	☐ Y	☐ N	(mixer, air sparge, recirc pump, etc):		
Hazardous requirements:	☐ Y	☐ N	(type):		

Notes: (Please include all required outputs, relays and any miscellaneous information):

Flow Application Assistance

Please provide as much detail as possible for prompt assistance. Send the completed form to Technical Support at your local GF sales office.

Date:	Company:	Contact:
Address:	City:	Zip/Postal Code:
Country:	State:	
Phone:	Ext:	Email:
Name of project:		
GF Distributor:	Contact:	Tel:
Description of application (use separate sheet if necessary):		

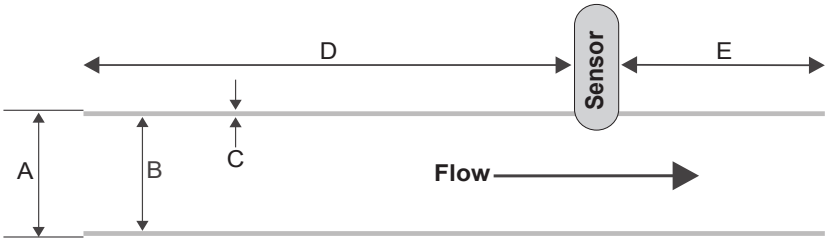


Figure 1: Pipe and straight run dimensions

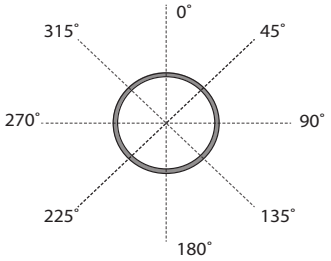


Figure 2: Sensor orientation

Pipe Size:		Pipe Material:	
Schedule:		Flow direction:	Vertical ☐ Horizontal ☐
Pipe full with flow:	Y ☐ N ☐	Pipe full with no flow:	Y ☐ N ☐
Pipe Dimensions: A:		B:	C:
Straight Run Pipe: D:		E:	Sensor Orientation:
Obstructions 50 pipe IDs upstream of sensor:			
Flow rate	Min:	Max:	Nominal:
Fluid temperature	Min:	Max:	Nominal:
Line press.	Min:	Max:	Nominal:
Cond./Resist.	Min:	Max:	Nominal:
Sensor mounted: Indoor ☐ Outdoor ☐			Indicator mounted: Indoor ☐ Outdoor ☐
Sensor mounted: In-line ☐ Submersible ☐			
If submersible, tank size and shape:			
Fluid to be measured:	(%).		(%)
Fluid viscosity:			Specific gravity:
Percent solids:		Description:	Size of solids:
Cable run from sensor indicator:			Available Power:
Required accuracy:		Unit of measurement:	
Hazardous Requirements: Y ☐		N ☐ (type):	
Required outputs & qty:			
Required Approvals:			
Notes (Please include all required outputs, relays and any miscellaneous information):			

pH/ORP Application Assistance

Please provide as much detail as possible for prompt assistance. Send the completed form to Technical Support at your local GF sales office.

Date:		Company:		Contact:
Address:		City:		Zip/Postal Code:
Country:		State:		
Phone:		Ext:		Email:
Name of project:				
GF Distributor:		Contact:		Tel:
Description of application (use separate sheet if necessary):				

Process pH:	Min:	Max:	Nominal:	
ORP:	Min:	Max:	Nominal:	
Pressure:	Min:	Max:	Nominal:	
Fluid temperature:	Min:	Max:	Nominal:	
Flow rate:	Min:	Max:	Nominal:	
Cond./Resist.:	Min:	Max:	Nominal:	
Pipe Mount:	Y ☐ N ☐			
Pipe Size:		Pipe Material:		
Schedule:		Angle:	Vertical ☐	Horizontal ☐
Tank Mount:	Y ☐ N ☐			
Tank Shape: Round ☐	Square ☐	Rectangle ☐	Other:	
Features: Open Top ☐	Flat Top ☐	Dome Top ☐	Flat Bottom: ☐	Conical Bottom: ☐
Tank Volume:	Tank Material:		Tank Liner:	
Fill Rate:				
Fluid to me measured:		(%).		(%)
Fluid Viscousity:		Specific Gravity:		
Percent Solids:		Description:		Size of Solids:
pH/ORP Monitoring: Y ☐ N ☐	pH/ORP:	Min:	Max:	Nominal:
pH/ORP Adjusting: Y ☐ N ☐	Incoming:	Min:	Max:	Nominal:
	Adjusted:	Min:	Max:	Nominal:
Regeant Chemical:		(%).		(%)
How is reagent being delivered:				
Batch Treatment ☐	Continuous Flow ☐	Single Pass ☐	Recirculating ☐	
Retention time:		Stages of Treatment:		Mixing Method:
Sensor mounted: Indoor ☐	Outdoor ☐	Indicator mounted: Indoor ☐	Outdoor ☐	
Sensor mounted: In-line ☐	Submersible ☐	Indicator mounted: Integral ☐	Remote ☐	Panel ☐
Sensor Location/Orientation:				
Cable run from sensor to indicator:				
Available Power:		Quantity of Sensors and Transmitters:		
Required Approvals:				
Notes (Please include all required outputs, relays and any miscellaneous information):				

