



Mounting and operating instruction

ZELM 06 ATEX 0299
ZELM 06 ATEX 0300

Please retain for future usage

Rev. 5 – 04.06.2012





OPTO....



CONTENT

	page
Safety information	1
Danger!	1
1. WORKING PRINCIPLE	2
1.2 Installation hints	4
1.2.1 Transducer Type OPTO.0042, connections for glass apparatus	4
1.2.2 Transducer Type OPTO.0032	4
1.2.3 Transducer Type OPTO.06XX	5
1.4 Quality	6
2. SELECTION TABLE	6
2.1 Multi-part Transducer Type OPTO.....06XX	7
2.1.1 Multi-part Transducer Type OPTO.0660	7
2.1.2 Multi-part Transducer Type OPTO.0680	7
2.1.3 Multi-part Transducer Type OPTO.0689	7
2.1.4 Multi-part Transducer Type OPTO.06XX.....	8
2.1.5 Construction details of Level and Interface sensors.....	8
2.2 One-piece Transducer Type OPTO.....0032.....	9
2.3 One-piece Transducer Type OPTO.....0042, completely made of glass	9
2.4 Amplifier 19" type OPTO.250Y.X7.....	10
2.5 Amplifier in a damp-proofed housing type OPTO.250Y.X1	12
3. PUTTING INTO OPERATION.....	13
Checking the completeness of the shipment	13
Intermediate Storage	13
<i>Safety note operating conditions</i>	13
3.1 Mechanical assembly of the transducer.....	13
<i>Safety note pressure balance</i>	13
<i>Safety note sensor head</i>	14
<i>Ex hint 'Use Directive'</i>	14
<i>Ex hint for operating type OPTO.06XX in zone 0</i>	14
<i>Ex hint ambient temperature</i>	14
<i>Safety note installation</i>	14
<i>Safety note assembly</i>	14
3.1.1 Pressure and leakage test	14
3.2 Mechanical Installation of Controller	15
3.3 Electrical connection transducer and amplifier.....	15
<i>Safety note electrical installation</i>	15
3.3.1 Connection diagram transducer and amplifier	16
3.3.2 Electrical Connection Transducer	17
<i>Earthing type OPTO.06XX</i>	17
3.3.3 Electrical Connection Amplifier	17
3.4 Connection supply	18
3.5 Connection relays	18
3.6 Function control	18
4. OPERATION	19
4.1 Setting of fail-safe direction with switch S1	19
4.2 Calibration with CAL	20
4.3 Justage of time delay	21
4.4 TEST-Procedure	22



4.5 Operating characteristics relay signal	23
4.6 Operating characteristics relay failure	23
5. MAINTENANCE	23
6. GUARANTEE	23
7. Disposal	24
8. REPAIR	24
8.1 Repair Transducer	24
8.2 Replacing fuse of amplifier	24
8.3 Miscellaneous	24
9. TROUBLE SHOOTING	25
10. TECHNICAL DATA	26
10.1 Transducer	26
10.1.1 One-piece transducer	26
10.1.2 Multipart transducer	27
10.2 Amplifier	29
11. SELECTION CODE	30
11.1 Type OPTO.0032 one-piece transducer..... 	30
11.2 Type OPTO.0042 completely made of glass, one-piece transducer	 31
11.3 Type OPTO...06XX multi-part transducer	 32
11.4 Type OPTO.250Y.XX Amplifier	 35
12 Safety Manual	36
12.1 General	36
12.1.1 Validity	36
12.1.2 Relevant standards	36
12.1.3 Determination of safety-related characteristics	37
12.2 Planning	37
12.2.1 Low demand mode	37
12.2.2 High demand or continuous mode	37
12.2.3 General	37
12.3 Set-up	38
12.3.1 Mounting and installation	38
12.4 Reaction during operation and in case of failure	38
12.5 Recurring function test	38
12.5.1 Safety-related characteristics	39





Safety information

Read these instructions before installing the OPTO....and putting then into operation.

These instructions are intended for the specialists in charge of mounting, installation and setup.

Comply with the relevant safety regulations when using the equipment.

Unauthorized access and impermissible use of the equipment will result in the loss of guarantee and liability protection.

Measures must be taken to prevent risks to persons and property in the event of a defect in the OPTO.....

Do not operate OPTO.... in the immediate vicinity of strong electromagnetic fields (minimum distance: 1 m).

OPTO....must not be exposed to heavy mechanical loads.

Comply with the maximum current and voltage values for intrinsically safe operation as specified in the installation and operating instructions.



Danger!

There is a risk of poisoning or suffocation when working in containers. Relevant personal protection measures (e.g. respirator y devices, protective clothing, etc.) must be taken before work is carried out.

Danger, risk of explosion!

An explosive atmosphere may develop in a container. Measures must be taken to prevent sparking. Work in such areas must be done by qualified personnel in accordance with the relevant safety regulations and guidelines.

1. WORKING PRINCIPLE

These devices are used for level detection. The conical tip of the sensor ensures really precise on-off performance level sensing. Its reaction is independent of various physical parameters of the liquid such as density, dielectric constant, conductivity, colour or refractive index. This allows the use for safe level switching as well as for precise level control applications. If there is any foam you even can decide whether to use the sensor for foam level or liquid level control, suppressing the influence of foam on switching.

If the sensor is supplied with a U-tip, it is able to sense changes in refractive index. So it can be used for example as an interface level switch for liquids.

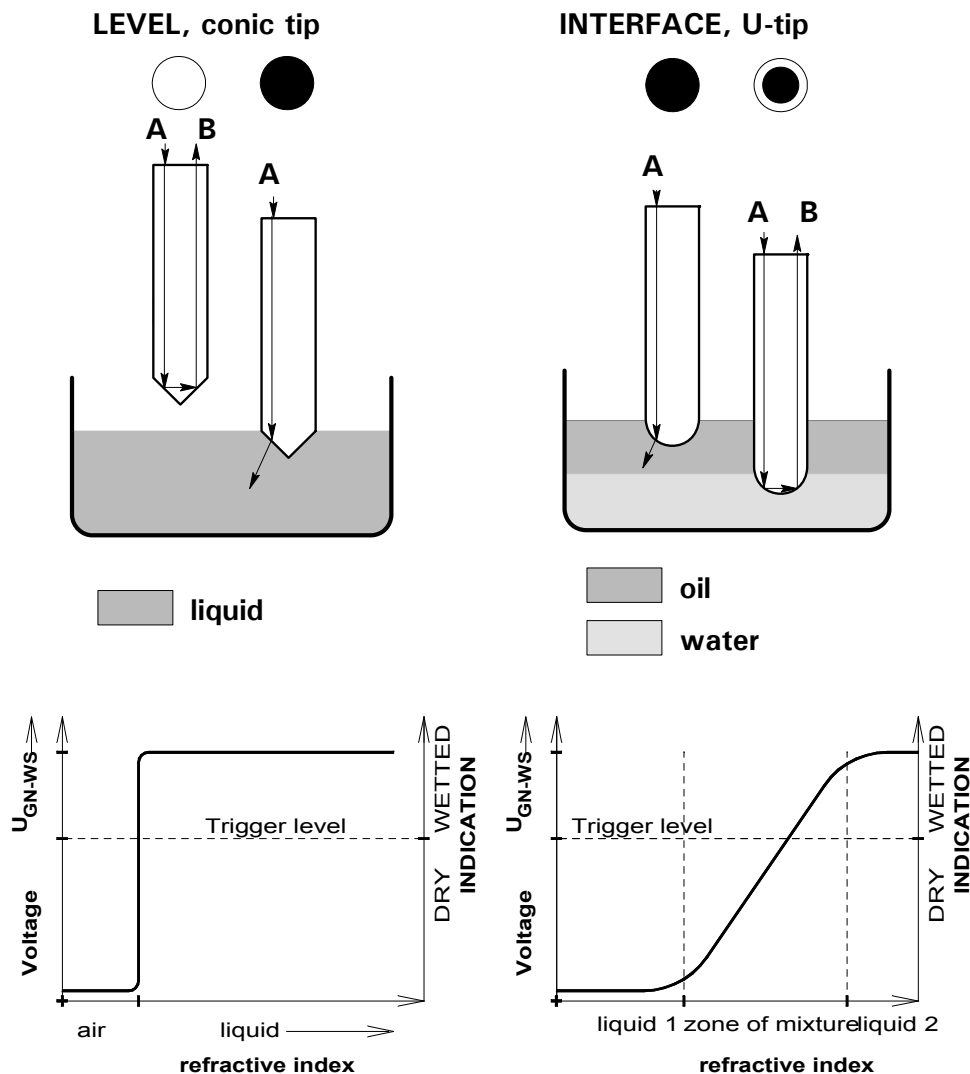
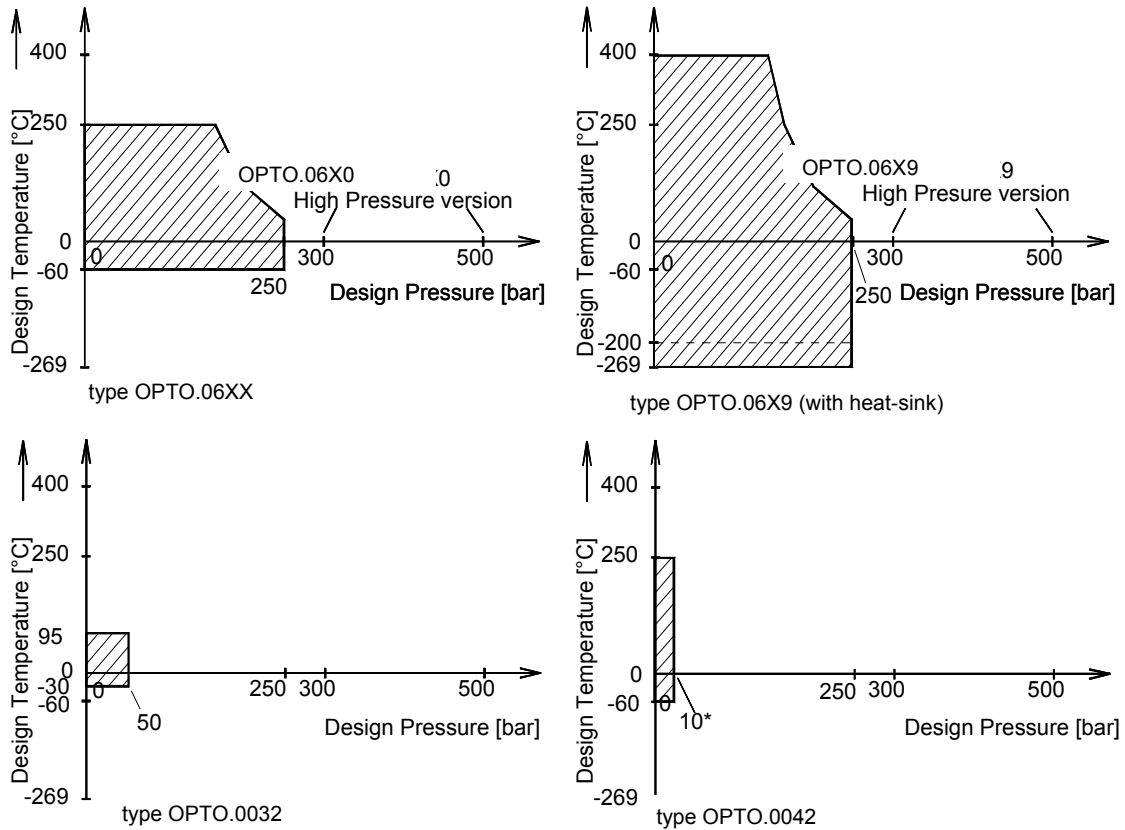


Fig. 1

1.1 Range of Application, Selection of products



* depending on connection type

Fig. 2

All these transducers need a switch amplifier type OPTO.250X.XY for power supply and switch state signalling.

