

LevelSET S

LEVEL SWITCH FOR SEPARATOR SYSTEMS



Operation and Installation Manual



CONTENTS

1	GENERAL.....	3
1.1	Copyright.....	3
1.2	Target group.....	3
1.3	Symbols	3
1.4	Safety instructions.....	4
1.5	Ambient conditions	4
2	INTRODUCTION	5
3	INSTALLATION	7
3.1	Probes in the same area and zone	9
3.2	Probes in different areas and zones	10
4	OPERATION AND SETTINGS	11
4.1	Special observations for commissioning the device	11
4.2	Operation	12
4.2.1	Test function	13
5	CHANGING THE SETTINGS	14
5.1	Selecting the probes in use.....	15
5.2	Address search for probes and selecting the probe slots.....	15
5.2.1	Restoring address default settings	16
5.3	Setting the mode.....	16
5.4	Setting the delay	16
5.5	Setting the relay operation	17
5.6	Acknowledging the maintenance alarm and resetting the counter	17
5.7	Commissioning the GSM modem	17
6	REPAIRS AND MAINTENANCE ACTIONS	18
6.1	Troubleshooting	18
6.2	Replacing faulty probe	19
	APPENDICES.....	20
	Appendix 1 Technical specifications.....	20
	Appendix 2 Name plate type marking.....	21
	Appendix 3 Interface values	22

1 GENERAL

1.1 Copyright

Copyright © 2010 Labkotec Oy. All rights reserved.

Copying, distributing, or saving this document entirely or partly is prohibited without the written authorisation of Labkotec.

Labkotec develops their products continuously and, therefore, reserves the right to make changes and improvements to any product mentioned in this document without any prior notice.

Labkotec is not liable for direct or indirect damages, including the loss of information or income.




The contents of this document are provided "as is". No direct or indirect guarantee is given for its accuracy, reliability, or the contents, or a specific guarantee for its marketability or suitability to a specific purpose, unless otherwise stipulated by law. Labkotec reserves the right to modify this document or remove it from distribution without any prior notice.

LabkoNet[®] is a registered trademark of Labkotec Oy.

1.2 Target group

The LevelSET S Operation and Installation Manual is directed to the installation personnel and the user.

1.3 Symbols

Symbol	Explanation
	Warning / Note
	To be carefully considered especially when installing in potentially explosive atmospheres.
	The device is protected with either double insulation or reinforced insulation.

1.4 Safety instructions



The LevelSET S measurement centre must not be installed in potentially explosive atmospheres, but a probe connected to it may be installed in potentially explosive atmosphere zones 0, 1, or 2.

In potentially explosive atmosphere installations, the national regulations and the appropriate standards *IEC/EN 60079-25 Intrinsically safe electrical systems "i"* and/or *IEC/EN 60079-14 Explosive atmospheres - Electrical installations* must be observed.



In case static electricity can cause hazards in the measurement environment, the equipotential bonding must be attended according to the regulations concerning potentially explosive atmospheres. Equipotential bonding is done by connecting all conductive parts to the same potential, for example, in a junction box. The equipotential bonding system must be grounded.



The device is not equipped with a mains switch of its own and, therefore, the supply voltage wires, near the device, should be fitted with a disconnecting coupler (250 VAC/1 A), which disconnects both wires (L1, N) to facilitate maintenance and repair actions. The switch is to be marked as the disconnecting coupler of the device.



When performing maintenance, inspections or repairs in potentially explosive atmospheres, standards IEC/EN 60079-17 and IEC/EN 60079-19 in regards to Ex devices inspection and maintenance should be observed.



See appendices 1 and 3 Interface values.

1.5 Ambient conditions

LevelSET S and LevelSET S GSM	
Dimensions	175 mm x 125 mm x 75 mm (w x h x d)
Enclosure	IP 65, material: polycarbonate
Operating temperature	-30°C...+50°C
Supply voltage	230 VAC ± 10%, 50/60 Hz Fuse 5 x 20 mm 160 mA (EN 60127-2/3) The device is not equipped with a mains switch
Power consumption	4.5 VA
Probes	Digital Labkotec SET probes
Data communication (only with LevelSET S GSM)	GSM text messages (SMS) Built-in GSM modem 850/900/1800/1900 MHz



LevelSET S is suitable to be used as a power source for probes located in potentially explosive atmosphere zones 0, 1, and 2. The inputs of the device are naturally intrinsic safety structures. LevelSET S must be installed to a safe area.

2 INTRODUCTION

LevelSET S is a versatile measurement and control centre for monitoring liquid levels. The most common applications are:

- alarms for oil and sand separators
- high and low level alarms for tanks
- alarms for condensation water
- level control

Depending on the order, the device has either one or two galvanically isolated digital measurement channels, to which up to three digital SET probes of Labkotec Oy can be connected. In terms of operation, the measurement channels and the terminal strips of the channel are equal and, therefore, the probes can be connected to the connectors of the device in any way the installation requires. Channel 1 has three terminal strips to facilitate separate cabling of probes. Only one probe can be connected to channel 2.

LevelSET S is also available with a built-in GSM modem. The device sends the alarms either directly to the GSM phone of the user, or to the LabkoNet[®] server to be stored and shared with other appropriate parties. The user settings of the GSM version can be changed using the user's own mobile phone (see the separate instructions for commissioning and using the LevelSET S GSM functionalities).

The indicator lights, buttons and interfaces of the device are illustrated in figure 1.

