"Alarmline LWM-1" System

Installation and Commissioning Manual

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ATTENTION!

Electronic components and modules may be damaged by even small amounts of static electricity. Therefore, when handling such components and modules, an antistatic bracelet or another earthing device must always be worn.

Observe the safety measures for handling components, which are sensitive to static electricity.

CAUTION !
SAFETY MEASURES AGAINST STATIC ELECTRICITY

OBSERVE PRECAUTIONS FOR HANDLING ELECTROSTATIC

ATTENTION!

Warning of electrostatic discharges (ESD). Touching a PC board or component is only permitted in electrostatically protected environment.

WHEN HANDLING ELECTRONIC COMPONENTS OR PC BOARDS, IT IS ESSENTIAL TO TAKE PRECAUTIONARY MEASURES AGAINST STATIC CHARGES AS OTHERWISE THE COMPONENTS COULD BE DAMAGED.

Observing the following notes helps to reduce static discharges.

1. Always use conductive or antistatic containers or packaging when returning parts for transport and storage.
2. Always wear a properly earthed bracelet when handling equipment.
3. Never push a part sensitive to static electricity over a surface which is not earthed. If possible, avoid touching the terminal pins and connections.
4. Never deposit parts sensitive to static electricity on plastic surfaces.
5. Try to avoid picking up parts sensitive to static electricity and printed circuit boards (PCBs).

1 System description

- Linear heat detector
- Combined fixed and rate-of-rise temperature detection
- Adjustable to sensitivity classes A1, A2, B, C as well as freely adjustable
- Sensor length up to 300 m
- Constant sensitivity over entire length of cable
- Resistant to mechanical and chemical influences, corrosion, humidity, dust
- Easy to install, economic
- Simple commissioning
- Suitable for use in Ex-zones (zone 1 and 2 or zone 21 and 22)
- VdS approval No.: G 20 50 66

The KIDDE Alarmline LWM-1 Linear Temperature Detection System allows early detection of fire or overheating. It is especially suited for confined areas or harsh environments where adverse ambient conditions cause other detection devices to be unreliable or difficult to use.

The system consists of two components: the sensor cable and the „Alarmline“ control unit LWM-1.

Material list

Item	Part No	Description
001	K82017	High-impedance temperature sensor cable (blue) The alarm line sensor cable consists of four copper conductors that are covered by a colour-coded material with a negative temperature coefficient. The cores are twisted and isolated by an outer sheath of temperature resistant, flame retardant plastic. At one end of the sensor cable the four conductors are connected to the control unit or an in-line box. At the other end of the sensor cable the conductors are joined in pairs and hermetically sealed to form two "out and return" loops. Both loops are permanently monitored. An open or short circuit on one of the two loops causes a fault signal in the control unit. A temperature change will cause a related change of the electrical resistance between the two loops; the resistance is reduced with increasing temperature.
002	K82021	High-impedance temperature sensor cable with nylon cover (black) (see 001)

Item	Part No	Description
003	K82078	High-impedance temperature sensor cable with bronze braid (see 001)
004	K98166	High-impedance temperature sensor cable with nylon cover and stainless steel braid (see 001)
005	53836-K239	Control unit LWM-1 Complete with Fire & Fault relay exits (2 A, 30 VDC) Measures W x H x D: 200 mm x 120 mm x 80 mm The control unit reports temperature differences by the permanent supervision of the resistance of the sensor cable. The response threshold Max-alarm can be adjusted by a 16-step dip-switch. The Max-alarm is triggered if the static alarm temperature of the sensor cable is reached or exceeded. Two 16-step dip-switches are available for the adjustment of the differential alarm: Diff-time and Diff-alarm. Diff-time changes the integration time of the ambient temperature; the shorter the time interval, the lesser sensitive the system responses. Diff-alarm changes the temperature range, which delivers a constant temperature/measurement-correlation. The higher the chosen Diff-alarm value, the higher the possible alarm temperature. Individual LED's for "Power", "Max-alarm", "Diff-alarm" and "Fault" indicate the actual status of the system. Two test buttons within the control unit allow an electrical check of the system for alarm and fault. All alarm and fault messages are latched in the control unit. A reset can be generated either by an interruption of the power supply or an activation of the External-Reset Input. The electronic PCB of the control unit is housed in a plastic housing (ABS: Protection class IP 65). Connections to supervising fire alarm panels can be made via potential-free relay contacts (2 A, 30 V) for alarms and faults.
006	K82023	End-of-line connectors for alarm line sensor cable Per control unit LWM-1 one end-of-line connector is required.
007	K82024	In-Line connector for alarm line sensor cables It is required to connect two lengths of Alarmline sensor cables.

