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PA/3W and PAH/3W

Capacitive level gauge

INSTALLATION AND OPERATING INSTRUCTIONS

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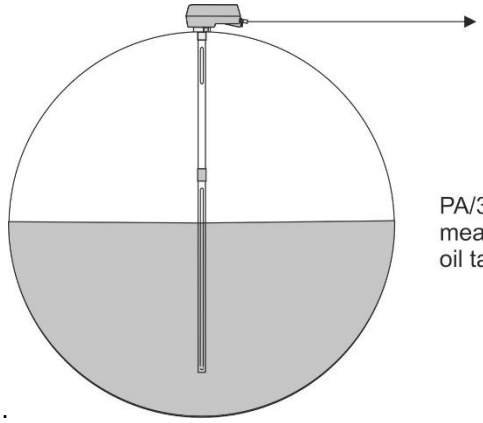
1 GENERAL

The tubular probes are used for liquid level measurement. Medium to be measured may be e.g. light oil, petrol, solvents, alcohol, acids and water. Probe materials are acid-proof AISI 316 steel and FEP for the PAH/3W probe and ordinary steel and FEP for the PA/3W probe.

The measurement is based on the variation of the probe's capacitance as a function of liquid level.

When ordering, please specify probe length L and medium to be measured. The probe is supplied in parts to be cut and mounted to desired size during installation. The probe is apparatus of equipment group II, category 1 G and can be installed in Zone 0/1/2 hazardous area.

Application examples:



PA/3W sensor used for level measurement in a heating oil tank

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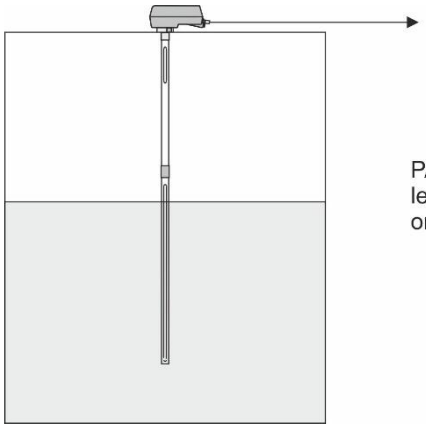


PAH/3W sensor used for level measurement in a water or chemical storage tank

2 ASSEMBLY AND INSTALLATION

2.1 Parts of the probe

The probe is supplied in pieces to be assembled according to Fig. 1. The delivery contains the transmitter A, the required number of probe tube pieces B of 1 m length, probe tube piece C and the measuring cable D. The locking details E and G as well as the retaining spring F which are used for fixing the measuring cable have been fixed on to the probe tube C for the period of transport.

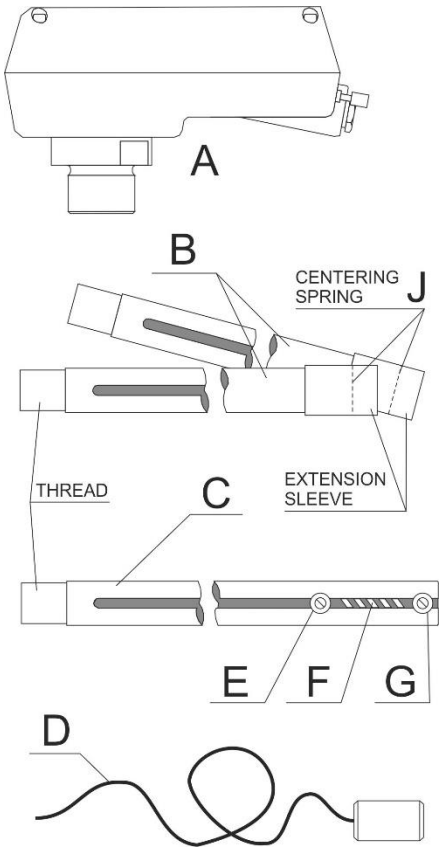


Fig. 1. *Parts of the probe*

2.2 Probe length

The probe's length L (Fig. 2) refers to the distance from the end of the probe tube to the sealing surface of the transmitter.

The measuring range begins about 55 mm from the low end of the probe tube.