For the multi-part transducers type OPTO.06XX the following certificates apply:
 Ex class Ex ib IIC T6 (to 60 °C) or T5 (to 75 °C), ZELM 06 ATEX 0000 zone 0 + zone 1



Transducer type OPTO.06XX:

If medium touches parts consist of titanium, the operator has to take care that no metallic fittings can beat to the sensor parts and therefore could trigger a blow spark in the container.



1.2 Installation hints

The sensors may be installed in any direction, i. e. from top, bottom, sideways or inclined. In some special applications it is recommended to use following hints:

- High viscosity: sideways or from bottom
- Dry Running protection for pumps: If the pipes to or from the pump are installed horizontally use top mounting for fast detection of liquid
- Overfill prevention devices: Usually vertically from above

1.2.1 Transducer Type OPTO.0042, connections for glass apparatus

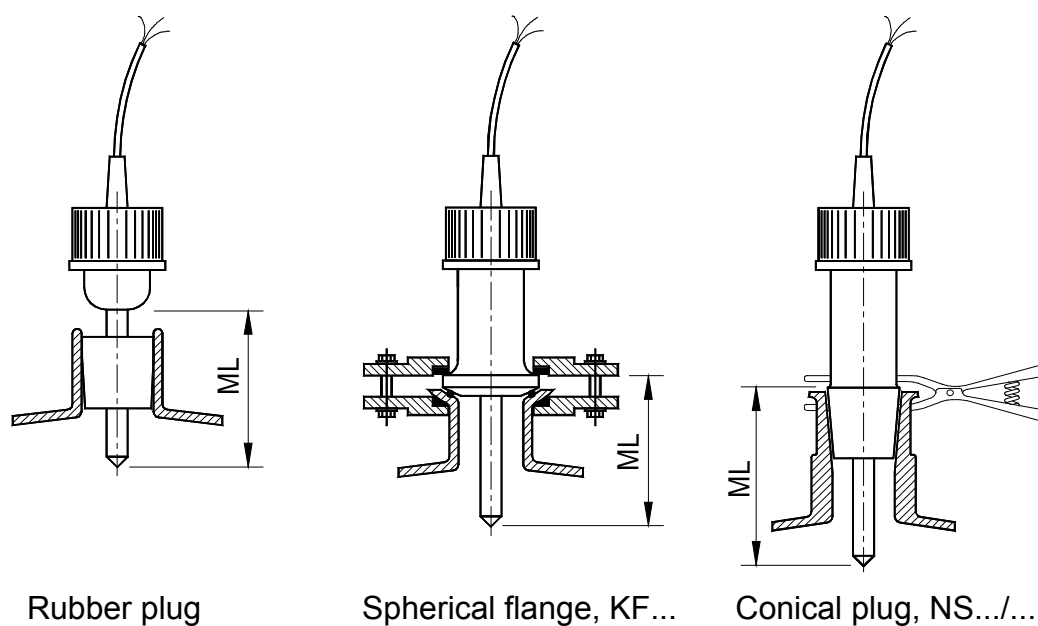
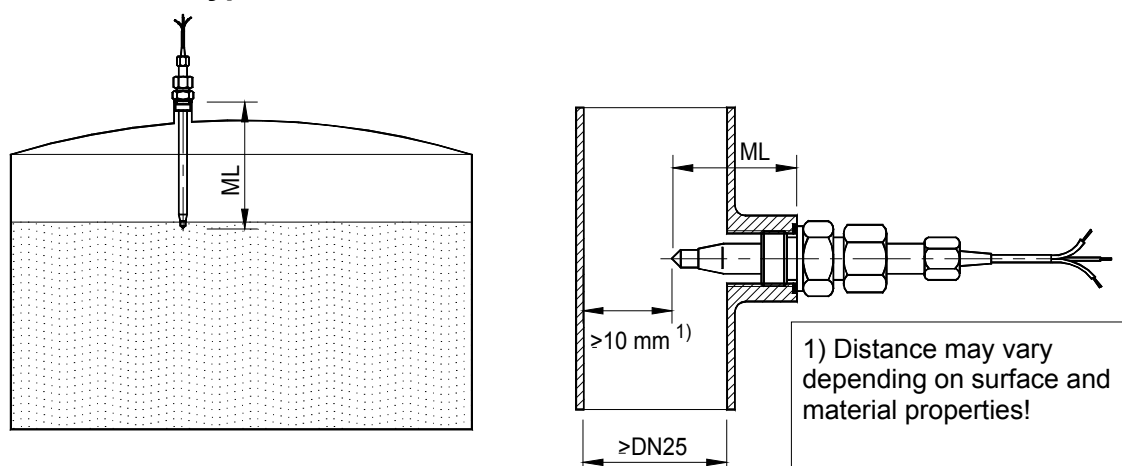


Fig. 3

1.2.2 Transducer Type OPTO.0032

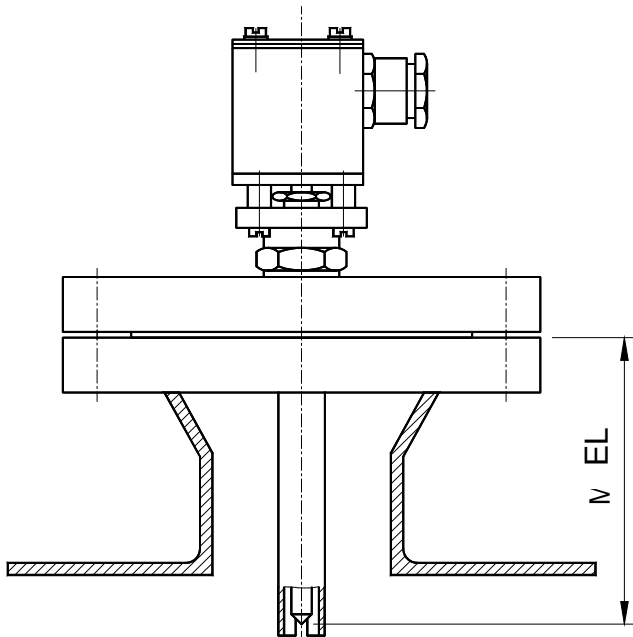


Installation from top for storage tanks
ML max. 2000 mm, if required fixing near the sensor tip is possible

Fig. 4

Installation sideways into pipe or tank wall, tip has to protrude beyond union to avoid sensing of gas bubbles

1.2.3 Transducer Type OPTO.06XX



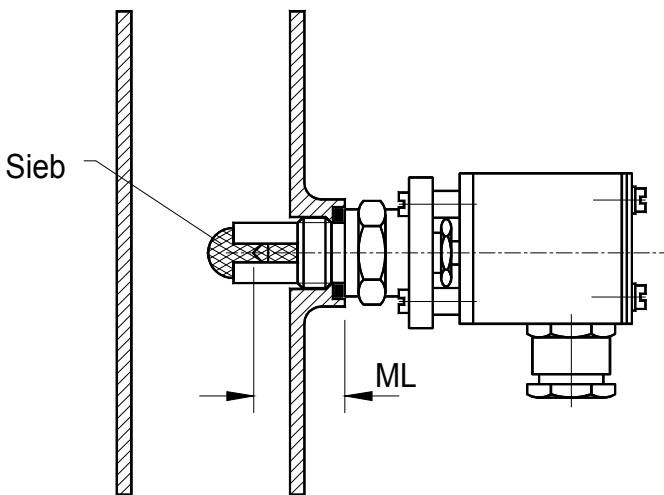
Installation of Type OPTO.0680 from top with flange connection e. g. as Overfill Prevention Device.

EL is measured between flange face and sensor tip.

Minimum flange size is DN25 PN6 or ANSI 1" 150 lbs and all face types may be used.

Flange and sensor housing may be welded together especially for dangerous or toxic media. In this case there is no hexagon at the sensor housing.

Fig. 5



Installation sideways into pipe or wall of Type OPTO.0660, e. g. in a pump's suction pipe.

It may be equipped with a sieve to reject gas bubbles from the sensor tip which ensures switching only when the pipe runs empty.

The Type OPTO.0660 shown here has a fixed measure ML of 25 mm..

Fig. 6

1.4 Quality

All devices are produced within an approved QM-System under DIN EN ISO 9001.

2. SELECTION TABLE

Each Unit consists of a Transducer and a Controller (Switch Amplifier). The Transducer may be of one-piece or multi-part design. Ex types are generally constructed as multi-part types. Multi-part Transducers can be equipped with a heat-sink to expand the temperature range.

Zone	Design Data		Measuring length ML [mm]	Transducer multi-part OPTO...06XX one-piece OPTO...0032 OPTO...0042	Amplifier
	Temp. [°C]	Pressure [MPa/bar]			
STD	-60/+250	0,5/5	50 - 250	OPTO.111X000XX.0042	OPTO.2501
STD	-30/+95	5/50	18 - 49	OPTO.11X300000.0032	OPTO.2501
	-30/+95	5/50	30 - 1500	OPTO.11X300XXX.0032	
STD	60/+250	25/250	25	OPTO.11X300000.0660	OPTO.2501
	-60/+250	25/250	50 - 960	OPTO.11X300XXX.0680	
	-269/+400	25/250	25	OPTO.11X300000.0669	
	-269/+400	25/250	50 - 960	OPTO.11X300XXX.0689	
Ex	-60/+250	25/250	25	OPTO.21X300000.0660	OPTO.2502
	-60/+250	25/250	50 - 960	OPTO.21X300XXX.0680	
	-269/+400	25/250	25	OPTO.21X300000.0669	
	-269/+400	25/250	50 - 960	OPTO.21X300XXX.0689	

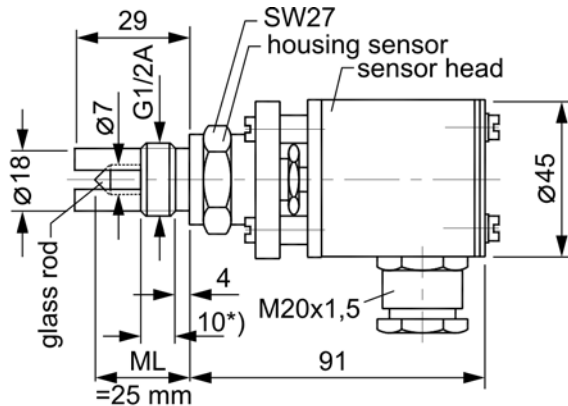
For X see selection code chapter 10.

Fig. 1

Amplifier may be constructed as 19" plug-in modules or built into a plastic housing with a clear cover.

2.1 Multi-part Transducer Type OPTO.....06XX

2.1.1 Multi-part Transducer Type OPTO.0660

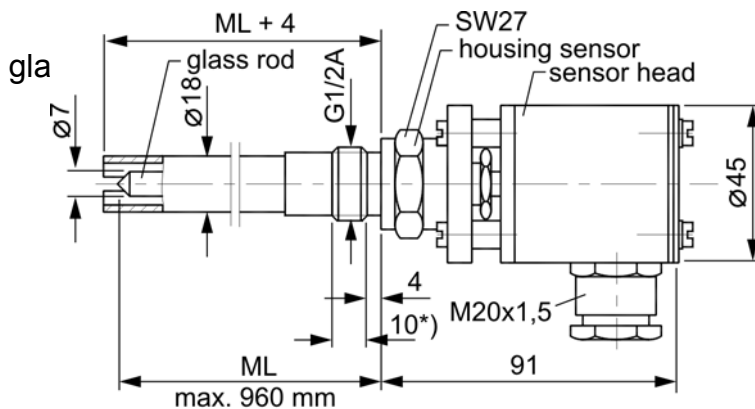


Fixed measuring length ML, no extension possible.
Protection fingers are part of the sensor housing.