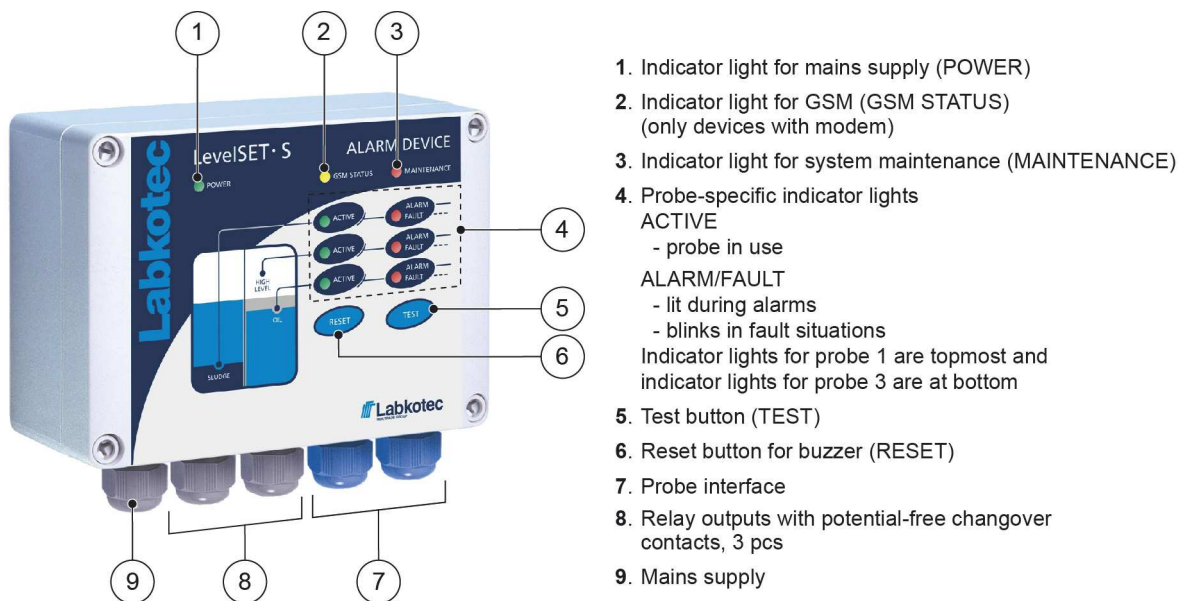


Figure 1. LevelSET S level switch features



LevelSET S is suitable to be used as a power source for probes located in potentially explosive atmosphere zones 0, 1, and 2. The inputs of the device are naturally intrinsic safety structures. LevelSET S must be installed to a safe area.

The device is equipped with two measuring channels, thus enabling measurements from different zones, as the channels are galvanically isolated from each other. Probes connected to a device with a single channel must be in the same area.

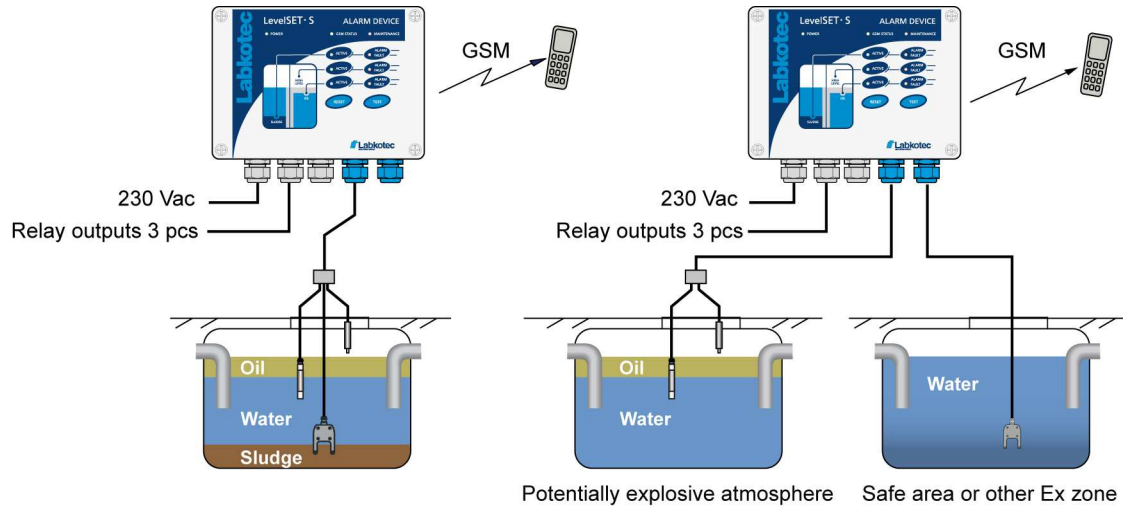
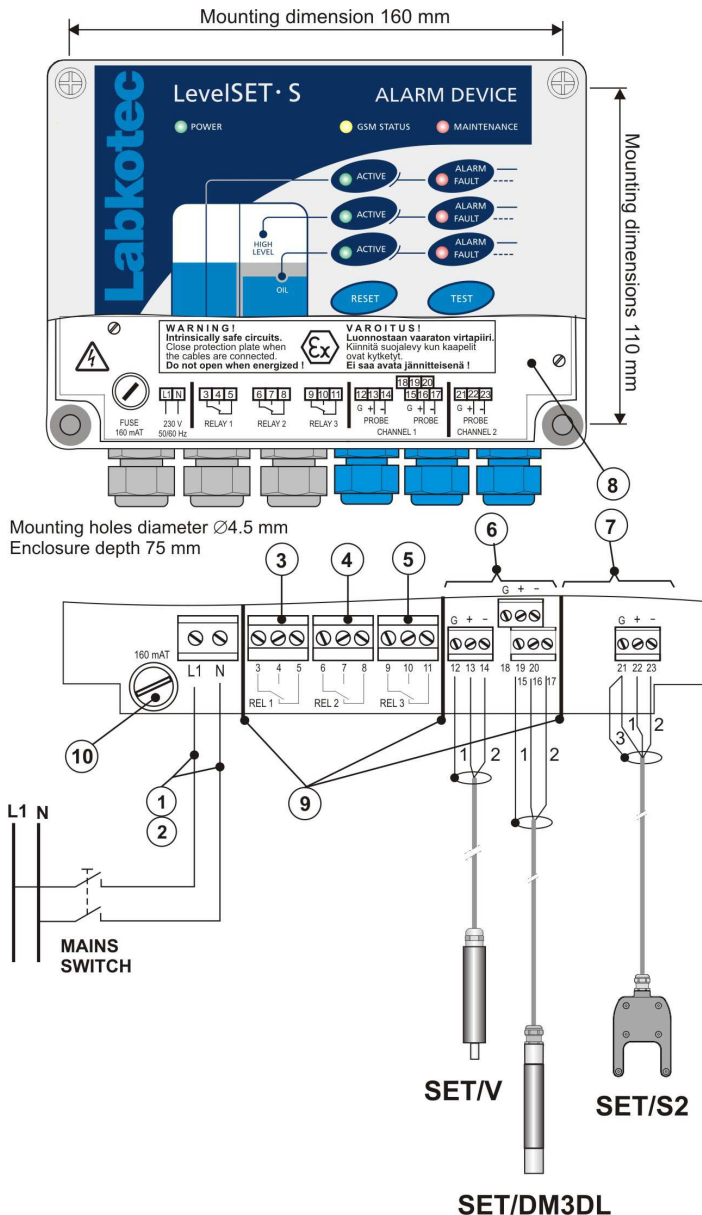


Figure 2. Application example: Alarms for oil and sand separators

3 INSTALLATION



NOTE: Before installation, see the safety instructions in chapter 1.4!