Conductivity Application Assistance

Please provide as much detail as possible for prompt assistance. Send the completed form to Technical Support at your local GF sales office.

Date:	Company:	Contact:
Address:	City:	Zip/Postal Code:
Country:	State:	
Phone:	Ext:	Email:
Name of project:		
GF Distributor:	Contact:	Tel:
Description of application (use separate sheet if necessary):		

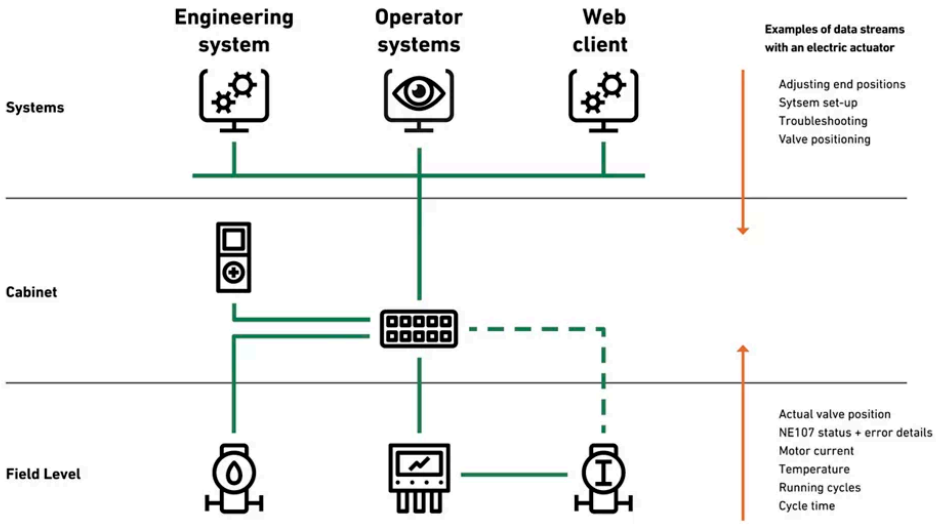
Pipe Size:	Pipe Material:	Tank Size:	Tank Material:	
Schedule:		Angle:	Vertical ☐	Horizontal ☐
Cond./Resist.:	Min:	Max:	Nominal:	
Line Pressure:	Min:	Max:	Nominal:	
Fluid temperature:	Min:	Max:	Nominal:	
Flow rate:	Min:	Max:	Nominal:	

*Sensor mounted in side of tee with integral sensor electronics. Hole in sensor pointing upwards to avoid air bubble entrapment	*In-line sensor with integral mount indicator & conductivity module (May require additional fitting)	*Submersible sensor with remote mounted sensor electronics	*Submersible sensor with integral mount indicator & conductivity module

Sensor mounted: Indoor ☐	Outdoor ☐	Indicator mounted: Indoor ☐	Outdoor ☐		
Sensor mounted: In-line ☐	Submersible ☐	Indicator mounted: Integral ☐	Remote ☐	Panel ☐	
Communication Requirements:	Display ☐	Blind ☐	Relay ☐	HART ☐	4 to 20 mA ☐
Sensor Location/Orientation:					
If Submersible, tank size and shape:					

Fluid to me measured:	(%).	(%)	
Fluid Viscosity:	Specific Gravity:		
Percent Solids:	Description:	Size of Solids:	
Cable run from sensor to indicator:			
Available Power:	Quantity of Sensors and Transmitters:		
Required Approvals:			
Notes (Please include all required outputs, relays and any miscellaneous information):			

Digital Communication



Digital communication enables GF valves, actuators and sensors to integrate seamlessly into modern automation systems by using standardized industrial networks. This chapter outlines the main communication technologies used in industrial environments—from Ethernet-based and fieldbus systems to protocol-specific interfaces—as well as additional options for monitoring and device interaction. It also introduces essential security concepts to ensure reliable, protected data exchange within automated cooling, heating, water treatment and process applications.

