

SandSET-1000

Sludge Alarm Device



Installation and Operating Instructions



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SYMBOLS



Warning / Attention



Pay special attention to installations at explosive atmospheres



Device is protected by double or reinforced insulation

1 GENERAL

SandSET-1000 is an alarm device to indicate the accumulation of sludge or sand layer on the bottom of a well or tank. Typical applications are sand and oil separators as well as settling tanks of wastewater treatment plants and other wells or basins. Depending on the order, the delivery consists of SandSET-1000 control unit, SET/S2 sensor, junction box and installation supplies.

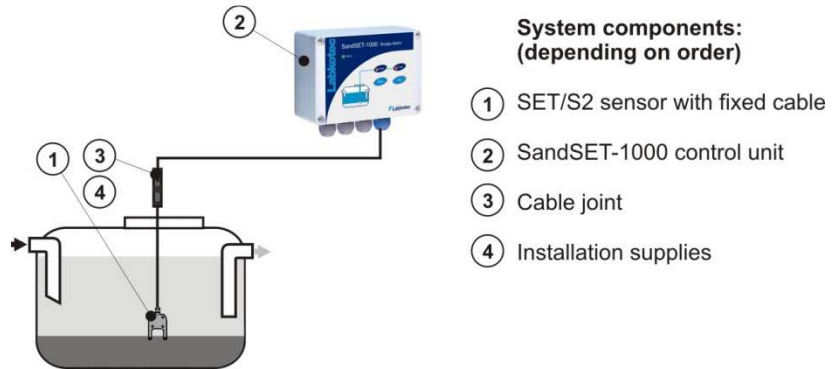


Figure 1. Sand separator alarm application

SET/S2 sensor is installed in the separator or tank and it gives an alarm when the sludge reaches the sensor. The sensor is normally immersed in water.

The principle of measurement is ultrasonic. When sludge, sand or other solid particles accumulate between the two sensor heads, the signal strength weakens, causing an alarm.

SET/S2 sensor can be installed in a zone 0, 1 or 2 potentially explosive atmosphere but the control unit must be mounted in a safe area.

The LED indicators, push buttons and interfaces of the SandSET-1000 control unit are described in figure 2.

