

SET-2000 Hi Level/Oil

Alarm Device with SET/DM3AL and SET/V sensors
for Oil Separators



Installation and Operating Instructions



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SYMBOLS



Warning / Attention



Pay attention to installations at potentially explosive atmospheres



Device is protected by double or reinforced insulation

1 GENERAL

SET-2000 Hi Level/Oil is an alarm device for monitoring the thickness of the oil layer accumulating in the oil separator and blocking of the separator. Depending on the order, the delivery consists of SET-2000 Hi Level/Oil control unit, SET/DM3AL sensor, SET/V sensor, junction box and installation supplies.

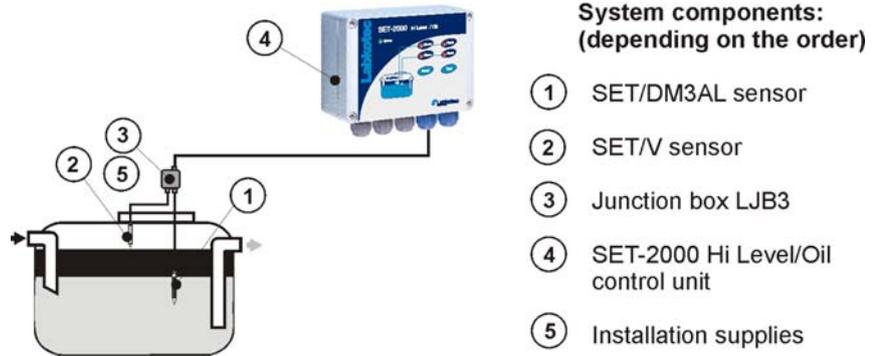


Figure 1. Oil separator alarm system with OilSET-2000 Hi Level/Oil

The SET/DM3AL sensor is installed into the light liquid storage chamber and gives an alarm when the chamber is filled to a pre-determined degree. The function is based on the measurement of the electrical conductivity of the surrounding liquid – water conducts electricity much better than oil. The sensor is normally immersed in water.

SET/V sensor is installed above separator’s outlet’s upper level. It monitors the total level of the separator, regardless of existence of the oil layer. The principle of the measurement is capacitive. the sensor is normally in the air.

Oil separator is regarded as a potentially explosive (Ex) atmosphere. The sensors can be installed in 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 device are described in figure 2.

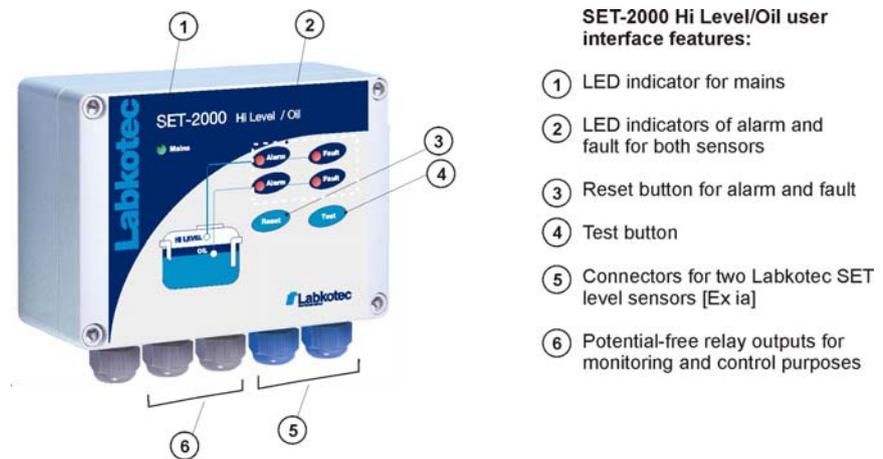


Figure 2. SET-2000 Hi Level/Oil – features

2 INSTALLATION

2.1 SET-2000 Hi Level/Oil Control Unit

The SET-2000 Hi Level/Oil 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!