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Introduction Digital Communication

Digital communication in process plants becomes increasingly important due to automation trends around digitalization and Industry 4.0 which can`t be supported by traditional 4-20mA analogue technology.

In the past decades, different standard organizations specified several digital communication technologies. End customers in the process industries can freely choice the technology that fits best to their needs, as there are plenty of device types available per technology.

Benefits/features

- Maximized engineering efficiency due to less hardware infrastructure components
- Minimized commissioning time due to remote parameterization of devices
- Increased operational performance and uptime of the plant due to additional and accurate process variables
- Improved maintenance processes due to real-time and remote diagnostic insights
- Continuous process and staff optimization due to monitoring and optimization applications based on the device data in the field level

Technology overview

GF Industry & Infrastructure Flow Solutions supports the most important digital communication technologies in the process automation portfolio for both sensors and actuators.

In general, digital communication technologies can be divided into Industrial Ethernet, Fieldbus and some other technologies. The table below gives a high-level comparison of the technologies.

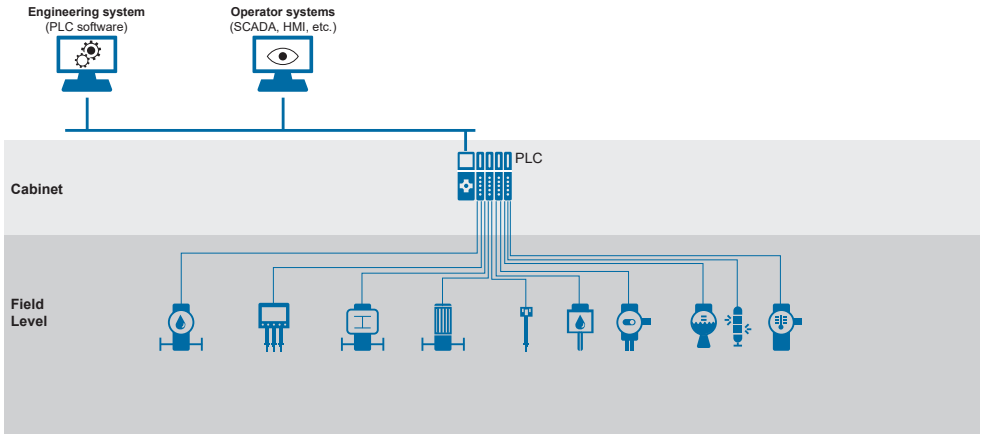
	Electrical	Fieldbus	Industrial Ethernet
	4-20 mA 0-10V	PROFIBUS Modbus RTU AS-I HART	PROFINET EtherNet/IP Modbus TCP
Number of Process Variables from device to PLC	1	all	all
Diagnostic information from device to PLC		yes	yes
Working principle	Analog signals	Master/Slave (half-duplex)	Switched network (full-duplex)
Data rate		Depending on technology; max. 12 Mbit/s	100 Mbit/s
Remote device access			yes (e.g. web server)

The following chapters consist of a short technology description and list all GF Industry & Infrastructure Flow Solutions products, which support this certain technology.

Analogue Network Topologies

A typical analogue network topology uses a direct wiring from analog or digital I/O cards to the field instrumentation. Such a concept requires a lot of space within the cabinet, expensive I/O cards and high wiring effort between field level and cabinet. The communication between field devices and PLC consists of one single value only. Additional device data, such as further process variables or diagnostic data, are locked within the device.

