GF Piping Systems

Instruction manual

2260 Ultrasonic Level Transmitter

Content

1. Safety and responsibility

1.1 Intended use

The 2260 Ultrasonic Level Transmitters are an excellent tool for the level measurement of liquids. Level measurement technology based on the non-contacting ultrasonic principle is especially suited for applications where, for any reason, no physical contact can be established to the surface of the material to be measured. Such reasons may include corrosive attack by the process medium against the measuring device material (acids), possible contamination (sewage) or particles of the process medium adhering to the measuring device (adhesive materials).

1.2 Safety regulations for the Ex approved units

The 2260 Ultrasonic Level Transmitter must be operated in intrinsically safe circuit only, see values in chapter "Technical Data". For temperatures see values in "Techical Data". Transducer head are made of plastic tending to charge up electrostatically, thus:

- ▶ The velocity of the filling and discharging process must be chosen according to the medium.
- ▶ During filling the material causing the hazard must be hindered from forming a mist
- ▶ It is not permitted to clean the plastic cover in explosion hazardous area
- ▶ The apparatus is not suitable for flame-proof enclosure towards the external area.

2. Transport and storage

- ▶ Transport and/or store product in unopened original packaging.
- ▶ Protect product from dust, dirt, dampness as well as thermal and UV radiation.
- ▶ Make sure that the product has not been damaged neither by mechanical nor thermal influences.
- ▶ Check product for transport damages prior to the installation.

3. Design and function

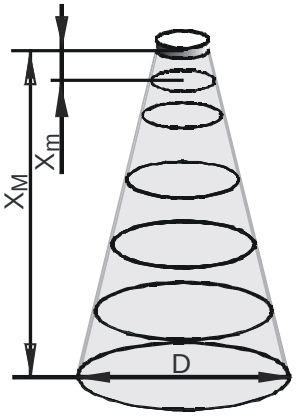
3.1 Design

3.2 Function

The ultrasonic level metering technology is based on the principle of measuring the time required for the ultrasound pulses to make a round trip from the sensor to the level to be measured and back. The sensor emits an ultrasonic pulse train and receives the echoes reflected. The intelligent electronic device processes the received signal by selecting the echo reflected by the surface and calculates from the time of flight the distance between the sensor and the surface which constitutes the basis of all output signals of the 2260 Ultrasonic Level Transmitter.

A Total beam angle of 5°-7° at –3 dB as is featured by transducers of transmitters and sensores ensuring a reliable measurement in narrow silos with uneven side walls as well as in process tanks with various protruding objects.

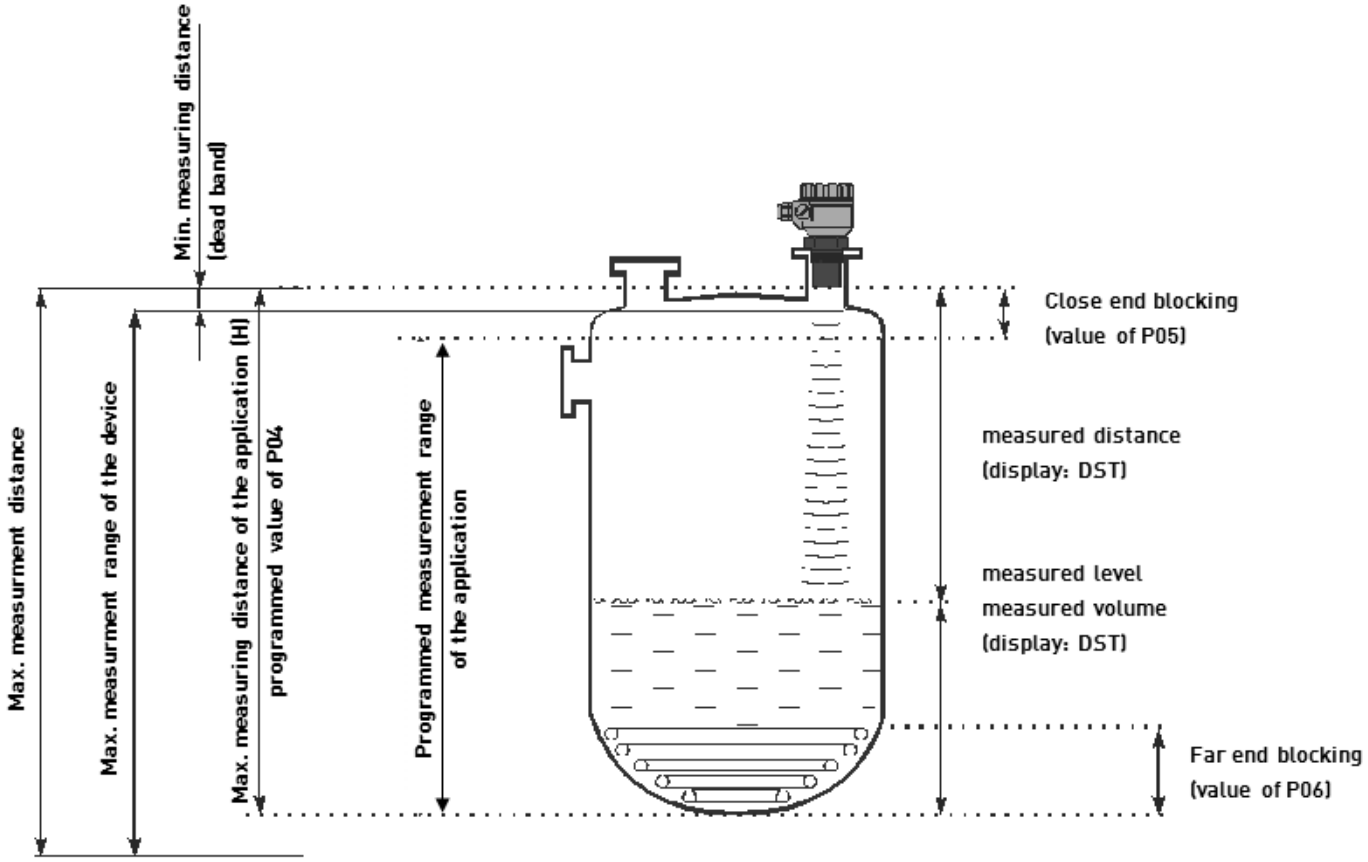
Furthermore, as a result of the narrow beam angle - the emitted ultrasonic signals have an outstanding focusing - deep penetration through gases, vapour and foam is ensured.



X	D
1 m	0,21 m
2 m	0,3 m
5 m	0,56 m
10 m	1 m
15m	1,45 m

Diameters corresponding to 5° beam angle.

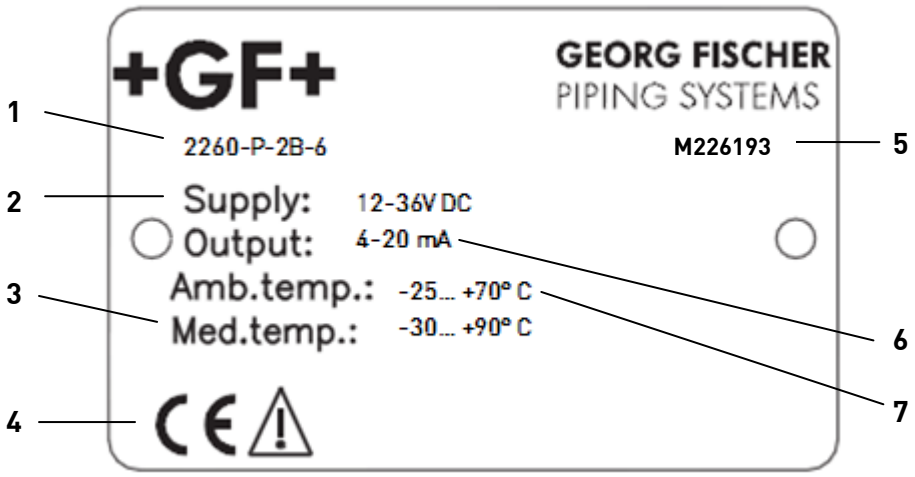
3.3 Basic concepts and elements of the ultrasonic measurement



Minimum measuring distance (X_m) (Dead Band) is determined by the design of the unit within which the measurement is not possible (Dead Zone). This distance can be extended by programming in order to avoid disturbing effects of possible disturbing echoes coming from fixed objects. (Close-end Blocking)..

Maximum measuring distance (X_M) is the greatest distance (determined by the design of the unit) which can be measured by the unit under ideal conditions. The maximum measuring distance of the actual application (H) must not be greater than X_M.

3.4 Identification



1	Type	**5**	Serial code
2	Media temperature	**6**	Output
3	Voltage	**7**	Ambient temperature
4	CE-marking		

4. Technical Data

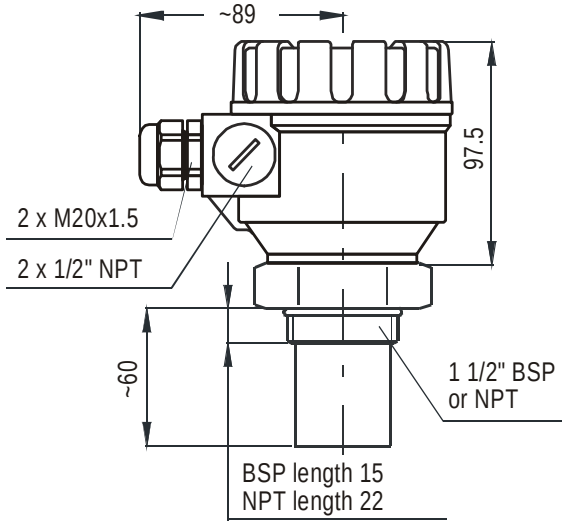
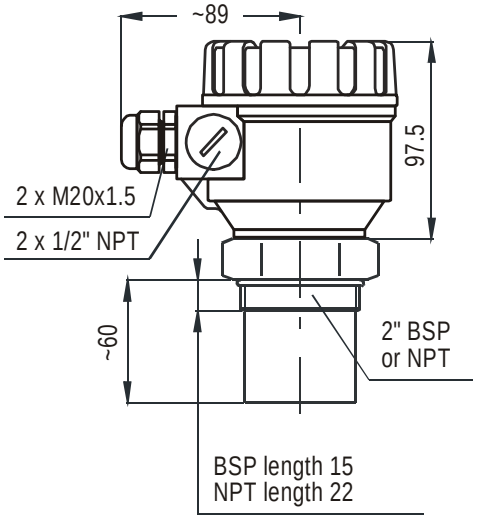
General			
Type	2260-X-XXX-4	2260-X-XXX-6	2260-X-XXX-15
Range	0.2 to 4 m / 0.65 to 13 ft *	0.25 to 6 m / 0.82 to 20 ft *	0.45 to 15 m / 1.5 to 49 ft *
Total Beam Angle	6°	5°	5°
Accuracy *	± (0.2 % of measured distance, 0.05 % of range)		
Measuring freq.	80 kHz	80 kHz	40 kHz
Enviromental			
Process temperature	-30° bis +90°		
Process pressure (absolute)	0.03 to 0.3 MPa (0.3 to 3 bar)		
Process connection	1 ½ in. BSP / NPT	2 in. BSP / NPT	DN125 flange
Enclosure			
Enclosure Material			
- Sensor Body	PP or PVDF		
- Housing	PBT		
Resolution	‹2m: 1 mm2 to 5 m: 2 mm 5 to 10 m: 5 mm ›10m: 10 mm		
Ingress protection			
- Sensor Body	IP 68, NEMA 6P		
- Housing	IP 68, NEMA 6P		
Electrical			
Outputs	2- wire 4–20 mA, HART protocol, max. 600 ohm		
Relay	(SPDT) 250V AC, 3A AC1		
Power Supply	1 to 36 VDC / 44 to 800 mW		
Power Consumption	DC 3.6 W, AC 4 VA		
Connection	2 x M20 x 1,5 plastic cable gland: Cable: Ø6 to 12 mm		
	Ex-version: 2 x M20x1,5 metal cable gland: Cable: Ø7 ... 13 mm		
Standards and Approvals			
ATEX Approval	ATEX II 1 G EEx ia II B T6 (available for 2-wire SP series only)		
Display Module			
Field indication	6 digits Custom LCD, icons and bargraph		
Ambient temperature	-25°C ... +70°C		
Housing material	PBT, low inflammability (DuPont®)		

** Under optimal circumstances of reflection and stabilised transducer temperature*

Additional data for EX certified devices

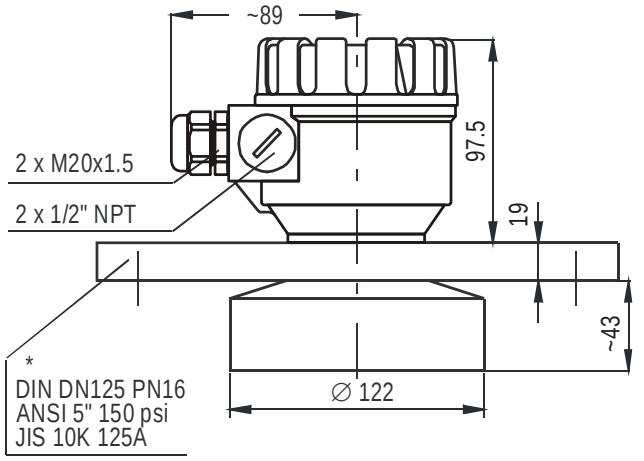
Ex marking	Ⓔx II1G EEx ia IIB T6 IP68
Intrinsically safety data	$C_i \leq$ 15 nF, $L_i \leq$ 200 μH, $U_i \leq$ 30 V, $I_i \leq$ 140 mA, $P_i \leq$ 1 W **Ex-device should be powered by EEx ia power supply.**
Ex power supply, loading	$U_0 <$ 30 V, $I_0 <$ 140 mA, $P_0 <$ 1 W, Voltage range 12...30 V, $R_{t\,max} = (U_s - 12\ V) / 0{,}02\ A$
Medium temperature	For PP transducer –20 °C ... +70 °C, for PVDF transducer –20 °C ... +80 °C, for PTFE transducer –30 °C ... +90 °C
Ambient temperature	-20 °C ... +70 °C