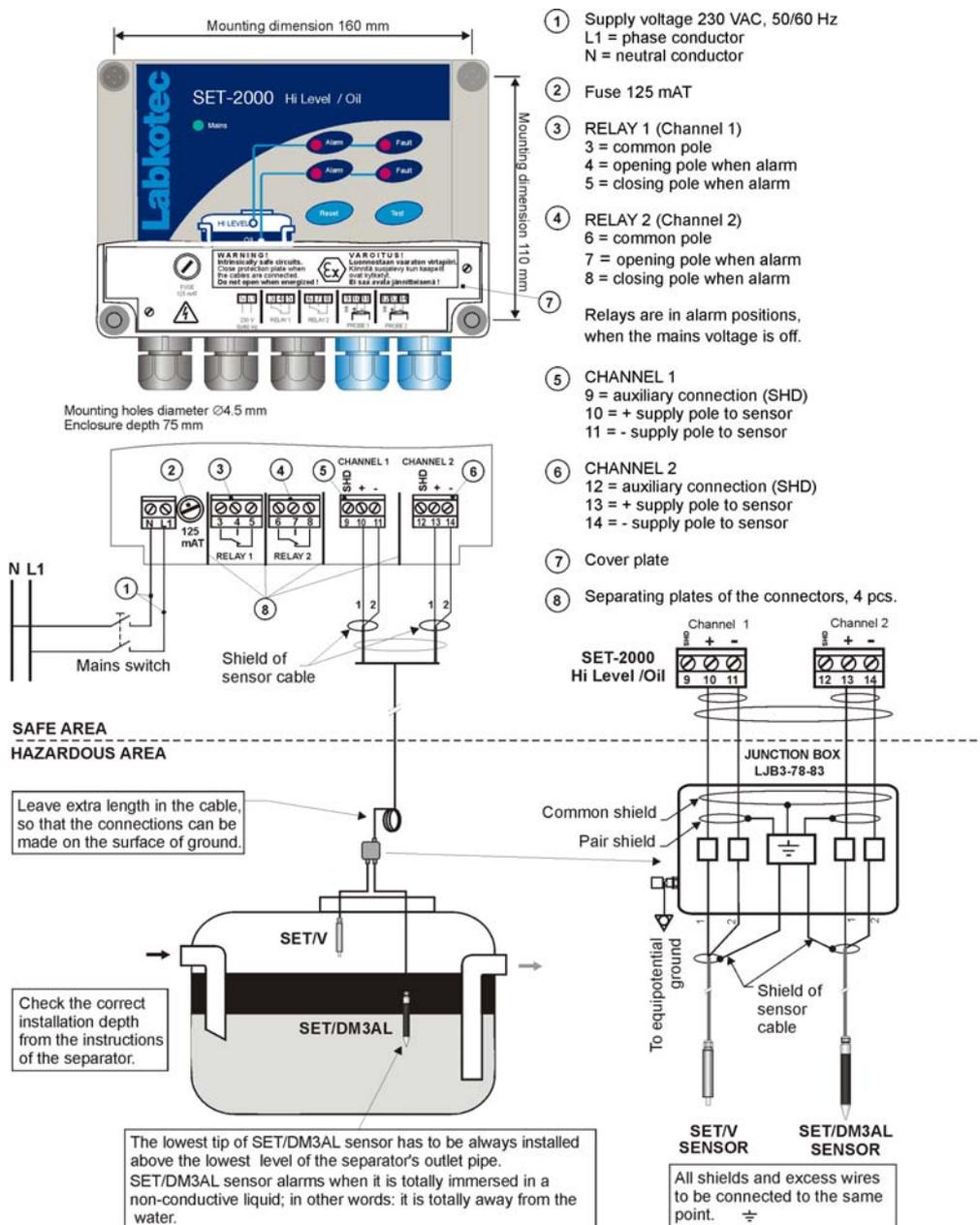


Figure 3. Installation of SET-2000 Hi Level/Oil alarm device.

2.2 Sensor installation

The sensor installation should be done as described in figure 3.

SET/DM3AL sensor gives an alarm when the upper electrode is in oil.