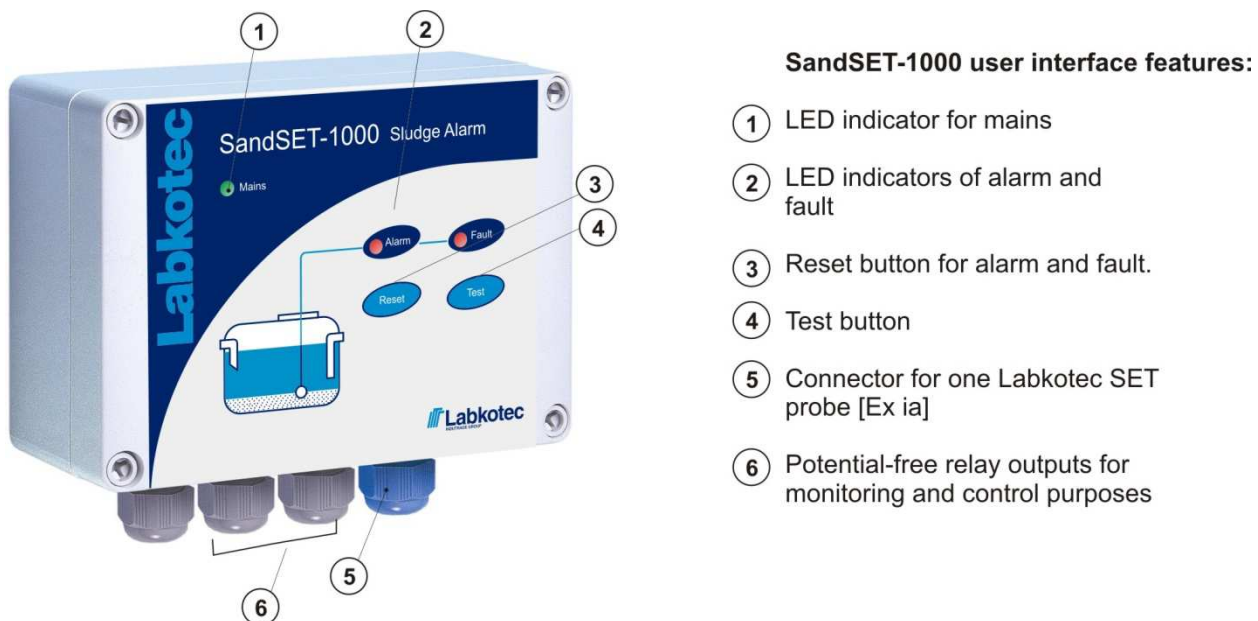


Figure 2. SandSET-1000 control unit - features

2 INSTALLATION

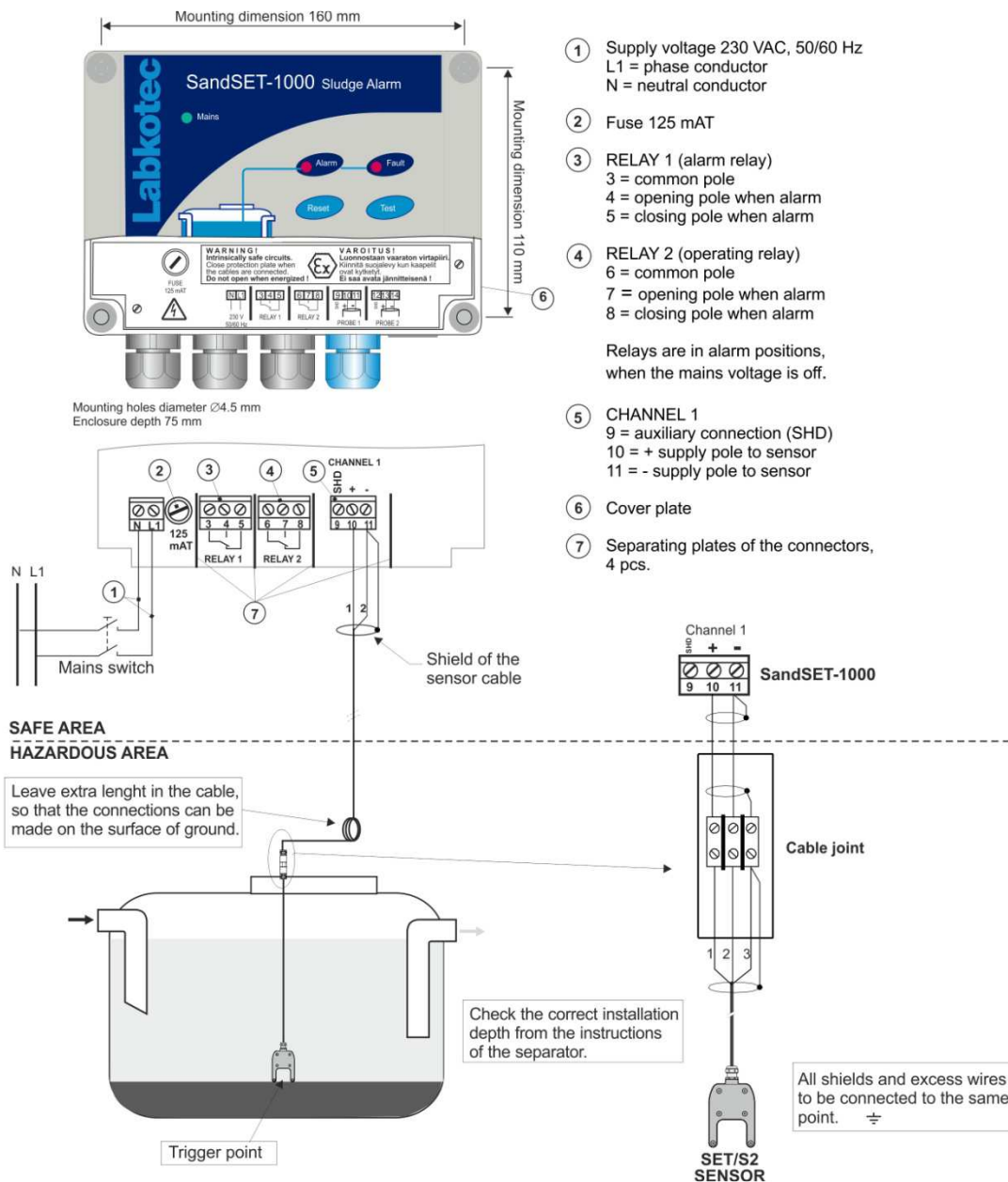
2.1 SandSET-1000 control unit

SandSET-1000 control unit can be wall-mounted. The mounting holes are located in the base plate of the enclosure, beneath the mounting holes of the front cover.