4.1 Dimensions

Version 1 ½" BSP/ NPT	Version 2" BSP/ NPT
	

Version Flange connection

Type	Process xxx	Range



** Min. Flange size*

4.2 Scope of delivery

- 2 x M20x1.5 cable gland
- Installation and Programming Manual
- Display Module

4.3 Maintenance and repair

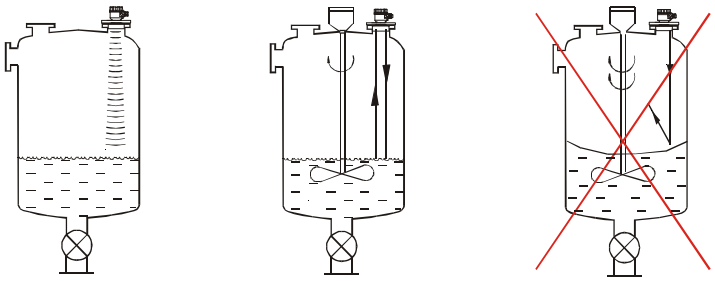
The 2260 Ultrasonic Level Transmitters do not require maintenance on a regular basis. In some very rare instances, however, the transducer may need a cleaning from deposited material. This must be carried out gently, without scratching or pressing the surface of the transducer.
Repairs during or after the warranty period are carried out exclusively at the Manufacturers. The equipment sent back for repairs should be cleaned or neutralised (disinfected) by the User.

5. Installation

5.1 Liquid Level Measurement

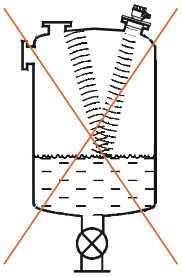
Position

The optimal position of the 2260 Ultrasonic Level Transmitter is on the radius r = (0.3 ... 0.5) R of the (cylindrical) tank / silo. (Take also sonic cone on page 1 into consideration.)



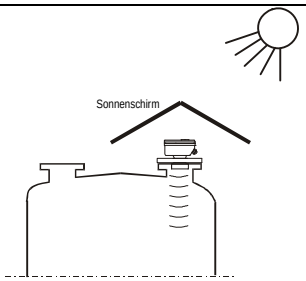
Sensor alignment

The sensor face has to be parallel to the surface of the liquid within ± 2-3°.



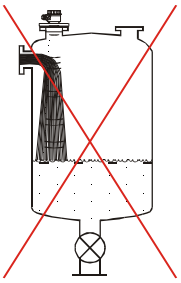
Temperature

Make sure that the 2260 Ultrasonic Level Transmitter will be protected against overheating by direct sunshine.



Obstacles

Make sure that no in-flow path or objects (e.g. cooling pipes, ladders, bracing members, thermometers, etc.) or no tank wall of the ragged surface protrude into the sensing cone of the ultrasonic beam.
One fix object in the tank / silo that disturb the measurement can be blocked out by the appropriate programming of the 2260 Ultrasonic Level Transmitters – see Parameter P29 "Blocking out of disturbing object"

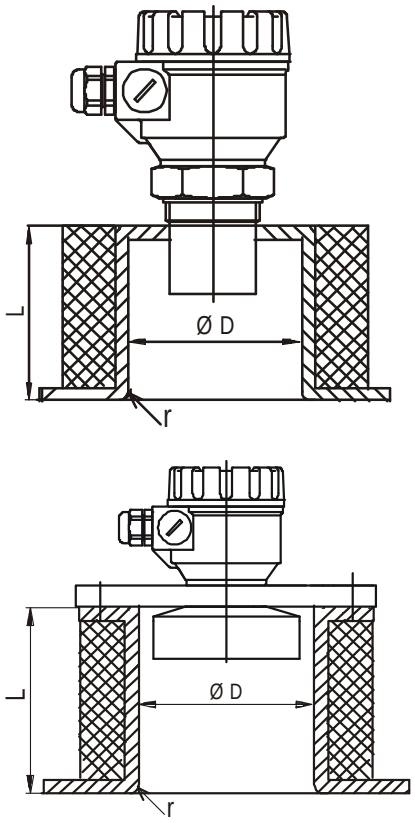


Foam

Foaming of the liquid surface may render ultrasonic level metering impossible. If possible, a location should be found, where foaming is the least (device should be located as far as possible from liquid inflow) or a stilling pipe or well should be used.

Stand-off-Pipe

The structure of the stand off pipe should be rigid; the inner rim where the ultrasonic beam leaves the pipe should be rounded.



L	D_{min}	
	BSP/ NPT 1 ½"	**BSP/ NPT 2"**
150	50	60
200	50	60
250	65	65
300	80	75
350	95	85

L	D_{min}
	Flange connection
90	130 mm
200	140 mm
350	150 mm
500	160 mm

Note: The mentioned values are indications. Depending on the assembling conditions larger diameters are to be considered.

Wind

Intensive air (gas) movements in the vicinity of the ultrasonic cone is to be avoided. A strong draft of wind may "blow away" the ultrasound. Devices with lower measuring frequency (40, 20 kHz) are recommended.

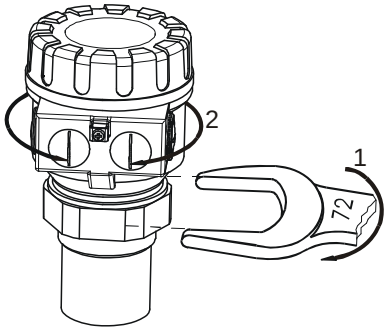
Fumes/ Vapours

For closed tanks containing chemicals or other liquids, which creats fume/gases above the liquid surface especially for outdoor tanks exposed to the sun, a strong reduction of the nominal measuring range of the ultrasonic device is to be considered during device selection.
Devices with lower measuring frequency (40, 20 kHz) are recommended in these cases units.

5.2 Installation and electrical connection

5.2.1 Installation of the (BSP or NPT) threaded models

▶ Screw the unit in to its place. Use open wrench for tightening; max torque is 20Nm



▶ After tightening the enclosure can be rotated to the proper position. (Safety bolt prevents rotation more than 350°)

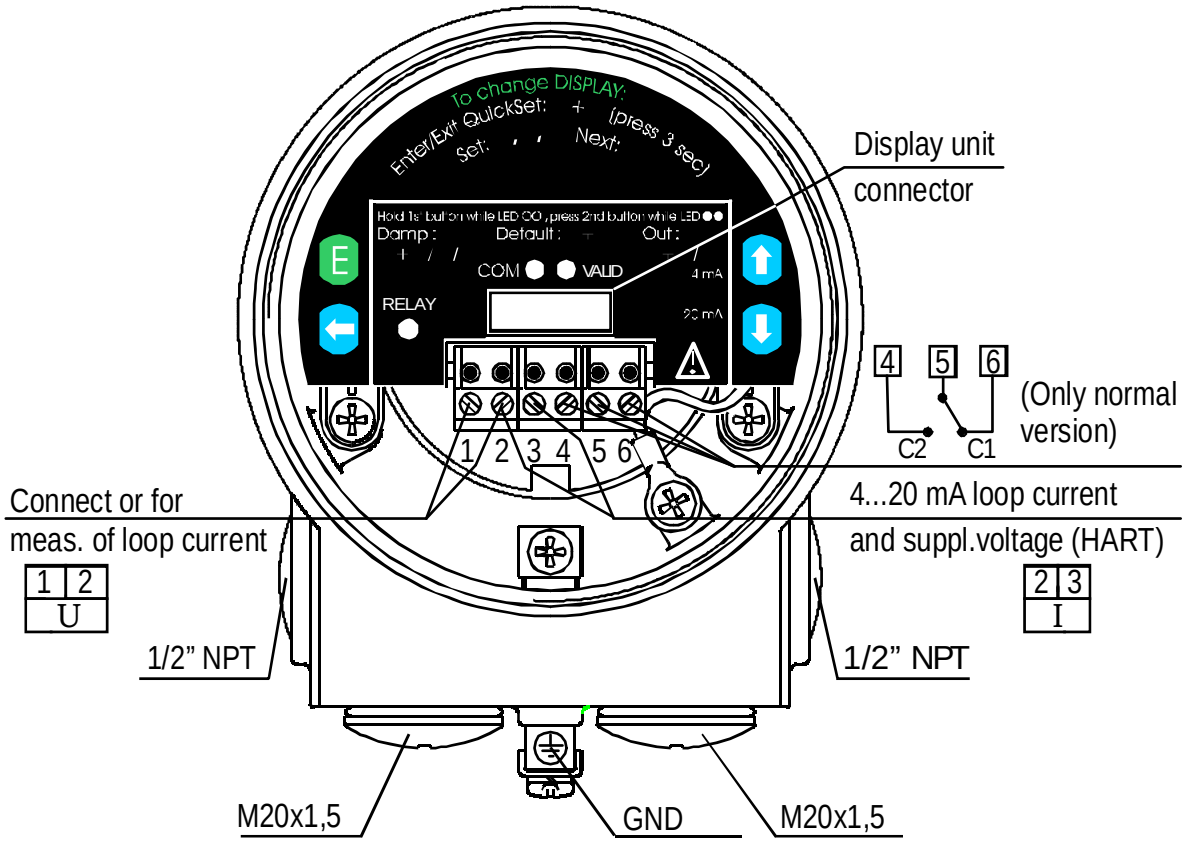
▶ The unit may be damaged by electrostatic discharge (EDS) via its terminal, thus apply the precautions commonly used to avoid electrostatic discharge e.g. by touching a properly grounded point before removing the cover of the enclosure.

▶ Ensure that the power supply is turned off at the source.

▶ With removal of the cover of the housing and taking out the display module (if any), the screw terminals can be accessed. Suggested cable core cross section:
0.5 ... 1.5 mm^2. Arrange grounding by the inner or outer grounding screw first.

▶ Switch on the unit and make necessary programming.

▶ After programming ensure proper sealing and closing of the cover.



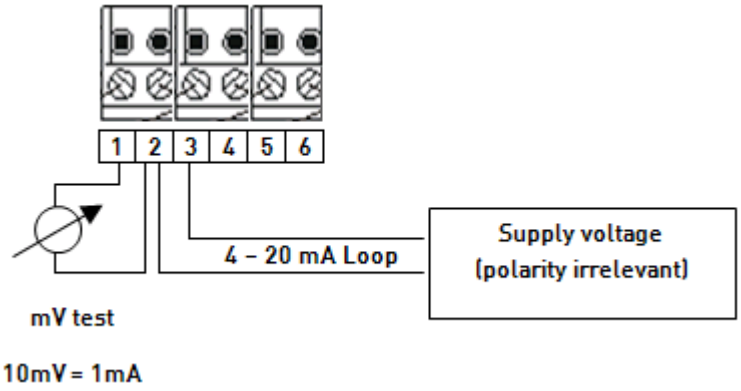
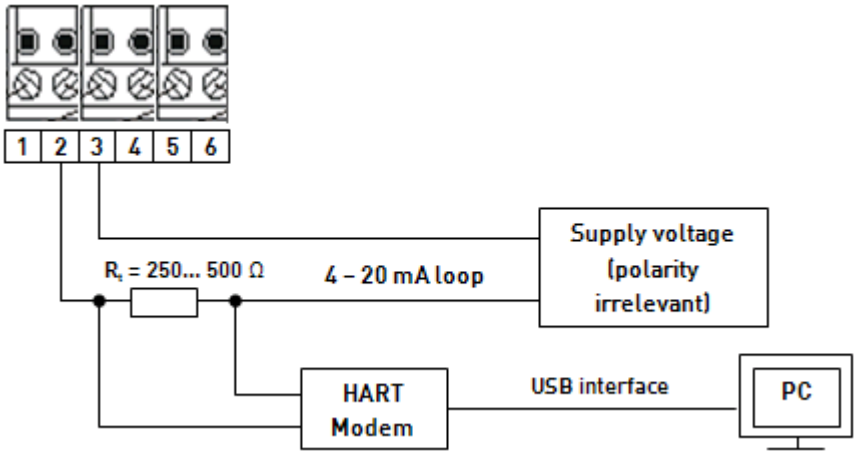
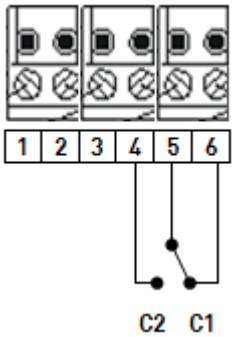
5.2.2 Details electrical connection