Example for analogue network topology



Digital Network Tolopogies

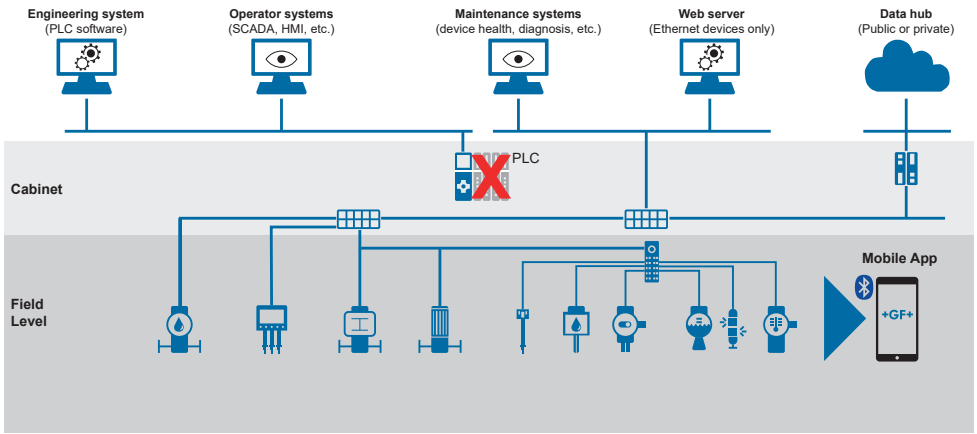
Digital communication technologies open up the potential for highest plant efficiency.

There is no need for expensive I/O cards and extensive device wiring as only one cable goes from the PLC to the field level. Flexible topology concepts support the individual needs of a process plant.

Smart field instruments share their valuable data to enable a continuous process improvement. The field of potential improvements ranges from diagnostic insights to simplify troubleshooting to extensive trend monitoring to optimize processes or avoid unplanned plant shutdowns.

Wireless communications between field devices and mobile applications complete the picture of a highly efficient process plant by providing a simple possibility to connect to a device for live device data or parameterization.

Example for digitized network topology



Industrial Ethernet

Industrial Ethernet technology with protocols like PROFINET, EtherNet/IP or Modbus TCP is best suited to fully support the trends around digitalization, as Ethernet technology is already the standard communication technology on the upper layers of the automation pyramid. By bringing Ethernet down to the field level, systems have a seamless data access to a single sensor or actuator with less hardware components and without protocol conversion. Global market studies show that the share of Industrial Ethernet compared to traditional field level technologies increased a lot and further will increase in future.

PROFINET

Description

PROFINET (Process Field Network) is an international standard led by the user association PROFIBUS PROFINET International with more than 1700 member companies. PROFINET extends the Ethernet physics and TCP/IP transport by a real-time deterministic protocol, which meets the requirements in factory and process automation industries for many years already.

Benefits/features

- Flexible topologies including redundancy mechanisms
- Simple device integration to PLC and basic device parameterization via GSD device driver
- All process variables of the device with precise accuracy due to digital transmission
- Remote access to embedded web server for parameterization and troubleshooting
- Plug & Play device exchange by automatic re-configuration
- Plenty of programmable logic controllers (PLC) and infrastructure components available

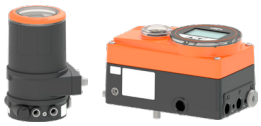
Technology

PROFINET uses a real-time channel for time-critical data such as cyclic process data or alarms and TCP/IP for not time-critical data such as configuration and diagnostics. The data rate of PROFINET is 100Mbit/s full-duplex with a maximum cable length of 100m with copper cables or 2 km with fiber optic.

A huge amount of official PROFINET guidelines supports users from system design to troubleshooting.

More information about PROFINET: www.profibus.com

GF components

Product	Type	Picture
Positioner for electro pneumatic actuator	• SPC D • SPC PID • RPC D • RPC PID	
Electric actuator	• EA 25-250	

EtherNet/IP

Description

EtherNet/IP is an international standard led by the user association ODVA with more than 350 member companies. EtherNet/IP extends the Ethernet physics and TCP/IP transport by a real-time deterministic protocol, which meets the requirements in factory and process automation industries.

Benefits/features

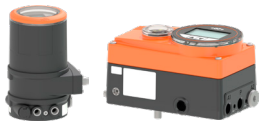
- Flexible topologies including redundancy mechanisms
- Simple device integration to PLC and device parameterization via EDS device driver or AOP (Rockwell systems only)
- All process variables of the device with precise accuracy due to digital transmission
- Remote access to embedded web server for parameterization and troubleshooting
- Plug&Play device exchange by automatic re-configuration

Technology

EtherNet/IP uses implicit messages via UDP for time-critical data such as cyclic process data or alarms and TCP for not time-critical data such as configuration and diagnostics. The data rate of EtherNet/IP is 100Mbit/s full-duplex with a maximum cable length of 100m with copper cables or 2 km with fiber optic.

