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1 GENERAL DESCRIPTION

The ultrasonic analogues-sensor SONODUL™ type 786.X001 is a precise continuous level gauge, which based on high-frequency sound waves (ultrasound). The sensor is conceived, mounting on the external-receptacle wall. The mounting needs no containment-opening and therefore it works media-touch-loosely.

Characteristics:

- sensor works media-touch-loosely outside the containment
- wear-free
- pressure-independent
- term-based measuring procedure
- the operating frequency is far above the range of audibility
- Sensor and entire electronics are mounted into a corrosion resistant SS-housing which is hermetically tight (IP65)
- high steady dissolution, since that signal is changed exclusively analogously
- hysteresis-free evaluation
- altitude-stand-dependent gain (integral action time-constant)
- measurement is immediately available after a voltage-cancellation
- internal self-supervision of the entire electronic circuit as well as the right attachment. The output signal will interrupted in failure-case

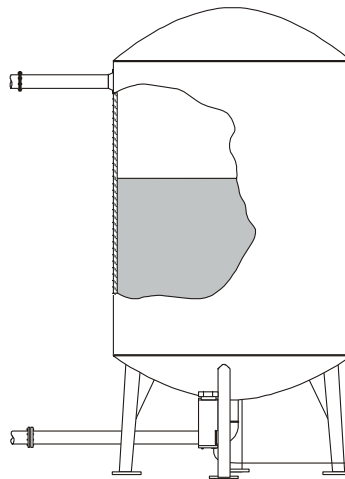


Fig. 1

1.1 Functional description

The actual sensor consists of a piezoceramics which transmits intermittently short sound pulses. They go through the containments-wall into the liquid medium. The sound waves will be reflected from the liquid-surface, and reaches the transmitter. The delay time is proportional to the liquid level. A small error must account by regarding the thickness of the wall because that will be constant. Since the ultrasonic speed in steel is approximately four times higher, then in liquids, the absolute error amounts, by considering a wall-thickness of 2 – 10 mm, approximately $\pm 0,75$ mm by a fixed adjust offset of 6 mm.

This corresponds to an error of 0.5 ‰ by consider a 2 m high tank. Another restriction is, that it is impossible to measure down to zero. This caused by time of decay of the pulse emitter.

1.2 Application field

The system is suitable very well by mounting it outside a containment with aggressive, toxic or high-pure liquids.

1.3 CE - Marking

These devices have been tested for the relevant criteria to achieve CE-marking.

The rules are given by the European Directives and the technical criteria are given by the relevant harmonised standards.

The relevant European Directives are:

89/336/EWG: EMC-Directive

89/392/EWG: Machinery Directive

The Ultrasonic level gauges are no machines in sense of above mentioned directive but may be installed onto such machines.

73/23/EWG: Low Voltage directive

1.4 Quality

The production of these devices is done under our well established and certified Quality management system in accordance with DIN EN ISO 9001.