WARNING

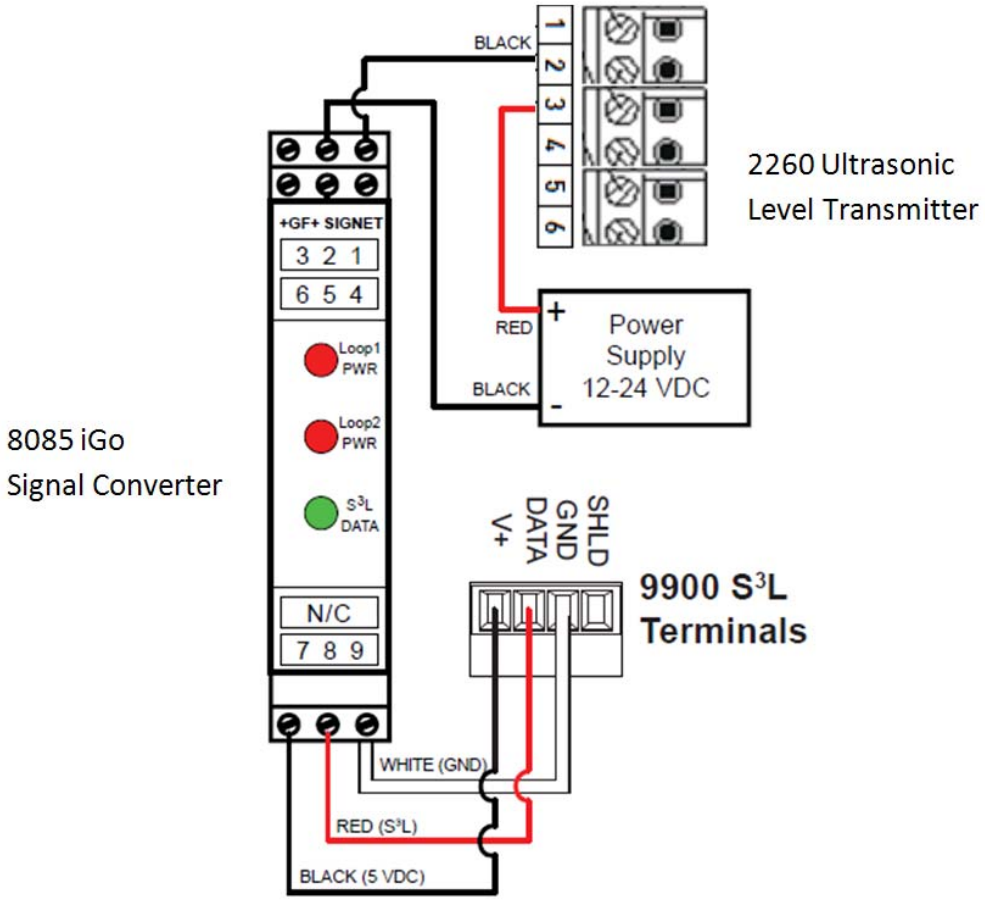
Risk of personal injury and damage of the product!

Damage due to supplying the terminals 1 and 2.

▶ Make sure that terminals 2 and 3 are supplied.

Connection 4 -20 mA + test output	
Connection 4 – 20mA + HART	 For questions on HART Modem: Contact representative of GF Piping Systems.
Connection internal relais	

Connection 9900 Universal Transmitter



5.3 Loop current checking

After removing the cover and the Display Module the actual loop current can be measured with an accuracy of 0.5% by connecting an voltmeter (in the range of 200 mV) to the terminals indicated on the drawing above.

6. Programming in general

The 2260 Ultrasonic Level Transmitters can be programmed by the following two ways:

1. **Programming without Display Module, see 6.1**
   Assignment of the levels to the 4 and 20 mA current output, error indication by the analogue signal and damping can be set.
2. **With Display Module, see 6.2**
   All features of the unit can be set, such as measurement configuration and optimisation, 32-point linearisation, dimensions for 11 tanks with different shape and for 21 different open channels (flume, weir, etc).

The devices are already equipped with the display module. The 2260 Ultrasonic Level Transmitter is fully operational without the display module. It is only needed for programming and/or displaying measurement values.

The unit will measure during programming in accordance with the previous parameters. The new, modified parameters will only be effective after returning to the Measurement Mode

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If the 2260 Ultrasonic Level Transmitter is left in Programming Mode by mistake, it will automatically return to Measurement Mode after 30 minutes and will operate with the parameters entered during the last completed programming. The 2260 Ultrasonic Level Transmitter will be delivered with the following Factory Default:

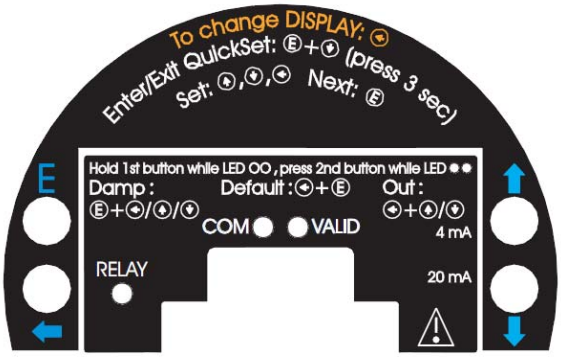
- Current output, display and bargraph: LEVEL
- 4 mA: assigned to the minimum level 0%
- 20 mA: assigned to the maximum level 100%
- Error indication by the current output: hold last value
- Damping: 60 sec

6.1 Programming without display module

Programming is only possible if the 2260 Ultrasonic Level Transmitter is in Level Measuring Mode and receives valid echo i.e. "VALID" LED is lit. The following can be programmed without display module:

- Assignment of the 4 mA to a required e.g. min. level / max. distance
- Assignment of the 20 mA to a required e.g. max. level / min. distance
- Error indication by the current output (Hold, 3.6 mA or 22 mA)
- Damping (10, 30 or 60 sec)
- Reset to the factory default

Note: Current output can also be assigned in inverted mode: 4 mA = 100% (Full), 20 mA = 0% (Empty)

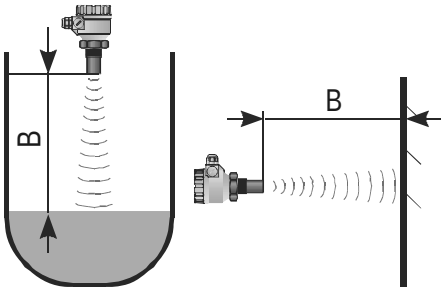


6.1.1 Procedure of programming

Press button in the relevant sequence and check the state of the LED-s. Symbols for the states of the LED-s:
○ = LED is off, ◐ = LED is blinking, ● = LED is on, ◐ ◑ = LEDs are blinking alternatively
⊗ = Dont care

6.1.2 Teach-in: Minimum level, (empty tank) assignment to 4 mA

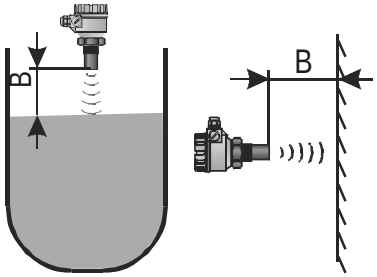
Action		LED state following the action
1)	Check for a valid ECHO	⊗● = Valid ECHO, transmitter programmable
2)	Press NEXT (E) button steadily	○○ = 2260 Ultrasonic Level Transmitter in programming mode
3)	Press up (▲) button steadily	●● = 4 mA assigned to the distance (see picture)
4)	Release buttons	○○ = Programming completed



Use level in tank or a fix target e.g. the wall

6.1.3 Teach-in: Maximum level (full tank) assignment to 20 mA

Action		LED state following the action
1)	Check for a valid ECHO	⊗○ = Valid ECHO, transmitter programmable
2)	Press NEXT (E) button steadily	○○ = 2260 Ultrasonic Level Transmitters in programming mode
3)	Press DOWN (▼) button steadily	●● = 20 mA as signed to the distance (see picture)
4)	Release buttons	○○ = Programming completed



Use level in tank or a fix target e.g. the wall

6.1.4 "Error state" indication by the analogue signal

(Check for a valid echo as above)
As a result of this setting the value of the analogue output will be 3.8 mA; 22 mA or according last value (hold) until the error is ceased.

Action		LED state following the action
1)	Press (▲) button steadily	○○ = 2260 Ultrasonic Level Transmitters in programming mode
2)	Press any of the DOWN (▼), ENTER (E), NEXT (E) buttons steadily	– hold last value ●● = – 3.6 mA – 22 mA
3)	Release buttons	○○ = Programming completed

6.1.5 Damping time setting

(Check for a valid echo as above)

Action	LED state following the action
1) Press ENTER Ⓔ button steadily	○○ = 2260 Ultrasonic Level Transmitter in programming mode
2) Press any of the NEXT ⓔ, UP ⓐ, DOWN ⓓ buttons steadily	– 10 sec ●● = – 30 sec – 60 sec
3) Release buttons	○○ = Programming completed

6.1.6 RESET: Returning to the default

(Check for a valid echo as above)

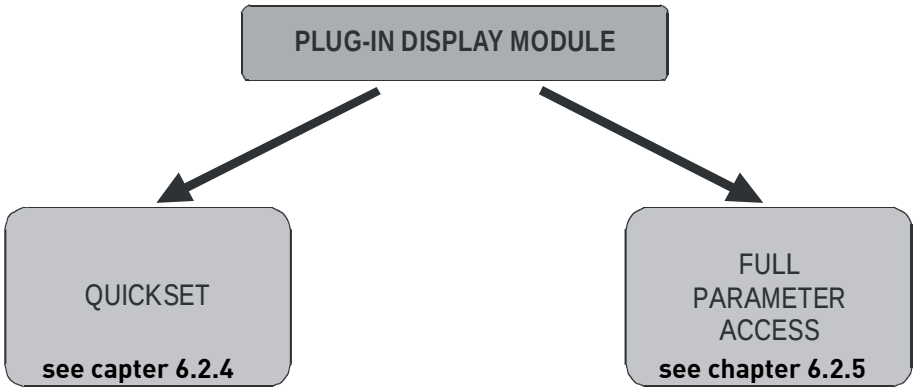
Action	LED state following the action
1) Press NEXT ⓔ button steadily	○○ = 2260 Ultrasonic Level Transmitter in programming mode
2) Press ENTER Ⓔ button steadily	●● = Default loaded

6.1.7 Indication of mistakes (by LEDs) made during programming

Action	Led state following the action	Possible correction
Attempted programming	◐◐ = blinking twice = no Echo	Find a valid Echo
Attempted programming	◐◐ = blinking three times = no access possible	With DISPLAY MODULE only See 5.2 (P99)
Attempted programming	◐◐ = blinking four times = 2260 Ultrasonic Level Transmitter not in Level Measurement Mode	With DISPLAY MODULE only See 5.2 (P01)

6.2 Programming with the Display Module

The 2260 Ultrasonic Level Transmitter should be adjusted to the process by programming the parameters. The Display Module can be used to display the parameters during programming and measurement values during measurement. The DISPLAY MODULE supports two separately accessible programming modes representing 2-layers of programming complexity, depending on user choice.



QUICKSET

Recommended as a simple and fast way to set up the 2260 Ultrasonic Level Transmitter, see „Quick Set Manual" at the beginning of this document. Qucikset by 6 basic parameters for the following basic settings, marked by abbreviations easy to remember:

- Engineering unit for the display (Metric or US)
- Maximum measuring distance (H)
- Assignment of min level to 4 mA
- Assignment of max level to 20 mA
- Error indication by the current output
- Damping time

Full Parameter Access

All features of the 2260 Ultrasonic Level Transmitter such as:

- Measurement configuration
- Outputs
- Measurement optimisation
- 11 pre-programmed tank shapes for volume calculation
- 21 pre-programmed formula for flow metering
- 32-point linearisation

6.2.1 Display Module

Symbols used on the LCD:

- DIST – Distance (measuring) mode
- LEV – Level (measuring) mode
- VOL – Volume (measuring) mode
- FLOW – Open channel (flow metering) mode
- PROG - Programming mode (device under programming)
- RELAY – 'C2' circuit of the relay is closed
- T1 - TOT1 volume flow totaliser (resetable aggregate)
- T2 - TOT2 volume flow totaliser (aggregate)
- FAIL - Measurement / device error
- ↑ ↓- Level changing direction
- Bargraph assigned to the current output or echo strength

Symbols used on the frame:
- M – Metric system
- US – US calculation system

LEDs lit
- COM – digital (Hart) communication
- VALID – presence of valid echo

IrDA – Infrared communication port for logger readout, diagnostics and software upgrade.

6.2.2 Steps of the Display Module

Programming will be performed by the pressing and releasing the relevant one or two keys (simultaneously).