Supply voltage 230 VAC, 50/60 Hz

- 1 L1 = phase conductor
- 2 N = neutral conductor

- 3 RELAY 1 (RELAY 1)
3 = common contact
4 = opening contact when alarm
5 = closing contact when alarm

- 4 RELAY 2 (RELAY 2)
6 = common contact
7 = opening contact when alarm
8 = closing contact when alarm

- 5 RELAY 3 (RELAY 3)
3 = common contact
4 = opening contact when alarm
5 = closing contact when alarm

See chapter 3 RELAY ACTIONS.

Relays are in alarm positions, when the mains voltage is off.

- 6 CHANNEL 1 (Measuring channel 1)
12 = 15 = 18 = cable shield (G);
13 = 16 = 19 = [+] supply contact to sensor
14 = 17 = 20 = [-] supply contact to sensor
Connectors are similar with each other.

- 7 CHANNEL 2 (Measuring channel 2)
21 = cable shield (G);
22 = [+] supply contact to sensor
23 = [-] supply contact to sensor

- 8 Cover plate
- 9 Separating plates 3 kpl
- 10 Fuse 5x20 mm 160 mAT

Figure 3. LevelSET S installation and interfaces with separate cabling

1. Mount the LevelSET S device on the wall using the provided screws.

The mounting holes are located at the bottom part of the enclosure, under the mounting holes for the cover.



NOTE: The connectors for the external interfaces are separated with separator walls. The separator walls must not be removed.

The protective plate covering the connectors must be reinstalled after connecting the cables.

2. You can connect the probes to the measurement channels directly with their own cables (as illustrated in figure 3), or by connecting the probe cables to the same channel with a junction box (see chapters 3.1 and 3.2).



NOTE: When installing, write down the **5-digit addresses** given in the **Code fields** of the probe name plates. These addresses are required if a probe must be reconnected to the current system or another measurement centre.

If the probe cables must be extended or the target requires equipotential bonding, it can be done using a junction box. A protected, twisted-pair instrumentation cable can be used as a connecting cable between the LevelSET S level switch and the junction box. For example, junction boxes LJB2, LJB3, LJB-D and LJB-DE enable extending cables in potentially explosive atmospheres. You can also shorten the probe cable.

The LevelSET S probe inputs are digital channels galvanically isolated from each other. This enables connecting probes of different Ex areas and zones to the device.

Identifying the digital probes and selecting the probe slot on the LevelSET S user interface is described in chapter 5.



NOTE: When installing, make sure that the electrical values of the probe cable and the probe do not exceed the stated interface values. The interface values are presented in Appendix 3.



NOTE: Seal the junction box carefully!

3. Plug the holes of unused bushings if exposure to dust and vapours is expected.
4. Tighten the enclosure cover so that the edges coincide with the bottom part of the enclosure.

This ensures proper operation of buttons and seals the enclosure.

3.1 Probes in the same area and zone

Example figure 4 illustrates that the cable sheaths and the extra wires are connected to the same point in the junction box. This point is connected to the equipotential bonding via grounding screw on the side of junction box LJB2, LJB3 or LJB-DE (the right-hand side example in figure 4). Also other conductive parts that can be connected to the equipotential bonding may be connected to the grounding screw.

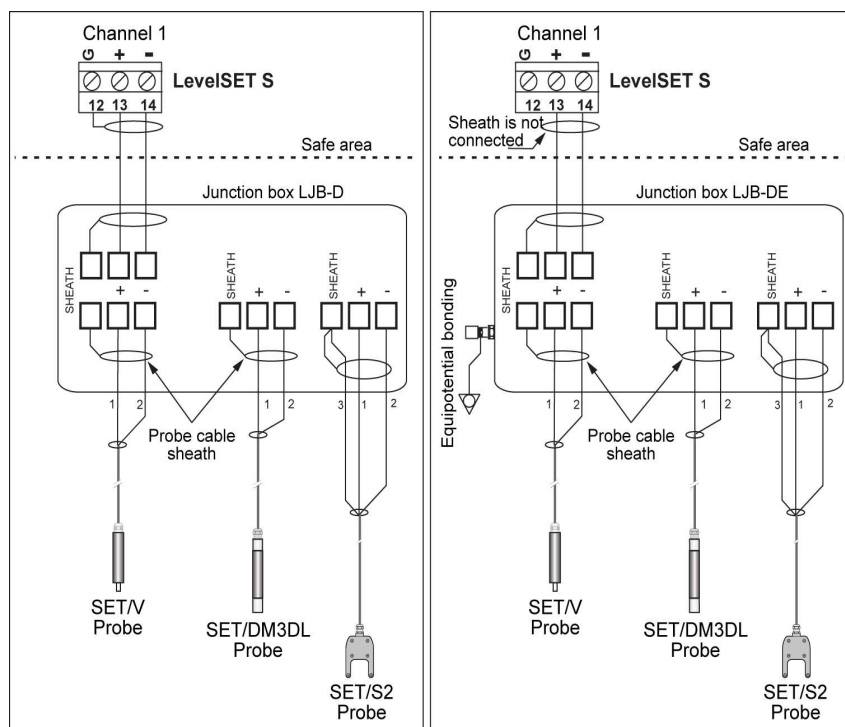


Figure 4. Cabling with junction boxes LJB-D and LJB-DE

To extend a single cable, it is also possible to use cable extension SK-3-2500.

If the equipotential bonding system is not in use, the cable sheath is connected to the connector (G) on the supplying device. In this case, equipotential bonding is not brought to the junction box, and the junction box must be isolated electrically from the liquid being measured and any conductive parts. In this case it is recommended to use the plastic Labkotec LJB-D box (the left-hand side example in figure 4).