SET/V sensor gives an alarm when the sensing element of the sensor is immersed in liquid.

Please check the correct installation depth also from the instructions of the oil separator.

2.3 Junction box

If the sensor cable must be extended or there is need for equipotential grounding, it can be done with the cable junction box. The cabling between the SET-2000 control unit and the junction box should be done with a shielded twisted pair instrument cable.

The cabling in figure 3 can be done with a two-pair shielded twisted pair cable, whereupon both pairs are equipped with their own shields. **Make sure that the signal wires of the cables can never be connected to each other.**

LJB3 junction box enables cable extension in potentially explosive atmospheres.

In figure 3 the shields and excess wires have been connected to the same point in galvanic contact with metallic frame of the junction box. This point can be connected to equipotential ground thru the ground terminal. Other components of the system that need to be grounded can also be connected to the same ground terminal.

The wire used for equipotential grounding must be min. 2.5 mm² mechanically protected or, when not mechanically protected, the minimum cross section is 4 mm².

Please make sure, that the sensor and the cable between SET-2000 control unit and the sensor do not exceed the maximum allowed electrical parameters – see chapter 7 Technical data.

Detailed cabling instructions can also be found in the installation instructions of SET/DM3AL and SET/V sensors.



Junction box of type LJB3 includes light alloy parts. When installing in explosive atmosphere, make sure, that the junction box is located so, that it can not be mechanically damaged or it will not be exposed to external impacts, friction etc. causing ignition of sparks.

Make sure, that the junction box is closed properly.

3 OPERATION AND SETTINGS

SET-2000 Hi Level/Oil is initialized at the factory. The operation of the device should always be checked after the installation. The operation should also be checked always when emptying the separator or at least once every six months.

- Functionality test* **Hi level alarm (SET/V sensor)**
1. Lift the sensor up in the air. The device should be in normal mode (see chapter 3.1).
 2. Immerse the sensor into water or oil. Hi level alarm should occur (see chapter 3.1).
 3. Lift the sensor up in the air again. The alarm should go off after 30 sec delay.

- Functionality test* **Oil alarm (SET/DM3AL sensor)**
1. Immerse the sensor into water. The device should be in normal mode (see chapter 3.1).
 2. Lift the sensor up in the air or oil. Oil alarm should occur. (see chapter 3.1).
 3. Immerse the sensor back into water. Alarm should go off after 5 sec delay.

Clean up the sensors before placing them 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 SET-2000 is described in this chapter.

<i>Normal mode – no alarms</i>	<p>SET/DM3AL sensor is totally in water and SET/V sensor is in the air. Mains LED indicator is on. Other LED indicators are off. Relays 1 and 2 are energized.</p>
<i>High level alarm</i>	<p>The level has hit the SET/V high level sensor. Alarm takes place when the sensing element of the sensor is immersed in liquid. Mains LED indicator is on. Hi level alarm LED indicator is on. Buzzer on after 5 sec delay. Relay 1 de-energizes after 5 sec delay. Relay 2 remains energized.</p>
<i>Oil alarm</i>	<p>SET/DM3AL sensor is in oil. The sensor gives an alarm when the upper electrode is in oil. (Note! The same alarm takes place when SET/DM3AL sensor is in the air) Mains LED indicator is on. Oil Alarm LED indicator is on. Buzzer on after 5 sec delay. Relay 1 remains energized. Relay 2 de-energizes after 5 sec delay.</p>
	<p>After removal of an alarm, the respective alarm LED indicators and buzzer will be off and respective relay will be energized after 5 sec delay.</p>
<i>Fault alarm</i>	<p>A broken sensor, sensor cable break or short circuit, i.e. too low or too high sensor signal current. Mains LED indicator is on.</p>

*Sensor circuit Fault LED indicator is on after 5 sec delay.
The relay of the respective channel de-energizes after 5 sec delay.
Buzzer is on after 5 sec delay.*

Reset of an alarm

*When pressing the Reset push button.
Buzzer will go off.
Relays will not change their status before the actual alarm or fault is off.*

TEST FUNCTION

Test function provides an artificial alarm, which can be used to test the function of the SET-2000 Hi Level/Oil and the function of other equipment, which is connected to SET-2000 via its relays.