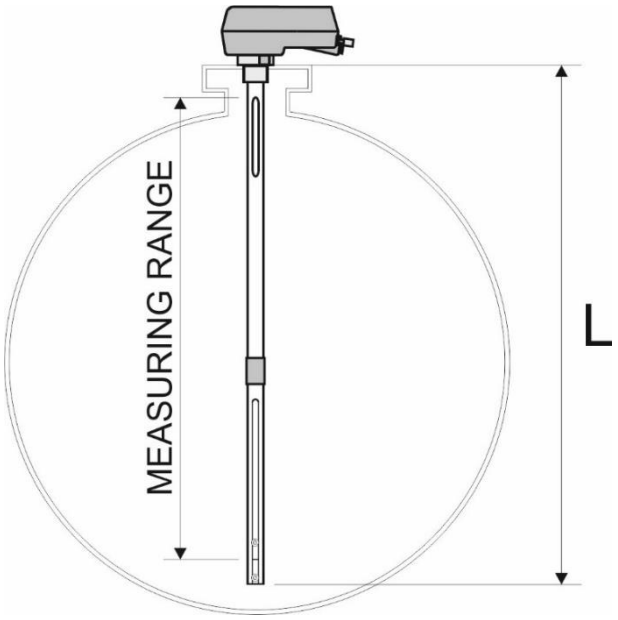


***Fig. 2**. Probe length*

The probe length L is determined on the basis of the target environment; the probe tube must fit in the tank. If there is risk of sludge and condensing water disturbing the measurement then some distance must be left between the bottom of the tank and the lower limit of the probe's measuring range; the distances required for vertical and cylindrical tanks are at least 5 % and 10 % of tank height, respectively.

The probe tube is supplied in 1 m pieces B and C. On installation, the desired length is obtained by shortening the lowermost probe tube C. The length of tube C is obtained by subtracting 10 mm from the probe length L and omitting any full metres. The length must, however, be at least 100 mm so that the probe cable can be fastened on to the lower end of the tube with its locking details.

Example. Cylindrical tank:

- diameter 1750 mm

- distance from sealing surface to tank bottom 1850 mm

When a distance of 10 % of the tank diameter (175 mm) is desired between the tank bottom and the probe's measuring range and when this range begins 55 mm from the probe tube end, the probe length L will be:

L = 1850 mm - 175 mm + 55 mm = 1730 mm

With a delivery including one 1 m probe tube piece B and one probe tube piece C, the length of piece C will be:

1730 mm - 10 mm = 1720 mm -> C is shortened to 720 mm.

The probe can also be supplied in shorter pieces on request if, for example, the space above the tank lid does not allow you to use 1 m pieces.

2.3 Assembly

The probe is assembled outside the tank ready for installation. If, for example, the space available for installation does not allow installing the probe in its full length, it can also be assembled from pieces inside the tank during installation

The probe is assembled as follows:

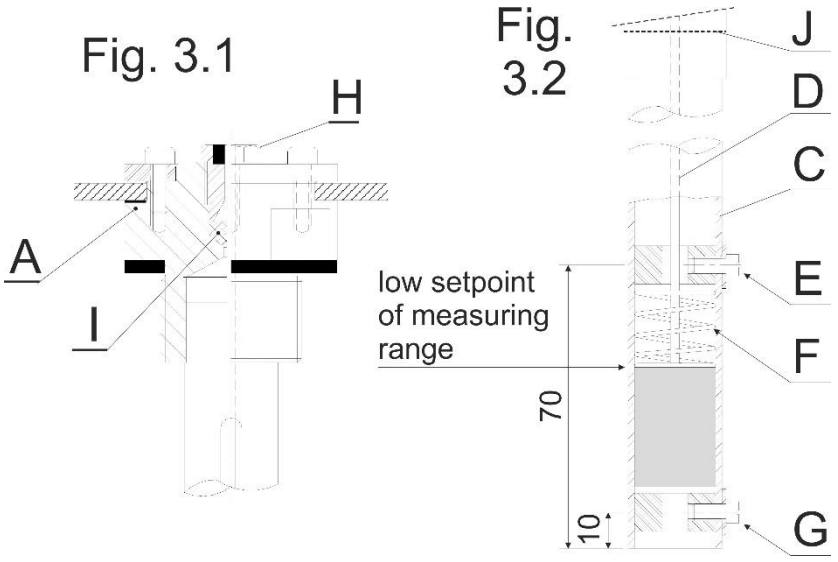


Fig. 3 *Probe assembly*

1. Fix the locking ring E at a distance of 70 mm from the lower edge of the probe tube C (Fig. 3.2).
2. Fit the tension spring F around the measuring cable D (Fig. 3.2).