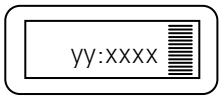
Single key pressing

ENTER (E) to select parameter address and go to parameter value
to save parameter value and return to parameter address

NEXT (◄) to move the blinking (sign of change) of the digit to the left

UP (▲) to increase value of the blinking digit

DOWN (▼) to decrease value of the blinking digit

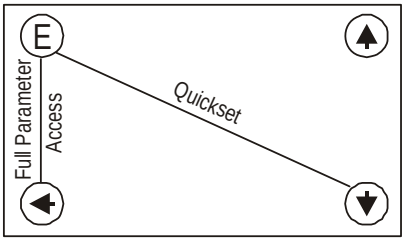


yy parameter address (P01, P02...P99)
xxxx parameter value (dcba)
bargraph

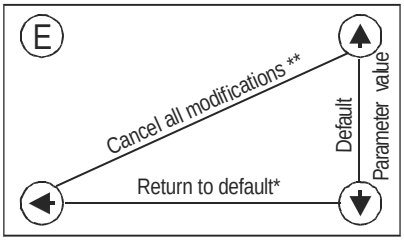
Double key pressing

Press the two keys simultaneously for desired programming step.

Enter into or quit programming modes

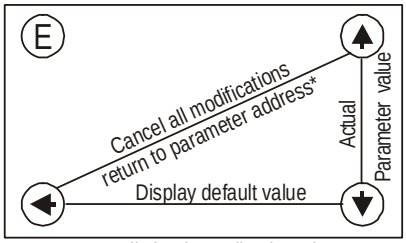


Basic steps while parameter address is blinking



* LOAD readout ** CANCEL readout

Basic steps while parameter value is blinking



* cancellation immediately active

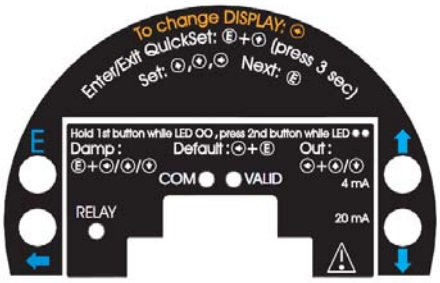
GET LEVEL function

Special function used only in level and distance measurement modes UP (▲) + DOWN (▼)

Notes. If after pressing ENTER (E) blinking does not spring over from the parameter address to the parameter value this means that
- the parameter is either a read-out type, or
- the secret code prevents the modification (see P99)

If the modification of the parameter value is not accepted i.e. the parameter value keeps blinking after pressing ENTER (E),
- the modified value is either out of the range, or
- the code entered is not a valid code

6.2.3 Indications of the DISPLAY MODULE and LED Status



LED indication

- **VALID (ECHO)-**LED lit in case of valid echo.
- **COM**-LED see description of HART
- **RELAY**-LED ON – when the 'C2' circuit of the relay is closed

DISPLAY MODULE indications

Depending on the measurement one of the below symbols will lit and the process value displayed (see P01 chapter 6.1). Engineering units will be indicated directly (°C, °F and mA) and by the lit arrow showing towards them on the frame

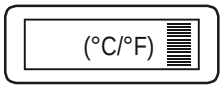
- DIST distance
- LEV level
- VOL volume
- FLOW flow
- T1/T2 totalised values
- FAIL (blinking) Error code displayed

For paging readouts NEXT ◄ key should be pressed.

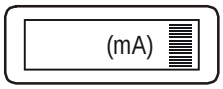
The following process values can be displayed

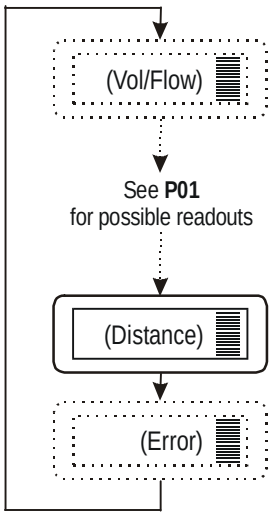
- Volume / Flow – if programmed so
- Level – if programmed so
- Distance – if programmed so
- Warning indications – FAIL blinking

Display screens can be scrolled by pressing key NEXT ◄.
To return to the screen of the selected measurement mode key ENTER E should be pressed (see P01 chapter 6.1)
Temperature can be displayed by pressing UP ▲.



Current output value can be displayed by pressing DOWN ▼.



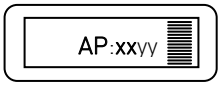
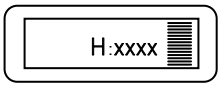
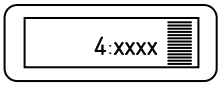


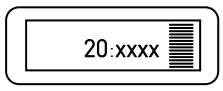
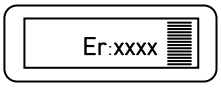
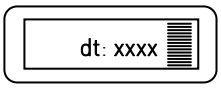
6.2.4 QUICKSET

Recommended as a simple and fast way to start up

QUICKSET programming (aided by 6 screens) is used in uncomplicated level metering applications to set the 6 basic parameters. The other parameters can only be modified in the Full Parameter Access Mode (P01).The instructions of this programming mode are also to be found on the front panel above the Display Module socket.

Keys	Function
ENTER Ⓔ + DOWN ⓓ (press for min 3 secs!)	Enter or exit QUICKSET programming mode
UP ⓤ, DOWN ⓓ, NEXT ⓛ	Increase/decrease and move left the blinking digit
UP ⓤ + DOWN ⓓ	"GET LEVEL" - display actual level measured by the 2260 Ultrasonic Level Transmitters
ENTER Ⓔ	Save readout and step to the next screen
NEXT ⓛ + UP ⓤ	Quit Current Output Scaling without saving the modifications (CANCEL))
NEXT ⓛ + DOWN ⓓ	Display of the DEFAULT value.

Screens	Actions
	AP*plication* xx= select "EU" (European) for metric or "US" for US engineering units *(Use* UP ⓤ */*DOWN ⓓ *keys)* yy= indicating "Li" for liquids DEFAULT: EU **Programming of this parameter will result in loading the factory default with the corresponding engineering units.**
	H = xxxx *maximum measuring distance* – Distance between transducer face and tank bottom • Manual: set value (Use UP ⓤ / DOWN ⓓ / NEXT ⓛ keys) and save it (by ENTER Ⓔ) • Automatic: use the "GET LEVEL" function (UP ⓤ + DOWN ⓓ) to obtain actual measured value with level in tank or a fixed target, i.e. wall. ("GET LEVEL" functions only if ECHO LED is lit) and save it as above. • DEFAULT: maximum measuring distance [m], see Technical Data Table
	4 mA xxxx – *level value* assigned to 4 mA current output • Manual: set level value (by UP ⓤ / DOWN ⓓ / NEXT ⓛ keys) and save it (by ENTER Ⓔ) • Automatic: use the "GET LEVEL" function (UP ⓤ + DOWN ⓓ) to display the actual measured value with level in tank or a fixed target, i.e. wall. ("GET LEVEL" functions only if ECHO LED is lit) and save it as above. • DEFAULT: 0 m (0%, Empty tank)

	20 mA xxxx – *level value* assigned to 20 mA current output • Manual: set level value *(Use* UP Ⓤ */*DOWN Ⓓ */*NEXT Ⓛ *keys)* and save it (by ENTER Ⓔ*)* • Automatic: use the "GET LEVEL" function *(*UP Ⓤ + DOWN Ⓓ*)* to obtain actual measured value with level in tank or a fixed target, i.e. wall. ("GET LEVEL" functions only if ECHO LED is lit) and save it as above. • DEFAULT: max. level = max. measuring distance – dead band [m] (100%, Full tank) (See Technical Data Table)
	Error indication by the current output – select "Hold", 3.8 mA or 22 mA (by UP Ⓤ / DOWN Ⓓ key) and save it as above. • DEFAULT: hold last value
	d*amping* t*ime*: select required damping time *(*by UP Ⓤ */*DOWN Ⓓ key*)* and save it as above. • DEFAULT: 60 sec for liquids, 300 sec for solids

Note: Current output can also be programmed for inverted operation: 4 mA= 100% (Full), 20 mA= 0% (Empty). Description of failures can be found under the chapter „Error codes".

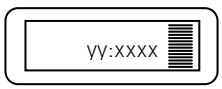
6.2.5 Full parameter access

Full Parameter Access is the highest programming level to access all features provided by the 2260 Ultrasonic Level Transmitters.
Description of all parameters can be found under the chapter "Parameter".

Keys	Function
ENTER Ⓔ + NEXT Ⓛ (press for 3 seconds)	Enter or exit Full Parameter Access programming mode.

In this programming mode, the display will indicate

yy Parameter Address (P01, P02 ... P99)
xxxx Parameter Value (dcba)
≡ bar graph



Measuring is going on during programming in accordance with the old parameter set. New parameter set will be valid after returning to the Measurement to the Programming Mode.

Steps and indications of the Full Parameter Access programming mode

pressing **Keys**	while **Parameter Address is blinking**	while **Parameter Value is blinking**
ENTER Ⓔ	Go to the Parameter Value	Save the modification of the Parameter Value and return to the Parameter Address
NEXT ◀ + UP ▲	Cancel all modifications of the actual programming phase. Pressing for 3 sec is required while CANCEL will be displayed for warning	Neglect the modification of the Parameter Value. and return to the Parameter Address without saving the modifications
NEXT ◀ + DOWN ▼	Reset entire device to Factory Default. Since this action will reset all parameters, "LOAD" will appear on the display: - to confirm, press - to escape, press any other key - Exception: clearing TOT 1 (See at parameter P77)	Display default of the Parameter Values (it can be saved by pressing ENTER Ⓔ)
NEXT ◀	Move blinking (changeability) of the digit to the left	
UP ▲ / DOWN ▼	Modify the blinking digit (increase, decrease) or scroll up/down	

7. Parameters – Description and Programming

7.1 Measurement configuration

P00: - cba Application/ Enginnering Units

Programming of this parameter will result in loading the factory default with the corresponding engineering units.

a	Operating (measurement) mode
0	Liquid level measurement

b	Engineering units (according to "c")	
	Metric	**US**
0	m	ft
1	cm	inch

c	Calculation system
0	Metric
1	US

Attention: mind the sequence!
When programming this parameter the right value "a" will be blinking first.

Factory Default: 000

P01: - ba Measurement Mode – Bargraph

Parameter value „a" will determine the basic measurement value that will be displayed and proportional with the current output. Depending on the value of "a" process values as listed in the 3d column can also be displayed by pressing NEXT ⊕. For return to the display of the basic value the ENTER Ⓔ key should be pressed.

a	Measurement Mode	Display symbol	Displayed values
0	Distance	DIST	Distance
1	Level	LEV	Level, Distance
2	Level in percentage	LEV%	Level%, Level, Distance
3	Volume	VOL	Volume, Level, Distance
4	Volume in percentage	VOL%	Volume%, Volume, Level, Distance
5	Flow	FLOW	Flow, TOT1, TOT2, Level, Distance

Attention: mind the sequence!
When programming this parameter the right value "a" will be blinking first.

Parameter value "b" will determine that the height of the Bargraph will be proportional to the current output or to the Echo strength.

b	Bargraph indication
0	Echo strength
1	Current output

Factory Default: 11

P02: - cba Calculation units

a	Temperature
0	°C
1	°F

Attention: mind the sequence!
When programming this parameter the right value "a" will be blinking first.

This table is interpreted according to P00(c), P01(a) and P02(c) and is irrelevant in case of percentage measurement (P01(a)= 2 or 4)

b	Volume		Weight (set also P32)		Volume flow	
	Metric	US	Metric	US	Metric	US
0	m3	ft3	-	lb (pound)	m3/time	ft3/time
1	liter	gallons	tons	tons	liter/time	gallons/time

c	Time
0	Sec
1	Min
2	Hour
3	Day

Factory Default: 000

P03: - - - a Values displayed - Rounding

It is important to keep in mind that the instrument is measuring distance.

Measured Distance	Resolution
X_{min} – 2m	1mm
2m – 5m	2mm
5m – 10m	5mm
10m over	10mm

The resolution depending on the distance can be considered as a kind of rounding that will be contained in all further value (of level, volume or volume flow) calculated. Therefore if programmed for DIST or LEV measurement the setting of P03 is irrelevant.

Displayed VOL or FLOW

Angezeigter Wert	Anzeigeformat
0,000 – 9,999	x,xxx
10,000 – 99,999	xx,xx
100,000 – 999,999	xxx,x
1000,000 – 9999,999	xxxx,x
10000,000 – 99999,999	xxxxx,x
100000,000 – 999999,999	xxxxxx,x
1 millió – $9{,}99999*10^9$	x,xxxx : e (exponential format)
Über $1*10^{10}$	(overflow) Err4

Obviously the decimal position will be shifted with increasing value displayed. (See table at the left). Values over one million will be displayed in exponential format whereas the value (e) represents the exponent. Over the value of 1x1010 Err4 (overflow) will be displayed.