*) 16 for high pressure sensor

Fig. 7

2.1.2 Multi-part Transducer Type OPTO.0680

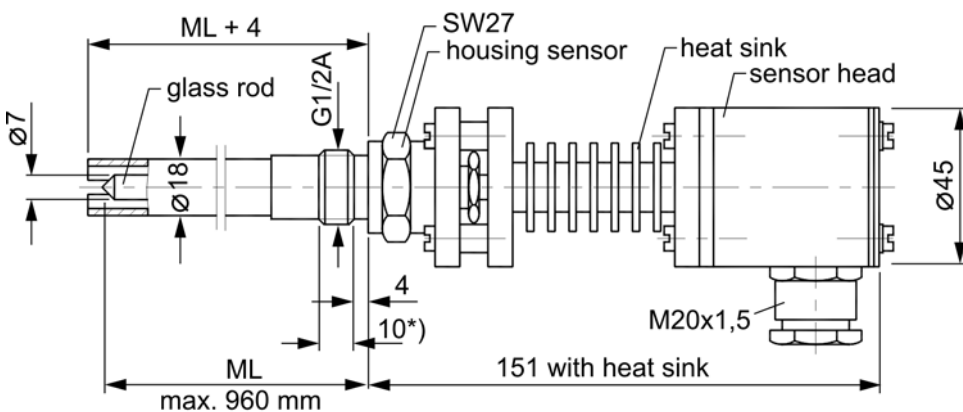


Measuring length ML from 50 to 960 mm.
Extension tube screwed into sensor housing.
Preferred lengths for ML: 50, 60, 80, 90, 100, 120, 150, 200, 300, 600 and 800 mm. Other lengths can also be supplied.

*) 16 for high pressure sensor

Fig. 8

2.1.3 Multi-part Transducer Type OPTO.0689

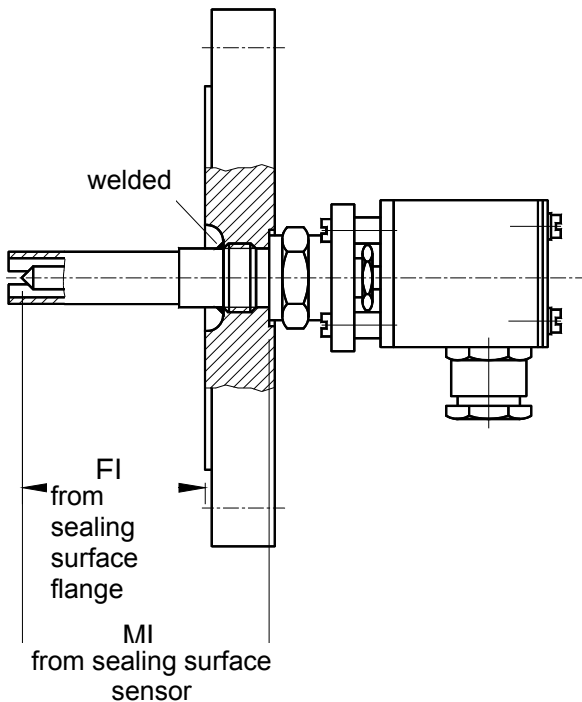


Extended temperature range with heat-sink. This may be combined with fixed ML 25 mm and with extended types.

*) 16 for high pressure sensor

Fig. 9

2.1.4 Multi-part Transducer Type OPTO.06XX



Connection with flanges from DN25 PN6 resp. ANSI 1" 150 lbs and all types of face.

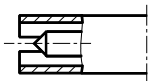
Tightness welding for dangerous or toxic media is always combined with a sensor housing without hexagon.

Insert length EL is calculated:

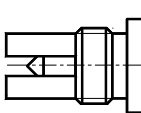
$$EL = ML - \text{flange thickness}$$

Fig. 10

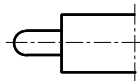
2.1.5 Construction details of Level and Interface sensors



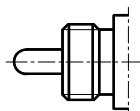
Level sensor with conical tip and Extension tube, measuring length ML 50 - 960 mm
Type OPTO.068X



Level sensor with conical tip, measuring length ML 25 mm
Type OPTO.066X



Interface sensor with U-tip and Extension tube, measuring length ML 50 - 960 mm
Type OPTO.068X



Interface sensor with U-tip, measuring length ML 25 mm
Type OPTO.066X

Fig. 11

2.2 One-piece Transducer Type OPTO.....0032

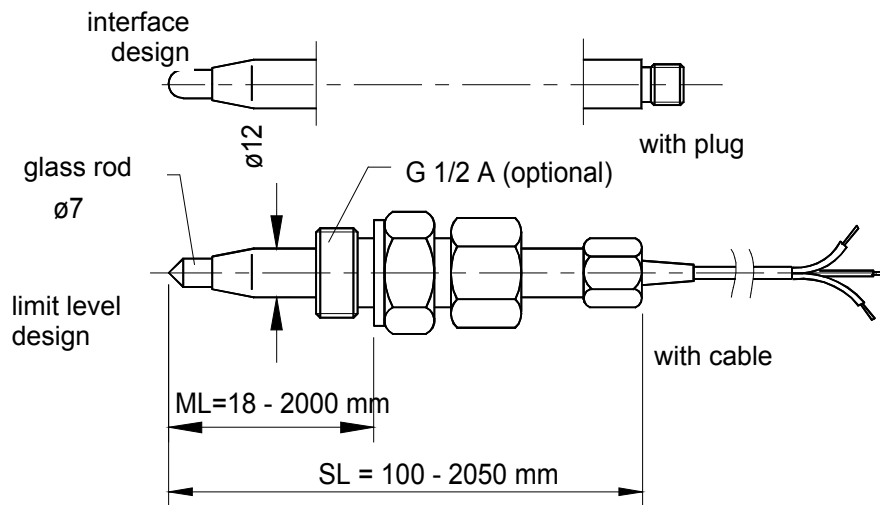
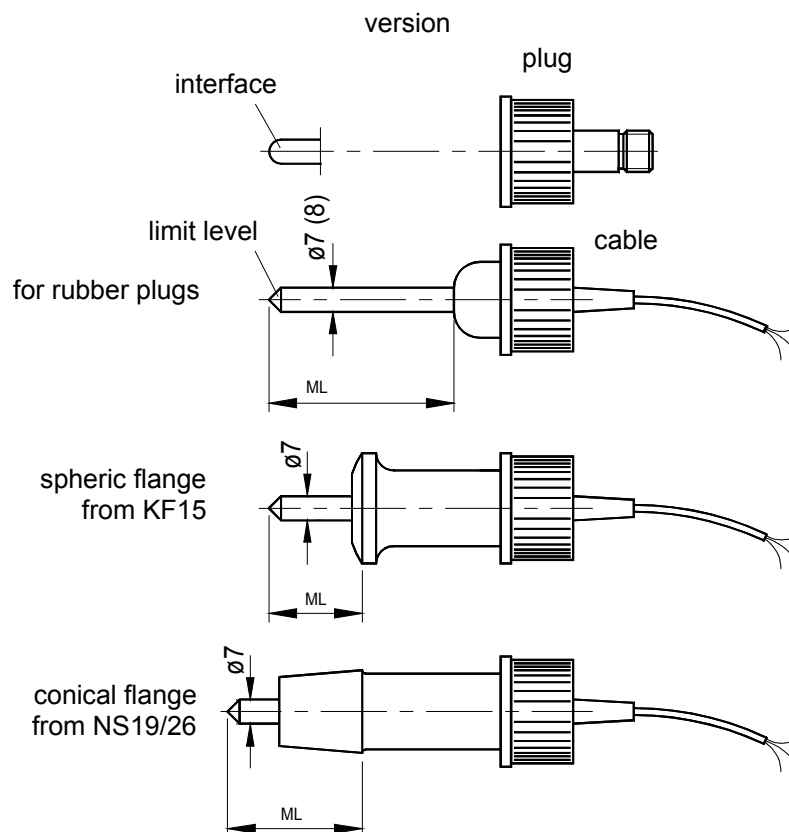


Fig. 12

2.3 One-piece Transducer Type OPTO.....0042, completely made of glass



ML max. 500 mm for all types OPTO.0042

Fig. 13

2.4 Amplifier 19" type OPTO.250Y.X7

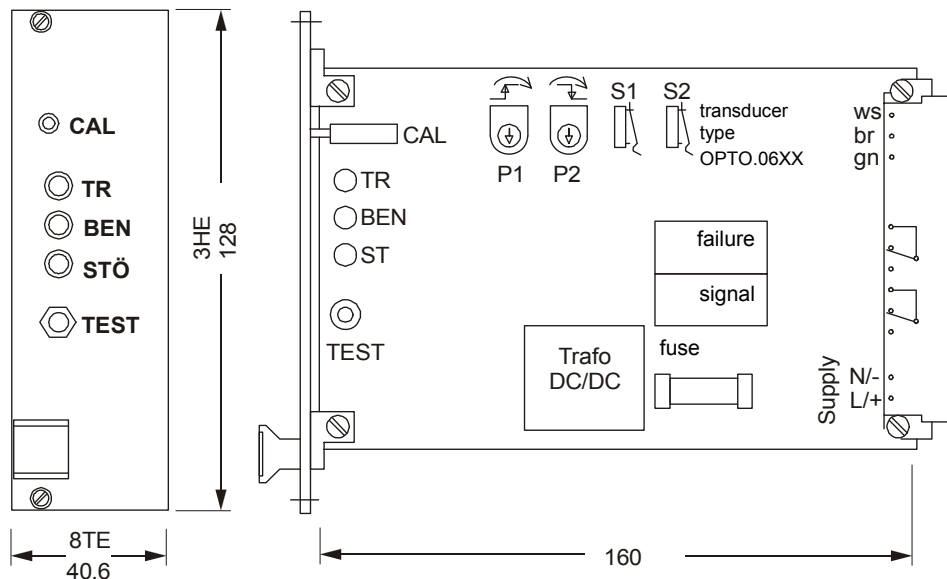


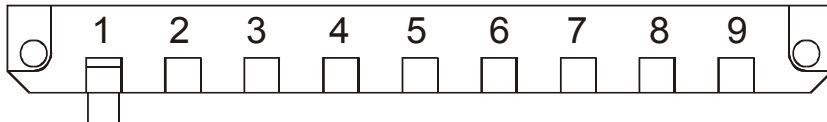
Fig. 14

For the version in an explosion proved type OPTO.2502.*7 the following points have in addition to be taken into account:

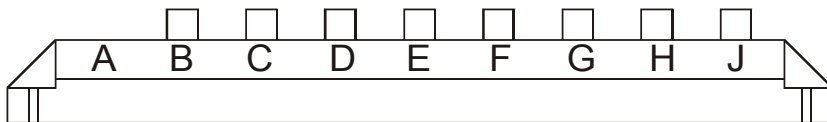
The amplifier is designed as a plug-in card for a 19" system. The plug-in card alone doesn't fulfill the ingress protection IP20 according to EN 60529:1991. It only is intended for the installation into a suitable rack which guarantees the minimum ingress protection IP20. Not used plug-in places have if necessary to be covered with blind plates. The distances and tracking distances particularly are between the individual plug-in cards as well as the intrinsic safe and not intrinsic safe circuits, the requirements on the wiring as well as the excess temperature and the dissipation power converted in the assemblies are to take into account according to EN 50020:1994. To avoid mistakes, the switch amplifiers are provided with an encoding system. It has to be made sure that the counter-strip is executed available and identically in the 19" rack.