   NOTE! DO NOT DAMAGE THE INSULATION OF THE MEASURING CABLE!
3. Lead the measuring cable D carefully up through the locking ring E (Fig. 3.2).
4. Fix the locking ring G at a height of 10 mm from the lower end of the probe tube C (Fig. 3.2) to prevent the measuring cable from falling off the tube when mounting the probe.
5. If the probe has B type tubes, lead the measuring cable D carefully through the **centering spring J** at the extension sleeve on the lower part of the next tube and through the tube itself. Connect the tube to the lower one with thread connection and **tighten the connection properly**. Repeat the procedure until all the probe tubes have been connected to one another.
6. Open the lid of the transmitter A, remove the locking nut H of the measuring cable and the sealing gasket I (Fig. 3.1) – **be careful not to damage the interference suppression ring embedded in the nut H!**
7. Lead the measuring cable D up to the transmitter housing (Fig. 4).
8. Turn the upper end of the assembled probe tube stem in the

transmitter and tighten the connection properly.

9. Insert the sealing gasket I back in its place with the round side down (Fig. 3.1).
10. Insert the locking nut H back in its place (Fig. 3.1).
11. Pull the measuring cable tight so that the spring F at the lower end is compressed and at the same time turn the locking nut H tight to retain the probe cable in tension.
12. Cut the measuring cable D to a length of about 8 cm measured from the locking nut H and strip about 1 cm of the insulation in the end of the cable.
13. Connect the stripped end of the measuring cable D to the pole marked Cx in the SENSOR terminal block on the transmitter. Connect the green conductor at the bottom of the housing to the outermost GND pole in the same terminal block (Fig. 4).

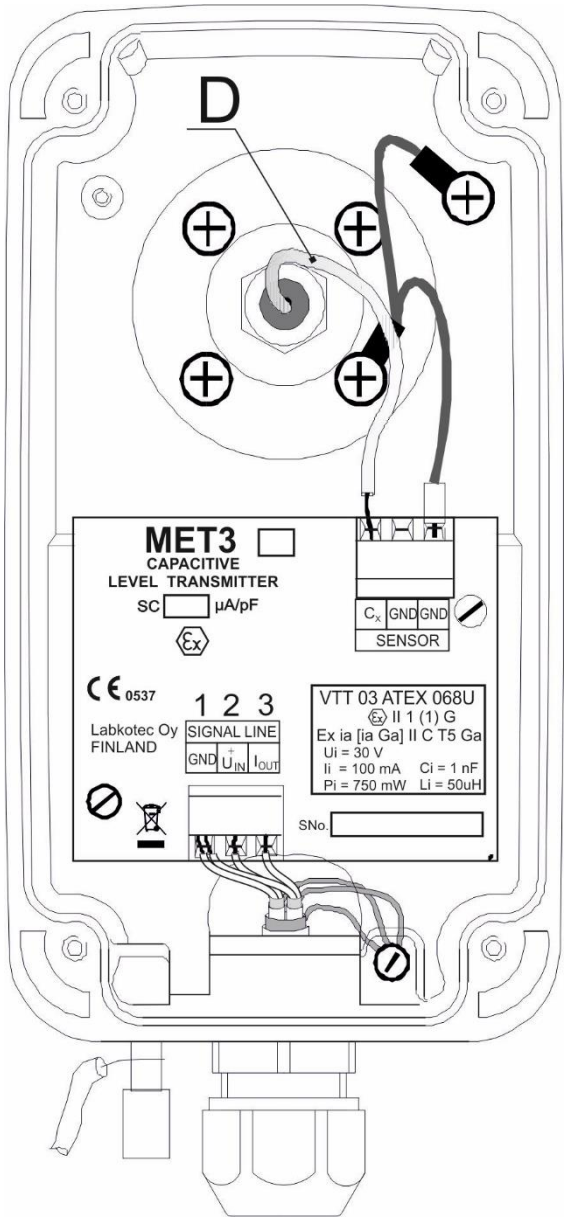


Fig 4. *Transmitter housing with lid removed.*

2.4 Installation

Before mounting the probe in its place, measure the level in the tank for upper limit calibration. If the tank is not empty the adjustment of the lower limit for the measuring range is made in air. It shall be carried out according to the instructions for the calibration of the probe control unit. (*A temporary fixing of cable to the control unit is needed if the probe is outside the tank.*) When installing probes longer than 3 m the probe must be supported at its lower end and along the probe's length at 3 m intervals.