2 DESIGN OF THE SENSOR

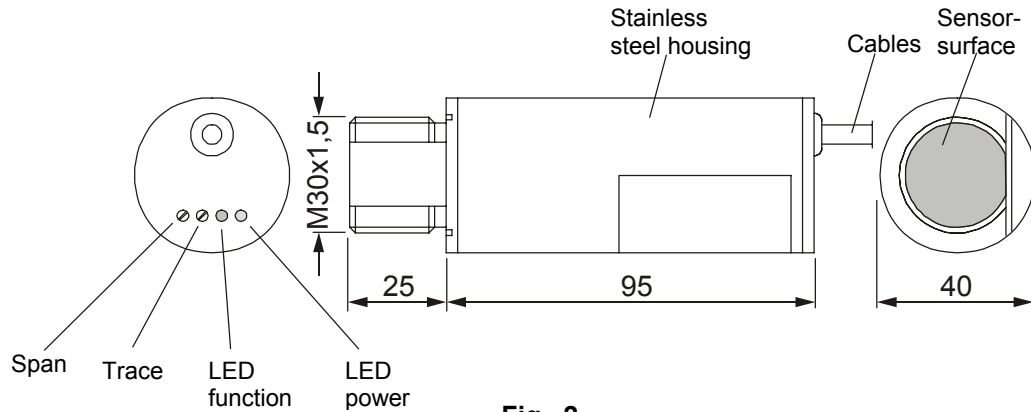


Fig. 2

3 PUTTING INTO OPERATION

Before unpacking we recommend to check for obvious damages. Any electrical work shall be performed by authorised personnel only. You always have to follow the valid local regulations for installing electrical means.

3.1 Mechanical mounting

For this you may follow chapter 1.3. Ensure that the coupling surface is clean, even and free of paint and rust etc.. The mounting adapter (nut M30x1,5 or prism) shall be perpendicular and centric to the containment, otherwise the measurement may be not reliable. The coupling surface now shall be covered sparingly with the coupling media. If this is done, the sensor is to be screwed into the holder only manually.

3.2 Installation - instruction

3.2.1 Vertically at the tank – bottom

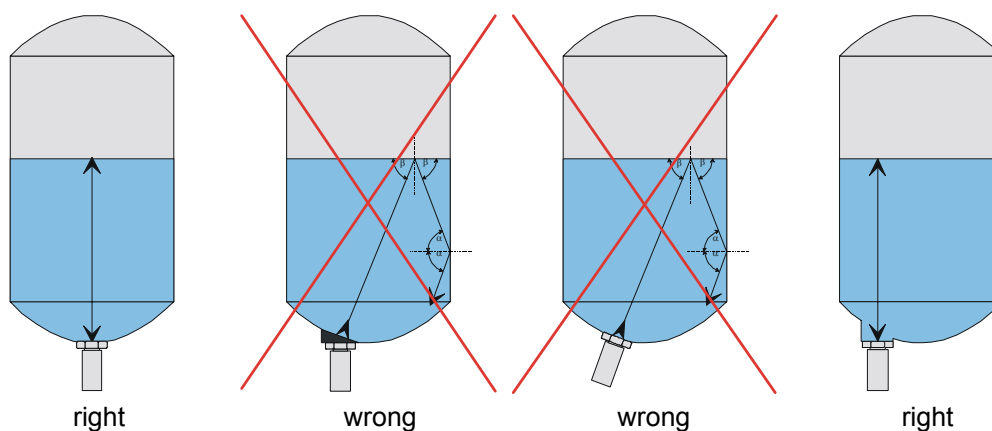
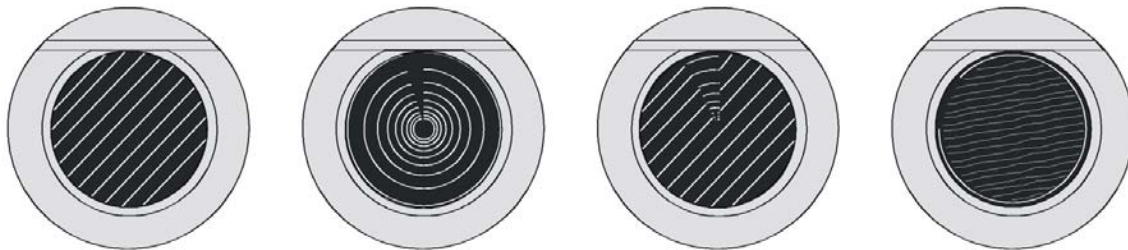


Fig. 3

The sensor must be installed orthogonal to the liquid-surface, so that the reflecting signal can back-succeed the transmitter on direct track. Otherwise no, or a faulty measurement will result hereby.