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

Normal situation

*When pressing the Test push button:
Alarm and Fault LED indicators are immediately on.
Buzzer is immediately on.
Relays de-energize after 2 sec of continuous pressing.
When the Test push button is released:
LED indicators and buzzer go immediately off.
Relays energize immediately.*

High level or Oil alarm on

*When pressing the Test push button:
Fault LED indicators are immediately on.
The Alarm LED indicator of the alarming channel remains on and the respective relay remains de-energised.
Alarm LED indicator of the other channel is on and the relay de-energizes.
Buzzer remains on. If it has been reset earlier, it will return to be on.
When the Test push button is released:
The device returns without delay to the preceding status.*

Fault alarm on

*When pressing Test push button:
The device does not react with regards to the faulty channel.
The device reacts as described above with regards to the functional channel.*

3.2 Factory settings

If the operation of SET-2000 Hi Level/Oil is not as described in the previous chapter, check that the device settings are as in figure 4. 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 Exi devices.

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

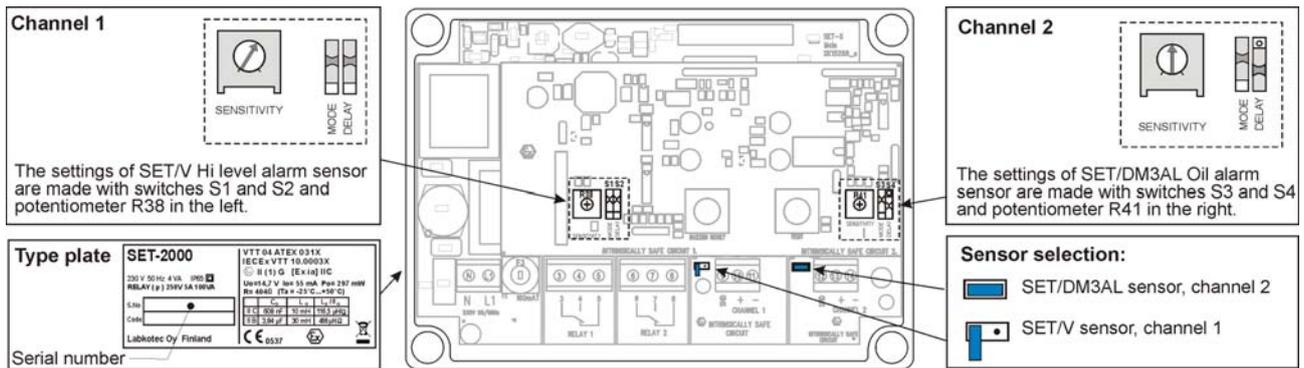
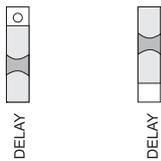


Figure 4. Factory settings of SET-2000 Hi Level / Oil

The settings are made with switches (MODE and DELAY) and potentiometers (SENSITIVITY) located in the upper printed circuit board (figure 4) and with the jumpers located in the lower board. Switches in figure 4 are as set in the factory.

OPERATIONAL DELAY SETTING (DELAY)



Delay 5 sec. Delay 30 sec.

Switches S2 and S4 are used to set the operational delay of the device. Factory setting to SET/DM3AL sensor is 5 seconds and to SET/V sensor 30 seconds.

When the switch is in low position relays de-energize and buzzer is on after 5 seconds after the level reaches trigger level, and if the level still remains on the same side of the trigger level.

When the switch is in high position, the delay is 30 seconds.

Delays are operational in both directions (energizing, de-energizing). Alarm LEDs follow the sensor current value and trigger level without delay. Fault alarm takes place after a fixed delay of 5 sec.

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 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 ± 10 %.

Problem: No alarm when SET/DM3AL sensor in oil or air, or the alarm will not go off

Possible reason: The SENSITIVITY setting is wrong in the control unit (see figure 4), or sensor dirty.