3 ELECTRICAL CONNECTIONS

After setting up the probe the cable between probe and control unit is connected to the terminals marked SIGNAL LINE on the probe according to Fig. 6. The connection and installation instructions for the (POP-22 EXI) control unit must be followed as well.

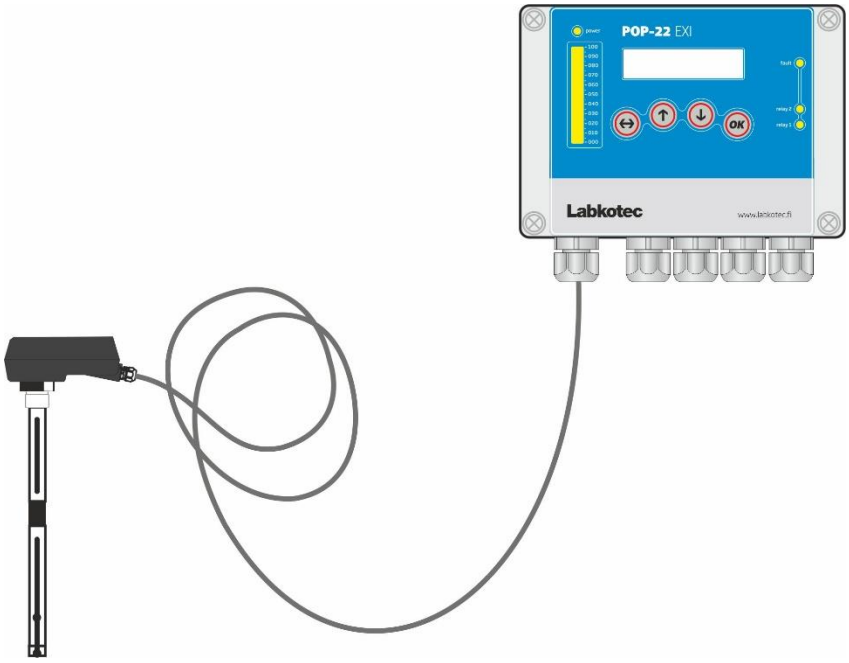


Fig. 5. *Connection of probe and control unit.*

Leave a length of cable at the probe end to allow for the probe to be lifted up entirely without disconnecting any connections.

Fig. 6a shows all shields connected to the earthing screw inside the probe housing, *in which case the shields are not connected at the other end* to equipotential ground.

NOTE! *If a* ***cable shield*** *is connected to equipotential ground at the other end (Fig. 6b), it is not connected to the probe earthing.* **In this case the cable shield must also be isolated from the probe frame and from other shields.**

For connections with a cable having only single shielding: The shield is connected either to the earthing screw inside the housing or to equipotential bonding (Fig. 6c), taking into account the instructions given above.

NOTE! *Use of one shield alone might weaken the system's immunity to interference.*

The earthing screw outside the housing is connected to equipotential ground using a yellow-green conductor of at least 2,5 mm2 mechanically protected or 4 mm2 without protection.

When installing in explosive atmosphere, notice, that the central electrode of the probe is covered with plastic parts. There may be hazard of electrostatic charges if the plastic parts are subjected to friction or to flow of non-conducting media or material.

Transmitter housing includes light alloy parts. When installing in explosive atmosphere, make sure, that the probe is located so, that it cannot be mechanically damaged or it will not be exposed to external impacts.

When installing the probe into an explosion hazardous zone (0/1/2), the following standards need to be followed; EN 60079-11 Electrical apparatus for potentially explosive atmospheres - Intrinsically safe electrical systems “i”, EN 60079-14 Electrical apparatus for explosive gas atmospheres. Part 14: Electrical installations in hazardous areas.