In the latter case (no equipotential bonding system), it is of utmost importance to make sure that static charges cannot cause any danger.

When installing, make sure that the device and the cabling are not close to strong current or other installations, and that they are not exposed to strong stream flows, mechanical friction, or impacts.



During maintenance actions (e.g. when maintaining oil/fuel separator systems), do not lift the probe out of the separator tank or install it back until there is water in the tank. Static electricity may occur!



Junction boxes LJB2 and LJB3 contain light alloy parts. When installing in potentially explosive atmospheres, the location of the junction box must be selected so that the box is not subject to damages, impacts due to metal objects, friction, or anything else that may cause sparking.

The equipotential bonding wire must be a 2.5 mm² mechanically protected or a 4 mm² mechanically unprotected wire.



NOTE: When installing, make sure that the electrical values of the probe cable and the probe do not exceed the stated interface values. The interface values are presented in Appendix 3.



NOTE: Seal the junction box carefully!

See also the probe-specific cabling instructions given in the operation and installation instructions of Labkotec SET probes.

3.2 Probes in different areas and zones

In the examples illustrated in figures 5A and 5B, the probes are located in different areas and zones. Thus, the probes must be connected to separate channels in the LevelSET S measurement centre. The equipotential bonding systems of the different areas may also be separate.

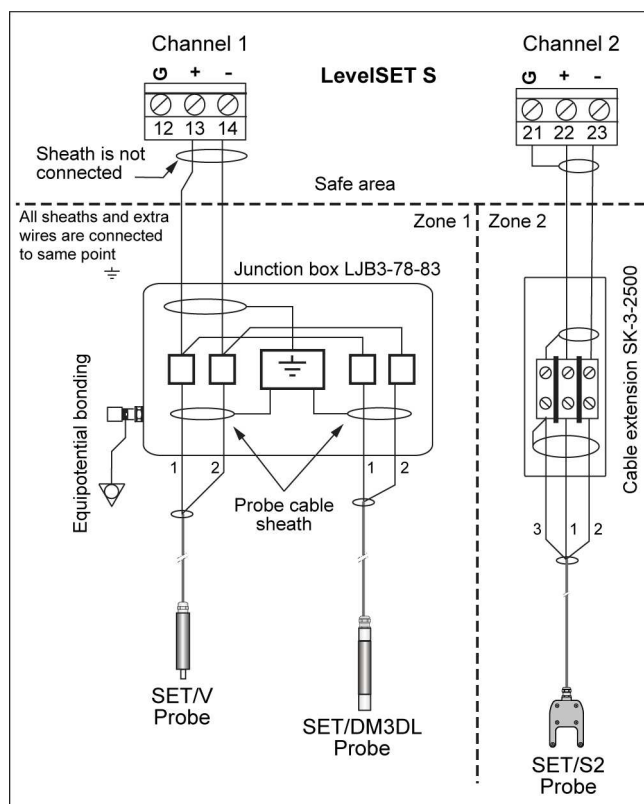


Figure 5A. Cabling with a junction box when the probes are located in different areas and zones

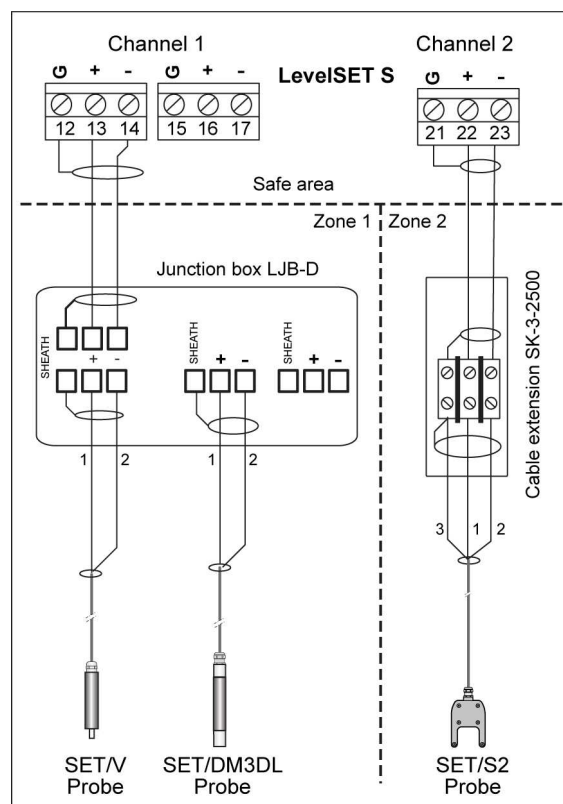


Figure 5B. Cabling with a junction box when no equipotential bonding is available

4 OPERATION AND SETTINGS

The LevelSET S measurement centre is set at the factory to function, by default, as an oil separator alarm as described below.



NOTE: Probe 1 refers to the probe that controls the topmost probe-specific indicator lights. Probe 2 controls the middle indicator lights, and probe 3 controls the bottom indicator lights (See figure 1).

The number of the measurement channel or the terminal strip of the channel does not affect on the probe numbering on the device. See chapter 5.2, *Address search for probes and selecting the probe slots*.

*Channel 1 - Probe 1
(*)*

An alarm is triggered when the sludge level reaches the probe (sludge alarm).

Channel 1 - Probe 2

An alarm is triggered when the liquid level reaches the probe (backwater alarm).

Channel 1 - Probe 3

An alarm is triggered when the water level leaves the probes (oil alarm).

Relays 1, 2 and 3

The relays are released during alarm and fault situations for the corresponding probes (the so-called fail safe function).

The operation delay is set to 30 seconds.

() In a two-channel device, Probe 1 is set by default to channel 2.*

See a more detailed description in chapter 4.2 *Operation*.

4.1 Special observations for commissioning the device

After installation, it is not necessary to change any of the device settings if the device is used as an oil separator alarm, as described above.

The device settings must be changed if the equipment has not been ordered and delivered as a total system, or if one or more probes must be replaced during maintenance and repairs. Changing the settings is described in chapter 5.



NOTE: When installing, write down the **5-digit addresses** given in the **Code fields** of the probe name plates. These addresses are required if a probe must be reconnected to the current system or another measurement centre.

The instructions for using GSM functionalities are described in a separate instruction manual.