Rounding

Parameter Value "a"	Steps In The Displayed Value
0	1 (no rounding)
1	2
2	5
3	10
4	20
5	50

A couple of millimetres of fluctuation of the basic DIST value (e.g. due to waves) will be enlarged by the mathematical operations. This enlarged fluctuation in displaying VOL or FLOW can (if disturbing) be avoided by rounding to be set in P03. Rounding value 2, 5, 10 etc represents the steps by which the calculated value will be changed in its (one or two) last digit(s).
Examples:
P03=1 steps by 2: 1,000; 1,002; 1,004
P03=5 steps by 50: 1,000; 1,050; 1,100 or 10,00; 10,05(0); 10,10(0); 10,15(0)
(the 0 from the steps 50, 100, 150 etc will not be displayed)

Factory Default: 0

P04 Maximum Distance to be Measured (H)

The maximum distance to be measured is the greatest distance between the surface of the transducer and the level to be measured.
This is the only parameter that has to be programmed for each application other than distance (however to avoid disturbing effect of possible multiple echos it is suggested to do this in distance measurement applications too).
Values of the maximum measuring distance will be displayed as below:

Engineering Unit	Display Format
m	x,xxx or xx,xx
cm	xxx,x
ft	xx,xx or xxx,x
inch	xxx,x

The factory programmed, greatest distances (DEFAULT values) which can be measured by the units are listed in the table below. For the actual application the maximum distance to be measured i.e. the distance between the sensor and the bottom of the tank should be entered in P04.
To obtain the best accuracy, measure this distance in the empty tank with the 2260 Ultrasonic Level Transmitters by using the "GET LEVEL" function (by double key pressing of UP ⊛ + DOWN ⊛) provided the bottom is flat. Enter the actual measured value displayed as P04.

2260 Ultrasonic Level Transmitters	Maximum measuring distance [m/ft]
	Transducer material PP / PVDF
Version I	4/13
Version II	6/20
Version III	15/49

Factory Default: according to the table

P05: Minimum measuring distance (Dead zone- Close-end blocking)

The 2260 Ultrasonic Level Transmitters will not accept any echo within the blocking distance set here.

Automatic Close-end-blocking (Automatic Dead Band control)

By using the factory default value, the unit will automatically set the smallest possible close-end-blocking distance i.e. the dead band.

Manual close-end-blocking

Manual close-end-blocking should be used for example to block out the echo originating from the bottom rim of a stand-off pipe or from any object protruding into the ultrasonic cone near to the transmitter.
By entering a value, higher than the factory default, the minimum measuring range will be extended and fixed to the specified value.

To return to the factoryprogrammed (DEFAULT value) of the minimum measuring distance press NEXT ⊙ + DOWN ⊙

2260 Ultrasonic Level Transmitters	**Minimum measuring distance X_M [m/ft]**
	Sensor material PP / PVDF
Version I	0,2 / 0,65
Version II	0,25 / 0,82
Version III	0,45 / 1,5

Factory Default: automatic dead band control

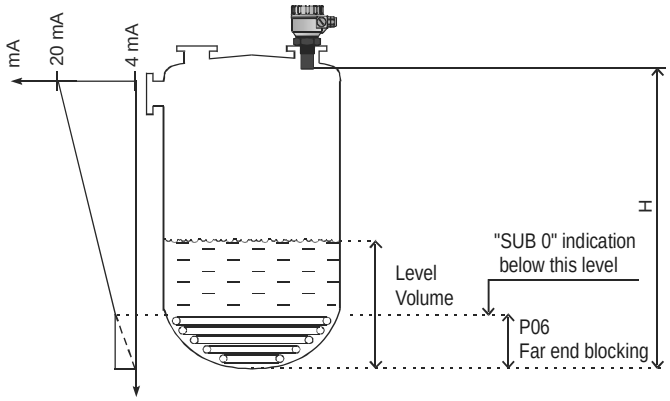
P06: Far end blocking

Far end blocking is used to neglect incorrect level/volume readings and output actions below a pre-set level programmed in P06.

A). Level measurement

The far-end blocking can be used to avoid disturbing effect of stirrer or heaters at the bottom of the tanks.

.



If the level of the medium sinks below the blocked out range:

- **"Sub 0"** will be indicated for the level and volume
- Distance value is not interpretable
- Current output will hold the value corresponding to the far end blocking level

If the medium level is above the blocked out range:

The calculation of level and volume will be based on the programmed tank dimensions, therefore the measured or calculated process values will not be influenced in any way, by the far end blocking value.

B). Open channel flow metering

Far end blocking will be used for those small levels below which the accurate volume flow calculation is no longer possible.

If the liquid level in the flume/weir falls below the blocked out range:
The 2260 Ultrasonic Level Transmitters will act as follows:
- Indicate "No Flow" on the Display
- Hold last valid data on the current output.

If the level in the flume/weir is above the blocked out range:
The calculation of volume flow will be based on the programmed flume/weir data; therefore the measurement values will not be influenced in any way, by the far end blocking value.

Factory Default: 0

7.2 Current output

P10: Value (of distance, level, volume or flow) assigned to 4 mA current output

P11: Value (of distance, level, volume or flow) assigned to 20 mA current output

Values are interpreted according to **P01(a).** Please note that in case of programming for (LEV or VOL) % measurement the min and max value has to be entered in the relevant engineering units of LEV (m, ft) or VOL (m3, ft3).

Assignment can be made so that the proportion between the change of the (measured or calculated) process value and the change of the current output be either direct or inverse. E.g. lev 1 m assigned to 4mA and lev 10 m assigned to 20 mA represents direct proportion and lev 1 m assigned to 20 mA and lev 10 m assigned to 4 mA represents the inverse proportion.

Factory Default:
P10 0 level (max distance)
P11 max level (min distance) H

P12: - - - a Error indication by the current output

In case of error the 2260 Ultrasonic Level Transmitter will provide one of the current outputs below. (For errors and their interpretation see Chapter 8).

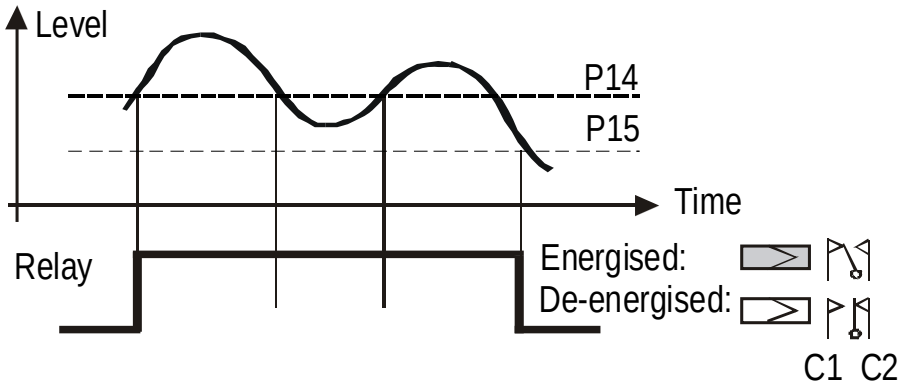
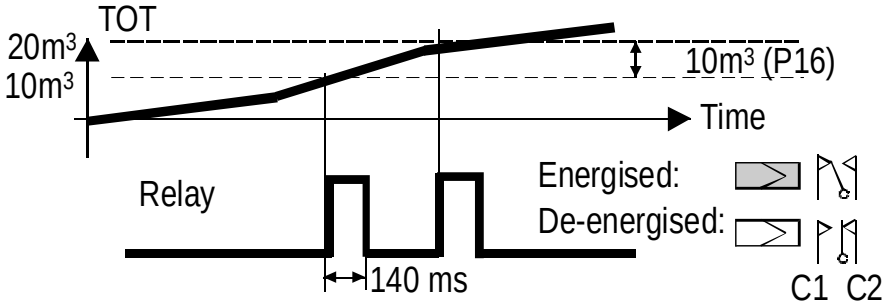
.

a	error indication (according to NAMUR)
0	Hold last value
1	3.8 mA
2	22 mA

Factory Default: 0

7.3 Relay Output

P13: - - - a Relay function

a	Relay function	Also set
0	DIFFERENTIAL LEVEL CONTROL (Hysteresis control) Relay is energised if the measured or calculated value exceeds the value set in P14 Relay is de-energised if the measured or calculated value descends under the value set in P15.  	P14, P15 There is a need to set (in level min 20mm) hysteresis between P14 and P15 **P14 › P15** – normal operation **P14 ‹ P15** – inverted operation
1	Relay is energised in case of Echo Loss	-
2	Relay is de-energised in case of Echo Loss	-
3	COUNTER Used for open channel flow metering. A 140 msec pulse is generated every 1, 10, 100, 1.000 or 10.000 m^3 according to P16.  	P16= 0: 1m^3 P16= 1: 10 m^3 P16= 2: 100 m^3 P16= 3: 1.000 m^3 P16= 4: 10.000 m^3

In de-energised state of the device the „C1" circuit is closed. The „Relay" LED is on when the „C2" circuit is closed.
Factory Default: 2

P14: - - - - Relay parameter – Operating value

Factory Default: 0

P15: - - - - Relay parameter – Releasing value

Factory Default: 0

P16: - - - - Relay parameter – Pulse rate P13(3)

Factory Default: 0

7.4 Digital Output

P19: - - - a HART polling address (only HART versions)

The polling address can be set between 0 and 15. For a single instrument the polling address is 0 and the output is 4...20mA (analogue output). If multiple units are used in HART Multidrop mode (max. 15pcs) the polling addresses should differ from 0 (1-15), in this case the output current will be fixed at 4mA.

7.5 Measurement optimisation

P20: - - - a Damping

This parameter can be used to reduce unwanted fluctuation of the display and output

a	Damping time (seconds)	LIQUIDS	
		None/moderate fume or waves	Heavy/dense fume or turbulent waves
0	no filter		
1	3	applicable	not recommended
2	6	recommended	applicable
3	10	recommended	recommended
4	30	recommended	recommended
5	60	recommended	recommended

Factory Default: 60 sec

P22: - - - a Dome top tank compensation

This parameter can be used to reduce disturbing effect of possible multiple echos..

a	Compensation	Applied
0	OFF	In case the 2260 Ultrasonic Level Transmitters is not mounted in the centre of the top and the top is flat.
1	ON	In case the 2260 Ultrasonic Level Transmitters is mounted in the centre of a tank with dome-shaped top

Factory Default: 0

P24: - - - a Target tracking speed

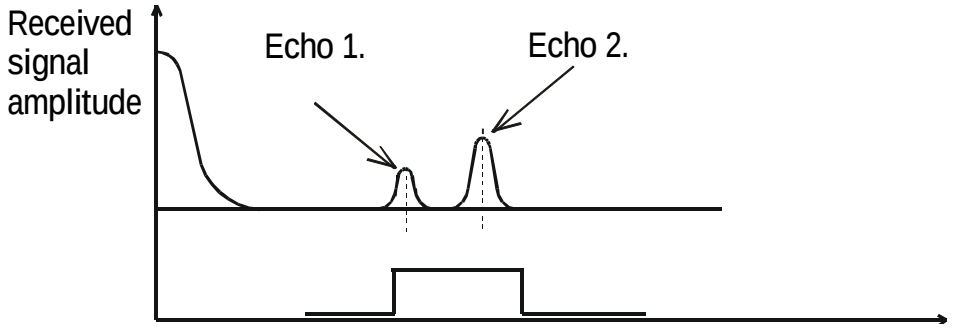
n this parameter evaluation can be speed up at the expense of the accuracy.

a	Tracking speed	Remark
0	Standard	For most applications
1	Fast	For fast changing level
2	Special	Only for special applications (measuring range is reduced to 50% of the nominal value) The measuring window is inactive and the 2260 Ultrasonic Level Transmitters will respond practically instantly to any target. Recommended to fast target tracking, but usually not applicable for level metering.

Factory Default: 0

P25: - - - a Selection of Echo within the measuring window

A so-called measuring window is formed around the echo signal. The position of this measuring window determines the flight time for calculation of the distance to the target. (the picture below can be seen on the test oscilloscope)



Some applications involve multiple (target + disturbing) echoes even within the measuring window. Basic echo selection will be done by the Quest + software automatically. This parameter only influences the echo selection within the measuring window.

a	Echo in the window to be selected	Remark
0	With the highest amplitude	For most applications (both with liquids and solids)
1	First one	For liquids applications with multiple echoes within the Measuring Window

Factory Default: 0

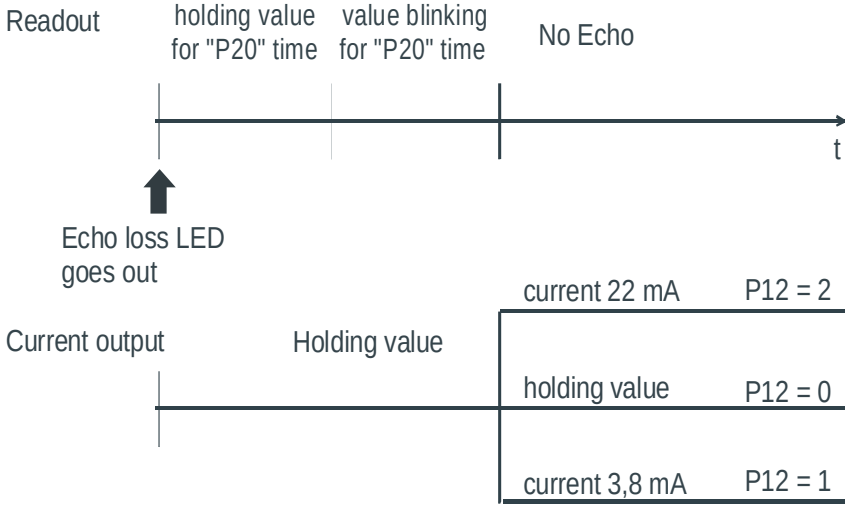
P26: Level elevation rate (filling speed) (m/h)

P27: Level descent rate (emptying speed) (m/h)

These parameters provide additional protection against echo loss in applications involving very heavy fuming.The parameters must not be smaller than the fastest possible filling/emptying rate of the actual technology. For all other applications, use the factory default setting..