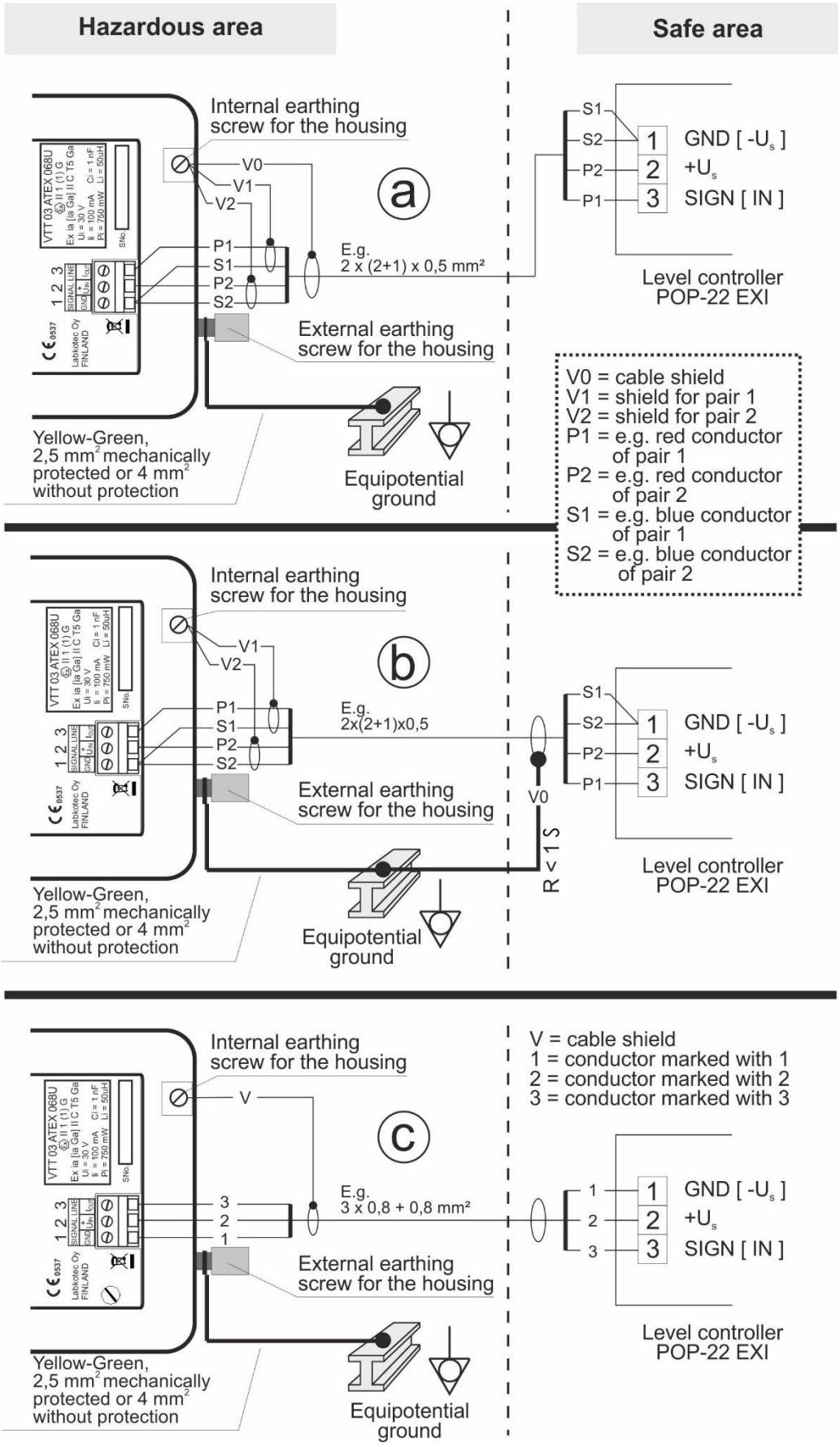


Fig. 6. *Connection examples*

4 IN CASE PROBE DOESN'T FUNCTION

If the probe is located in a hazardous area an Exi-classified multimeter must be used and the Ex-standars mentioded in 5. SERVICE AND REPAIR must be followed.