4.2 Operation

This chapter describes the functions of the factory-set LevelSET S level switch in different situations. If the probe does not operate as described, check the device settings (chapter 5) or contact a representative of the manufacturer.

<i>Normal situation</i>	<i>The liquid being measured is below the HIGH LEVEL probe, the OIL probe is in the water, and the SLUDGE probe is in the water.</i> <i>The voltage supply indicator light and the ACTIVE indicator lights are on. Other indicator lights are off.</i> <i>Relays 1, 2 and 3 are pulled.</i>
<i>High level alarm</i>	<i>The liquid level has reached the HIGH LEVEL probe.</i> <i>The voltage supply indicator light and the ACTIVE indicator lights are on.</i> <i>The ALARM indicator light for the HIGH LEVEL probe turns on.</i> <i>The buzzer sounds after a 30-second delay.</i> <i>Relay 2 releases after a 30-second delay.</i> <i>Relays 1 and 3 remain pulled.</i>
<i>Oil alarm</i>	<i>The OIL probe is completely in the oil.</i> <i>The voltage supply indicator light and the ACTIVE indicator lights are on.</i> <i>The ALARM indicator light for the OIL probe turns on.</i> <i>The buzzer sounds after a 30-second delay.</i> <i>Relay 3 releases after a 30-second delay.</i> <i>Relays 1 and 2 remain pulled.</i>
<i>Sludge alarm</i>	<i>The sludge bed has reached the SLUDGE probe.</i> <i>The voltage supply indicator light and the ACTIVE indicator lights are on.</i> <i>The ALARM indicator light for the SLUDGE probe turns on.</i> <i>The buzzer sounds after a 30-second delay.</i> <i>Relay 1 releases after a 30-second delay.</i> <i>Relays 2 and 3 remain pulled.</i>
<i>Alarm off</i>	<i>After the alarms have cleared, the ALARM indicator lights turn off, the buzzer turns off, and the relays pull after a 30-second delay.</i>
<i>Fault alarm</i>	<i>There is a fault in the probe or probe cabling.</i> <i>The voltage supply indicator light and the ACTIVE indicator lights are on.</i> <i>The ALARM/FAULT indicator light for the faulty probe circuit starts blinking after a fixed 5-second delay.</i> <i>The buzzer sounds after a 5-second delay.</i> <i>The relay corresponding to the probe releases after a 5-second delay.</i>
<i>Acknowledging the alarm</i>	<i>The alarm is acknowledged by pressing the RESET button.</i> <i>The buzzer turns off.</i> <i>The relays do not change their state before the alarm or fault situation is cleared.</i>
<i>Maintenance alarm</i>	<i>Automatically in intervals of approximately six (6) months, the device notifies of the need for system maintenance. This is indicated by the MAINTENANCE indicator light. The purpose of the maintenance notification is to remind the user that the probes must be cleaned and their operation checked regularly.</i>
<i>Resetting the maintenance alarm</i>	<i>The maintenance alarm counter can be reset after maintenance by pressing the RESET button for 10 seconds. The counter has been reset when</i>

counter the MAINTENANCE indicator light blinks for 2 seconds. The maintenance notification indicator light turns on again after six months.

4.2.1 Test function

The test function creates an artificial alarm, which is used to ensure the appropriate operation of the LevelSET S level switch and any other possible devices or systems controlled by its relays in a real alarm situation.



NOTE: Before pressing the TEST button, make sure that relay operations do not cause hazards via controlled systems!

Test function in a normal situation

When pressing the TEST button:

The ALARM indicator lights turn on immediately.

The buzzer sounds immediately.

The relays release only after the button is pressed continuously for 2 seconds.

When releasing the TEST button:

The ALARM indicator lights and the buzzer turn off immediately.

The relays pull immediately.

Test function when alarm is already on

When pressing the TEST button:

The ALARM indicator lights turn on immediately.

The ALARM indicator light for the alarming probe is still on and the relay remains released.

The other ALARM indicator lights turn on and the relays release after 2 seconds.

The buzzer still sounds. The previously acknowledged buzzer sounds again.

When releasing the TEST button:

The device returns to the state it was in before the test.

Test function when fault alarm is on

When pressing the TEST button:

In terms of the faulty probe, the device does not react to the test in any way.

In terms of functional probes, the operation is as described above.

In case LevelSET S includes a GSM modem, it sends the user a text message if the test button is pressed for slightly over 5 seconds. All of the ACTIVE and ALARM indicators lights blink to indicate a test alarm.

5 CHANGING THE SETTINGS

The commissioning procedures described in this chapter are necessary, if you wish to change the probe order of the standard delivery, or use different probes.

The factory-set probe combination and its order are:

Probe slot	Probe
1	Sludge probe SET/S2 (SLUDGE)
2	High level probe SET/V (HIGH LEVEL)
3	Oil probe SET/DM3D or SET/DM3DL (OIL)



Only persons familiar with Ex i devices and with proper related training may perform the following procedures.



NOTE: It is recommended to have the device de-energized when changing device settings, or to make the changes before installing the probes into an area with a possibly explosive atmosphere.

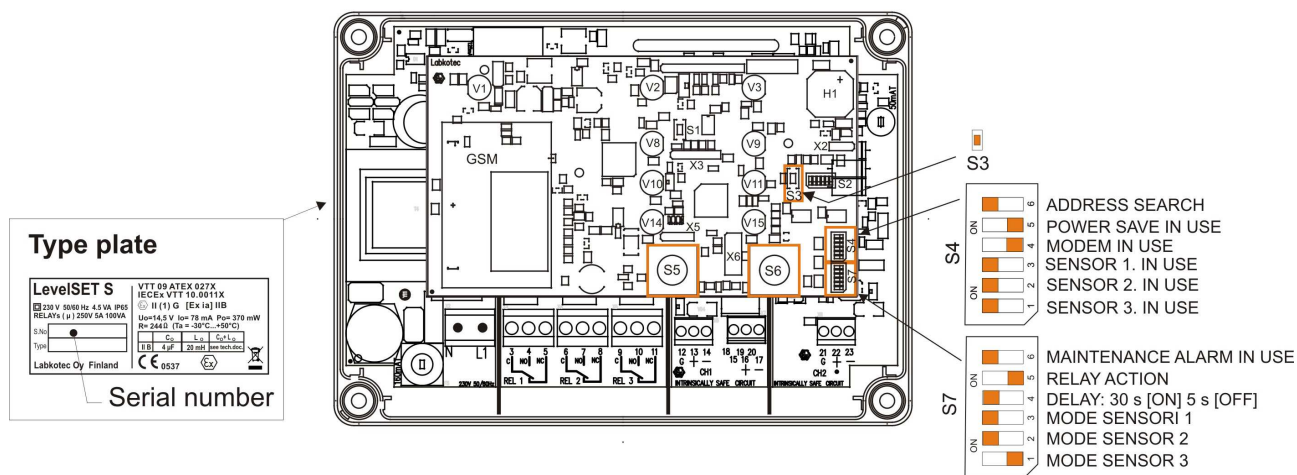
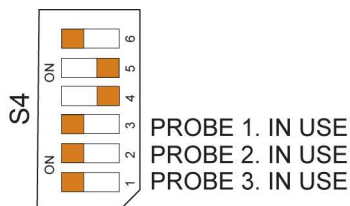