Factory Default: 2000 for both P26 and P27

P28: - - - a Echo loss indication

a	Echo loss indication	Remark
0	Delayed indication	During echo-loss, display and analogue output will hold last value. If the echo-loss prevails for 10 sec plus the time period set in P20 (damping time), the reading on the display will change to "no Echo" and the outputs will change according to the "Error Indication Mode" pre-set in P12 
1	No indication	For the time of echo-loss, display and analogue output will hold last value.
2	Advance to full	During echo-loss in case of filling, the reading on the display and analogue output will shift towards the "full" tank state with a level elevation rate (filling speed) pre-set in P26
3	Immediate indication	In case of echo-loss, the display will immediately change to "no Echo", and the outputs will change according to the "Error Indication Mode" pre-set in P12
4	Empty tank indication	Echo-loss may occur in completely empty tanks with a spherical bottom due to deflection of the ultrasonic beam, or in case of silos with an open outlet. If the echo is lost when the tank is completely empty, the indication will correspond to empty tank, in all other cases echo-loss indication will function according to the "Delayed".

Factory Default: 0

P29: Blocking out of disturbing object

One fixed object in the tank, disturbing the measurement, can be blocked out.
Enter distance of the object from the transducer. Use the Echo Map (P70) to read out the precise distance of disturbing objects.

Factory Default: 0

P31: Sound velocity at 20°C (m/sec or ft/sec depending on P00(c))

Use this parameter if the sound velocity in the gases above the measured surface differs largely from that of in air.
Recommended for applications where the gas is more or less homogeneous. If it is not, the accuracy of the measurement can be improved using 32-point linearisation (P48, P49).
For sound velocities in various gases see section "Sound Velocities".

Factory Default: Metric (P00: "EU"): 343.8 m/s, US (P00: "US"): 1128 ft/s

P32: Specific gravity

If you enter a value (other than "0") of specific gravity in this parameter, the weight will be displayed instead of VOL.

Factory Default: 0 [kg/dm^3] or [lb/ft^3] depending on P00 (c)

7.6 Volume Measurement

P40: - - ba Tank shape

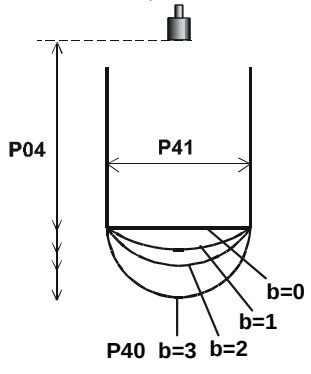
ba	Tank shape	Also to be set
b0	Standing cylindrical tank shape (value of "b" as below)	P40 (b), P41
01	Standing cylindrical tank with conical bottom	P41, P43, P44
02	Standing rectangular tank (with chute)	P41, P42, (P43, P44, P45)
b3	Lying cylindrical tank shape (value of "b" as bellow)	P40 (b), P41, P42
04	Spherical tank	P41

Attention!
The value „a" determining the shape of the tank should be set first..

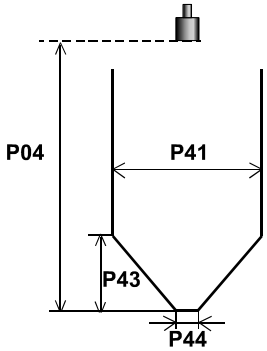
Factory Default: 00

P41-45: Tank dimensions

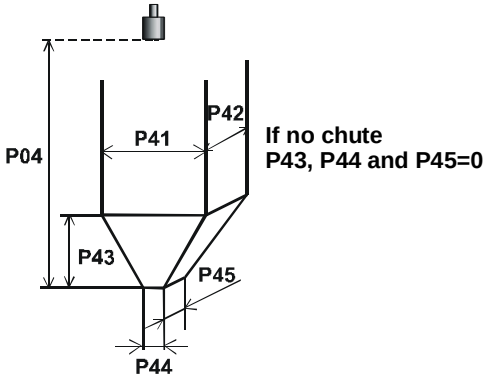
Standing cylindrical tank with hemispherical bottom



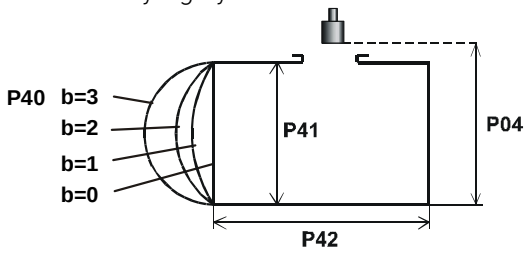
Standing cylindrical tank with conical bottom



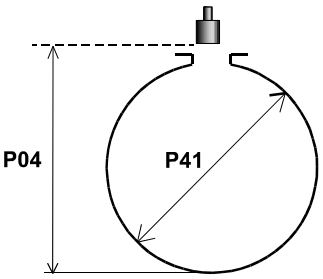
Standing rectangular tank with or without chute



Lying cylindrical tank



Spherical tank



7.7 Volume Flow Measuring

7.7.1 Open Channel Flow Measurement

- For ultimate accuracy, install the sensor as close as possible above the expected maximum water level (see minimum measuring range).
- Install the device in a place defined by the characteristics of the metering channel along the longitudinal axis of the flume or weir.
- In some cases foam may develop on the surface. Make sure that the surface, opposite to the sensor remain free of foam for proper sound reflection.
- From the point of view of measurement accuracy the length of the channel sections preceding and following the measuring flume and their method of joining to the measuring channel section are of critical importance.
- Despite of the most careful installation, the accuracy of flow metering will be lower than that of specified for the distance measurement. It will be determined by the features of the flume or weir applied.

P40: - - ba Devices, formula, data

ba	Devices, formula, data						Also to be set
	Type		Calculation formula	Qmin [l/s]	Qmax [l/s]	"P" [cm]	
00	Parshall flume	GPA-1 P1	Q[l/s]= 60,87*h^{1,552}	0,26	5.38	30	P46
01		GPA-1 P2	Q[l/s]= 119,7*h^{1,553}	0,52	13,3	34	P46
02		GPA-1 P3	Q[l/s]= 178,4*h^{1,555}	0,78	49	39	P46
03		GPA-1 P4	Q[l/s]= 353,9*h^{1,558}	1,52	164	53	P46
04		GPA-1 P5	Q[l/s]= 521,4*h^{1,558}	2,25	360	75	P46
05		GPA-1 P6	Q[l/s]= 674,6*h^{1,556}	2,91	570	120	P46
06		GPA-1 P7	Q[l/s]= 1014,9*h^{1,556}	4,4	890	130	P46
07		GPA-1 P8	Q[l/s]= 1368*h^{1,5638}	5,8	1208	135	P46
08		GPA-1 P9	Q[l/s]= 2080,5*h^{1,5689}	8,7	1850	150	P46
09	General PARSHALL flume						P46, P42
10	PALMER-BOWLUS (D/2)						P46, P41
11	PALMER-BOWLUS (D/3)						P46, P41
12	PALMER-BOWLUS (Rectangular)						P46, P41, P42
13	Khafagi Venturi						P46, P42
14	Bottom-step weir						P46, P42

ba	Devices, formula, data	Also to be set
15	Suppressed rectangular or BAZIN weir	P46, P41, P42
16	Trapezoidal weir	P46, P41, P42
17	Special trapezoidal (4:1) weir	P46, P42
18	V-notch weir	P46, P42
19	THOMSON (90°-notch) weir	P46
20	Circular weir	P46, P41
21	General flow formula: Q[l/s]= 1000*P41*h^{P42}, h [m]	P46, P41, P42

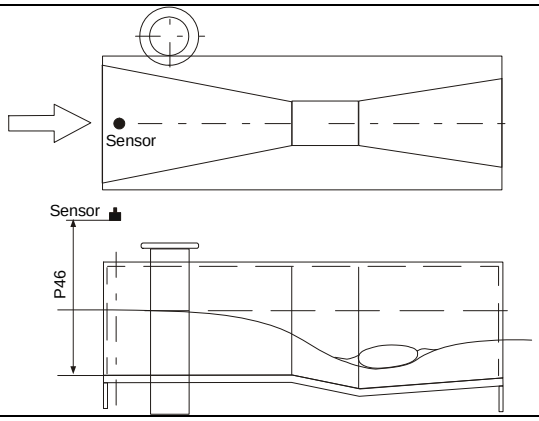
Factory Default: 0

P41-45: Flume/ weir dimensions

Factory Default: 0

P40= 00

Parshall flumes (GPA1P1 ... GPA-1P9)
For further details see the Manual of the Parshall flume



P40= 09

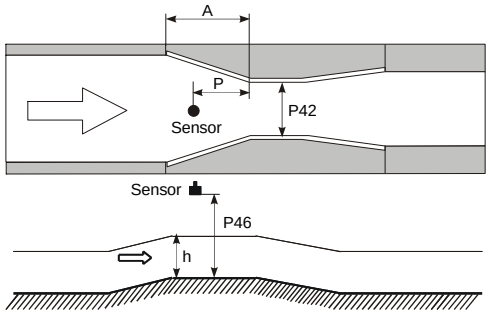
General Parshall flume
0,305 ‹ P42(Breite) ‹2,44

$$Q[l/s] = 372 \cdot P42 \cdot (h/0{,}305)^{1.569 \cdot P42^{0.026}}$$

2,5 ‹ P42
Q[m^3/s]= K*P42*$h^{1,6}$

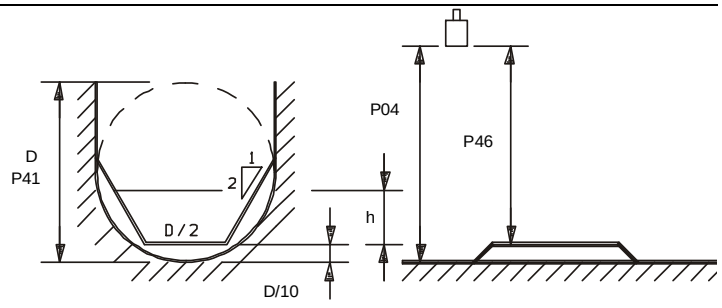
P= 2/3*A

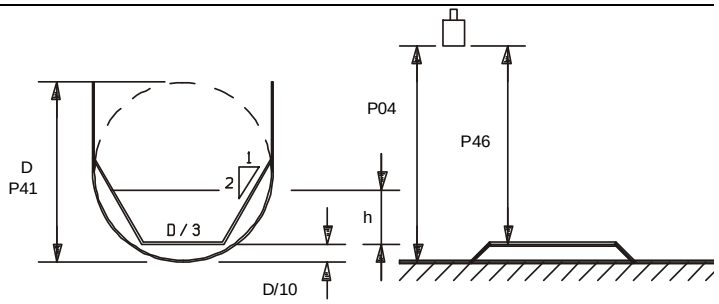
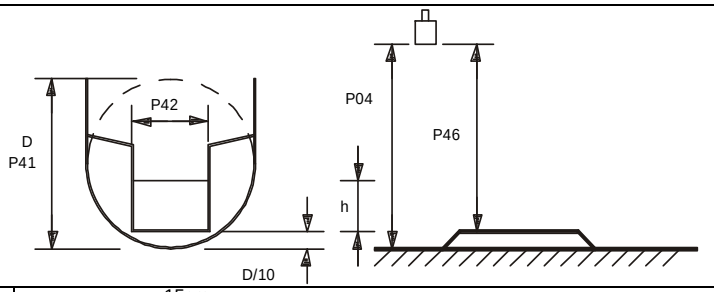
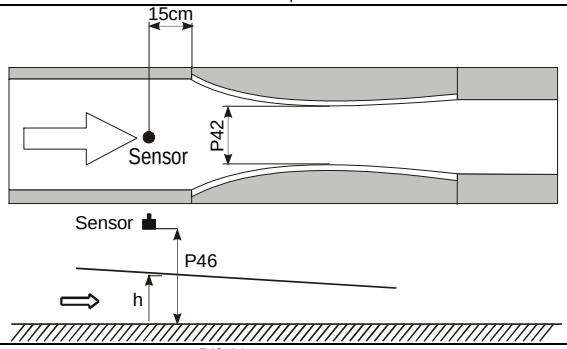
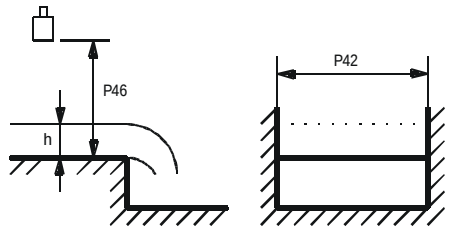
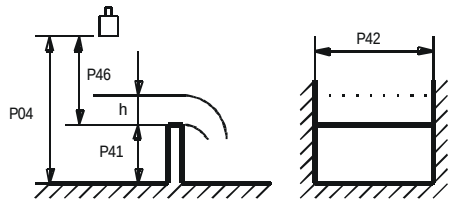
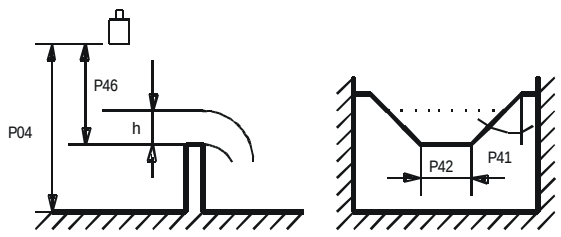
s[m]	K
3.05	2.450
4.57	2.400
6.10	2.370
7.62	2.350
9.14	2.340
15.24	2.320