The default coding has to be gathered from the following table:

Supply version	Encoder-strip rack, provided at these positions with coding pins	Encoder-strip rack, provided at these positions with one coding pin
230 VAC	B-C-D-E-F-G-H-J	1
115/120 VAC	A, C-D-E-F-G-H-J	2
24 VAC	A-B, D-E-F-G-H-J	3
24 VDC	A-B-C, E-F-G-H-J	4



Encoder-strip plug-in card

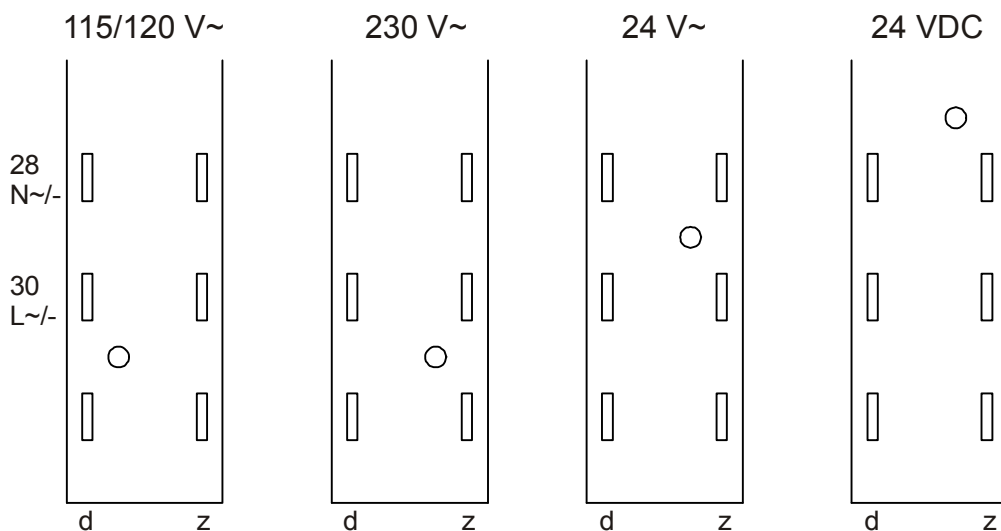


Encoder-strip rack

Example: 230 VAC supply version.

We exclusively recommend the use of suitable racks for the guarantee of the requirements to the company Rolf Heun GmbH.

Alternatively the coding can take place directly in the female connector (rack side) and the associated male connector (amplifier side) after the following coding plan:



The coding pin is inserted with a tool captive in the appropriate place in the female connector and at the opposite side in the male connector is a drilling.

2.5 Amplifier in a damp-proofed housing type OPTO.250Y.X1

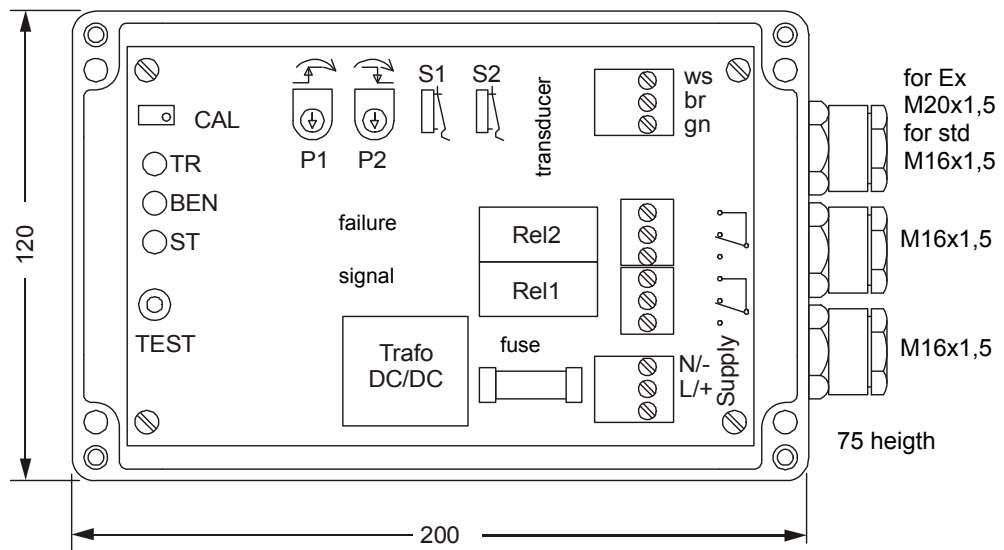


Fig. 15

3. PUTTING INTO OPERATION

Checking the completeness of the shipment

The completeness of the shipment has to be checked when unpacking. Provided that not agreed particularly, the device travels on the risk of the customer. Possible damages in transit can be immediately asserted under enclosing the documentation according to the legal regulations.

Intermediate Storage

If the assembly doesn't immediately take place after the delivery, the Level Gauge must be stored so much that no negative influences can have an effect. We recommend a dry storage place at temperatures below 0 degrees Celsius without additional other objects stacked on this.

Furthermore a check of the function can be carried out before the installation. The device attached provisionally and the glass tip are one and from dived to this for the test in a glass with liquid (justify if necessary in accordance with 4.2). The electrical connection only may be carried out by authorized specialist staff. The appropriate VDE regulations have to be taken into account.

Safety note operating conditions



Before further steps the customer has to check whether furthermore the operating conditions agreed on at the order are valid and the device is suitable for the scheduled purpose. This particularly applies to the features pressure, temperature and medium.

3.1 Mechanical assembly of the transducer



Safety note pressure balance

May work only after a complete pressure balance be carried out. Corresponding safety and environmental protective measures must be adhered to.

The glass tip should have a distance of at least 10 mm to an opposite wall after assembly having been carried out. This minimum distance can vary depending on geometry and surface composition of the wall.

One-piece transducer
Type OPTO.0032:

- use a -screwed pipe e. g. G12S with thread G 1/2 A to screw into a union

One-piece transducer
Type OPTO.0042:

- use the appropriate glass connection

Multi-part transducer
Type OPTO.06XX:

- screw it directly into a 1/2" union by using a metallic seal or in case of flanges mount it onto the appropriate counterpart. Please ensure that the spanner SW27 does not stress the transducer's screw heads.



Safety note sensor head

Never try to loosen the transducer sensor head from sensor housing!



Ex hint 'Use Directive'

The operator has to pay attention to the compliance with the European Use Directive 99/92/EC, harmonized Directive EN 60079-10:1996 pp..

Ex hint for operating type OPTO.06XX in zone 0



If medium touched parts consist of titanium, the operator has to take care that no metallic fittings can beat to the sensor parts and therefore could trigger a blow spark in the container. Perhaps a protection cage has to be attached outside the

container around the sensor head.

Ex hint ambient temperature

If the measuring transducer is installed vertically, the operator has to provide it, the max. temperatures indicated in the technical data do not exceed at all over T6: +60 C and T5: +75 degrees Celsius.



Safety note installation

The transducer should be assembled with caution and care, is particularly respected on the break risk of the glass. Measures for the protection of the transducer head have to be taken if a lateral load has to be expected. The customer has to provide the suitable choice of the seal materials and materials. The torque corresponds in the pipe line engineering for usual values. The transducer has to be installed unstressedly.



Safety note assembly

The transducer may not be charged at the side under any fuss when installing and in the built-in condition at the sensor head. Also see 7. repair. When screwing into a connection thread do not use the sensor head for turning.

3.1.1 Pressure and leakage test

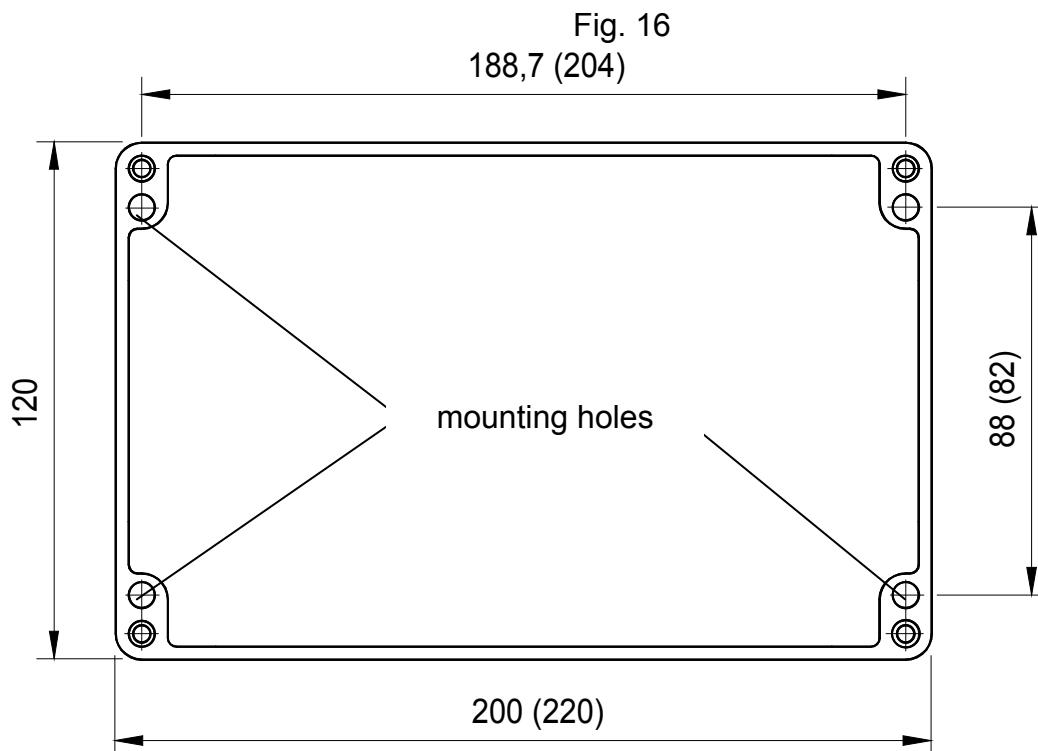
Every device is subjected to a pressure examination in the work. If in the plant still a strength examination (system pressure examination) be required, pressure may not exceed the examining pressure means 1.5 times the indicated pressure on the type plate and the flange.



Attention: For all examinations and uses, in principle, these are indicated on the type plate authoritatively!

3.2 Mechanical Installation of Controller

- Amplifier
in Makrolon housing:
- prepare mounting holes acc. to Fig. 16
 - detach the clear cover from the housing
 - insert mounting screws from cover side into the mounting holes
 - tighten the mounting screws



3.3 Electrical connection transducer and amplifier



Safety note electrical installation

At the electrical installation the operator has to guarantee the compliance with all correct regulations.

The transducer and amplifier connections are both marked with the colors WS (white) respective 2d, BR (brown) respective 4d and GN (green) respective 6d. Connect them according to the connection plan.

The cable must not be shielded, however, should not be laid directly besides strong electrical interference sources either. Including line resistance, contact resistance goes the maximum line length and with that by the following table the maximum:

wire cross section [mm ²]	wiring distance [m]	wiring resistance [Ω]
0,5	175	6,3
0,75	300	7,2
1,0	400	7,2
1,5	600	7,2

Tab. 2

A complete resistance of 9Ω , inclusive of contact resistances, should not be exceeded since otherwise a failure signal is carried out. A max. inductance of $L_a \leq 0,5 \text{ mH}$ and a max. capacity all over are in addition at of keep $C_a \leq 3 \mu\text{F}$ for (incl. the values of the switch amplifier).