Figure 6. Changing the LevelSET S settings

The settings are made using the upper circuit board (figure 6) buttons S3, S5 and S6, and the DIL switch strips S4 and S7. In figure 6, the switches are according to the two-channel non-GSM version (Device type A2M. See Appendix 2).

5.1 Selecting the probes in use

As it is possible to connect 1 - 3 probes to the LevelSET S device, the device must be indicated of which probe slots are in use.



1. Select the probe into use by setting the DIL switch in position ON (left):

- Probe 1 : S4/3 (the third switch from the bottom)
- Probe 2 : S4/2 (the second switch from the bottom)
- Probe 3 : S4/1 (the bottom switch)

The probe in question is in use when the switch is in position ON (left). It does not matter to which channel the probe is connected.

5.2 Address search for probes and selecting the probe slots



NOTE: The digitally communicating SET series probe connected to the LevelSET S central unit has a 5-digit probe address in the Code field of its name plate.

Write down the address given in the Code field!

In LevelSET S control units, there is attached a label to the backside of the enclosure cover where the address can be written. E.g.

NBR	SENSOR	CODE
← 1	SET/DM3DL oil sensor, separator 1	12345
← 2	SET/V high level sensor, erotin 2	23456
← 3	SET/DM3DL oil sensor, separator 2	34567
More information about the order of sensors can be found from <i>LevelSET S Operation and Installation Manual</i> .		

S3



1. Set the S4/6 DIL switch in position ON (left).
2. Press the S3 button.

During this function, the ACTIVE and ALARM/FAULT indicator lights blink for all of the probe slots in use. The search takes 10-120 s.

When all probes have responded, all indicator lights turn off, except for the lights for the first used probe slot. By this the device suggests that the probe with the smallest address would be set there.

3. Accept the probe slot suggested by the device with the TEST button (S6), or select another probe slot.
 - a. If you wish to have some other probe slot for the probe on the display, move it in increments to the desired position with the RESET button (S5).

The ACTIVE and ALARM/FAULT indicator lights indicate of the current probe slot.

- b. When you reach the desired probe slot, select it by pressing the TEST button (S6).

After this, the device suggests a probe slot for the probe with the next largest address, etc. Perform the selection as described above.



NOTE: If a probe gives no response, all ALARM indicator lights turn on.

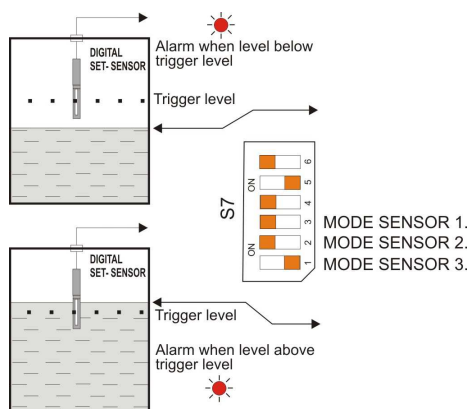
An unsuccessful search may result from connecting a different amount of probes than selected in use with DIL switches S4/1, S4/2 and S4/3, or there may be a fault in the probe cabling.

Check the cabling and the probe selection, and restart the function.

5.2.1 Restoring address default settings

Start the probe address search normally by pressing button S3. When ACTIVE and ALARM/FAULT indicator lights start blink, press RESET button (S5) during 5 s. Now default settings are restored and LevelSET S works with the basic probe combination that's described in a table in the beginning of chapter 5.

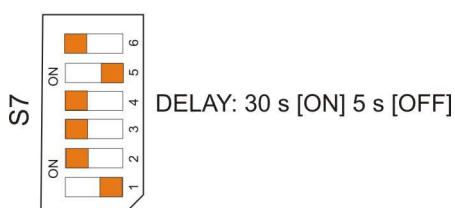
5.3 Setting the mode



1. Set the probe mode by placing DIL switch S7/1, S7/2 and/or S7/3 to position OFF or ON.

- position OFF (right): the alarm indicator light turns on, the buzzer sounds, and the relay releases when the level of the measured liquid is below the low limit value of the probe (low level function). This setting is also used when alarms are needed for oil layers on the water surface (oil separation function).
- position ON (left): the alarm indicator light turns on, the buzzer sounds, and the relay releases when the level of the measured liquid is above the limit value of the probe (e.g. high level function and sludge alarm).

5.4 Setting the delay



1. Specify the device delay for alarm situations by setting the S7/4 DIL switch to position OFF or ON.

Delay operates in both directions (release/pull).

- position OFF (right): the relays act and the buzzer sounds in approximately 5 seconds after the limit value is exceeded, if the liquid level has been con-

tinuously on the same side of the limit value during the entire delay period.

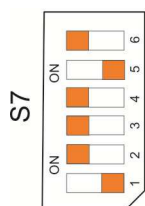
- position ON (left): the alarm delay is 30 s.

When sludge probe SET/S2 is connected to LevelSET S it's recommended to use 30 s delay. In other cases 5 s delay is generally enough.



NOTE: The alarm indicator lights follow the probe message and the limit value without delay.

5.5 Setting the relay operation



RELAY ACTION

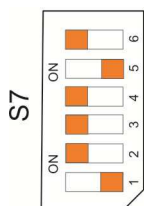
1. Select the relay operation for alarm situations by setting the S7/5 DIL switch to position OFF or ON.