The mounting position must be smoothly, clean, rusts - and varnish free. For the sensor-mounting, a nut, a flange or another appliance with an internal thread of the dimension M30 x 1.5 and a maximum thickness of 15 mm is required (be accessories). The reception either can be welded at the ground of the containment, or it can be agglutinated. As well, corresponding glues are accessories.

After cleaning the mounting-position and fasten the reception, a contact-test shall be enforced. For this, the sensor surface (blue) must thin covered (approximately 0.1 mm) with skin cream or Vaseline followed by screw in and screw out the sensor to the reception. The pattern of the sensor-surface gives information about the correct adaptation. If necessary the holder must be removed and installed again. If the alignment is correct, the sensor can finally screwed into the mounting-adapter with a suitable catalyst. Depending of temperature, it will be recommend two-component-glues on epoxy resin-basis, (for example UHU „Endfest 300“), greases, based on mineral oil or soap, or copper paste. During a test-use, with welded adapters, we strongly recommend, never to use glue.



The sensor surface must covered with grease so that a straight strip pattern originates.

Surface picture with optimal attachment of the fortification adapter.

Mounting adapter was fortified diagonally at the containment. Repeat mounting.

Inside the mounting-adapter, there are filth or glue remains. If possible it must be removed, otherwise the mounting must be repeated.

Fig. 4

3.3 Electrical connection

3.3.1 Wiring diagram

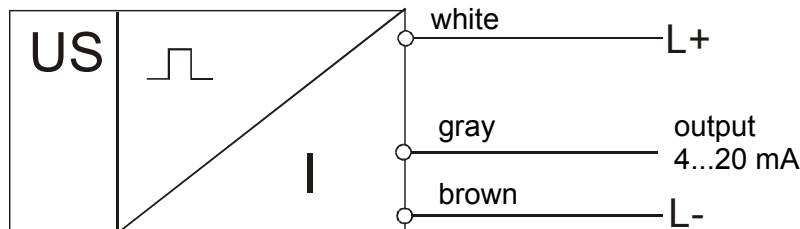
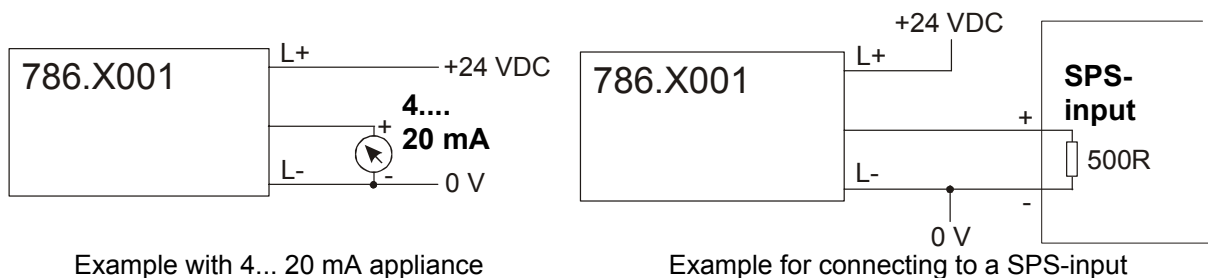


Fig. 5

3.3.2 Connection

The cables L+ and L- shall be connected to a 24 VDC power supply. Connect the output to the external device. Pay attention to the limit of load (50 – 600 Ω).



Example with 4... 20 mA appliance

Example for connecting to a SPS-input

Fig. 6

3.4 Functional check

A functional check can be performed only after completion of mechanical mounting acc. to 3.1.

4 OPERATION

4.1 Alignment

- The ultrasonic level gauge is installed accordingly 3.1 and connected electrically accordingly 3.2, the LED "POWER" will light green.
- containment is either filled to maximum debit-level, or to a known height. This should be in any case more than 0.5 m.
- A connected ampere-meter should display a value of at least 5,5 mA. For control, turn the adjusting screw „TRACE“ slowly clockwise about 180° and then anticlockwise into the original position. The output current may not change. Otherwise, or a value nearby 4 mA is indicated, the Trimmer „TRACE“ must be turned clockwise slowly, until the value on the amperemeter follows a transitional-function. This Point must be determined as exact position, by repeating the above procedure several times. Finally adjusting screw 45° clockwise.