More information about EtherNet/IP: www.odva.org/technology-standards/key-technologies/ethernet-ip

GF components

Product	Type	Picture
Positioner for electro pneumatic actuator	• SPC D • SPC PID • RPC D • RPC PID	
Electric actuator	• EA25-250	

Modbus TCP

Description

Modbus TCP uses the Modbus protocol over Ethernet and TCP/IP. The Modbus protocol is maintained by the Modbus organization.

Benefits/features

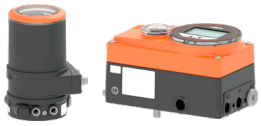
- Simple integration to PLC via standard Modbus function codes and registers
- No device driver needed for PLC integration
- All process variables of the device with precise accuracy due to digital transmission
- Remote access to embedded web server for parameterization and troubleshooting

Technology

Modbus is based on a request and response model, where the master initiates a request and the field device responses accordingly. Standardized function codes define the type of the read or write request and response. A data model defines the type of registers that can be accessed.

More information about Modbus: www.modbus.org

GF components

Product	Type	Picture
Positioner for electro pneumatic actuator	• SPC D • SPC PID • RPC D • RPC PID	
Electric actuator	• EA25-250	

Fieldbus

With fieldbus technologies such as PROFIBUS or Modbus RTU, it is possible to establish a real digital communication network. These technologies are suitable for field device integration that enables the field network to communicate digital. Main differentiation to Industrial Ethernet is the proprietary technology and thus an increased complexity for upper layer integration as well as special expertise during engineering and troubleshooting.

PROFIBUS

Description

PROFIBUS (Process Field Bus) according to IEC 61158/61784 is a worldwide leading standard for fieldbus communication in manufacturing, process and building automation. PROFIBUS also enables communication between devices from different manufacturers without special interface adaptations.

Benefits/features

- Established transmission technology
- Quick and easy device configuration
- Communication of devices from different manufacturers
- Real-time capable protection mechanisms against incorrect parameterization (DP)
- Safe condition in case of failure

Technology

PROFIBUS DP (Decentralized Peripherals) is used for communication of central automation devices with decentralized field devices via a fast serial connection. In addition to user data transmission, DP also provides powerful functions for diagnostics and commissioning. Data transmission rates of up to 12 MBit/s on twisted two-wire lines and/or fiber optic cables are possible.

More information about PROFIBUS: www.profibus.com

GF components

Product	Type	Picture
PROFIBUS Concentrator	• 0486 PROFIBUS Concentrator	
PROFIBUS DP module for Electric actuator	• PROFIBUS DP Module for EA25-250	

Modbus RTU

Description

Modbus is an open communication protocol for the transmission of information between electronic devices via a serial line. The protocol ensures that a master device and one or more slave devices are connected to each other. In this way, different devices can be controlled or data can be transmitted. Modbus has developed into a widely used protocol used by many manufacturers in different sectors, but especially in industry.

Benefits/features

- Widely used and proven
- Open system without license fees
- Simplistic protocol
- Low demands on the hardware performance of the system

More information about Modbus: www.modbus.org

GF components

Product	Type	Picture
Transmitter	• Modbus module for 9900 Transmitter	
	• Modbus module for 9950 Transmitter	
Electric Actuator	• Modbus Module for EA25-250	
Ultrasonic Flowmeter	• U1000 V2 WM • U1000 V2 WHM	
	• U3000 V2 • U3000 V2 HM	

Other technologies

Some other technologies became popular over the last decades for certain use cases and in certain applications.

HART

Description

HART (Highway Addressable Remote Transducer) is a standardized, widely used communication technology. HART enables the digital communication via a 2-wire cable. This technology is based on the widely used 4...20 mA analogue signal. Existing lines of the existing analog system are overlaid with additional information using Frequency Shift Keying (FSK) technology. The HART protocol communicates at 1,200 bit/s without interruption of the 4...20 mA signal and enables the host application (master) to receive two or more digital updates per second from a field device. Since the digital signal of the frequency shift keying takes place in continuous phases, the 4...20 mA signal is not disturbed.