If the probe gives erroneous values, check the following:

1. Is the cable connected correctly?
2. Is there too thick buildup of the medium on the measuring electrode?
3. Is the insulation of the measuring electrode damaged?
4. The measuring electrode must be properly tightened, otherwise measurement values will be unstable.
5. Have the connections on the protective tube been properly tightened?

5 SERVICE AND REPAIR

Service, inspection and repair of Ex-apparatus needs to be done according to standards IEC 60079-17 and IEC 60079-19.

6 ORDERING INSTRUCTIONS

Specify:

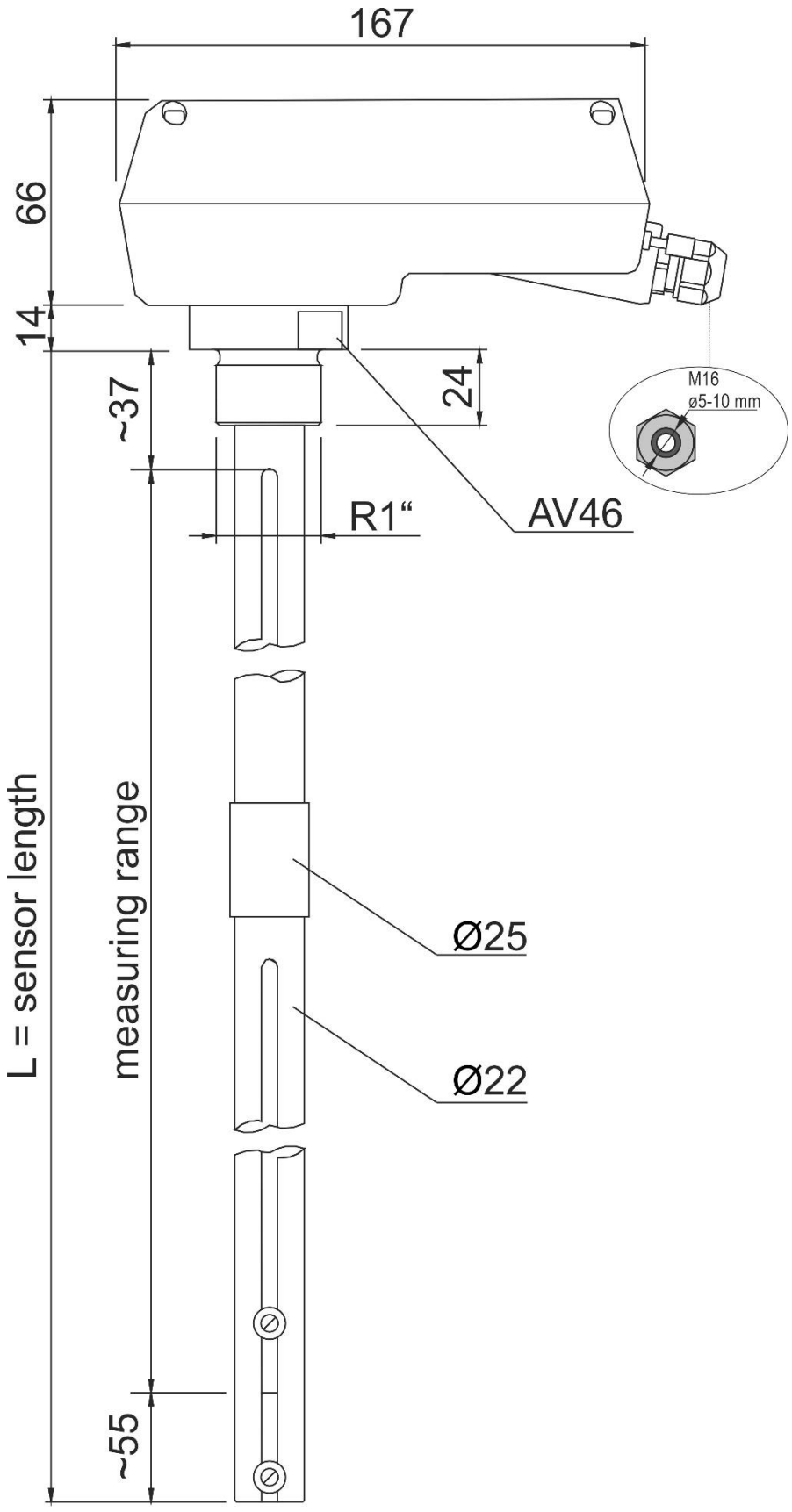
- medium to be measured
- probe length L
- probe material; ordinary steel (PA) or acid proof steel (PAH)
- probe tube length (unless 1 m)

The correct type of transmitter to suit the probe is selected at factory on the basis of medium and probe length. The type is marked in the name plate inside the transmitter housing.