2 Control unit

2.1 Description

The control unit reports temperature differences by the permanent supervision of the resistance of the sensor cable.
The response threshold Max-alarm can be adjusted by a 16-step dip-switch. The setting '0' is the factory default setting and causes a ‘fault’ message. The installer must select the appropriate setting according to this manual. The Max-alarm is triggered if the static alarm temperature of the sensor cable is reached or exceeded.
Two 16-step dip-switches are available for the adjustment of the differential alarm: Diff-time and Diff-alarm. Diff-time changes the integration time of the ambient temperature; the shorter the time interval, the lesser sensitive the system responses. Diff-alarm changes the temperature range, which delivers a constant temperature/measurement-correlation. The higher the Diff-alarm is chosen, the higher is the possible alarm temperature.
Individual LED’s for “Power”, “Max-alarm”, “Diff-alarm” and “Fault” indicate the actual status of the system. Two test buttons within the control unit allow an electrical check of the system for alarm and fault. All alarm and fault messages are latched in the control unit. A reset can be generated either by an interruption of the power supply or an activation of the External-Reset Input.
The electronic PCB of the control unit is housed in a plastic housing (ABS: Protection class IP 65). Connections to supervising fire alarm panels can be made via potential-free relay contacts (2 A, 30 V) for alarms and faults.

2.2 Technical data Alarmline LWM-1 control unit

General		
Material	ABS	
Dimension	200 mm x 120 mm x 80 mm (W x H x D)	
Weight	Approx. 550 g	
Protection class	IP 65	
Colour	Grey, similar to RAL 7035	
Temperature range	-20 °C to +50 °C	
Voltage supply		
Voltage	10-30 VDC	
Quiescent current consumption	Max. 25 mA (at 24 V)	
Current consumption at Diff-alarm or Max-alarm	Max. 25 mA (at 24 V)	
Current consumption at Fault condition	Max. 15 mA (at 24 V)	
Starting current peak	< 100 mA (at 24 V)	
Displays		
	LED green:	Power, steady light
	LED red:	Alarm Diff, steady light, latched
	LED red:	Alarm Max, steady light, latched
	LED yellow:	Fault, flashing light, latched
Test keys		
	2 x for the simulation of alarm, fault and LED test	

Terminal assignment

Pin	Description
1 downside	0 V
2 downside	10 -30 V DC
5 downside	Sensor cable 1 (orange)
6 downside	Sensor cable 2 (white)
7 downside	Sensor cable 3 (blue)
8 downside	Sensor cable 4 (red)
9 downside	Reset connection
10 downside	Reset connection
1 upside	Diff-alarm relay NO
2 upside	Diff-alarm relay COMMON
3 upside	Diff-alarm relay NC
4 upside	Max-alarm relays NO
5 upside	Max-alarm relays COMMON
6 upside	Max-alarm relays NC
7 upside	Fault relay NO
8 upside	Fault relay COMMON
9 upside	Fault relay NC