3.3.1 Connection diagram transducer and amplifier

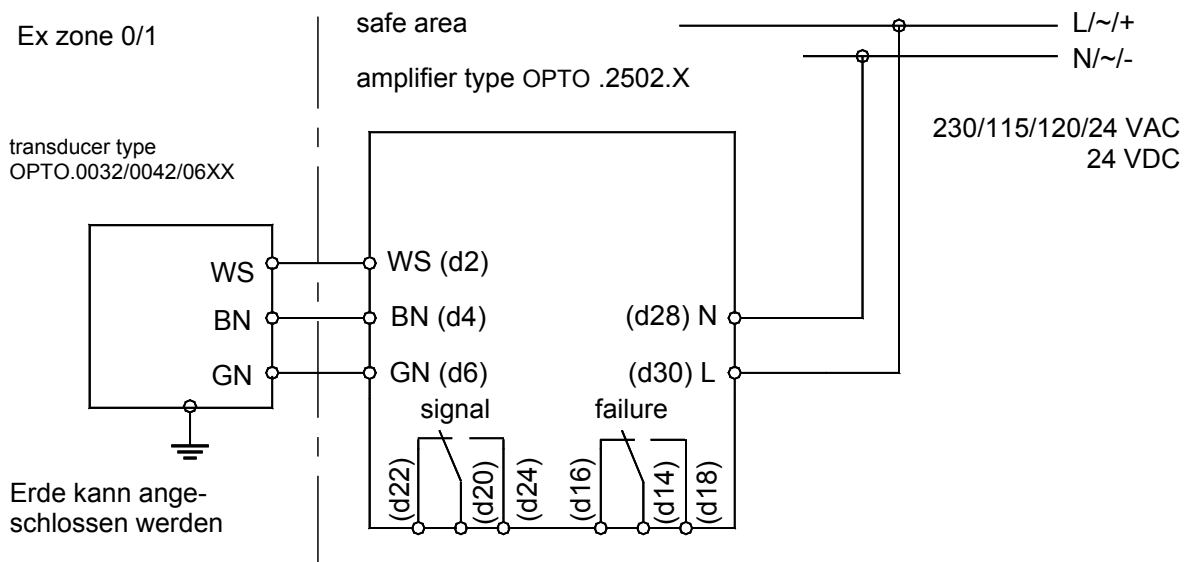


Fig. 17

Cable marked light blue or light blue colored to the measuring transducer by the switch amplifier must all over be installed at (intrinsic safe circuit). The switch amplifier has to be installed in safe area, the sensor body may be installed in zone 1 or 2.

3.3.2 Electrical Connection Transducer

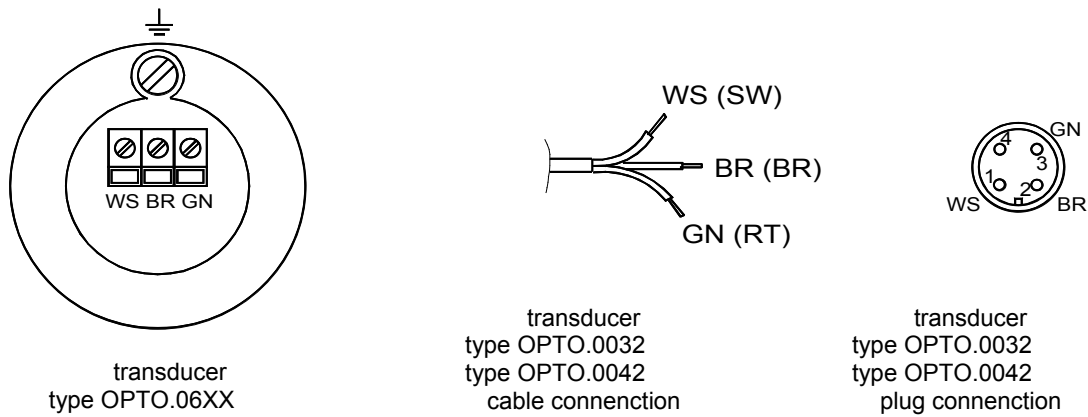
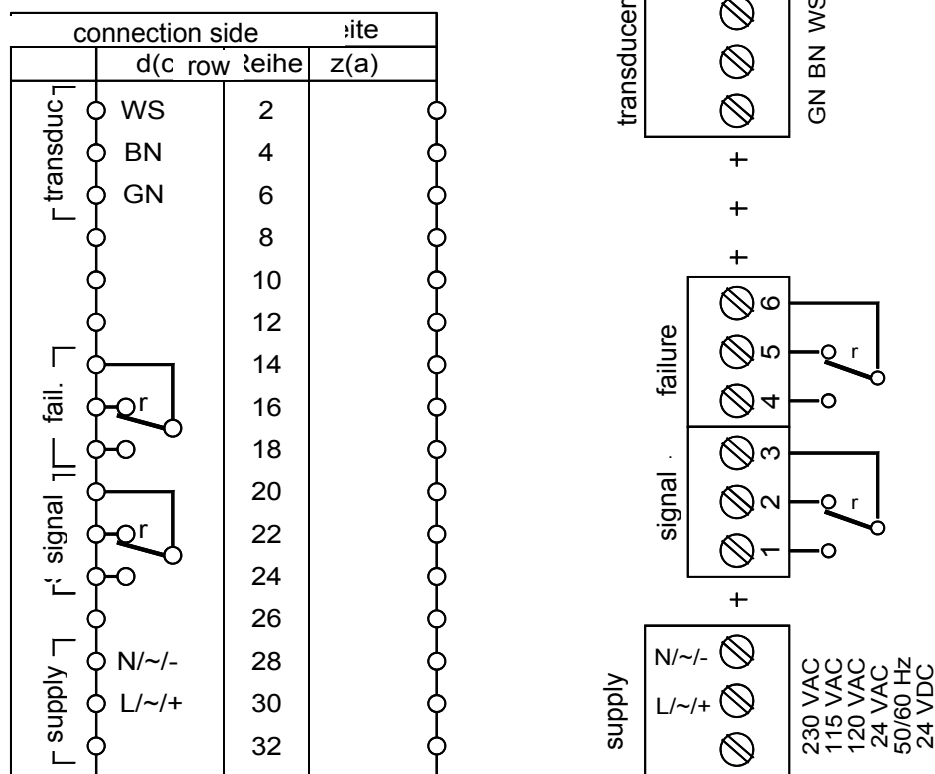


Fig. 18

Earthing type OPTO.06XX

Earth can be connected at the internal earthing screw (is not necessary for intrinsic safe) or the connection is carried out via the metallic contact of the screwing thread with the container.

3.3.3 Electrical Connection Amplifier



19" card, male plug acc. to DIN 41612

plastic housing, screw terminals

Fig. 19

At cards with male connector acc. to DIN 41612 D the contact row a corresponds to z of the type F and row c corresponds to d.

3.4 Connection supply

Whether the existing supply voltage agrees with the voltage version of the amplifier should be checked first. This is obvious from the marking on the circuit board.

230 V ~	OPTO.250Y.1X
115/120 V ~	OPTO.250Y.2X
24 V ~	OPTO.250Y.3X
24 V =	OPTO.250Y.4X
24 V = without isolation	OPTO.250Y.7X

At the version built in a plastic housing the line terminals "supply" is marked with the operating voltage in addition and it is the connection to see directly from the imprint. The connection is carried out in accordance with fig. 17. The connections of the plug-in card are as follows:

d 28 (c28) = N (-)
d 30 (c30) = L (+)

3.5 Connection relays

The signals "signal" and "failure" are provided for per a relay with change over contacts. These are potential-free and can be used for every arbitrary application. The connections can be seen directly from the imprint on the pboard.

Connections:

failure	signal	contact
4 / d18	1 / d24	NO
5 / d16	2 / d22	NC
6 / d14	3 / d20	root

Tab. 3

3.6 Function control

After wiring been carried out and checked the supply can be switched on. One of the green LED's should come on now. By pressing the button "test" at closed switch S2 (time delay turned off) one of the two green LED shines approx. 1 s. After this the other green LED is flashing as long as the test button remains pressed. This shows that wiring and switch amplifiers are all right. If this should not be the case, the justage instructions chapter 4.2 first following. If this should not lead to success, see trouble shooting chapter 7.

4. OPERATION

4.1 Setting of fail-safe direction with switch S1

Switch S1 is a wire-hook switch which may be shortened by soldering or permanent opened by cutting the switch wire.

- High alarm (H): - S1 open,
 - Signal relay released if sensor tip is immersed
- Low alarm (L): - S1 closed
 - Signal relay released if sensor tip is dry
- Factory setting: - S1 open

Table operating status, switch direction S1, LED reaction, relay reaction

operating status \	S1	green LED wet	green LED dry	signal relay
immersed (sensor tip in medium with higher refractive index)	open H high alarm	flashing	off	released
	closed L low alarm	permanent on	off	energized
dry (sensor tip in medium with lower refractive index)	open H high alarm	off	permanent on	energized
	closed L low alarm	off	flashing	released

Tab. 4

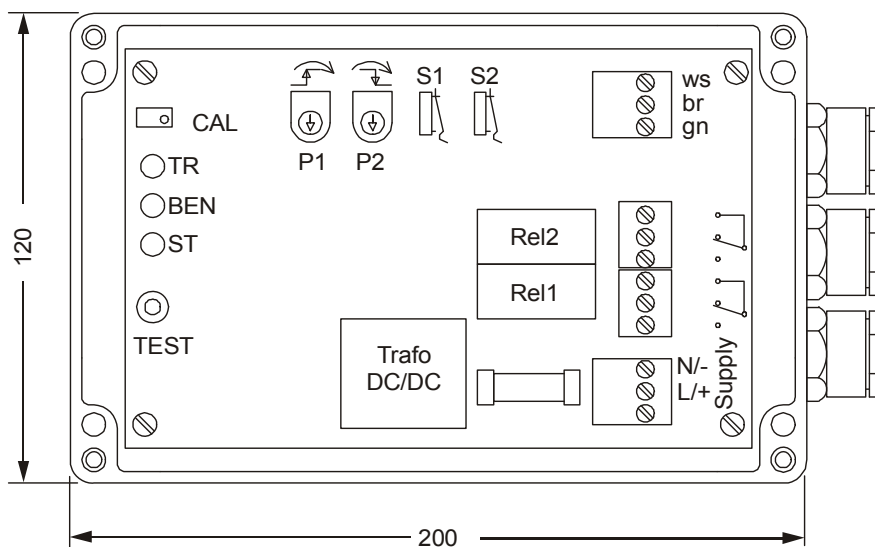


Abb. 20

4.2 Calibration with CAL

This is only required at the first putting into operation or after the wiring to compensate for all variable influences of the measuring equipment.

Calibrate only when the sensor tip is in the medium with higher refractive index, e. g.:

- level limit: liquid / gas = calibrate when sensor tip is in the liquid
- interface e. g.: water / oil = calibrate when sensor tip is in oil

The photo transistor voltage can be measured between "GN" and "WS" of the transducer connection with a voltage instrument ($R_i \geq 10 \text{ M}\Omega$, measurement range 10 V=).

	voltage between GN / WS [V]	
	dry ¹⁾	immersed
level limit (conical tip)	0,2 - 1,0 ²⁾	4,5 - 6 ³⁾

1) do not adjust, only check this value

2) 0.2 V at short measuring lengths and clean conical tip, up to 1.0 V at larger measuring lengths and dirty conical tip.

3) adjust this value in the immersed condition only, the switching quality of the system

1. sensor/amplifier can be influenced by variation of this value:

- ca. 4,5 V = less drop sensitive, foam insensitive
- ca. 5,0 V = normal low viscous, clean application, no influence of temperature- fluctuations of the medium up to ± 25 degrees Celsius
- ca. 5,5 V = at strong temperature fluctuations of the medium up to ± 40 degrees Celsius
- ca. 6,0 V = detektion of condensation, foam (must have stable, reproducibile qualitiy)

Tab. 5

	voltage between GN / WS [V]	
	medium with lower refractive index ¹⁾	medium with higher refractive index
interface (spheric shape)	0,2 - 3,0 ²⁾	4,5 - 6 ³⁾

- 1) do not adjust, only check this value
- 2) the tension takes off two media and at this measuring of the refractive index difference can therefore vary strongly.
- 3) adjust this value only when the sensor tip is immersed from the medium with higher refractive index. The switching quality of the system sensor/amplifier can be influenced by variation of this value.

To get a stable measuring it should be tried to adjust a difference as big as possible between these two values.