Benefits/features

- Cost-effective and simple: use of existing analog wiring
- Transport of additional process information with the existing analog signal
- Particularly robust fieldbus solution
- Open protocol
- Worldwide spread and proven
- The protocol is constantly evolving
- Bidirectional and acyclic communication

More information about HART: www.fieldcommgroup.org/technologies/hart

GF components

Product	Type	Picture
Transmitter	• HART module for 9900 Transmitter	
Level	• Ultrasonic Level Transmitter 2260 • Ultrasonic Level Transmitter 2270	

AS-Interface

Description

The AS interface (ASi) is an automation technology which enables the connection of simple sensors and actuators to a digital network topology. It cannot replace complex networks but has advantages in cost reduction by low cable efforts and simple installation and configuration.

Benefits/features

- Economical cabling concept for the lower field level for the harsh industrial setting
- Connection to all common field bus systems via gateways, links or network couplers
- Low connection costs per participant
- Low cost of installation
- Simple handling during commissioning and service

More information about ASi: www.as-interface.net/en/technology

GF Components

AS interface for electrical actuators

Actuator types EA25-250



AS interface for pneumatic lift actuators
DN15 – DN50

Actuator types
- DIASTAR Ten
- DIASTAR Ten Plus
- DIASTAR Sixteen



AS interface for manual valves

With integrated feedback
- Ball valve
- Butterfly valve
- Diaphragm valve



AS interface for pneumatic actuators

Actuator types
- PPA04–80 FC, FO, DA
- PA30-90 FC, FO, DA



AS interface for pneumatic lift actuators
DN65 – DN150

Actuator types
- DIASTAR 025 FC/FO DN65 - 150



AS interface for sensors

With switch output
- Level sensor
- Flow sensor
- Pressure sensor
- Temperature sensor



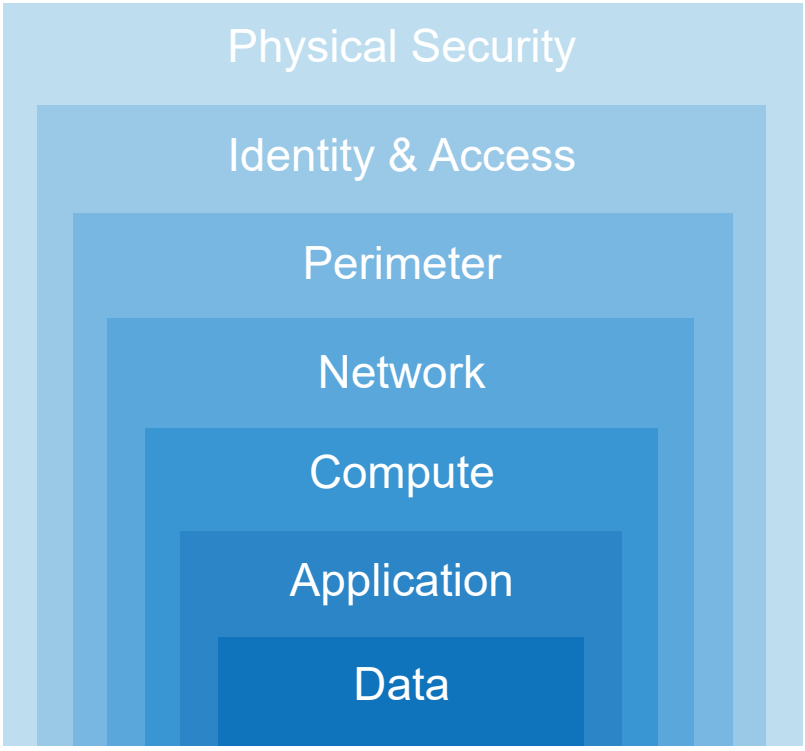
System Security

Product defense in depth

In the context of IEC62443, product defense in depth is a security strategy that involves implementing multiple layers of security measures to protect a product from cyber attacks. This approach is based on the principle that no single security measure can provide complete protection against all possible attacks.

The customer responsibility is to guarantee an on-site defense in depth strategy. Different layers of security shall be considered.

Example different layers of security



GF recommends following the “Security risk assessment” described inside the international standard IEC 62443 Part 3-2.