- To do:**
1. Clean-up the sensor and lift it up in the air or immerse it into oil.
 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 oil. The sensor should give an alarm again.

Problem: No alarm when SET/V sensor is in liquid or the alarm will not go off when the sensor is on air

Possible reason: The sensor is dirty or the settings of control unit are wrong.

- To do:**
1. Clean and dry the sensor. Check out that the SENSITIVITY potentiometer and MODE switch are in right positions (see Fig. 4).
 2. If the sensor doesn't give an alarm, set the sensor's switching sensitivity by turning potentiometer max. ¼ round. The sensitivity grows when potentiometer is turned anti-clockwise and gets lower when it is turned clockwise.
 3. Finally check the function by immersing the sensor in oil and lift it up again in air.

Problem: FAULT LED indicator is on

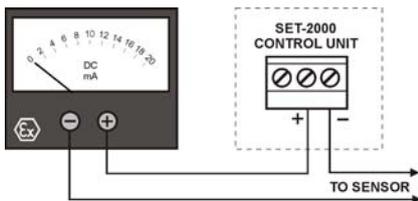
Possible reason: Current in sensor circuit too low (cable break) or too high (cable in short circuit). The sensor might also be broken.

- To do:**
1. Make sure, that the sensor cable has been connected correctly to the SET-2000 control unit. See sensor specific instructions.
 2. Measure the voltage separately between the poles 10 and 11 as well as 13 and 14. The voltages should be between 10,3...11,8 V.
 3. If the voltages are correct, measure the sensor current one channel at a time. Do as follows:
 - 3.1 Disconnect sensor's [+] wire from sensor connector (poles 11 and 13).
 - 3.2 Measure short circuit current between [+] and [-] poles.
 - 3.3 Connect mA-meter as in figure 5.
 - 3.4. Make a comparison to the values in Table 1.
 - 3.4. Connect the wire/wires back to respective connector(s).

If the problems 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 !



	SET/V, Channel 1 Poles 10 [+] and 11 [-]	SET/DM3AL, Channel 2 Poles 13 [+] and 14 [-]
Shortcircuit	20 mA – 24 mA	20 mA – 24 mA
Sensor in the air	5 – 8 mA	9 – 11 mA
Sensor in the oil	10 – 14 mA	9 – 11 mA
Sensor in the water	10 – 14 mA	3 – 4 mA
Factory setting for alarm point	approx. 9.5 ma	approx. 6.5 mA

Figure5. Sensor current measurement

Table 1. Sensor currents

5 REPAIR AND SERVICE

The sensors should be cleaned and the operation of the alarm device should 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 sensors up in the air and put them 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 Exi devices and is authorized by the manufacturer.

In case of queries, please contact Labkotec Oy's service:

labkotec.service@labkotec.fi.

6 SAFETY INSTRUCTIONS



SET-2000 Hi Level/Oil must not be installed in potentially explosive atmosphere. Sensors connected to it may be installed in zone 0, 1 or 2 potentially explosive atmosphere.

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

Warning! If the cabling is voltage-tested, the sensor must be disconnected.



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

SET-2000 Hi Level/Oil	
Dimensions	175 mm x 125 mm x 75 mm (L x H x D)
Enclosure	IP 65, material polycarbonate
Operation 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	4 VA
Sensors	Labkotec SET/V and SET/DM3AL
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 60079-11)
EMC	Emission Immunity IEC/EN 61000-6-3 IEC/EN 61000-6-2
Ex-classification Special conditions (X)	 II (1) G [Ex ia] IIC (Ta = -25 °C...+50 °C) VTT 04 ATEX 031X IECEX VTT 10.0003X
Electrical parameters	U _o = 14,7 V I _o = 55 mA P _o = 297 mW R = 404 Ω
Characteristic curve of the output voltage is trapezoidal See table 2.	
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 µH/Ω (IIC) and 466 µH/Ω (IIB)