Tab. 6

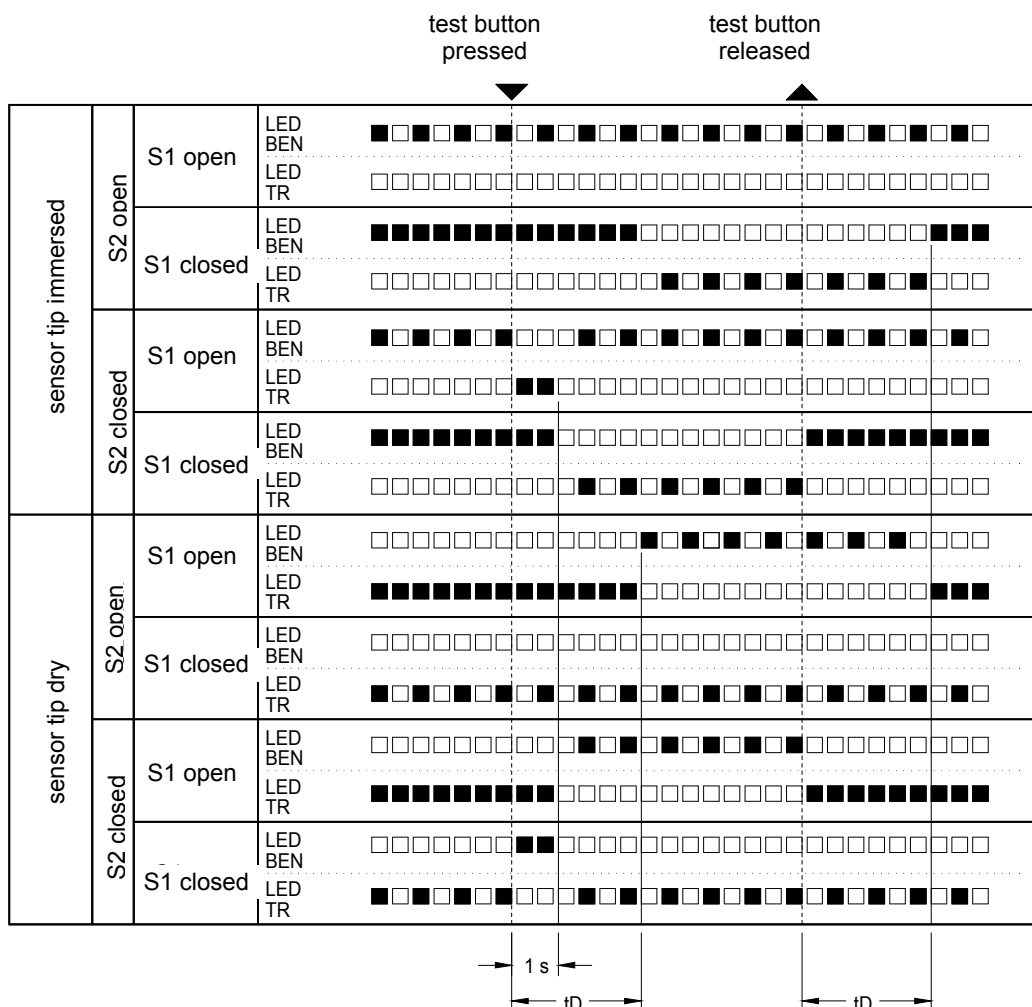
4.3 Justage of time delay

The switch S2 is a wire-hook switch and is to or switch off the delay of the signal relay which separated is adjustable for relay energize and release, e.g. at restless surface or strong fumigations or formations of bubbles in the liquid.

- No time delay: - close S2 or shorten by soldering
- With time delay: - time to energize relay ($_ \uparrow$)
with P1 as required (0-8 s) adjust
- release time ($\downarrow _$)
with P1 as required (0-8 s) adjust
- Factory settings: - S2 open, P1 and P2 middle position (ca. 3 - 4 s)

4.4 TEST-Procedure

Test expiry when pressing the test button:



Legend: BEN = immersed TR = dry tD = delay time to adjust with P1 and P2

- = LED off
- = LED flashes
- = LED permanent on

Fig. 21

Conditions:

- P1 and P2 middle position, ca. 3 - 4 s time delay if P2 is open
- transducer correct connected and in function
- no failure present

The time delay is, with S2 open, = switched on, must sufficiently be pushed for a long time the button so that the complete test can go off. No test can go off, the alarm was already entitled taken there is with S1 open, S2 open and sensor tip immersed. The same applies S1 closed, S2 open and sensor tip dry. Failure, LED red and a green one flashes, can go off no test at.

The test function makes possible a checking the measuring chain switch amplifier separately and e.g. post-connected signal amplifier, signaling devices, control devices or a correction device at a connected and operating transducer and a reliable information gives about the proper function of the circuit board.

4.5 Operating characteristics relay signal

See Tab. 4.

4.6 Operating characteristics relay failure

Das Relais STÖRUNG ist im Normal-Betrieb angezogen und fällt unter folgenden Bedingungen ab (fail-safe-Verhalten):

The relay failure is energized in the normal operation and releases under the following conditions (fail safe behavior):

- the supply voltage breaks down (≥ 100 ms)
- the internal supply voltage for the intrinsic safe circuit breaks down
- short circuit (BR-WS) or interruption to IR-LED (BR)
- short circuit (GN-WS) or interruption to phototransistor (GN)

Behavior of the LED's see Tab. 4.

5. MAINTENANCE

Im Regelfall ist der Optoelektronische Grenzwertgeber wartungsfrei. Ist in der Anlage jedoch mit stärkerer Verschmutzung oder Verkrustung zu rechnen, empfiehlt es sich, eine Wartungsanweisung zu erstellen. Diese kann sich evtl. auf eine elektrische Messung der Spannungswerte an GN/WS des Messwandleranschlusses beschränken:

The optoelectronic limit switch is maintenance-free in the rule. Stronger pollution is in the plant, however, recommends himself to make a maintenance instruction. Perhaps this can confine himself to an electrical measuring of the voltage between GN and WS of the transducer:

- immersed (BEN) in the rule 5 V^*
- dry (TRO) in the rule $0,2 - 1 \text{ V}^*$

*) see Tab. 5 + 6.

If the values adjusted at the putting into operation do not adapt, the condition of the glass tip should be checked. At pollution clean. Transducer send in at broken glass for the repair at the manufacturer (**Caution! Into original packing**)

6. GUARANTEE

We grant a guarantee period from 24 months on our products. Condition is the proper treatment and the use as agreed according to the operation instructions. The guarantee confines itself to material and construction faults at wear and spare parts.

The manufacturer takes on the responsibility about the execution as agreed in accordance with customer details. The customer takes on the responsibility about the assembly as agreed and use.

7. Disposal

The customer/enduser is obliged to take care for the disposal within the legal regulations.

8. REPAIR

Spare parts recommended exclusively by us have to be used to the maintenance. Repairs must be coordinated in writing with us since otherwise our guarantee and responsibility goes out.

8.1 Repair Transducer

A repair of the transducer from operator side is not scheduled. If the operator liked to carry out a repair on own responsibility, he has to seek the consent of the manufacturer absolutely.

8.2 Replacing fuse of amplifier

- Switch net supply off.
- Taking fuse out. Use a new fuse only with the value printed on the circuit board.

Supply	OPTO.250Y.XX
230 VAC	T 50 mA
115/120 VAC	T 100 mA
24 VAC	T 400 mA
24 VDC with Potential separation	see marking on PCB
24 VDC without Potential separation	T 400 mA

Tab. 7

- Switch net supply on.

8.3 Miscellaneous

Complete electronics is maintenance-free at use as agreed. If a defect should appear, the repair must be carried out at the manufacturer or of the operator with inspection control by a work expert in the case of a Ex device.



Ordering spare parts

At spare part orders absolutely exact type, series no. and commission no. the manufacturer indicate.

9. TROUBLE SHOOTING

FAILURE	POSSIBLE REASON	REMEDY
no function	Power supply been cancelled	Measure mains voltage, check fuse, check terminal screws (not soldering ends of the cable)
Flashing of the red and a green LED	transducer not connected Cable interrupted to the transducer Cable short-circuited to the transducer Cal. P3 adjusted too far about switching threshold	transducer connect up Connections and cables check Connections and cables check Adjusting in accordance with instructions 4.2
LED changes, signal relay changes, however no reaction of the outer circuit	Contacts of the RelaisREL 1 do not close/open	measure Relay contacts
The signal relay switches none over despite level change	P3 adjusted wrongly, (under switching point) transducer faulty (mechanical defects) (electrical defects) Glass tip facing too near at opposite surface	Justage acc. to manual 4.2 Carrying out circuit board test. Circuit board test faultless, glass top on damage or dirt approach search, clean or exchange if under change transducer see chapter 3.1.
Equipment reacts invers	S1 in a wrong position	S1 change position
Equipment reacts apparently not or too slowly to level change	S2 open, P1, P2 on the right stop, delay on	S2 close or P1, P2 turn aniti-clockwise or wait until delay time has passed
Test button no reaction	S2 open, P1, P2 on the right stop, delay on	S2 close or P1, P2 on the left stop shift and leave S2 open. Pressing test button so long till the delay time has passed

Tab. 8

10. TECHNICAL DATA

10.1 Transducer

10.1.1 One-piece transducer

	Unit	OPTO.....0032	OPTO.....0042
Repeatability			
- level (conical tip)	mm	±0,5	±0,5
- refractive index (U-shape)	R.I.	±0,01	±0,01
Temperature			
- medium	°C	-30...+95 ¹⁾	-60...+250
- ambient	°C	-25...+95	-25...+95
P_{proc}	MPa/bar	0-5/0-50 ¹⁾	0-0,5/0-5
Measuring length			
- standard	mm	18-49	50
- maximal	mm	2050	500
Mechanical conn.			
- standard		pipe Ø12 for union G ½ A	glass plug KF, NS or acc. to customer's spec.
Material			
- sensor housing		1.4571	quartz glass
- sensor tip see Fig. 12, Fig. 13		quartz	quartz glass
- sealing		graphite	quartz glass
Weight	kg	0,1 +5g/cm elongation	0,1 +1,3g/cm elongation
Electr. connection		3 m PVC cable 3x0,14 mm ² or 4 pole plug	3 m PVC cable 3x0,14 mm ² or 4 pole plug
Cable outlet		safety against buckling	safety against buckling
Ingress protection acc. to EN 60529		IP 67	IP 67
Switch amplifier		type OPTO.0250/.250Y.XX	type OPTO.0250//.250Y.XX