The official URL to report a variability for all Georg Fischer devices is

https://www.gfps.com/cyber-security

Further information for a practical approach to adopt the IEC standards could be found at the Global Cybersecurity Alliance: https://gca.isa.org

Defense in depth – expected measures

In practice a single security measure can not provide complete protection against all possible attacks. Often a combination of measures is used to complicate the attack of a system.

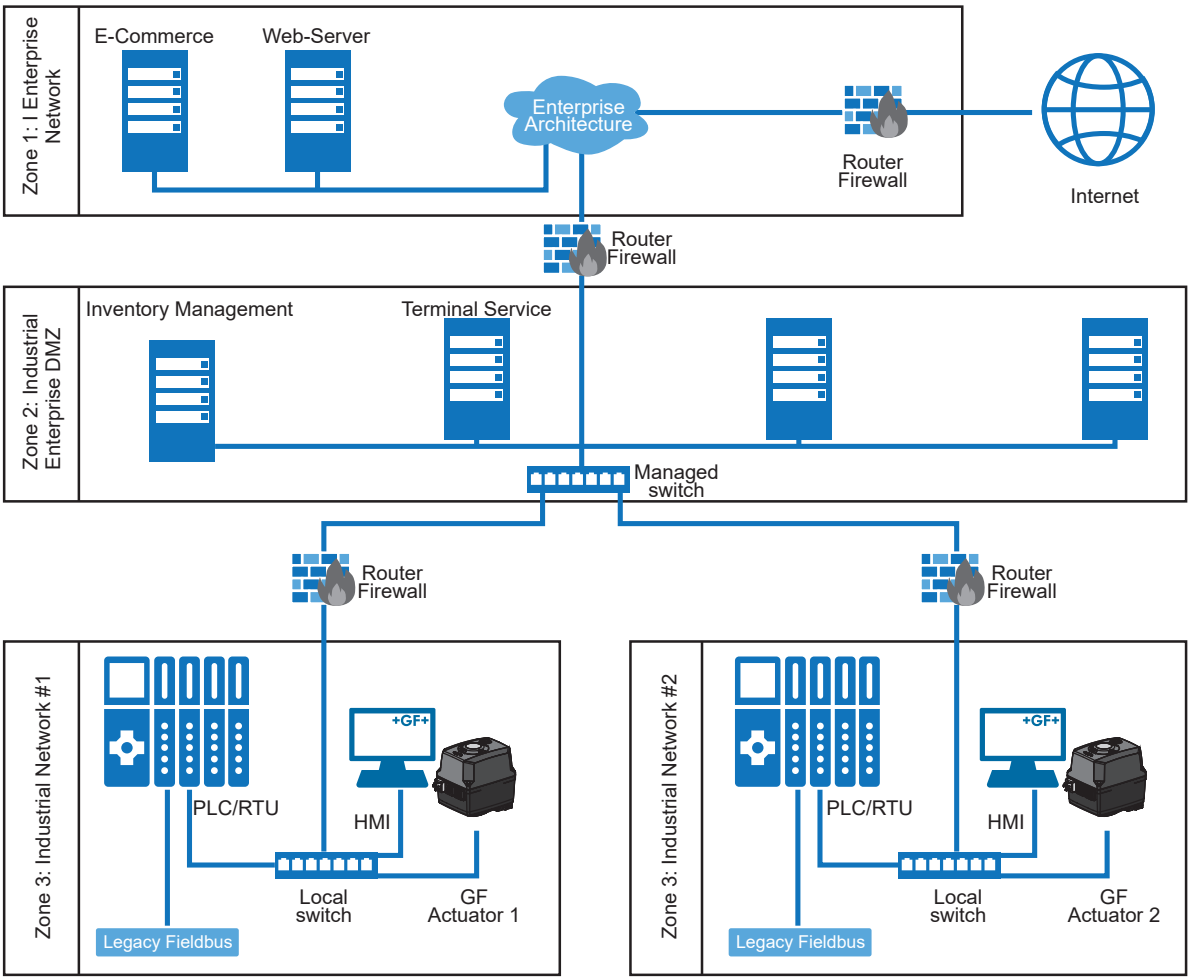
The least expected measures are described inside this chapter.

Physical Security

The physical security contains the direct access control to the device. This access shall be limited to the least possible roles, e.g. plant operator, network administrator.

Network Segmentation

Example of a network segmentation



To encapsulate the embedded devices, it is important to set up different zones. Each zone shall be protected by a own firewall containing at least port filtering and auditing.

