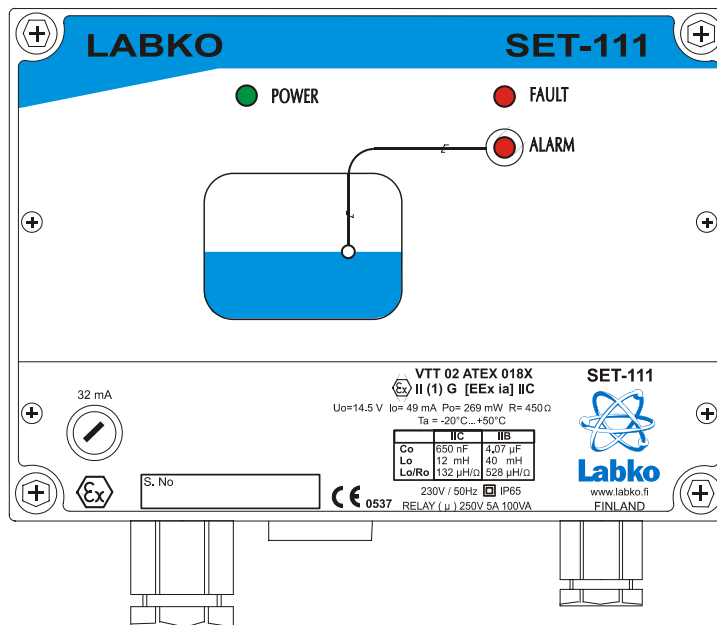


SET-111

Control Unit

Installation and Operating Instructions



Leakage Detection

High Level Alarm

Condensed Water Alarm

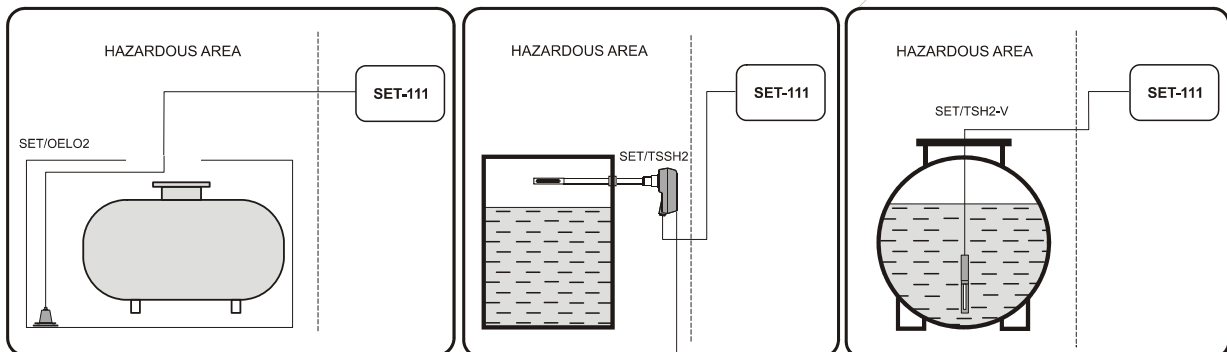


Figure 2. Application examples

1. GENERAL

The SET-111 is a single-channel amplifier unit of equipment group II, category 1 G (Dir. 94/9/EU) that is purpose-built for Labko's capacitive interface probes. Typical applications are the detection of high- and low-level limits for tanks, control of filling and draining, oil/water interface detection, and generation of leak alarms. Probes are selected on the basis of the application.

The SET-111 has an indicator light for sensor operation and signalling a short circuit or break in the probe circuit (fault LED) as well as a relay contact output.

2. TECHNICAL DATA

Supply voltage	230 V, 50/60 Hz. Fuse IEC127 5 x 20 mm / 32 mA The device has no isolating mains switch.
Electrical safety	EN 61010-1 CAT II, Class II
Power consumption	2 VA
Operating temperature	-20 °C...+50 °C
Probe connection	One LABKO SET/ probe
Output	Potential-free switching contact: 250 V, 5 A, 100 VA. Operation delay is 2–5 sec. The relays are preset at the factory to release on alarm.
Max. loop resistance between control unit and probe	75 Ω; see 3.1
Dimensions	175 mm x 125 mm x 75 mm (W x H x D)
Enclosure	IP 65, polycarbonate material
Ex class	⊕ II (1) G [EEx ia] IIC VTT 02 ATEX 019X
Special conditions	Ta = -20 °C...+50 °C
Connection values	U _o = 14.5 V I _o = 49 mA P _o = 269 mW R = 450 ohm
Output voltage is non-linear (trapezoidal)	IIC Co = 650 nF Lo = 12 mH Lo/Ro = 132 μH/ohm
	IIB Co = 4.07 μF Lo = 40 mH Lo/Ro = 528 μH/ohm
	See 3.1 !
EMC	
Emission	EN 50 081-1
Immunity	EN 50 082-1

3. INSTALLATION

The SET-111's structure complies with the Ex ia structure as set out in the EN 50014 and EN 50020 standards. A probe located in a Zone 0 hazardous area, such as a petrol tank, can be directly connected to the device. The SET-111 itself must always be installed in a safe area.