- position OFF (right): the relays act probe-specifically, releasing both in alarm and fault situations.
- position ON (left): the relays are shared by all probes. In this case, relay 1 is a shared alarm relay, relay 2 is an acknowledgeable alarm relay, and relay 3 is a shared fault alarm relay.

5.6 Acknowledging the maintenance alarm and resetting the counter

Especially oil separator probes should be cleaned and their functions checked regularly. LevelSET S reminds the user every 6 months of the need for maintenance (MAINTENANCE indicator light).

The maintenance alarm is in use when the DIL switch S7/6 is in position ON (left).

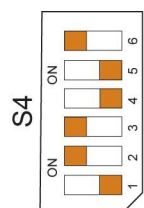


MAINTENANCE ALARM

1. Acknowledge the alarm by pressing the RESET button.
2. Reset the maintenance alarm counter by pressing the RESET button for 10 seconds.

The MAINTENANCE indicator light blinks for 2 seconds after the counter has been reset.

5.7 Commissioning the GSM modem



MODEM IN USE

1. Select a GSM modem into use by setting the DIL switch S4/4 in position ON.



NOTE: Do not set the switch in position ON, if the device is not equipped with a GSM modem. A device equipped with a modem can be identified by the GSM light on the cover, and from the name plate.

6 REPAIRS AND MAINTENANCE ACTIONS

The mains fuse (marked 160 mAT) can be replaced with another EN 60127-2/3 compliant 5 x 20 mm/160 mAT glass tube fuse.



NOTE: Other device-related repairs may only be performed by persons with Exi device training, and by the authorisation of Labkotec Oy.

If problems occur, contact the maintenance of Labkotec Oy: labkotec.service@labkotec.fi.

6.1 Troubleshooting

Problem: THE VOLTAGE SUPPLY INDICATOR LIGHT IS NOT ON

Explanation: The voltage to the device is too low, or the fuse has blown.

- Actions:**
1. Check if the voltage has been cut with a disconnecting coupler.
 2. Check the fuse.



3. Measure the voltage from connectors N and L1. The voltage should be 230 VAC \pm 10%.

Problem: THE ALARM/FAULT INDICATOR LIGHT(S) BLINK

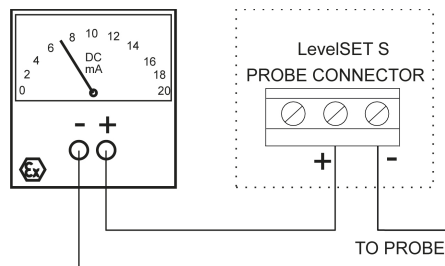
Explanation: A probe communication problem. The cable is short-circuited, cut or disconnected from the connector. The probe could also be damaged.

- Actions:**
1. Make sure the probe is connected appropriately to the central unit. See the probe manual for probe-specific connection instructions.
 2. Measure the voltage separately from the probe connectors of the probe in question. The voltage should be 10.1–10.3 V.
 3. If the voltage is correct, measure the current from the probe circuit, one circuit channel and one terminal strip at a time. Actions:
 - 3.1 Disconnect the [+] wire of the probe from the probe connector.
 - 3.2 Measure the short-circuit current between the [+] and [-] connectors of the probe connector.
 - 3.3 Connect a mA meter to the probe circuit as illustrated in figure 7.
Compare the values to the standard values given in Table 1.
 - 3.4 After measurements, reconnect the disconnected wire to the connector.

If problems occur, contact the maintenance of Labkotec Oy.



NOTE: If the probe is in a possibly explosive atmosphere, the measuring device must also have Exi classification!



Kuva 7. Measuring the probe current

	Channel 1. E.g. connectors 13 [+] and 14 [-]	Channel 2 Connectors 22 [+] and 23 [-]
Short-circuit current	30 mA...40 mA	17 mA...22 mA
Current / Probe	6 mA...7 mA	6 mA...7 mA

Table 1. Probe currents

6.2 Replacing faulty probe

In cases where the basic probe combination, like described in a table in the beginning of chapter 5, is used the faulty probe can simply be replaced with new one and the system is ready for use.

With other probe combinations it's need to be done the address search so that the control unit recognises the new probe. It can be done in two alternative ways:

Alternative 1:



Do the probe address search like described in chapter a 5.2. When using this method is required that all probe addresses are known. Probe has its 5-digit address in Code field in the name plate.

Alternative 2:

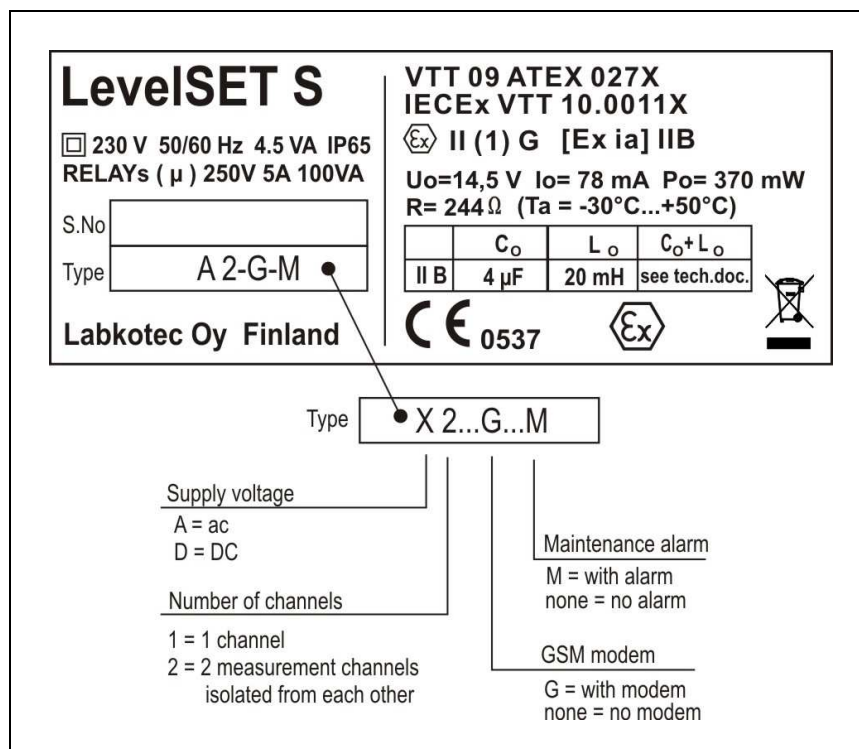
Remove the probe slots from use like described in a chapter 5.1 except the probe slot where replaceable probe has been. In addition make a temporary connection where only the new probe is connected to LevelSET S control unit. Do the probe address search like described in chapter a 5.2. The probe can be set only the probe slot that's not removed from use. An advantage in this method is that you don't need to known the addresses of probes. When the probe search is done restore the connection and switch S4 settings.