The connectors of the external conductors are isolated by separating plates. The plates must not be removed. The plate covering the connectors must be installed back after executing cable connections.

The cover of the enclosure must be tightened so, that the edges touch the base frame. Only then do the push buttons function properly and the enclosure is tight.

Before installation, please read the safety instructions in chapter 6 !



Kuva 3. SandSET-1000 alarm device installation.

2.2 SET/S2 sensor

SET/S2 sensor should be installed as described in figure 3.

The sensor gives an alarm when there is enough sand or sludge accumulated between the two heads of the sensor. When the sludge layer on the bottom of the separator or settling tank is pretty solid, the correct installation depth can be adjusted based on the current level. In case the level is not that clear, a tryout period of couple of days may be useful.

Please check the instruction for correct installation depth also from the instructions of the oil separator or other application.

The sensor can be mounted suspended from the ceiling of the tank by its cable or installed with an installation conduit equipped with a $\frac{3}{4}$ inch inner thread.

Variations in the water level in the well or basin must be taken into account during installation. A false alarm results if the sensor is left hanging in the air.

2.3 Cable joint



Fig. 4 Cable joint

Connections of the sensor cable inside the cable joint are explained in figure 3. Cable shields and possible excess wires need to be connected to the same point in galvanic contact.

Please make sure, that the sensor and cable between SandSET-1000 control unit and the sensor do not exceed the maximum allowed electrical parameters – see chapter 7 Technical data.

IP rating of the cable joint is IP67. Make sure, that the cable joint is closed properly.

If the sensor cable must be extended and there is a need for equipotential grounding, it should be done with the junction box LJB2. The cabling between the SandSET-1000 control unit and the junction box should be done with a shielded twisted pair instrument cable.



Fig. 5. Cable installation example



Fig. 6. Installation accessories

3 OPERATION AND SETTINGS

The SandSET-1000 alarm device is initialized at the factory.

The operation of the alarm device should be checked always after the installation.

Functionality test

1. Immerse the sensor into water. The device should be in normal mode.
2. Lift the sensor up in air or sink it into sludge. Alarm LED indicator should be lit in 10 seconds. When LED is on should relays de-energize and buzzer be on after selected delay (5 or 30 sec). See chapter 3.1 for more details.
3. Immerse the sensor back into water. Alarm LED should go off in 10 seconds. Relays and buzzer should go back to the normal state after delay (5 or 30 sec). Clean up the sensor if necessary before placing it back into the separator.

A more detailed description of the operation is provided in chapter 3.1. If the operation is not as described here, check the factory settings (chapter 3.2.) or contact a representative of the manufacturer.

3.1 Operation

The operation of a factory-initialized SandSET-1000 is described in this chapter.

Normal mode – no alarms

*The two heads of the SET/S2 sensor are totally immersed in water.
 Mains LED indicator is on.
 Other LED indicators are off.
 Relays 1 and 2 are energized.*

Alarm

*The two heads of the SET/S2 sensor are immersed in sludge or sand.
 Mains LED indicator is on.
 Alarm LED indicator is on in 10 sec. (Delay of the sensor.)
 Buzzer is on after 30...40 sec delay. (Delay of the control unit incl.)
 Relays de-energize after 30...40 sec delay.
 (Note. The same alarm takes place when SET/S2 sensor is in the air.)*

After removal of an alarm (the two heads of the sensor are in water), the Alarm LED indicator will be off. Relays will be energized and buzzer will be off after a delay of 30...40 sec.