Both during installation and when the probe cable is being extended, the requirements set forth in standard EN 50039 and/or EN 60079-14 must be adhered to.

An isolating switch (250 VAC / 1 A) that isolates both conductors (L1, N) must be wired into the power supply wires in the vicinity of the unit to facilitate servicing and operation. The switch must be labelled as the isolating switch for the device.

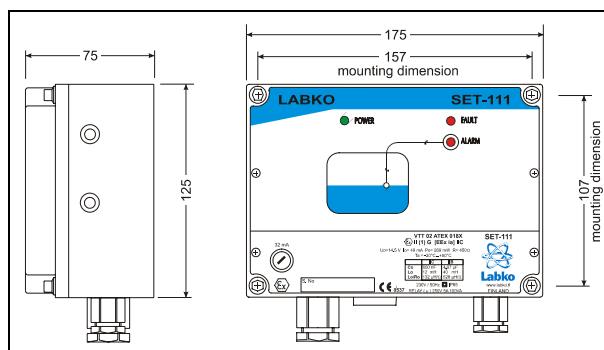


Figure 3. Dimensional drawing of the SET-111 control unit's enclosure.

3.1 Probe connections and cabling

The cabling between the SET-111 control unit and junction box is connected as shown in Figure 4. A shielded twisted pair instrumentation cable, 2 x (2 + 1) x 0.5 mm², can be used as a jumper cable.

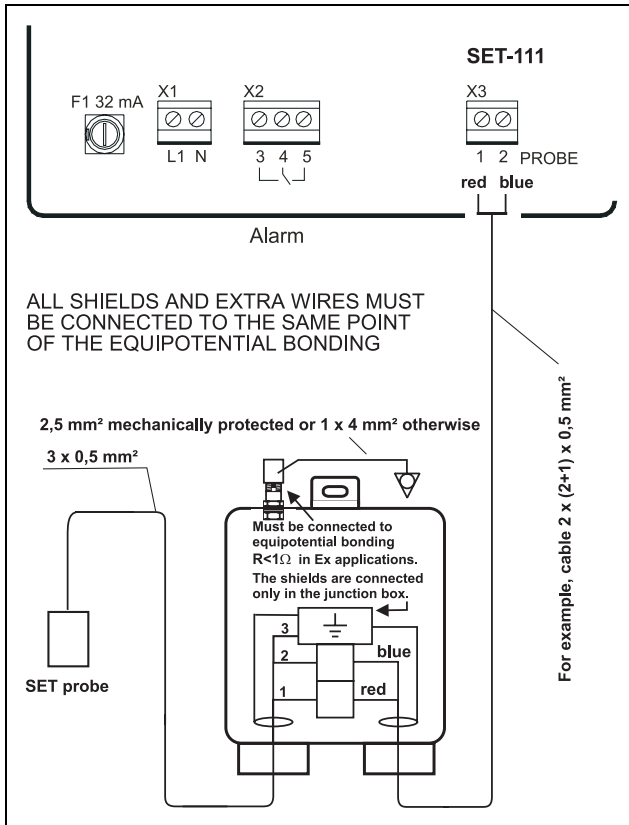


Figure 4. Connection example, using a junction box and connecting a sensor to the control unit.

As the source voltage is non-linear, the combined effect of the capacitance and inductance must be taken into account. The table below shows the maximum connection values in explosion groups IIB and IIC for the SET-101 control unit. For group IIA, the IIB values can be applied.

	Combined Co and Lo	
IIC	600 nF	0.15 mH
	490 nF	0.5 mH
	400 nF	1 mH
	350 nF	2 mH
IIB	3.2 µF	0.5 mH
	2.5 µF	1 mH
	2 µF	2 mH
	1.7 µF	5 mH

The maximum length of the cable is determined by the maximum allowed probe loop resistance (75 Ω) and by the other connection values of the probe circuit (Co, Lo, and Lo/Ro).

Example: An instrumentation cable has a DC resistance for a wire pair at +20 °C of approx. 81 Ω/km. When other transfer resistances of the circuit are approximated to be 10 Ω, the maximum length for the connection cable will be (75 Ω - 10 Ω) / 81 Ω / km = 0.80 km.