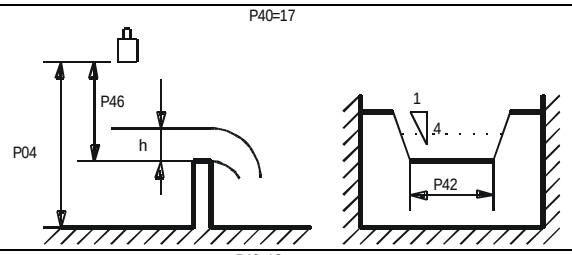
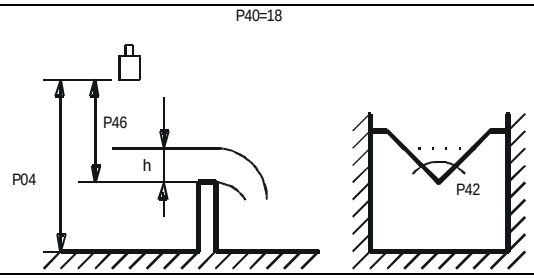
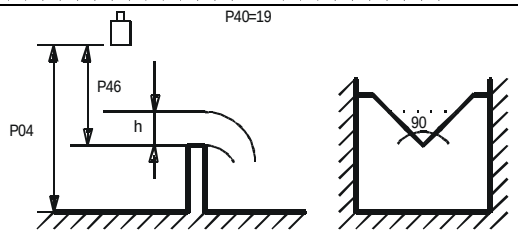
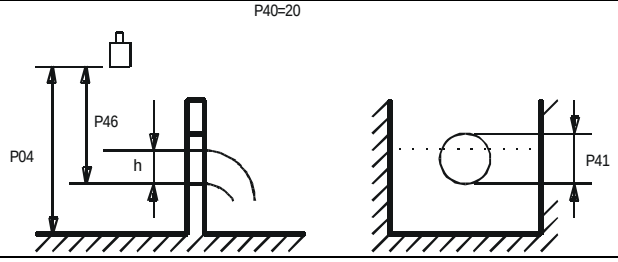


P40= 10

Palmer-Bowlus (D/2) flume
Q[m^3/s]= f(h1/P41)*$P41^{2.5}$,
where h1[m]= h+(P41/10)



P40= 11	**Palmer-Bowlus (D/3) flume** Q[m^3/s]= f(h1/P41)*P41$^{2.5}$, where h1[m]= h+(P41/10)	
P40= 12	**Palmer-Bowlus (Rectangular) flume** Q[m^3/s]= C*P42*h$^{1.5}$, where C= f(P41/P42)	
P40= 13	**Khafagi Venturi flume** Q[m^3/s]= P42*1.744*h$^{1.5}$ + 0.091*h$^{2.5}$	
P40= 14	**Bottom step weir** 0.0005 ‹ Q[m^3/s] ‹ 1 0.3 ‹ P42[m] ‹ 15 0.1 ‹ h[m] ‹ 10 Q[m^3/s]= 5.073*P42*h$^{1.5}$ Accuracy: ±10%	P40=14 
P40= 15	**Suppressed rectangular or BAZIN weir** 0.001 ‹ Q[m^3/s] ‹ 5 0.15 ‹ P41[m] ‹ 0.8 0.15 ‹ P42[m] ‹ 3 0.015 ‹ h[m] ‹ 0.8 Q[m^3/s]= 1.7599*[1+(0.1534/P41)]*P42*(h+0.001)$^{1.5}$ Accuracy: ±1%	P40=15 
P40= 16	**Trapezoidal weir** 0.0032 ‹ Q[m3/s] ‹ 82 20 ‹ P41[°] ‹ 100 0.5 ‹ P42[m] ‹ 15 0.1 ‹ h[m] ‹ 2 Q[m3/s]= 1.772*P42*h1.5+1.320*tg(P41/2)*h$^{2.47}$ Accuracy: ±5%	P40=16 

P40= 17	**Special Trapezoidal (4:1) weir** 0.0018 ‹ Q[m3/s] ‹ 50 0.3 ‹ P42[m] ‹ 10 0.1 ‹ h[m] ‹ 2 Q[m3/s]= 1.866*P42*$h^{1.5}$ Accuracy: ±3%	
P40= 18	**V-notch weir** 0.0002 ‹ Q[m3/s] ‹ 1 20 ‹ P42[°] ‹ 100 0.05 ‹ h[m] ‹ 1 Q[m3/s]= 1.320*tg(P42/2)*$h^{2.47}$ Accuracy: ±3%	
P40= 19	**THOMSON (90°-notch) weir** 0.0002 ‹ Q[m3/s] ‹ 1 0.05 ‹ h[m] ‹ 1 Q[m3/s]= 1.320*$h^{2.47}$ Accuracy: ±3%	
P40= 20	**Circular weir** 0.0003 ‹ Q[m^3/s] ‹ 25 0.02 ‹ h[m] ‹ 2 Q[m^3/s]= m*b*$D^{2.5}$ m= 0.555+0.418h/P41+(P41/(0.11*h)) Accuracy: ±5%	

P46: **Distance between transducer face and level of Q=0**

P46 is always the distance between the transducer face and the level, where the volume flow is 0.

Factory Defalt: 0

7.8 32-Point-Linearisation

P47: - - - a Linearisation

Linearisation is the method of assigning requested (calibrated or calculated) level, volume or flow to values measured by the transmitter.
It can be used for instance if the sound velocity is not known (LEVEL⇒LEVEL) or in the case of tank with other shape than under 6.4 or open channel other than under 6.5 (LEVEL ⇒ VOLUME or LEVEL ⇒ FLOW).

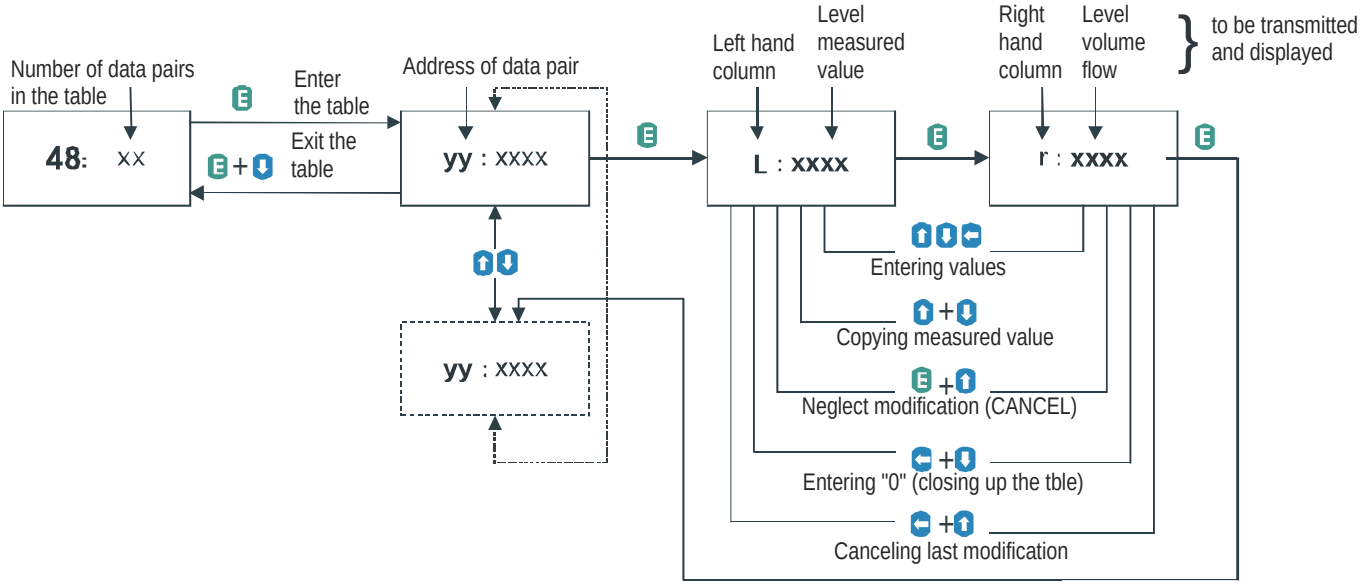
a	Linearisation
0	OFF (FACTORY DEFAULT)
1	ON

P48: Linearisation table

Data-pairs of the linearisation table are handled in a 2x32 matrix, consisting of two columns..

Left column "L"	Right column "r"
LEVEL measured	LEVEL or VOLUME or FLOW to be transmitted and displayed

The left column values (indicated on the display as "L") contain the measured LEVEL values.
The right column values (indicated on the display as "r") contain the calibrated values and are interpreted according to the selected measurement value in P01(a).



Conditions of correct programming of the data pairs:

Left column "L"	Right column "r"
L(1)= 0	r(1)
L(i)	r(i)
:	:
L(j)	r(j)

The table must always start with: L(1)= 0 and r(1)= value (assigned to 0 level)
The table must be ended either with the 32nd data pair i.e. j=32 or if the linearisation table contains less than 32 data-pairs j‹32, the table must be closed by a level value "0" e.g. L(j‹32)= 0.
The 2260 Ultrasonic Level Transmitters will ignore data after recognising level value "0" with serial number other than "1".
If the above conditions are not met, error codes will be displayed (see chapter: Error Codes).

7.9 Informational parameters (read out parameters)

P60: Overall operating hours of the unit (h)

Indication varies according to the elapsed time:

Operating hours	Indication form
0 to 999.9h	xxx,x
1000 to 9999h	xxxx
Over 9999h	X,xx: e meaning x,xx 10^e

P61: Time elapsed after last switch-on (h)

Anzeige jeweils genauso, wie in P60.

P64: Actual temperature of the transducer (°C/°F)

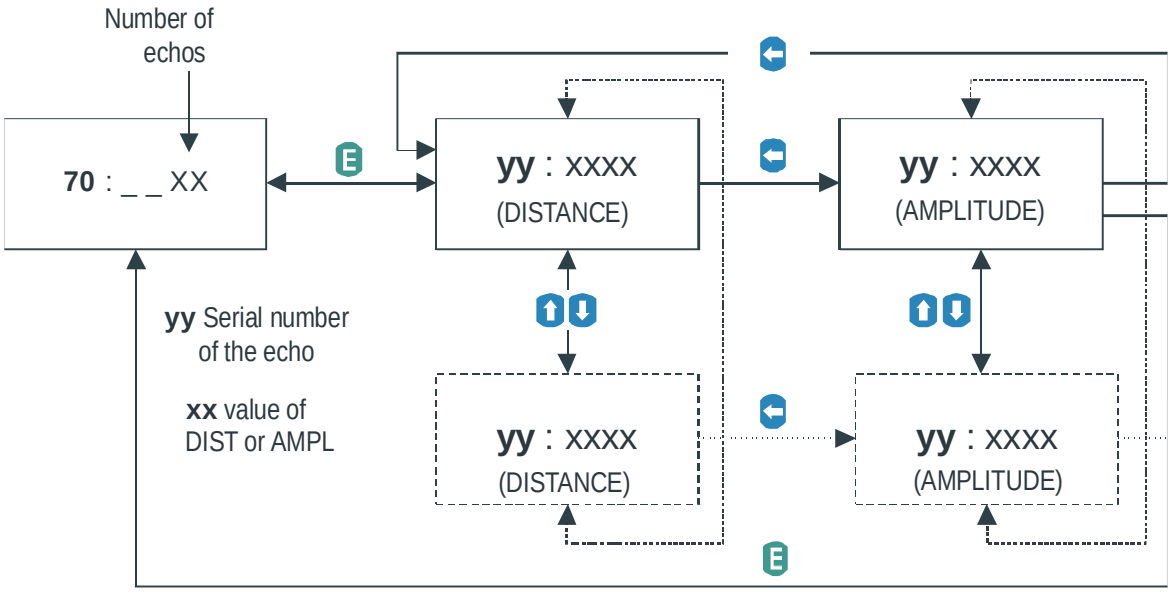
P65: Maximum temperature of the transducer (°C/°F)

P66: Minimum temperature of the transducer (°C/°F)

In case of a breaking in the temperature measuring Pt10 element „PtErr" will be displayed (see Chapter „Error codes"). The transmitter will perform temperature correction corresponding to 20°C.

P70: Number of Echoes / Echo Map

2260 Ultrasonic Level Transmitters is monitoring the echo conditions.Entering this parameter will save the actual echo map. Number, distance and amplitude of these echoes can be read-out one by one.



P71: Distance of the of Measuring Window

P72: Amplitude of the Echo in the Measuring

P73: Echo Position (time) :(ms)

P74: Signal To Noise Ratio

Ratio	Measurement conditions
Over 70	Excellent
Between 70 and 30	Good
Under 30	Unreliable

P75: Blocking Distance

The actual close-end blocking distance will be displayed (provided automatic blocking was selected in P05.

7.10 Additional parameters of the flow metering

P76: Head of flow (LEV)

The Headwater value can be checked here. This is the "h" value in the formula for flow calculation.