4.2 Balance the level

With the Trimmer „SPAN“ the output current must be revised accordingly to the actual level in relation to the maximum level. Turning clockwise increases and turning anticlockwise reduces the output current. Alterations should be performed only slowly, because the output responds with delay.

Example:

Maximum level 2 m, actual level 1 m, output current must be balanced to a value of: $(4 + 16/2)\text{mA} = 12 \text{ mA}$.

5 MAINTENANCE

The Ultrasonic level switch is maintenance free. You should check the sensor for being fixed firmly in the holder, because otherwise the acoustic coupling could be interrupted.

If the sensor is damaged, please send it back for repair to PHÖNIX ANALYTEC Marketing GmbH, if available, in the original packing.

6 GUARANTEE

We grant a guarantee period of 24 months, under the condition this device has been handled and operated according to this manual. For wear and spare parts the guarantee is restricted to failures in material or construction.

7 TROUBLE SHOOTING

Failure	Possible reasons	Remedy
No LED indication	<ul style="list-style-type: none"> - power supply missing, wrong wiring - Sensor defect 	<ul style="list-style-type: none"> - check power supply, check cable connection - send back sensor for repair to manufacturer
LED function lights permanently or temporarily yellow and the output current changes or remains on 0 mA	<ul style="list-style-type: none"> - no couple medium applied - sensor not tight - reception is not mounted vertically - paint and rust prevents acoustic coupling - adjusting of screw „TRACE“ was not done correctly - level in containment too high or surface of liquid moves too much or solid particles in the containment 	<ul style="list-style-type: none"> - apply couple medium on couple surface of sensor thrifty aufbringen - tighten sensor (only manually) - mount reception again but vertically acc. to Fig. 3 and Fig. 4 - clean and smooth surface of containment - repeat adjusting acc. to chapter 4.1. Fill containment to 20% at least. - reduce level, place sensor as far as possible from drain, perhaps disable signal while filling the containment, remove solid particles
Output current remains at 4...5,5 mA, even varying the liquid level	<ul style="list-style-type: none"> - alignment of the adjusting screw „TRACE“ was not enforced correctly 	<ul style="list-style-type: none"> - repeat alignment according to chapter 4.1, containment should be filled to 20% at least

Output current remains below 20 mA, even liquid level rises	- ultrasonic sound waves are reflected from a solid part in the containment or from the curved tank top	- mount sensor as central as possible at containment bottom or look in the containment drawing where ist the best place
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8 SPECIFICATIONS

8.1 General conditions data

	Unit	Value
Reproducibility	mm	<2
Resolution	mm	0,5
Effective measuring range	mm	50 ...10.000 depends on medium and wall-thickness
Linearity	%	<0,5
Temperature coefficient	ppm/°C	30
Variance-speed	%/s	0,1
Automatic function test every	s	0,7
Wall-thickness of containment	mm	3 - 15
Internal containment diameter	mm	>25
mounting situation		vertically from bottom orthogonal to the medium surface
Connection thread		M30 x 1,5
Dimension of sensor housing	mm	∅40x120
Weight	kg	0,25 + weight of cables

8.2 Design data

	Unit	Value
Temperature ambient	°C	-10 ... +85 max. 30 min -20 ... +115
Temperature storage	°C	-15 ... +85
Material housing		SS
Material sensor surface		epoxide resin

8.3 Electrical data

	Unit	Value
Supply voltage	VDC	24 ±10%
Supply current	mA	58
Output / burden	mA / Ω	4...20 / 200 - 600
Connections		5 m PVC-cable 5*0,25 mm ²
Ingress protection EN 60529		IP65

9 Model code

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1	compact	Version
2	splitted	