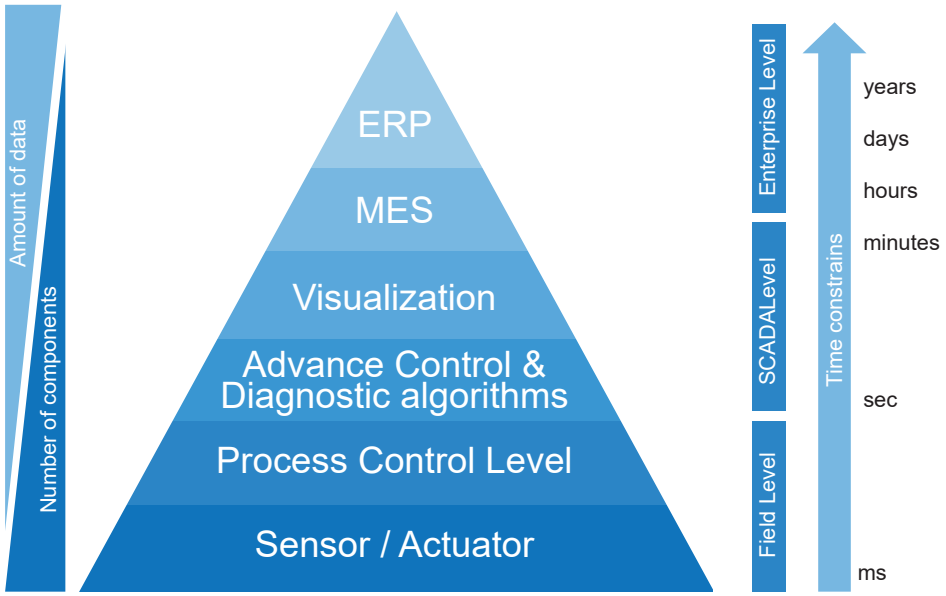
Data

The data is stored on the device itself. A sufficient password shall be used to protect access to the log data. Personal data is not used on field devices.

Product Security context

Process automation communication pyramid

The Process automation communication pyramid illustrates a typical setup with different device classes.



Source: https://www.researchgate.net/figure/An-Automation-Pyramid_fig1_320187633

Our portfolio currently comprises three types of device: Sensors, actuators and transmitters, which are assigned to the “Field Area”.
In industry environments the sensor and actuators talk directly to the “Process Control Level” – which for example could be a remote transmitter or a classical PLC.

Although the transmitters belong to the Process Control Level, they usually do not have a communication interface to the “Advance Control & Diagnostic algorithms”. Nevertheless, in cases of enabled parallel communication, special care needs to be taken in the overall context, see generic (high-speed) and generic (wireless) content.

Examples of communication protocols with the process control level:

Protocol	Example
Analog	Mostly 4-20 mA to represent a measuring value or set a desired position. Since analogue interfaces are not really in scope of the security context, all following protocols are digital.
Proprietary (low speed)	Usually low speed (RS-485 Uart based communication) to transfer cyclic data - process data measurement values and acyclic data e.g. calibration, diagnosis, etc. The upper laying device to which the sensor/actuator is connected to is always well known. Due to that fact, encryption is not in focus here. It is about authentication to protect Intellectual property.
Generic (low-speed) (e.g. IO-Link, Modbus RTU, etc.)	Aim of these protocols is to define a best cost interface for simple field devices and connect them to different devices on the Process Control Level. In case there are security requirements given (by the standard), the device needs to implement them to ensure compliance to the standard.
Generic (high-speed) (PROFINET, Ethernet/IP, Modbus TCP)	The communication of cyclic and acyclic data is the same as for generic low speed protocols. Since the transport layer is based on standard Ethernet (IEEE 802.x) there is the possibility to enable parallel communication, e.g. by implementing a embedded webserver directly on the device. This is common in industry environments to ease up commissioning and diagnosis. Nevertheless, whenever a parallel communication is enabled, special care needs to be taken to ensure no security leak in the overall product security environment.
Generic (wireless) (Bluetooth, WiFi)	Some devices provide an additional parallel wireless interface. Today this is exclusively used for commissioning and diagnosis. Same fact as for parallel communication on the generic high-speed interface is true: special care needs to be taken to ensure no security leak in the overall product security environment.

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