1) special version on demand

Tab. 9

10.1.2 Multipart transducer

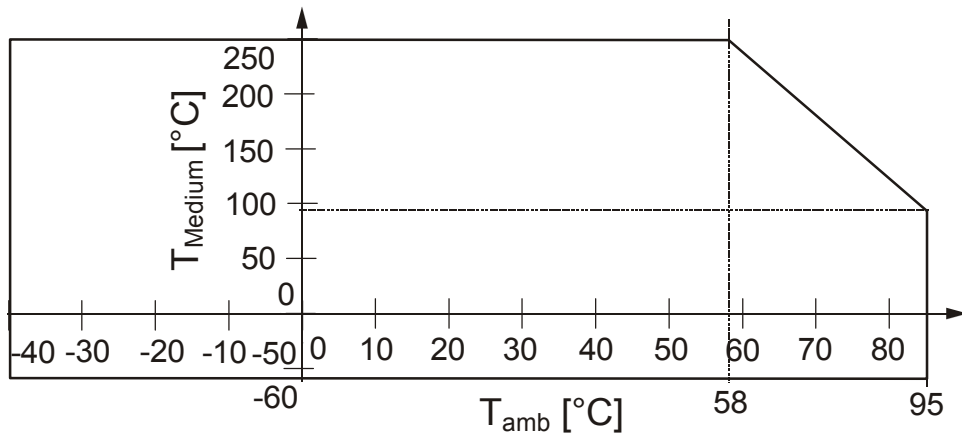
	Unit	OPTO.....0660 OPTO.....0680	OPTO.....0669 OPTO.....0689
Repeatability - level (conical tip) - refractive index (U-shape)	mm R.I.	$\pm 0,5$ $\pm 0,02$	$\pm 0,5$ $\pm 0,03$
Temperature - medium - ambient	$^{\circ}\text{C}$ $^{\circ}\text{C}$	-60...+250 -40...+95 T6: +60 $^{\circ}\text{C}$ T5: +75 $^{\circ}\text{C}$	-269...+400 ²⁾ -40...+95 T6: +60 $^{\circ}\text{C}$ T5: +75 $^{\circ}\text{C}$
P_{proc}	MPa/bar	0-25/0-250 ¹⁾	0-25/0-250 ¹⁾
Measuring length - standard - max.	mm mm	25 960	25 960
Mechanical conn. - standard - other ⁷⁾		G ½ A to customer's spec.	G ½ A to customer's spec.
Material - sensor housing ⁸⁾ - sensor body - dissipator - glass tip		1.4571... ⁸⁾ ~1.4301 ~1.4301 cladded core glass, quartz, sapphire	1.4571... ⁸⁾ ~1.4301 ~1.4301 cladded core glass, quartz, sapphire
Weight	kg	0,77 +9,3g/cm elongation	1,07 +9,3g/cm elongation
electrical conn.		screw terminals with wire protection 2,5 mm ²	screw terminals with wire protection 2,5 mm ²
Cable outlet		M20X1,5 for Ex light blue	M20X1,5 for Ex light blue
Ingress protect. acc. to EN 60529		IP 65	IP 65
Certificates		II 1/2 G Ex ib op is IIC T6/T5 ³⁾	II 1/2 G Ex ib op is IIC T6/T5 ³⁾
Switch amplifier		type OPTO.250Y.XX ⁶⁾	type OPTO.250Y.XX ⁶⁾

Tab. 10

- 1) spezial designs differing (up to 500 bar)
 2) Noticing derating diagram Fig.22
 3) II 1/2 G Ex ib op is IIC T6, T5
 ZELM 06 ATEX 0299

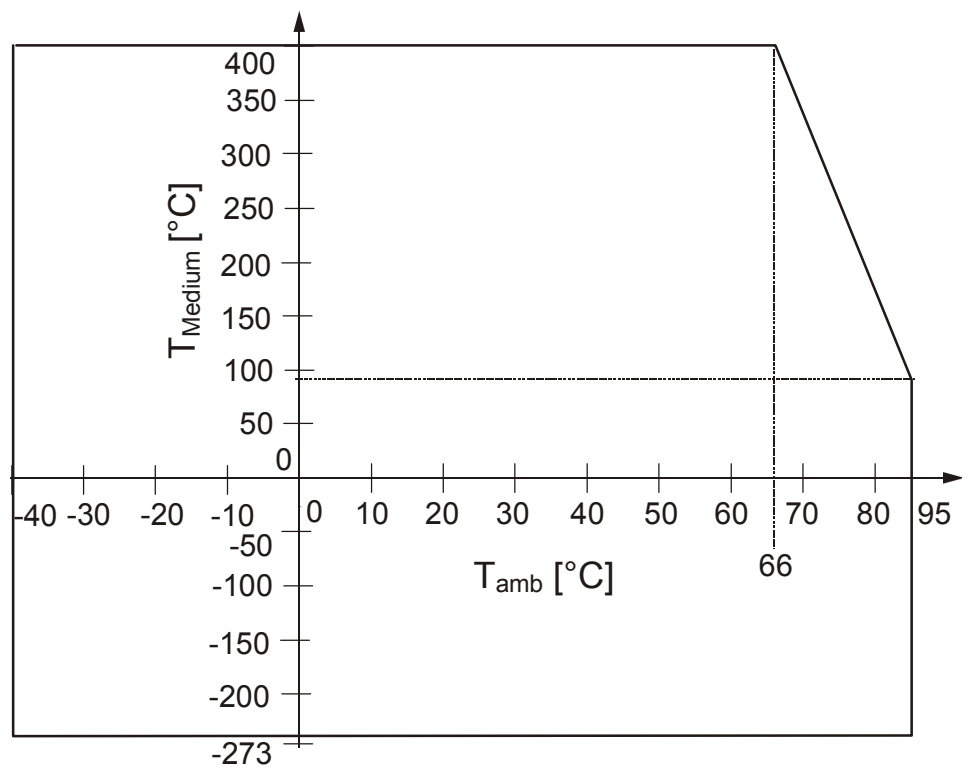
- 6) The certificates are valid only in connection with the switch amplifier mentioned above with the certificate no.
 II (2) G [Ex ib] IIC ZELM 06 ATEX 0300
 7) e. g. flanges acc. to DIN, ANSI, ..., also with leak-proof welding sensor housing/flange
 8) all metallic materials in accordance with customer specification, no light metals, at titanium are to follow the special notes in chapter 3.1

Subject to alterations!



Derating diagramm transducer type OPTO.06X0, without dissipator

Fig. 22



Derating diagramm transducer type OPTO.06X0, with dissipator

Fig. 23

10.2 Amplifier

	Unit	OPTO.2501.XX	OPTO.2502.XX
LED indicators			
- immersed (BEN)		X	X
- dry (TRO)		X	X
- failure (STÖ)		X	X
Functions			
- alarm, BEN or TRO flashes, depends on S1		X	X
- monitoring short-circuit and open-circuit to transducer, Fail-safe, LED failure flashes		X	X
- test button, test of all circuit functions		X	X
- time delay signal relays, energized or released	s	0 - 8	0 - 8
Temperature ambient			
- 19" plug-in card	°C	-25 ... +60	-25 ... +60
- Plastics housing	°C	-40 ... +40	-40 ... +40
Power supply			
- AC-voltage	VAC	230 ±10 %	230 ±10 %
- AC-voltage	VAC	24, 115/120 ±15 %	24, 115/120 ±15 %
- DC-voltage	VDC	24 ±25%	24 ±25%
Power consumption	VA	2,8	2,8
Output			
- signal, relay, 1 x SPDT	V/A/VA	250/3/100	250/3/100
	V/A/W	40/2/100	40/2/100
- failure, relay, 1 x SPDT	V/A/VA	250/3/100	250/3/100
	V/A/W	40/2/100	40/2/100
Plastics housing			
- housing H x B x T	mm	200 x 120 x 75	200 x 120 x 75
- cable inlet		3 x M20x1,5	2 x M20x1,5 1 x M20x1,5 blue
- electrical connection		screw terminals with wire protection 2,5 mm ²	screw terminals with wire protection 2,5 mm ²
- ingress protect. acc. to EN 60529		IP 65	IP 65
- weight	kg	0,6	0,73
19" plug-in card			
- printed circuit board	mm	160 x 100	160 x 100
- front plate		3HE, 8TE	3HE, 8TE
- connector male plug		DIN 41612 form F (z, d) oder form D (a, c)	DIN 41612 form F (z, d) oder form D (a, c) with coding, use only in housing with IP 20
- ingress protection acc. to EN 60529		-	-
- weight	kg	0,31	0,36
Certificates			
Ex		- -	II (2) G [Ex ib] IIC ZELM 06 ATEX 0300

Subject to alterations!

Tab. 11

11. SELECTION CODE

11.1 Type OPTO.0032 one-piece transducer

T_{proc} -30 bis +95 °C

P_{proc} 0 ... 5 MPa (0 ... 50 bar)

OPTO . 0032 X X X X

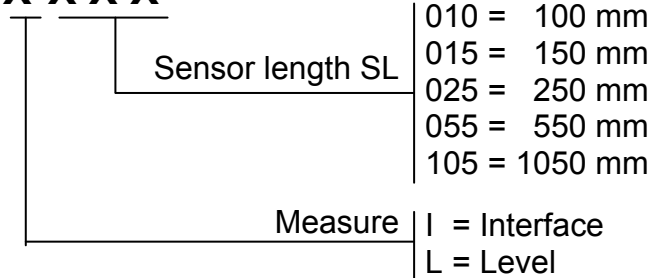


Fig. 24

Level (conical tip)

Sensor length SL [mm]	Type / Ordering-no.
100	OPTO0032L010
150	OPTO0032L015
250	OPTO0032L025
550	OPTO0032L055
1050	OPTO0032L105

Interface (U-tip)

Sensor length SL [mm]	Type / Ordering-no.
100	OPTO0032I010
150	OPTO0032I015
250	OPTO0032I025
550	OPTO0032I055
1050	OPTO0032I105

Tab. 12

11.2 Type OPTO.0042 completely made of glass, one-piece transducer

T_{proc} -60...+250 °C

P_{proc} 0...1 MPa (0...10 bar)

OPTO. 0042 X V A R

Measure | I = Interface
| L = Level

Selection key:

X X X X

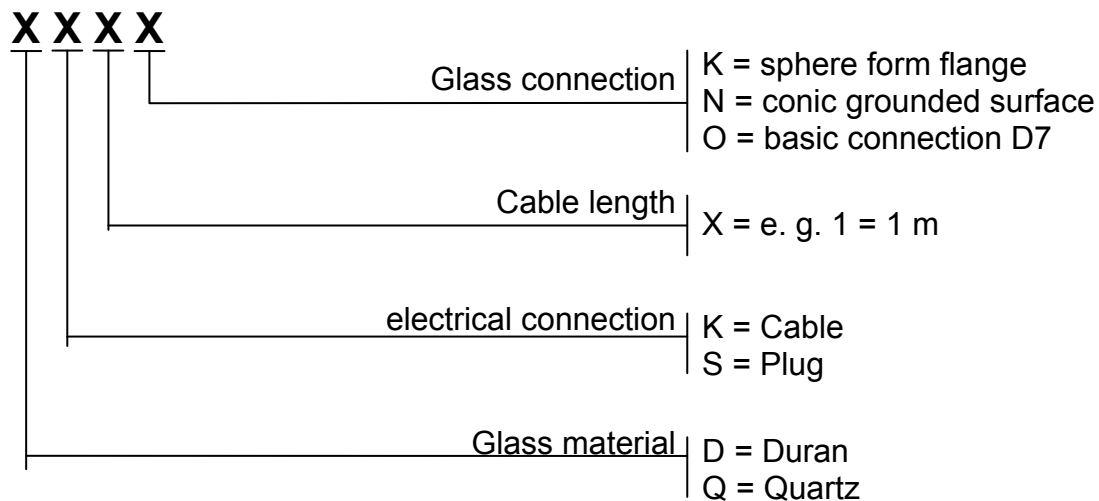


Fig. 25

Level (conical shape)

Measuring length ML [mm]	Type / Ordering-No.
50 - 250 (Duran)	OPTO0042LVAR
50 - 500 (Quartz)	OPTO0042LVAR

Interface (U-shape)

Measuring length ML [mm]	Type / Ordering-No.
50 - 250 (Duran)	OPTO0042IVAR
50 - 500 (Quartz)	OPTO0042IVAR

Tab. 13

11.3 Type OPTO...06XX multi-part transducer

T_{proc} without dissipator -60...+250 °C

T_{proc} with dissipator -269...+400 °C

P_{proc} 0...25 MPa (250 bar)