Fig. 2.1: Connections of the Control unit LWM-1

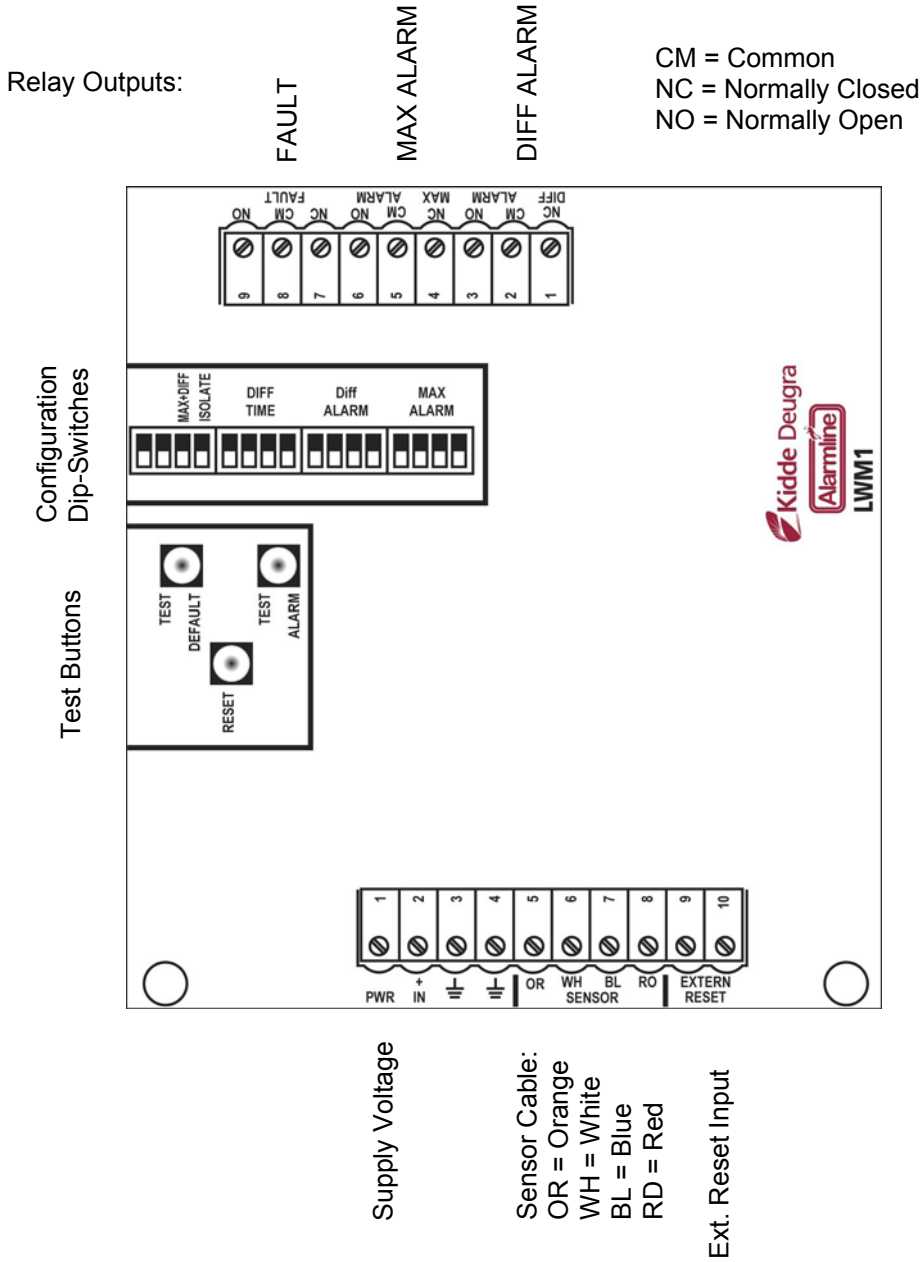
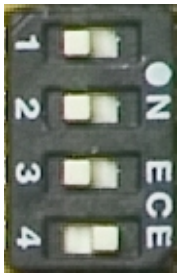
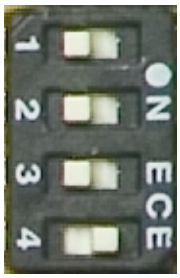
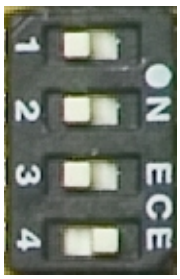
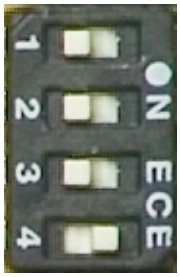