PA/3W and PAH/3W probes are cut to size on the installation site. They can be assembled either outside the tank or during installation in the tank.

7 PROBE DIMENSIONS

The width of the housing is 92 mm.



8 TECHNICAL DATA

PA/3W and PAH/3W probe	
Transmitter types	**MET3** / VL / V / R
Supply voltage	16...30Vdc
Control unit	POP-22 EXI
Operating principle	Capasitive
Measuring range The characteristics of the measurement control unit may affect the range.	Water: [V] 0 - 0,3...2,2 m [R] 0 – 1,8...20 m Oil: [V] 0 - 1...2,8 m [R] 0 – 2,6...13 m
Output current	approx. 6 mA at max. measuring capacitance (load 300 S) VL approx.41..44 μA/pF V approx.10 μA/pF R approx.1,2 μA/pF
Measurement error Of max. measuring range	±1%
Max. measuring capasitance	VL 150 pF V 650 pF R 5500 pF
Temperature drift Of max. Measuring range ±0…+50°C -25°C…+60°C	 ±1 % ±2 %
Materials Wetted parts Transmitter housing	 PA/3W: FEP and steel PAH/3W: FEP and acid-resistant AISI 316 steel Cast aluminium
Measuring cable gland gasket	NEOPREN
Housing	IP65
Operating pressure	Air pressure
Ambient temperature Sensing element Transmitter	 -40…+150 ºC -25…+60 ºC
Connection	R1"
Cable min. (3+1) x 0,5 mm^2	Shielded pair instrument cable, 2 x (2+1) x 0,5 mm^2 Ø 4-8 mm. Armoured cable when mounting into ground.
EMC	EN IEC 61000-6-2:2019 EN IEC 61000-6-3:2021
Ex-Classification	 II 1 G EEx ia IIB T5 Ga VTT 03 ATEX 067X
Ex-connection values	Ui=30V, Ii=100mA, Pi=750mW, Ci= 1 nF, Li = 50 μH
Year of manufacture	xxx x xxxxx xx YY x where YY = year of manufacture

(See serial number from the type plate)	(e.g. 19 = 2019)

NOTE!
The measurement is based on changes in the probe's capacitance – variations in the dielectric constant or electrical conductivity of the medium being measured will affect measurement results.

Probe may be installed in zone 0/1/2 hazardous area with the following special conditions:

- **ambient temperature of sensing element is -40...+150/C and housing - 25...+60/C**
- **transmitter housing must be connect to equipotential ground**

EU DECLARATION OF CONFORMITY

We hereby declare that the product named below has been designed to comply with the relevant requirements of the referenced directives and standards.

Product Measuring and control unit
PA/3W, PAH/3W

Manufacturer Labkotec Oy
Myllyhaantie 6
FI-33960 Pirkkala
Finland

Directives The product is in accordance with the following EU Directives

2014/30/EU	Electromagnetic Compatibility Directive (EMC)
2014/34/EU	Equipment for Potentially Explosive Atmospheres Directive (ATEX)
2011/65/EU	Restriction of Hazardous Substances Directive (RoHS)

Standards The following standards were applied:

EMC: EN IEC 61000-6-2:2019
EN IEC 61000-6-3:2021

ATEX: EN IEC 60079-0:2018
EN 60079-11:2012

EC-type examination certificate: VTT 03 ATEX 067X.
Notified Body: VTT Expert Services Ltd, Notified Body number 0537.

The revised harmonised standards have been compared to the previous standard versions used in the original type certification and no changes in the "state of the art" apply to the equipment.

RoHS: EN IEC 63000:2018

The product is CE-marked since 1997.

Signature This declaration of conformity is issued under the sole responsibility of the manufacturer. Signed for and on behalf of Labkotec Oy.

Pirkkala 28.9.2021

Janne Uusinoka, CEO
Labkotec Oy