Fault alarm

*Sensor cable break, short circuit or a broken sensor, i.e. too low or too high sensor signal current.
 Mains LED indicator is on.
 Sensor circuit Fault LED indicator is on after 5 sec delay.
 Buzzer is on after 5 sec delay.
 The relays de-energize after 5 sec delay.*

Reset of an alarm

*When pressing the Reset push button.
 Buzzer will go off.
 Relay 1 energizes.
 Relay 2 will stay de-energized until the actual alarm or fault is off.*

The operational delay of SET/S2 prevents false alarms from occurring when garbage or other obstacles, which weaken the measurement signal momentarily, pass across the sensors heads.

Note! When testing the sensor operation in a separate vessel, the water put into the vessel should stand for about 30 minutes before testing. This prevents false alarms caused by the attachment of air bubbles on the sensor heads.

TEST FUNCTION

Test function provides an artificial alarm, which can be used to test the function of the SandSET-1000 alarm device and the function of other equipment, which are connected to SandSET-1000 via its relays.



Attention! Before pressing the Test button, make sure that the change of relay status does not cause hazards elsewhere!

<i>Normal situation</i>	<p><i>When pressing the Test push button:</i> Alarm and Fault LED indicators are immediately on. Buzzer is immediately on. Relays de-energize after 2 sec of continuous pressing.</p> <p><i>When the Test push button is released:</i> LED indicators and buzzer go immediately off. Relays energize immediately.</p>
<i>Alarm on</i>	<p><i>When pressing the Test push button:</i> Fault LED indicator is immediately on. Alarm LED indicator remains on. Buzzer remains on. If it has been reset earlier, it will return to be on. If relay 1 was already reset, it will de-energize again after 2 sec. of continuous pressing. Test will not affect relay 2, because it is already in alarm status.</p> <p><i>When the Test push button is released:</i> The device returns without delay to the preceding status.</p>
<i>Fault alarm on</i>	<p><i>When pressing the Test push button:</i> The device does not react to the test at all.</p>

3.2 Factory settings

If the operation of SandSET-1000 is not as described in the previous chapter, check that the device settings are as in figure 7. Change the settings according to the following instructions if needed.



The following tasks must only be executed by a person with proper education and knowledge of Ex-i devices.

We recommend, that when altering the settings the mains voltage is off or the device is initialized before the installation is executed.

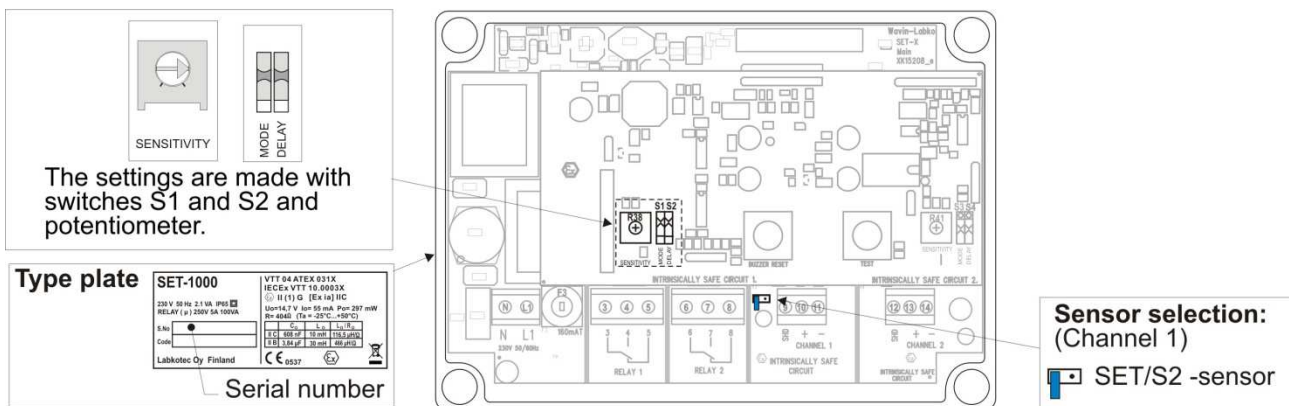




Figure 7. Factory settings

The settings are made with switches (MODE and DELAY) and potentiometer (SENSITIVITY) located in the upper printed circuit board, and the jumper located in the lower board (figure 7). In figure 7, the switches are as set in the factory.