The inductance of the cable is about 2–3 uH/m, so the total inductance is 2.4 mH. The L/R ratio is thus about 37 uH/Ω, which is below the maximum allowed value.

The pair capacitance of the cable is approx. 70 nF/km, which brings the total cable capacitance to 56.1 nF. Cable and, for example, SET/OS2 probe total values are 59.1 nF and 2.43 mH.

The earth cable cross-section should be 2.5 mm² if the cable is mechanically protected or 4 mm² if it is not mechanically protected.

Junction box

The metallic junction box of the probe (Labko LJB2-78-83) should be connected to the equipotential bonding through its grounding terminal.

Seal the junction box carefully.



WARNING!

The junction box includes light alloy parts!

When installation occurs in potentially explosive atmospheres, consider placing the junction box so that it cannot be damaged or hit by other metal objects.

4. SETTINGS AND OPERATION

On the basis of the order specifications, the SET-111 is preset at the factory to act as either a high- or low-level switch. Relay K1 is set to release on alarm.

4.1 High and low level alarms, oil/water interface alarm

NOTE! The following actions may be carried out only by persons familiarised with and trained in working on Ex i devices. The procedures must not be carried out when the unit is energised.

If the SET-111 has not been ordered as a preset high- or low-level switch, you can check and set the operation mode by opening the transparent cover and removing the upper front panel.

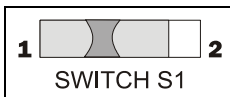


Figure 5. Alarm operation mode switch S1. (See also Figure 9.)

If switch S1 has been set in the left position (position 1), the SET-111 indicates an alarm (the alarm LED is lit) when the level recedes from the probe (low level or oil/water interface in an oil separator, for example).

The device generates an alarm when the probe is in air or in oil when monitoring the oil/water interface.

When switch S1 is in position 2, the SET-111 indicates an alarm when the level reaches the probe (high-level alarm or condensed water alarm in an oil tank).

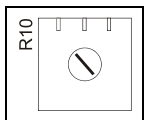


Figure 6. Trimmer R10 for sensitivity adjustment. (See also Figure 9.)

The sensitivity is adjusted via trimmer R10 as follows (see Figures 6 and 7):

- Immerse about half of the probe's sensing element in the liquid to be determined.
- Turn trimmer R10 so that the alarm LED is lit and the relay is activated.
- Check operation by lifting up the probe and immersing it in the liquid to be determined.

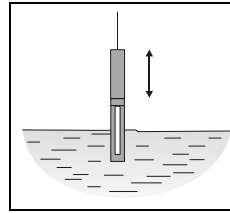


Figure 7. Sensitivity adjustment for, e.g., sensor SET/TSH2.

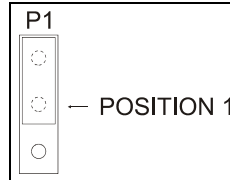


Figure 8. Jumper P1 for setting the relay operation mode as follows:

When the jumper connects the upper two pins, as in Figure 8, the relay releases on alarm. When the lower two pins are connected, the relay operates on alarm.

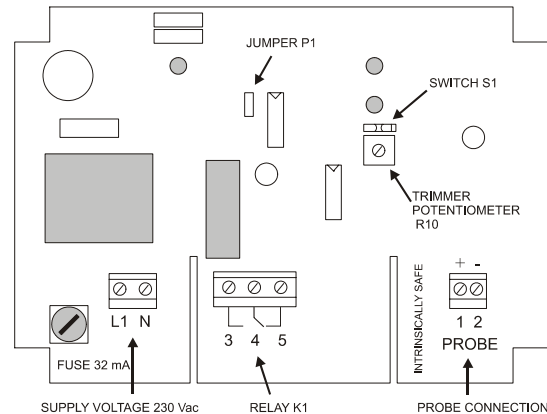


Figure 9. SET-111 component layout.

5. TESTING OPERATION

The easiest way to check the operation of the device is to lift the probe from the liquid and then immerse it again. The relay and the alarm LED should be activated when about half of the probe's sensing element is in the liquid to be determined.

Note! The relay has a delay of 2–5 seconds.

6. SERVICING AND REPAIRS

The mains fuse (marked '32 mA') can be replaced with another IEC127-compliant 5 x 20 mm / 32 mA glass tube fuse. Other repair and servicing work on the unit may be carried out only by persons trained to perform such work on Ex i devices and authorised by Wavin-Labko Oy.



In conducting any servicing, inspection, or repair operations, the instructions in standards IEC 60079-17 and IEC 60079-19 concerning the inspection and servicing of Ex devices should be observed.