Fig. 2.2: Configuration Dip-Switches

Off	On	Function
		
	———	Unused
	———	Unused
	———	DIFF + MAX-Alarm combined
	———	Isolate
		DIFF-Time (Differential-Alarm-Window)
		DIFF-Alarm (Differential-Alarm-calibration switch)
		MAX-Alarm (Maximal-Alarm-calibration switch)

2.3 LWM-1 setup.

The LWM-1 shall be capable of being set-up via switches in the following manner:

- 4- bit calibration switch for a max. of 16 Max – Alarm temp. calibration settings

- 4- bit calibration switch for a max. of 16 differential (rate of rise) temp. calibration settings

- 4- bit calibration dip switch for 16 diff time windows

- 1 bit switch for “Isolate”, (If “ON” , then both alarm relays will be deactivated, on alarm only the corresponding LED will on, fault relay is always de-energised (shows fault) Fault LED is permanently on , isolate “OFF” will put the fault relay back in the normal energised status.
- 1 bit switch for “Max+ Diff”. This switch setting will combine both alarms in the following manner:

MAX + DIFF = OFF
1. On Max Alarm : LED Max Alarm and relay Max Alarm are activated as usual
2. ON Diff Alarm: LED Diff Alarm and relay Diff Alarm are activated as usual

MAX + DIFF = ON
If either Max- or Diff-Alarm occurs both alarm relays will be activated. The corresponding alarm-LED´s will be activated on their individual alarms.

Default configuration (factory settings):
switches:
- Max + Diff = ON
- Isolate = OFF
- Max Alarm = OFF
- Diff Alarm = most unsensitive setting (15)
- Diff Time = Smallest time interval (0)

2.3.1 Adjustment of the calibration switch Max-Alarm

The Max – Alarm calibrating switch is in the factory default setting (see configuration switch chapter 2.2) in position '0'. This causes a fault signal at the control unit. See Table 2 for correct setting.

During the installation of the "Alarmline" system the correct adjustment of the calibrating switch Max-Alarm must be verified. This is necessary to ensure false alarm immunity and fire alarm safety. The correct adjustment of the calibrating switch relates to the length of the sensor cable and the maximum ambient temperature in the room to be protected.

Typical applications with the maximum ambient temperatures are shown in table 1.

Table 1 for application-specific adjustments

Application	Max. ambient temperature [°C]
Underground installation (no road tunnels)	40
Installation under concrete ceilings and other not heat conducting material above ground, not exposed to direct solar radiation	45
Installation under insulated metal roof or metal container not exposed to direct solar radiation	50
Installation under non-insulated metal roof or exposed to direct solar radiation	60
Road tunnel	50

These recommendations are not valid if there is any excessive heat being produced locally. If you have problems with the correct adjustment, please contact KIDDE PRODUCTS.

Table 2: Calibration adjustment depending on sensor length and max. ambient temperature

Calibration switch	Max. ambient temperature [° Celsius]	Sensor length .[m]
4	30	100
6	35	100
8	40	100
9	45	100
11	50	100
12	55	100
13	60	100
6	30	150
7	35	150
9	40	150
10	45	150
12	50	150
13	55	150
14	60	150
6	30	200
9	35	200
10	40	200
11	45	200
12	50	200
13	55	200
7	30	250
9	35	250
10	40	250
12	45	250
13	50	250
14	55	250
8	30	300
9	35	300
11	40	300
12	45	300
13	50	300
14	55	300

The alarm temperature is 10 °C to 12 °C above the maximum ambient temperature (detail see nomogram).