 Delay 5 sec.	 Delay 30 sec.	<p>Switch S2 is used to set the operational delay of the control unit.</p> <p>When the switch is in low position, relays operate and buzzer is on after 5 seconds after the sensor current has reached the trigger level, and if the level still remains on the same side of the trigger level.</p> <p>When the switch is in high position, the delay is 30 seconds.</p> <p>Delays are operational in both directions (energizing, de-energizing). Alarm LED follows the sensor current value and trigger level without delay. Fault alarm takes place after a fixed delay of 5 sec.</p>
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4 TROUBLE-SHOOTING

Problem: MAINS LED indicator is off

Possible reason: Supply voltage is too low or the fuse is blown. Transformer or MAINS LED indicator is faulty.

- To do:**
1. Check if the two pole mains switch is off.
 2. Check the fuse.
 3. Measure the voltage between poles N and L1. It should be 230 VAC \pm 10 %.

Problem: No alarm when sensor in sludge or air, or the alarm will not go off

Possible reason: The SENSITIVITY setting is wrong in the control unit (see figure 7).

- To do:**
1. Lift the sensor up in the air or immerse it into sludge and wait 10 seconds.
 2. Turn the SENSITIVITY potentiometer slowly anticlockwise until the sensor gives an alarm.
 3. Immerse the sensor into water and wait until the alarm goes off. If the alarm does not go off, turn the potentiometer slowly clockwise until the alarm goes off.
 4. Lift the sensor up in the air or sink into sludge. The sensor should give an alarm again.

Problem: FAULT LED indicator is on

Possible reason: Current in sensor circuit too low (cable break) or too high (cable in short circuit). The sensor might also be broken.

- To do:**
1. Make sure, that the sensor cable has been connected correctly to the SandSET-1000 control unit. See instructions from chapter 2 or SET/S2 installation and Operating Instructions.
 2. Measure the voltage separately between the poles 10 and 11. The voltages should be between 10,3...11,8 V.
 3. If the voltage is correct, measure the sensor current. Do as follows:
 - 3.1 Disconnect sensor's [+] wire from sensor connector (pole 10).
 - 3.2 Measure short circuit current between [+] and [-] poles.
 - 3.3 Connect mA-meter as in figure 8.
 - 3.4 Connect the wire back to the connector.

If the problem can not be solved with the above instructions, please contact Labkotec Oy's local distributor or Labkotec Oy's service.



Attention! If the sensor is located in an explosive atmosphere, the multimeter must be Exi-approved!

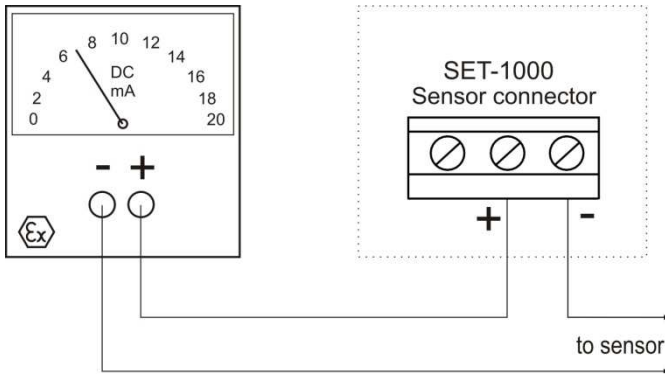


Figure 8. Sensor current measurement

	SET/S2, channel 1 Poles 10 [+] ja 11 [-]
Shortcircuit	20 mA – 24 mA
Sensor in the air	13 – 14 mA
Sensor in sludge	12 – 14 mA
Sensor in the water	6 – 8 mA
Factory setting for alarm point	approx. 11 mA

Table 1. Sensor currents

5 REPAIR AND SERVICE


The sensor should be cleaned and the operation should also be tested when emptying the oil storage chamber or at least once every six months. The easiest way to check the operation is to lift the sensor up in the air and to put it back to the separator. The operation is described in chapter 3.

For cleaning, a mild detergent (e.g. washing-up liquid) and a scrubbing brush can be used.


The mains fuse (marked 125 mA) can be changed to another glass tube fuse 5 x 20 mm / 125 mA complying IEC/EN 60127-2/3. Any other repair and service works on the device may be carried out only by a person who has received training in Ex-i devices and is authorized by the manufacturer.


In case of queries, please contact Labkotec Oy's service: service@labkotec.fi.