Table 2. SET-2000 Hi Level/Oil electrical parameters

SET/DM3AL sensor (Oil alarm)	
Principle of operation	Measurement of conductivity
IP-classification	IP68
Material	AISI 316, PVC (black), NBR, PA
Temperature	Operation: 0 °C...+60 °C Safety: -30 °C...+60 °C
Supply voltage	Approx. 12 VDC from SET control unit
Cable	Fixed oil resistant, shielded cable 2 x 0,75 mm ² , standard length 5 m.
EMC:	Emission Immunity IEC/EN 61000-6-3 IEC/EN 61000-6-2
Ex-classification Special conditions (X)	 II 1 G Ex ia IIA T5 Ga (Ta -30 °C...+60 °C) - The risk of electrostatic charge must be observed ! VTT 09 ATEX 026X IECEX VTT 10.0001X
Electrical parameters	U _i = 16 V I _i = 80 mA P _i = 400 mW C _i = 3,5 nF L _i = 80 µH
Manufacturing year: Please see the serial number on the type plate	x xxx x xxxxx xx YY x where YY = manufacturing year (e.g. 10 = 2010)

SET/V sensor (Hi level alarm)	
Principle of operation	Vibration
IP-classification	IP68
Material	PA, PVC, aluminium, NBR
Temperature	Operation: 0 °C...+60 °C Safety : -30 °C...+60 °C
Supply voltage	Approx. 12 VDC from SET control unit
Cable	Fixed oil resistant shielded cable 2 x 0,75 mm ² , standard length 5 m.
EMC:	Emission Immunity IEC/EN 61000-6-3 IEC/EN 61000-6-2
Ex-classification Special conditions (X)	 II 1 G Ex ia IIB T5 Ga (Ta -30 °C...+60 °C) - The risk of electrostatic charge must be observed ! VTT 09 ATEX 025X IECEX VTT 10.0006X
Electrical parameters	U _i = 16 V I _i = 80 mA P _i = 400 mW C _i = 3500 pF L _i = 85 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)

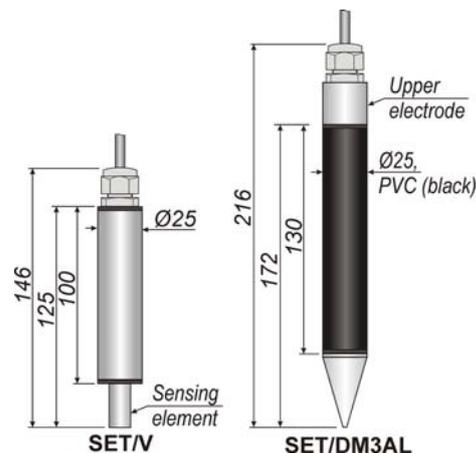


Figure 6. Dimensional drawings of SET/V and SET/DM3AL sensors

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

Labkotec Oy Myllyhaantie 6 FI-33960 Pirkkala, Finland
Tel. +358 29 006 260, Fax +358 29 006 1260

Declaration of Conformity

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

Description of the apparatus: Level sensor
Type: SET/DM3D, SET/DM3DL, SET/DM3AL
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.

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'
EN 60079-26 (2007) Explosive atmospheres — Part 26: Equipment with equipment protection level (EPL) Ga

EC-type examination certificate: VTT 09 ATEX 026X
Ex-classification :  II 1 G Ex ia II B T5 Ga Ta = -30...+60°C (SET/DM3D)
 II 1 G Ex ia II A T5 Ga Ta = -30...+60°C (SET/DM3DL, SET/DM3AL)

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 14.10.2011


Heikki Helminen
CEO
Labkotec Oy

Declaration of Conformity

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

Description of the apparatus: Level sensor
Type: SET/V
Manufacturer: Labkotec Oy
Myllyhaantie 6
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.

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'
EN 60079-26 (2007) Explosive atmospheres — Part 26: Equipment with equipment protection level (EPL) Ga

EC-type examination certificate: VTT 09 ATEX 025X
Ex-classification :  II 1 G Ex ia II B T5 Ga Ta = -30...+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