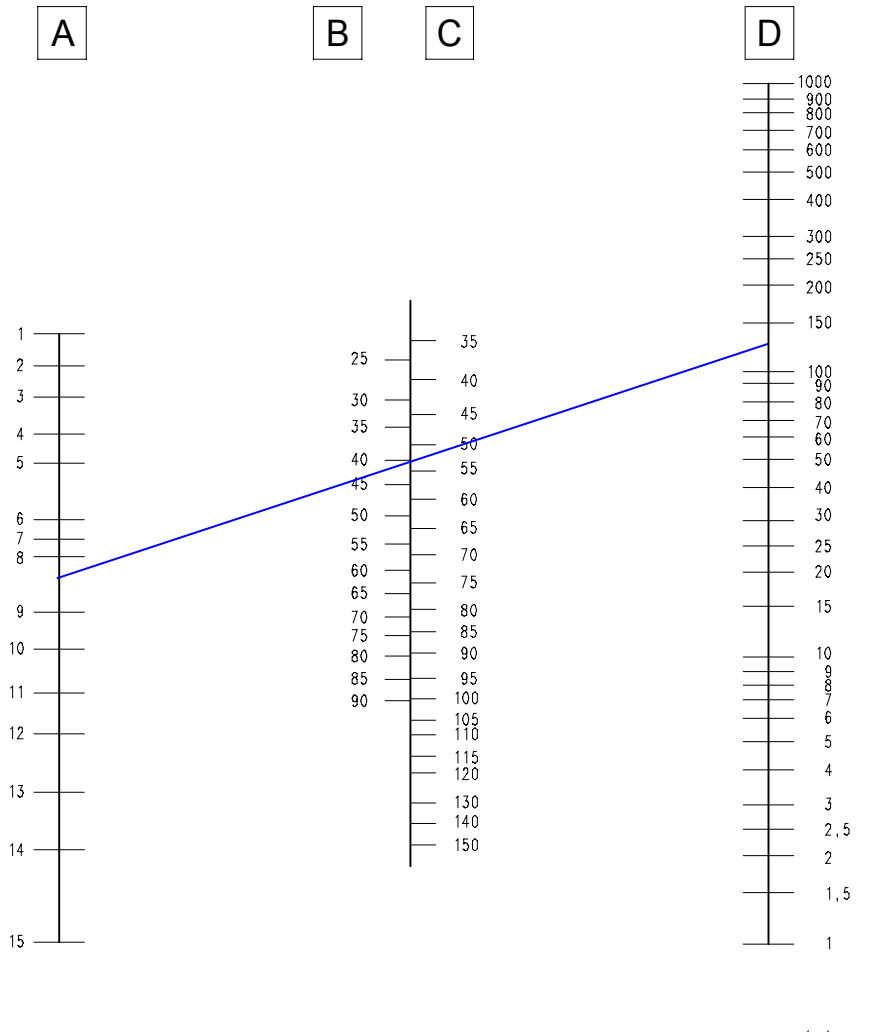
The numerical arrangement for the calibrating switch is based on binary code. For clarification please refer to the table below when setting the switches:

Calibration switch: Max-Alarm sensitivity				
1	2	3	4	Switch position
Off	Off	Off	Off	0 (factory setting)
On	Off	Off	Off	1
Off	On	Off	Off	2
On	On	Off	Off	3
Off	Off	On	Off	4
On	Off	On	Off	5
Off	On	On	Off	6
On	On	On	Off	7
Off	Off	Off	On	8
On	Off	Off	On	9
Off	On	Off	On	10
On	On	Off	On	11
Off	Off	On	On	12
On	Off	On	On	13
Off	On	On	On	14
On	On	On	On	15

To find an adjustment, which differs from the standards in table 2, the “Alarmline“ Nomogram (fig. 2.3) must be consulted. Please proceed as follows:

a) Marking of the cable length on scale "D"
b) Marking of the maximum ambient temperature on scale "B"
c) Draw a line across the two marks up to the scale's "A" (calibrating switch).
d) The adjustment of the switch has to be read from the intersection point of the line with the scale "A" whereby in principle the value has to be rounded up (e.g. from 3.3 to 4).

Fig. 2.3: "Alarmline LWM-1" nomogram



A cable length of 300 m sensor cable per control unit may not be exceeded.

2.3.2 Adjustment of the calibration switch Diff-Alarm

To find the optimal, application-specific adjustment for the Diff-Alarm, a compromise between false alarm immunity and maximum sensitivity must be found. There are two different adjustments for the Diff-Alarm, which can be set up individually:

Diff-Time
Diff Alarm sensitivity

The switch adjustments, which define the switch positions for DIFF Time and DIFF Alarm sensitivity, are shown in the following tables.