6 SAFETY INSTRUCTIONS

 SandSET-1000 control unit must not be installed in potentially explosive atmosphere. Sensors connected to it may be installed in zone 0, 1 or 2 potentially explosive atmospheres.



In case of installations in explosive atmospheres the national requirements and relevant standards as IEC/EN 560079-25 and/or IEC/EN 60079-14 must be taken into account.

 If electrostatic discharges can cause hazards in the operating environment, the device must be connected into equipotential ground according to requirements with regards to explosive atmospheres. Equipotential grounding is made by connecting all conductive parts into same potential e.g. at the cable junction box. Equipotential ground must be earthed.

 The device does not include a mains switch. A two pole mains switch (250 VAC 1 A), which isolates both lines (L1, N) must be installed in the main power supply lines in the vicinity of the unit. This switch facilitates maintenance and service operations and it has to be marked to identify the unit.

 When executing service, inspection and repair in explosive atmosphere, the rules in standards IEC/EN 60079-17 and IEC/EN 60079-19 about instructions of Ex-devices must be obeyed.

7 TECHNICAL DATA


SandSET-1000 control unit	
Dimensions	175 mm x 125 mm x 75 mm (L x H x D)
Enclosure	IP 65, material polycarbonate
Ambient temperature	-25 °C...+50 °C
Supply voltage	230 VAC ± 10 %, 50/60 Hz Fuse 5 x 20 mm 125 mA (IEC/EN 60127-2/3) The device is not equipped with a mains switch
Power consumption	2 VA
Sensors	One Labkotec SET sensor (SET/S2)
Max. resistance of the current loop between the control unit and a sensor	75 Ω.
Relay outputs	Two potential-free relay outputs 250 V, 5 A, 100 VA Operational delay 5 sec or 30 sec. Relays de-energize at trigger point. Operation mode selectable for increasing or decreasing level.
Electrical safety	IEC/EN 61010-1, Class II  , CAT II / III
Insulation level Sensor / Mains supply voltage	375V (IEC/EN 60079-1)
EMC Emission Immunity	IEC/EN 61000-6-3 IEC/EN 61000-6-2
Ex-classification Special conditions (X) ATEX IECEX	 II (1) G [Ex ia] IIC (Ta = -25 °C...+50 °C) VTT 04 ATEX 031X IECEX VTT 10.0003X
Electrical parameters Characteristic curve of the output voltage is trapezoidal See table 2.	U _o = 14,7 V I _o = 55 mA P _o = 297 mW R = 404 Ω
Manufacturing year: Please see the serial number on the type plate	xxx x xxxxx xx YY x where YY = manufacturing year (e.g. 10 = 2010)

Due to non-linear characteristics of the sensor voltage, the interaction of both, capacitance and inductance, must be taken into account. The table below indicates the connecting values in explosion groups IIC and IIB. In explosion group IIA the values of the group IIB can be applied.

	Max. permissible value		Combined Co and Lo	
	Co	Lo	Co	Lo
II C	608nF	10 mH	568nF	0,15 mH
			458 nF	0,5 mH
			388 nF	1,0 mH
			328 nF	2,0 mH
			258 nF	5,0 mH
II B	3,84µF	30 mH	3,5 µF	0,15 mH
			3,1 µF	0,5 mH
			2,4 µF	1,0 mH
			1,9 µF	2,0 mH
			1,6 µF	5,0 mH

$L_o/R_o = 116,5 \mu\text{H}/\Omega$ (IIC) and $466 \mu\text{H}/\Omega$ (IIB)

Table 2. SandSET-1000 electrical parameters

SET/S2 sensor	
Principle of operation	Ultrasonic
Enclosure	IP68 Materials: PP, PVC, AISI 304, AISI 316 and NBR rubber
Ambient temperature	0 °C...+60 °C
Supply voltage	Approx. 12 VDC from SET control unit
Cable	Fixed oil resistant PVC cable 3 x 0,5 mm ² , standard length 5 m.
Weight	Approx. 450 g
EMC Emission Immunity	IEC/EN 61000-6-3 IEC/EN 61000-6-2
Ex-classification ATEX IECEX	 II 1 G Ex ia IIB T5 Ga VTT 07 ATEX 0051X IECEX VTT 10.0002X
Electrical parameters	U _i = 16 V I _i = 80 mA P _i = 320 mW C _i = 3 nF L _i = 80 µH
Manufacturing year: Please see the serial number on the type plate	xxx x xxxxx xx YY x where YY = manufacturing year (e.g. 10 = 2010)

Special conditions concerning Ex-classification (X):

- Ambient temperature -25 °C...+60 °C
- Shielded sensor cable and extra wires shall be connected to equipotential ground
- If sensor cable have to be extended, please use LJB2-78-83 or LJB3-78-83 junction box. The junction box shall also be connected to equipotential ground.