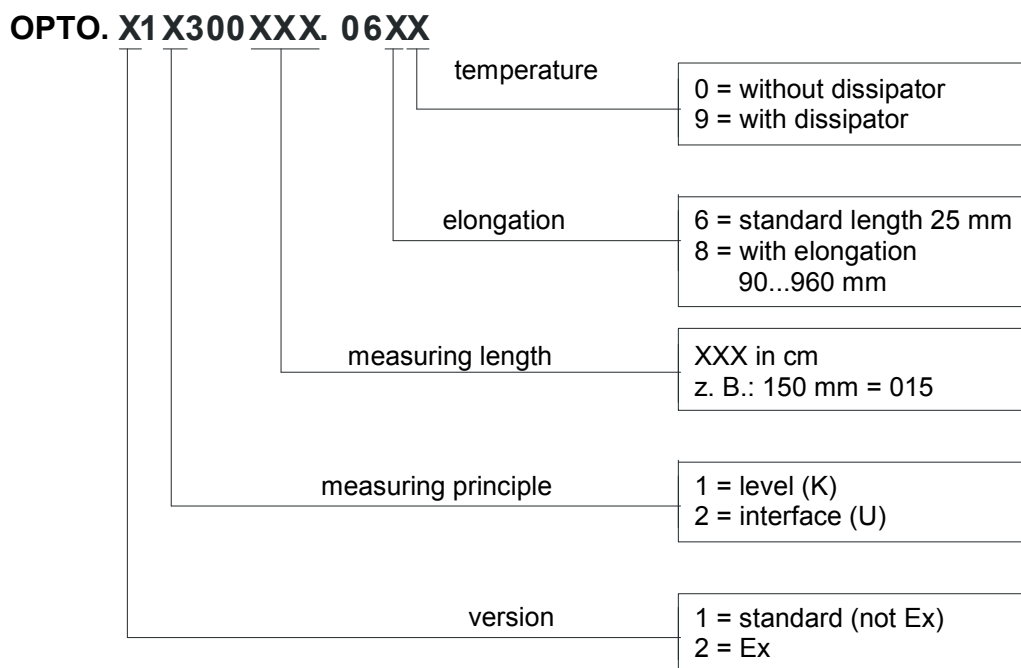


Fig. 26

Level (conical shape), Standard (not Ex)

Measuring length ML [mm]	Type
25	OPTO.111300000.0660
50	OPTO.111300005.0680
60	OPTO.111300006.0680
80	OPTO.111300008.0680
90	OPTO.111300009.0680
100	OPTO.111300010.0680
120	OPTO.111300012.0680
150	OPTO.111300015.0680
200	OPTO.111300020.0680
300	OPTO.111300030.0680
600	OPTO.111300060.0680
800	OPTO.111300080.0680

Level (conical shape), Ex

Measuring length ML [mm]	Type
25	OPTO.211300000.0660
50	OPTO.211300005.0680
60	OPTO.211300006.0680
80	OPTO.211300008.0680
90	OPTO.211300009.0680
100	OPTO.211300010.0680
120	OPTO.211300012.0680
150	OPTO.211300015.0680
200	OPTO.211300020.0680
300	OPTO.211300030.0680
600	OPTO.211300060.0680
800	OPTO.211300080.0680

Interface (U-shape), Standard (Not Ex)

Measuring length ML [mm]	Type
25	OPTO.112300000.0660
50	OPTO.112300005.0680
60	OPTO.112300006.0680
80	OPTO.112300008.0680
90	OPTO.112300009.0680
100	OPTO.112300010.0680
120	OPTO.112300012.0680
150	OPTO.112300015.0680
200	OPTO.112300020.0680
300	OPTO.112300030.0680
600	OPTO.112300060.0680
800	OPTO.112300080.0680

Interface (U-shape), Ex

Measuring length ML [mm]	Type
25	OPTO.212300000.0660
50	OPTO.212300005.0680
60	OPTO.212300006.0680
80	OPTO.212300008.0680
90	OPTO.212300009.0680
100	OPTO.212300010.0680
120	OPTO.212300012.0680
150	OPTO.212300015.0680
200	OPTO.212300020.0680
300	OPTO.212300030.0680
600	OPTO.212300060.0680
800	OPTO.212300080.0680

Tab. 14

Material and length variable types, level, conical tip, standard

ML [mm]	Material	Type
25	variable	OPTO.111300000.0660
XXX	1.4571	OPTO.111300XXX.0680
XXX	variabel	OPTO.111300XXX.0680

Material and length variable types, interface, U-shape, standard

ML [mm]	Material	Type
25	variable	OPTO.112300000.0660
XXX	1.4571	OPTO.112300XXX.0680
XXX	variabel	OPTO.112300XXX.0680

Material and length variable types, level, conical tip, Ex

ML [mm]	Material	Type
25	variable	OPTO.211300000.0660
XXX	1.4571	OPTO.211300XXX.0680
XXX	variabel	OPTO.211300XXX.0680

Material and length variable types, interface, U-shape, Ex

ML [mm]	Material	Type
25	variable	OPTO.212300000.0660
XXX	1.4571	OPTO.212300XXX.0680
XXX	variabel	OPTO.212300XXX.0680

Tab. 15

11.4 Type OPTO.250Y.XX Amplifier

OPTO . 2 5 0 Y . X X

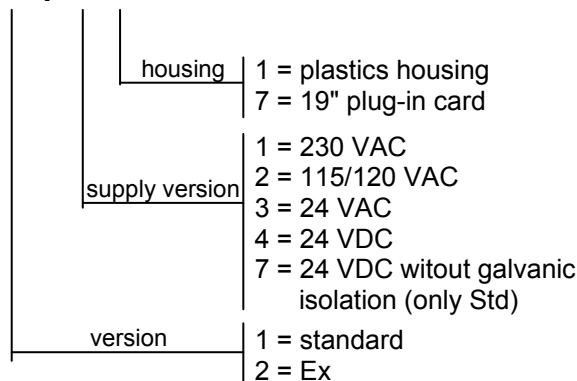


Fig. 27

Plastics housing, standard (not Ex)

Supply	Type/Ordering-no.
230 V AC	OPTO.2501.11
115/120 V AC	OPTO.2501.21
24 V AC	OPTO.2501.31
24 V DC with galvanic isolation	OPTO.2501.41
24 V DC without galvanic isolation	OPTO.2501.71

Plastics housing, Ex

Supply	Type/Ordering-no.
230 V AC	OPTO.2502.11
115/120 V AC	OPTO.2502.21
24 V AC	OPTO.2502.31
24 V DC with galvanic isolation	OPTO.2502.41

19" plug-in card, standard (not Ex)

Supply	Type/Ordering-no.
230 V AC	OPTO.2501.17
115/120 V AC	OPTO.2501.27
24 V AC	OPTO.2501.37
24 V DC with galvanic isolation	OPTO.2501.47
24 V DC without galvanic isolation	OPTO.2501.77

19" plug-in card, Ex

Supply	Type/Ordering-no.
230 V AC	OPTO.2502.17
115/120 V AC	OPTO.2502.27
24 V AC	OPTO.2502.37
24 V DC with galvanic isolation	OPTO.2502.47

Tab. 16

12 Safety Manual

Functional safety acc. to IEC 61508 / IEC 61511

Optoelectronic Limit Switch type OPTO.06XX in connection with Amplifier type OPTO.250Y.

12.1 General

12.1.1 Validity

This safety manual applies to Optoelectronic Limit Switch type OPTO.06XX in connection with Amplifier type OPTO.250Y, called “measuring system”.

Application range

The measuring system can be used for the following functions which meet the specific requirements of the safety technology:

- overflow protection
- dry run protection
- detection of an individual level

The functions can be also used simultaneously.

The functions can be used in the mode of operation with low demand mode as well as in the mode of operation with high demand or continuous mode.

The measuring system is qualified in all modes to meet the requirement degree SIL1 acc. to IEC 61508-2 / IEC 61511-1.

The lifetime of the measuring system for the use in safety applications is outlined for 10 years.

In safety-related systems with an architecture 1oo2D and the requirement SIL2, the measuring system must be combined with a comparator chain, so the complete measuring system fulfills in the mode of operation with low demand mode

$$PFD = PFD_{CH1} \cdot PFD_{CH2} + CC$$

$$PDF < 10^{-2}$$

The safety-related characteristics must be calculated separately.

11.1.2 Relevant standards

IEC 61508 Part 1, 2, 4

Functional safety of electrical / electronic / programmable electronic systems

IEC 61511-1

Functional safety - safety instrumented systems for the process industry sector - Part 1: Framework, definitions, system, hardware and software requirements

12.1.3 Determination of safety-related characteristics

The failure limit values for a safety function, depending on the SIL class.

Safety integrity level	Low demand mode	High demand or continuous mode level
SIL	PFD _{avg}	PFH
1	□ 10 ⁻² bis <10 ⁻¹	□ 10 ⁻⁶ bis <10 ⁻⁵

from IEC 61508, part 1/7.6.2)

Safety integrity of the hardware:

Limitations due to the architecture for safety-related subsystems of type B

Safe failure fraction SFF	Hardware fault tolerance HFT	
	0	1(0) ¹⁾
<60 %	nicht erlaubt	SIL1
60 % bis <90 %	SIL1	SIL2

1) Acc. to IEC 61511-1, paragraph 11.4.4 the fault tolerance specified acc. to the above chart can be reduced by one for all subsystems if the following conditions are met:

- instrument has proven during operation
- the safety function needs less than SIL 4

12.2 Planning

12.2.1 Low demand mode

If the demand rate is only once a year, then the measuring system can be used as safety relevant subsystem in „low demand mode“ (see IEC 61508-4, 3.5.12).

Corresponding characteristics : PFDavg (average probability of dangerous failure on demand).

It is dependent on the test interval TProof between the function tests of the protective function.

12.2.2 High demand or continuous mode

If the demand rate is more than once a year, the measuring system must be used as safety relevant subsystem in „high demand or continuous mode“ (see IEC 61508-4, 3.5.12).

Corresponding characteristics: PFH (probability of a dangerous failure per hour)

12.2.3 General

Definition of a dangerous undetected failure:

- the instrument does not react to the demand of the process

Otherwise the tolerance data in the operating instructions manual are applicable. Make sure

that the measuring system is used as it was intended for the application (see operating instructions

manual). The application-specific limits must be complied with and the specifications must not be exceeded (see operating instructions manual).

12.3 Set-up

12.3.1 Mounting and installation

The prevailing plant conditions influence the safety of the measuring system. Therefore note

the mounting and installation instructions of the appropriate operating instructions manual and references in this Safety manual chapter 2.3.1 mounting and installation. Therefore the assembly and installation hint are to be considered according to the operating instructions, in particular the safety references in chapters 3., 3.1 und 3.3. To absolutely avoid for a safe function are:

- Alignment of the measuring system with first start-up and exchange of the transducer or the amplifier (see manual)
- Examination of the complete function by dive in / out-dip or if not possible through pressing the test key (see manual)
- Examination on perfect condition of the glass tip (cleanly, not damaged)
- lateral load of the measuring body avoid (possibly attach mechanical protection)
- attach deflecting plate from glass tip with high flow rates and particles
- if with the transducer a transport lock is attached in case of heavy flange, remove only briefly before the installation the transport lock
- include measuring system after mounting into the pressure test also
- Operation only by experienced operators

12.4 Reaction during operation and in case of failure

In case of detected failures or fault signals, the entire measuring system must be switched out

of service and the process held in a safe condition by means of other measures.

12.5 Recurring function test

The recurring function test serves to reveal potential dangerous errors that are otherwise not discernible.

The function of the measuring system must be checked at adequate intervals. The operator is responsible for choosing the type of test and the intervals in the stated time frame.

The time intervals depend upon the applied PFDavg value acc. to the chart and diagram in the paragraph „Safety-related characteristics“.

The test must be carried out in a ways that verifies the flawless operation of the safety functions in conjunction with all system components. This is ensured by a controlled reaching of the response height during a filling.

If the function test proves negative, the entire measuring system must be switched out of service and the process held in a safe condition by means of other measures.

12.5.1 Safety-related characteristics

Architecture 1001D	SIL 1
HFT	0
SFF	>60 %
PFD _{avg} ¹⁾	<0,10 · 10 ⁻² at T _{proof} = 1 year ²⁾ <0,50 · 10 ⁻² at T _{proof} = 5 years
PFH [1/h]	<2 · 10 ⁻⁶

¹⁾ PFD_{avg} this value correlates almost linearly to the operating time. It is only valid for the corresponding selection circuit.

²⁾ T_{proof} is the interval after which a periodically recurring complete function test (to check the safety function) must be carried out.

REV. 02-03-2012