P77: TOT1 volume flow totaliser (resetable)

P78: TOT2 volume flow totaliser (non-resetable)

Resetting TOT1 totaliser:

- ▶ Go to the parameter P77.
- ▶ Press NEXT ⊙ + DOWN ⊙ simultaneously.
- ▶ Display will indicate: "t1 Clr".
- ▶ Press ENTER Ⓔ to delete.

7.11 Test parameters

P80: Current output test (mA)

Going to this parameter, the actual current output (corresponding to the measured process value) will be displayed. By pressing ENTER Ⓔ the (now blinking) current value can be set for any value between 3,9 and 20.5 mA. The current output has to show the same value which can be checked by an ampere meter, according to the description under 4.4. Press ENTER Ⓔ to quit test mode and return the parameter address.

P97: b:a.aa Software code

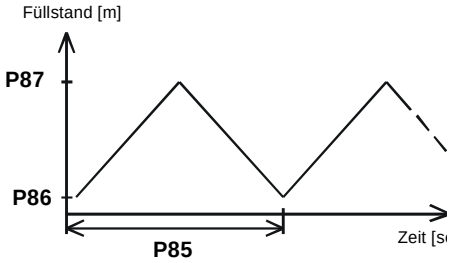
a.aa: Number of the software version
b: Code of the special version

7.12 Simulation

This function enables the user to test the settings of the outputs. The 2260 Ultrasonic Level Transmitters can simulate the static or continuous change of level according to the simulation cycle time, high level and low level set in P85, P86 and P87. (The simulation levels must be within the programmed measuring range set in P04 and P05.)
After selecting simulation type in P85 and setting simulation values Measurement Mode has to be re-entered. While the 2260 Ultrasonic Level Transmitters is in simulation mode the DIST, LEV or VOL symbol will be blinking. To quit Simulation Mode P84= 0 should be set.

P84: - - - x Selection of the simulation

X	Simulation typ
0	No simulation
1	The level changes continuously up and down between the level values set in P86 and P87 with a cycle time set in P85



P85: Cycle time for simulation (sec)

P86: Simulated low level value (m)

P87: Simulated high level value (m)

7.13 Access Lock

P99: dcba Access Lock by Secret Code

The purpose of this feature is to provide protection against accidental (or intentional) re-programming of parameters.

The Secret Code can be any value other than 0000. Setting a Secret Code will automatically be activated when the 2260 Ultrasonic Level Transmitters is returned to the Measurement Mode. If the Secret Code is activated, the parameters can only be viewed, this is indicated by the a flashing colon ":" between the parameter address and the parameter value.

In order to program the device locked by a secret code, first enter the Secret Code in P99. The Secret Code is re-activated each time the 2260 Ultrasonic Level Transmitters is returned to Measurement Mode. To delete the Secret Code, enter the Secret Code in P99. After confirming it with [E] re-enter the parameter P99 and enter 0000.

[dcba (Secret Code)] → Ⓔ → Ⓔ → [0000] → Ⓔ ⇒ Secret Code deleted

8. Error Codes

Error Code	Error description	Causes and solutions
1	Memory error	Contact representative of GF Piping Systems
kein Echo	Echo loss	No echo received (no reflection), see chapter „Indication of mistakes (by LEDs) made during programming"
3	Hardware error	Contact representative of GF Piping Systems
4	Display overflow	Check settings
5	Sensor error or improper installation/mounting, level in the dead band	Verify sensor for correct operation and check for correct mounting according to the User's Manual
6	The measurement is at the reliability threshold	Better location should be tried.
7	No signal received within the measuring range specified in P04 and P05	Review programming, also look for installation mistake
12	Linearisation table error: both L(1) and L(2) are zero (no valid data-pairs)	See the Section "Linearisation"
13	Linearisation table error: there are two same L(i) data in the table	See the Section "Linearisation"
14	Linearisation table error: the r(i) values are not monotone increasing	See the Section "Linearisation"
15	Linearisation table error: measured Level is higher than the last Volume or Flow data-pair	See the Section "Linearisation"
16	The check sum of the program in the EEPROM is wrong	Contact representative of GF Piping Systems
17	Parameter consistency failure	Check programming
18	Hardware failure	Contact representative of GF Piping Systems

9. Parameter table

Par.	Page	Description	Value d c b a	Par.	Page	Description	Value d c b a
P00	22	Application/Engineering Units		P28	30	Echo loss indication	
P01	22	Measurement Mode		P29	31	Blocking out of disturbing object	
P02	22	Calculation units		P30		N.A.	
P03	23	Rounding		P31	31	Sound velocity in different gases	
P04	24	Maximum Measuring Distance		P32	31	Specific gravity	
P05	25	Minimum Measuring Distance		P33		N.A.	
P06	25	Far End Blocking		P34		N.A.	
P07		N.A.		P35		N.A.	
P08		N.A.		P36		N.A.	
P09		N.A.		P37		N.A.	
P10	26	Value assigned to „4 mA"		P38		N.A.	
P11	26	Value assigned to „20 mA"		P39		N.A.	
P12	26	"Error" indication by the current output		P40	32	Selection of tank shape/ open channel	
P13	27	Relay function		P41	31	Dimensions of tank / Open Channel	
P14	27	Relay parameter – Operating value		P42	31	Dimensions of tank / Open Channel	
P15	27	Relay parameter – Releasing value		P43	31	Dimensions of tank / Open Channel	
P16	27	Relay parameter – Pulse rate		P44	31	Dimensions of tank / Open Channel	
P17	-	N.A.		P45	31	Dimensions of tank / Open Channel	
P18	-	N.A.		P46	35	Dist. Btw. Transducer face and level of Q=0	
P19	28	Digital Output.		P47	35	Linearisation	
P20	28	Damping		P48	36	Linearisation table	
P21		N.A.		P49		N.A.	
P22	28	Dome top tank compensation		P50		N.A.	
P23		N.A.		P51		N.A.	
P24	28	Target tracking speed		P52		N.A.	
P25	29	Selection of Echo in the measuring window		P53		N.A.	
P26	29	Level elevation rate		P54		N.A.	
P27	29	Level descent rate		P55		N.A.	

Par.	Page	Description	Value d	c	b	a
P56		N.A.				
P57		N.A.				
P58		N.A.				
P59		N.A.				
P60	37	Overall operating hours of the unit				
P61	37	Time elapsed after last switch-on				
P62	37	Operating hours of the relay				
P63	-	Number of switching cycles of the relay				
P64	37	Actual temperature of the transducer				
P65	33	Maximum temperature of the transducer				
P66	37	Minimum temperature of the transducer				
P67		N.A.				
P68		N.A.				
P69		N.A.				
P70	37	Echo Map				
P71	37	Distance of the measuring window				
P72	37	Amplitude of the in the measuring window				
P73	37	Distance of the in the measuring window				
P74	38	Signal / noise ratio				
P75	38	Blocking Distance				
P76	38	Waterhead of the flow				
P77	38	TOT1 volume flow totaliser				
P78	38	TOT2 volume flow totaliser				
P79		N.A.				
P80	38	Current generator test				
P81	38	Relay test				
P82		N.A.				
P83		N.A.				
P84	39	Simulation mode				
P85	39	Simulation cycle time				
P86	39	Simulation low level				
P87	39	Simulation high level				
P88		N.A.				
P89		N.A.				
P90		N.A.				
P91		N.A.				
P92		N.A.				
P93		N.A.				
P94		N.A.				
P95		N.A.				
P96		N.A.				
P97	38	Software code				
P98		N.A.				
P99	39	Access lock				

10. Sound velocities in different gases

The following table contains the sound velocity of various gases measured at 20°C.

Gases		Sound Velocity (m/s)
Acetaldehyde	C_2H_4O	252.8
Acetylene	C_2H_2	340.8
Ammonia	NH_3	429.9
Argon	Ar	319.1
Benzene	C_6H_6	183.4
Carbon dioxide	CO_2	268.3
Carbon monoxide	CO	349.2
Carbon tetrachloride	CCl_4	150.2
Chlorine	Cl_2	212.7
Dimethyl ether	CH_3OCH_3	213.4
Ethane	C_2H_6	327.4
Ethanol	C_2H_3OH	267.3

Gases		Sound Velocity (m/s)
Ethylene	C_2H_4	329.4
Helium	He	994.5
Hydrogen sulphide	H_2S	321.1
Methane	CH_4	445.5
Methanol	CH_3OH	347
Neon	Ne	449.6
Nitrogen	N_2	349.1
Nitrogen monoxide	NO	346
Oxygen	O_2	328.6
Propane N.A.	C_3H_8	246.5
Sulphur hexafluoride	SF_6	137.8

11. Article overview

Code	Type	Article description
159 300 090	2260-P-0DB-4	Range 4 m, PP body, 4..20 mA 2-wire , BSP thread
159 300 091	2260-P-2DB-4	Range 4 m, PP body, 4..20 mA 2-wire / relay / HART, BSP thread
159 300 092	2260-P-0DB-6	Range 6 m, PP body, 4..20 mA 2-wire, BSP thread
159 300 093	2260-P-2DB-6	Range 6 m, PP body, 4..20 mA 2-wire / relay / HART, BSP thread
159 300 094	2260-P-0DF-15	Range 15 m, PP body, 4..20 mA 2-wire, DIN Flange DN125
159 300 095	2260-P-2DF-15	Range 15 m, PP body, 4..20 mA 2-wire / relay / HART, DIN Flange DN125
159 300 101	2260-V-0DB-4	Range 4 m, PVDF body, 4..20 mA 2-wire, BSP thread
159 300 102	2260-V-2DB-4	Range 4 m, PVDF body, 4..20 mA 2-wire / relay / HART, BSP thread
159 300 103	2260-V-0DB-6	Range 6 m, PVDF body, 4..20 mA 2-wire, BSP thread
159 300 104	2260-V-2DB-6	Range 6 m, PVDF body, 4..20 mA 2-wire / relay / HART, BSP thread
159 300 105	2260-V-0DF-15	Range 15 m, PVDF body, 4..20 mA 2-wire, DIN Flange DN125
159 300 106	2260-V-2DF-15	Range 15 m, PVDF body, 4..20 mA 2-wire / relay / HART, DIN Flange DN125
159 300 112	2260-V-1DBX-4	Range 4 m, PVDF body, 4..20 mA 2-wire / HART, ATEX, BSP thread
159 300 113	2260-V-1DBX-6	Range 6 m, PVDF body, 4..20 mA 2-wire / HART, ATEX, BSP thread
159 300 114	2260-V-1DFX-15	Range 15 m, PVDF body, 4..20 mA 2-wire / HART, ATEX, DIN Flange DN125
159 300 120	2260-P-0DN-4	Range 4 m, PP body, 4..20 mA 2-wire, NPT thread
159 300 121	2260-P-2DN-4	Range 4 m, PP body, 4..20 mA 2-wire / relay / HART, NPT thread
159 300 122	2260-P-0DN-6	Range 6 m, PP body, 4..20 mA 2-wire, NPT thread
159 300 123	2260-P-2DN-6	Range 6 m, PP body, 4..20 mA 2-wire / relay / HART, NPT thread
159 300 124	2260-P-0DA-15	Range 15 m, PP body, 4..20 mA 2-wire, ANSI Flange 5 inch
159 300 125	2260-P-2DA-15	Range 15 m, PP body, 4..20 mA 2-wire / relay / HART, ANSI Flange 5 inch

Code	Type	Article description
159 300 131	2260-V-0DN-4	Range 4 m, PVDF body, 4..20 mA 2-wire, NPT thread
159 300 132	2260-V-2DN-4	Range 4 m, PVDF body, 4..20 mA 2-wire / relay / HART, NPT thread
159 300 133	2260-V-0DN-6	Range 6 m, PVDF body, 4..20 mA 2-wire, NPT thread
159 300 134	2260-V-2DN-6	Range 6 m, PVDF body, 4..20 mA 2-wire / relay / HART, NPT thread
159 300 135	2260-V-0DA-15	Range 15 m, PVDF body, 4..20 mA 2-wire, ANSI Flange 5 inch
159 300 136	2260-V-2DA-15	Range 15 m, PVDF body, 4..20 mA 2-wire / relay / HART, ANSI Flange 5 inch
159 300 142	2260-V-1DNX-4	Range 4 m, PVDF body, 4..20 mA 2-wire / HART, ATEX, NPT thread
159 300 143	2260-V-1DNX-6	Range 6 m, PVDF body, 4..20 mA 2-wire / HART, ATEX, NPT thread
159 300 144	2260-V-1DAX-15	Range 15 m, PVDF body, 4..20 mA 2-wire / HART, ATEX, ANSI Flange 5 inch

12. Disposal

- Before disposing of the different material, separate it by recyclables, normal waste and special waste.
- Comply with local legal regulations and provisions when recycling or disposing of the product, the individual components and the packaging.
- Comply with National regulations, standards and directives..

WARNING

Parts of the product may be contaminated with medium which is detrimental to health and the environment and therefore cleaning is not sufficient!

Risk of personal and health injury caused by this medium.

Prior to the disposal of the product:

- Collect any medium which has escaped and dispose of it in accordance with the local regulations.
- Neutralize residues of media in the product.
- Separate materials (plastics, metals etc.) and dispose of them in accordance with the local regulations.

If you have questions regarding the disposal of your product, please contact your national GF Piping Systems representative.

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