Figure 9. Dimensional drawing of SET/S2 sensor

Declaration of Conformity

This declaration certifies that the below mentioned apparatus conforms to the essential requirements of the EMC directive 2004/108/EY, Low-Voltage directive (LVD) 2006/95/EC and ATEX directive 94/9/EC.

Description of the apparatus: Measuring and control unit
Type: SET-1000 and SET-2000 series
Manufacturer: Labkotec Oy
Myllyhaantie 6
FI-33960 Pirkkala
FINLAND

The construction of the appliance is in accordance with the following standards:


EMC:

EN 61000-6-2 (2005) Electromagnetic compatibility, Generic immunity standard, class: Industrial environment.
EN 61000-6-3 (2007) Electromagnetic compatibility, Generic emission standard, class: Residential, commercial and light industry.
EN 61000-3-2 (2000) Electromagnetic compatibility, Product family standard: Harmonic current emissions.
EN 61000-3-3 (1995)
+A1:2001+A2:2005 Electromagnetic compatibility, Product family standard: Voltage fluctuations and flicker sensation.

LVD:

EN 61010-1 (2001) Safety requirements for electrical equipment for measurement, control and laboratory use. Part 1: General requirements.

ATEX:

EN 60079-0 (2009) Electrical apparatus for explosive gas atmospheres — Part 0: General requirements.
EN 60079-11 (2007) Explosive atmospheres — Part 11: Equipment protection by intrinsic safety 'i'.
EC-type examination certificate: VTT 04 ATEX 031X
Ex-classification:  II (1) G [Ex ia] II C Ta = -25...+50°C
Production quality assurance notification: VTT 01 ATEX Q 001
Notified Body: VTT Expert Services Ltd; notified body number 0537.
Address of the notified body: P.O. Box 1001, FI-02044 VTT, Finland

The product is CE-marked since 2004.

Signature

The authorized signatory to this declaration, on behalf of the manufacturer, and the Responsible Person based within the EU, is identified below.

Pirkkala 02.11.2010


Heikki Helminen
CEO
Labkotec Oy

Declaration of Conformity

This declaration certifies that the below mentioned apparatus conforms with the essential requirements of the EMC directive 2004/108/EY and ATEX directive 94/9/EC.

Description of the apparatus: Level sensor
Type: SET/S2
Manufacturer: Labkotec Oy
Myllyhaantie 6
33960 Pirkkala
FINLAND

Standards which are used as a basic for conformity:

EMC:
EN 61000-6-3 (2007), Electromagnetic compatibility, Generic emission standard, class: Residential, commercial and light industry.
EN 61000-6-2 (2005), Electromagnetic compatibility, Generic immunity standard, class: Industrial environment.

ATEX:
EN 60079-0 (2009), Explosive atmospheres - Part 0: Equipment - General requirements.
EN 60079-11 (2007), Explosive atmospheres - Part 11: Equipment protection by intrinsic safety "i".
EN 60079-26 (2007), Explosive atmospheres - Part 26: Equipment with equipment protection level (EPL) Ga.

EC-type examination certificate: VTT 07 ATEX 051X

Ex-classification:  II 1 G Ex ia II B T5 Ga Ta = -25...+60°C

Production quality assessment notification: VTT 01 ATEX Q 001

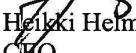
Notified Body: VTT Expert Services Ltd; notified body number 0537.

Address of the notified body: P.O. Box 1001, FI-02044 VTT, Finland

Signature

The authorized signatory to this declaration, on behalf of the manufacturer, and the Responsible Person based within the EU, is identified below.

Pirkkala 02.11.2010


Heikki Helminen
CEO
Labkotec Oy