APPENDICES

Appendix 1 Technical specifications

LevelSET S	
Dimensions	175 mm x 125 mm x 75 mm (w x h x d)
Enclosure	IP 65, material: polycarbonate
Operating temperature	-30°C...+50°C
Supply voltage	230 VAC \pm 10%, 50/60 Hz Fuse 5 x 20 mm 160 mA (EN 60127-2/3) The device is not equipped with a mains switch
Power consumption	4.5 VA
Data communication (only with LevelSET S GSM)	GSM text messages (SMS) (Built-in GSM modem 900/1800 MHz)
Probes	Digital Labkotec SET probes
Maximum loop resistance between the central unit and a probe	75 Ω . See the cabling calculation in Appendix 2.
Relay outputs	250 V, 5 A, 100 VA Potential-free changeover contacts. Operation delays 5 or 30 seconds. Relays are set to release at the limit value. Can be set for either ascending or descending level.
Electrical safety	EN 61010-1, Class II  , CAT II
Insulation level	375V (EN 60079-11) Measurement channel / Mains voltage Measurement channel 1 / Measurement channel 2
EMC	
Emissions	EN 61000-6-3
Immunity (tolerance)	EN 61000-6-2
Ex classification	 II (1) G [Ex ia] IIB (Ta = -30 °C...+50 °C)
Special terms (X)	
ATEX	VTT 09 ATEX 027X
IECEx	IECEx VTT 10.0011X
Interface values / measurement channel	U _o = 14.5 V I _o = 78 mA P _o = 370 mW R = 244 Ω
Characteristic curve of output voltage is trapezoidal	C _o = 4.0 μ F L _o = 20 mH
Maximum allowed IIB	
NOTE! See Appendix 3	
Manufacturing year	xxx x xxxxx xx YY x
See the serial number on the type plate	where YY = manufacturing year (eg. 10=2010)

Appendix 2 Name plate type marking



The above name plate is from a device with 230 Vac supply voltage, two measurement channels isolated from each other, a GSM modem, and a maintenance interval alarm.

Appendix 3 Interface values

When installing, make sure that the electrical values of the probe cable and the probe do not exceed the stated interface values.

The cabling for the measurement centre and junction box can be done according to figures 4, 5A or 5B. A protected, twisted-pair instrumentation cable can be used for cabling.

In terms of the LevelSET S probe connection cable, the parameters must allow the combined effect of capacitance and inductance. The table below shows the interface values in certified temperature class IIB. In class IIA, the IIB values can be observed.

$$U_o = 14.5 \text{ V} \quad I_o = 78 \text{ mA} \quad P_o = 370 \text{ mW} \quad R = 244 \text{ } \Omega$$

The characteristic curve of output voltage is trapezoidal.

Maximum value allowed			Co and Lo together	
	Co	Lo	Co	Lo
II B	4.0 μ F	20 mH	3.48 μ F	0.08 mH
			3.00 μ F	0.43 mH
			2.40 μ F	1.00 mH
			1.85 μ F	2.00 mH
			1.65 μ F	5.00 mH

Table 2. Interface values

The cable length is determined based on the maximum allowed probe loop resistance 75 Ω (technical specifications) as well as on other probe circuit interface values (Co, Lo).

Example calculation to determine the maximum length of a jumper cable - three probes in one channel

Channel 1 has three probes with $C_i = 3,5 \text{ nF}$ and $L_i = 85 \text{ } \mu\text{H}$.

The cabling is implemented with a single instrumentation cable with the following properties:

- The twin wire DC resistance is approximately 81 Ω/km .
- Inductance is 3 $\mu\text{H}/\text{m}$.
- Pair capacitance is 70 nF/km.

Effect of resistance When the estimated other transfer resistance is 10 Ω , the maximum length of the jumper cable is:
 $(75 \text{ } \Omega - 10 \text{ } \Omega) / (81 \text{ } \Omega/\text{km}) = 800 \text{ m}$

Effect of inductance The total inductance of an 800-metre cable is $0.8 \text{ km} \times 3 \text{ } \mu\text{H}/\text{m} = 2.4 \text{ mH}$.
The total inductance is 2.66 mH for the cable and probes $3 \times [L_i = 85 \text{ } \mu\text{H}]$.

Effect of capacitance The capacitance of an 800-metre cable is $0.8 \text{ km} \times 70 \text{ nF}/\text{km} = 56 \text{ nF}$.
The total capacitance is 66.5 nF for the cable and probes $3 \times [C_i = 3.5 \text{ nF}]$.

According to Table 2. (the shaded values), it can be stated that the values do not limit the 800-metre cable length in group IIB.

Example calculation to determine the maximum length of cables - three separately cabled probes

The sum values of equally long separate cables must not exceed the values given in Table 2.

Effect of inductance Probes $3 \times [L_i = 85 \text{ } \mu\text{H}]$ have total inductance of 0.255 mH. Therefore, the cables may be left with $5 \text{ mH} - 0.255 \text{ mH} = 4.745 \text{ mH}$, and thus length of a single cable is $(4.74 \text{ mH} / 3 \text{ } \mu\text{H}) / 3 = 526.6 \text{ m}$.

Effect of capacitance The total capacitance of the cables and probes is $(3 \times 36.86 \text{ nF}) + 10.5 \text{ nF} = 121.1 \text{ nF}$, which is less than 1.65 μF .

In this case, the maximum length of the probe cable is 526.6 metres.

Declaration of Conformity

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

Description of the apparatus: Measuring and control unit
Type: LevelSET S series
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.
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 09 ATEX 027X

Ex-classification :  II (1) G [Ex ia] II B Ta = -30...+50°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

The product is CE-marked since 2009.

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