Calibration switch: Diff-Time (time window Diff-alarm)				
1	2	3	4	Switch position
Off	Off	Off	Off	0 (factory setting)
On	Off	Off	Off	1
Off	On	Off	Off	2
On	On	Off	Off	3
Off	Off	On	Off	4
On	Off	On	Off	5
Off	On	On	Off	6
On	On	On	Off	7
Off	Off	Off	On	8
On	Off	Off	On	9
Off	On	Off	On	10
On	On	Off	On	11
Off	Off	On	On	12
On	Off	On	On	13
Off	On	On	On	14
On	On	On	On	15

Calibrating switch: Diff-Alarm sensitivity				
1	2	3	4	Switch position
Off	Off	Off	Off	0
On	Off	Off	Off	1
Off	On	Off	Off	2
On	On	Off	Off	3
Off	Off	On	Off	4
On	Off	On	Off	5
Off	On	On	Off	6
On	On	On	Off	7
Off	Off	Off	On	8
On	Off	Off	On	9
Off	On	Off	On	10
On	On	Off	On	11
Off	Off	On	On	12
On	Off	On	On	13
Off	On	On	On	14
On	On	On	On	15 (Factory setting)

The LWM-1-System can be used as heat detector of the classes A1, A2, B and C. The adjustments are given in the tables 3.1 and 3.2 depending on sensitivity class and the length of the installed sensor cable.

Table 3.1:
Switch positions to be adjusted for different heat detector/sensitivity classes

Adjustment for class **A1** (Diff-time/Diff-alarm switch setting)	Adjustment for class **A2** (Diff-time/Diff-alarm switch setting)	Adjustment for class **B** (Diff-time/Diff-alarm switch setting)	Adjustment for class **C** (Diff-time/Diff-alarm switch setting)
5/5 (only blue cable)	**5/8**	**5/9**	**6/13**
5/4 (only black cable)			

When choosing the sensitivity class a reasonable level of immunity to nuisance alarms should be achieved. It makes for example no sense to install a heat detector of the sensitivity class A1 underneath a non-insulated metal roof. It is very likely, that the sun will heat up the roof and cause a false alarm.

Recommendations for specific application adjustments are listed in the following table.

Table 3.2 for application-specific adjustments of the Diff-Alarm

Application	Diff-Time	Diff-Alarm	Sensitivity class
Underground installation (no road tunnels)	5 5 5	5 4 8	A1 (only blue cable) A1 (only black cable) A2
Installation on concrete ceilings and other non-heat conducting materials above ground, not exposed to direct solar radiation	5 5 5 5 6	5 4 8 9 13	A1 (only blue cable) A1 (only black cable) A2 B C
Installation on insulated metal ceiling or metal container not exposed to direct solar radiation	5 5 5 5 6	5 4 8 9 13	A1 (only blue cable) A1 (only black cable) A2 B C
Installation on un-insulated metal ceiling or if exposed to direct solar radiation	5 6	9 13	B C
Road tunnel	5 5 5 5 6	5 4 8 9 13	A1 (only blue cable) A1 (only black cable) A2 B C

These recommendations are not valid if the areas being monitored produce additional heat. If you experience problems to find the correct setting, please contact KIDDE-PRODUCTS.

In order to avoid the propensity for nuisance alarms the following options may be chosen:
- Reduction of sensor length per Control Unit
- Usage of lower sensitivity class (i.e. use A2 instead of A1, use B instead of A2 etc.)

2.4 Approval tests

It is proven by type-test that the line-type heat detection system Alarmline-LWM-1 shows response behaviour in accordance with EN 54-5:2000 in the following configurations (see table). The adjustments of Diff- and Max-Alarm specified in the previous chapters are based on the results of this type-test.

Cable type	Heated up Sensor length	Remaining length at Rt	Diff-time	Diff-alarm	Max-alarm	Class
K82017	10 m	290 m	5	5	5	A1
			5	8	6	A2
			5	9	9	B
K82021	10 m	290 m	5	4	5	A1
			5	8	6	A2
			5	9	9	B
			6	13	12	C
K98166	10 m	290 m	5	9	8	B

Rt = Room temperature (typical 25 °C).

2.5 Function / tests

2.5.1 Status LEDs

Status LEDs are required for:
Normal operation (POWER), Green, continuing on
Max Alarm (MAX), Red, continuing on
Diff Alarm (DIFF), Red continuing on
Fault conditions, flashing yellow (2 Hz)
Fault condition (Isolate), permanent yellow

2.5.2 LED Test

The LWM-1 will perform an LED test when the on-board **fault** and **alarm** test buttons are pressed simultaneously for a min. of 2 seconds. All 4 LED's will stay on for 5 seconds and then go off automatically.

2.5.3 Alarm Test

The LWM-1 will perform an alarm self test when the on-board **alarm** test button is pressed for a min. of 2 seconds

2.5.4 Fault Test (Short Circuit)

The LWM-1 will perform a fault self test when the on-board **fault** test button is pressed for a min. of 2 seconds.

2.5.5 Internal Reset

The LWM-1 will perform a fault soft reset when the on-board **reset** button is pressed for a min. of 2 seconds

2.5.6 External Reset

The LWM-1 will perform an external reset when a 3.6K ohm resistor is connected in series with an external reset switch. In normal operation the switch will be monitored with an 8.2K ohm End of Line resistor. See fig 4.1

3 Sensor cable

3.1 Description

The Alarmline sensor cable consists of four copper conductors. These are covered by a material with a negative temperature coefficient and sheathed by a temperature resistant, flame retardant cover.

The sensor cable is interconnected at the end and hermetically sealed in a manner that two separate loops are formed. Both loops are permanently monitored. An interruption or a short circuit causes a fault signal in the control unit.
At a temperature rise the electrical resistance changes between the two loops; with increasing temperature the resistance is reduced.

Provided that the sensor is not heated up to over 100° C, it will return to its normal operating state, even after activation of an alarm (see technical data). If the sensor is destroyed, a fault signal is triggered.

Name	Base cable (blue)	+ nylon cover (black)	+ stainless steel braided
Part number	K82017	K82021	22-11800-013
Outside diameter (nominal)	3.15 mm	4.8 mm	5.8 mm
Weight (200 m)	3.2 kg	4.7 kg	9.7 kg
Minimum tensile strength (N)	100	100+	1000
Conductor diameter	0.46 mm		
Isolation thickness	0.34 mm		
Thickness of the outer sheath	0.25 mm		
Conductor material	Conductor 2+4: Copper, conductor 1+3: Copper with polyester enamelling covering		
Insulation	Conductor 2+4: special doted NTC-Polymer, Conductor 1+3: non-conducting Polymer		
Conductor colours	❶- orange ❷- white ❸- blue ❹- red		
Temperature resistance	< 100 °C, unlimited, < 150 °C - 350 h, < 175 °C - 25 h >- 5 °C for 22-11800-010 - unlimited >- 60 °C for 22-11800-011 and 22-11800-013 - unlimited		

Check for satisfactory removal of any polyester enamelling covering conductor 1 (orange) and conductor 4 (red).

The **blue base cable** is used if increased dust and/or humidity charges have to be expected in the supervised zone. For outdoor applications this cable is not recommended, as its ability to withstand UV light is limited.

The **black sensor cable with nylon coating** provides an increased resistance against chemical and biological environments. Therefore, it should be used where acid, basic or solvent vapours are likely to occur. Furthermore, this cable is UV resistant and thus suitable for outdoor applications.

The **black sensor cable with stainless steel braiding** is protected against rough mechanical damages (e.g. conveyor protection) and against chemical and biological contamination

3.2 Applications

Two basic types of applications can be distinguished at the project stage of the "Alarmline" sensor cable: the linear installation and the area-coverage installation

3.2.1 Linear installation

This type of installation is required when long linear objects like cable trays etc. need to be protected. It is required to pay attention to the type of objects, which need protection. The following most common applications will be discussed:

Cable tray

Fig. 3.1: Sensor cable arrangement within the cable tray

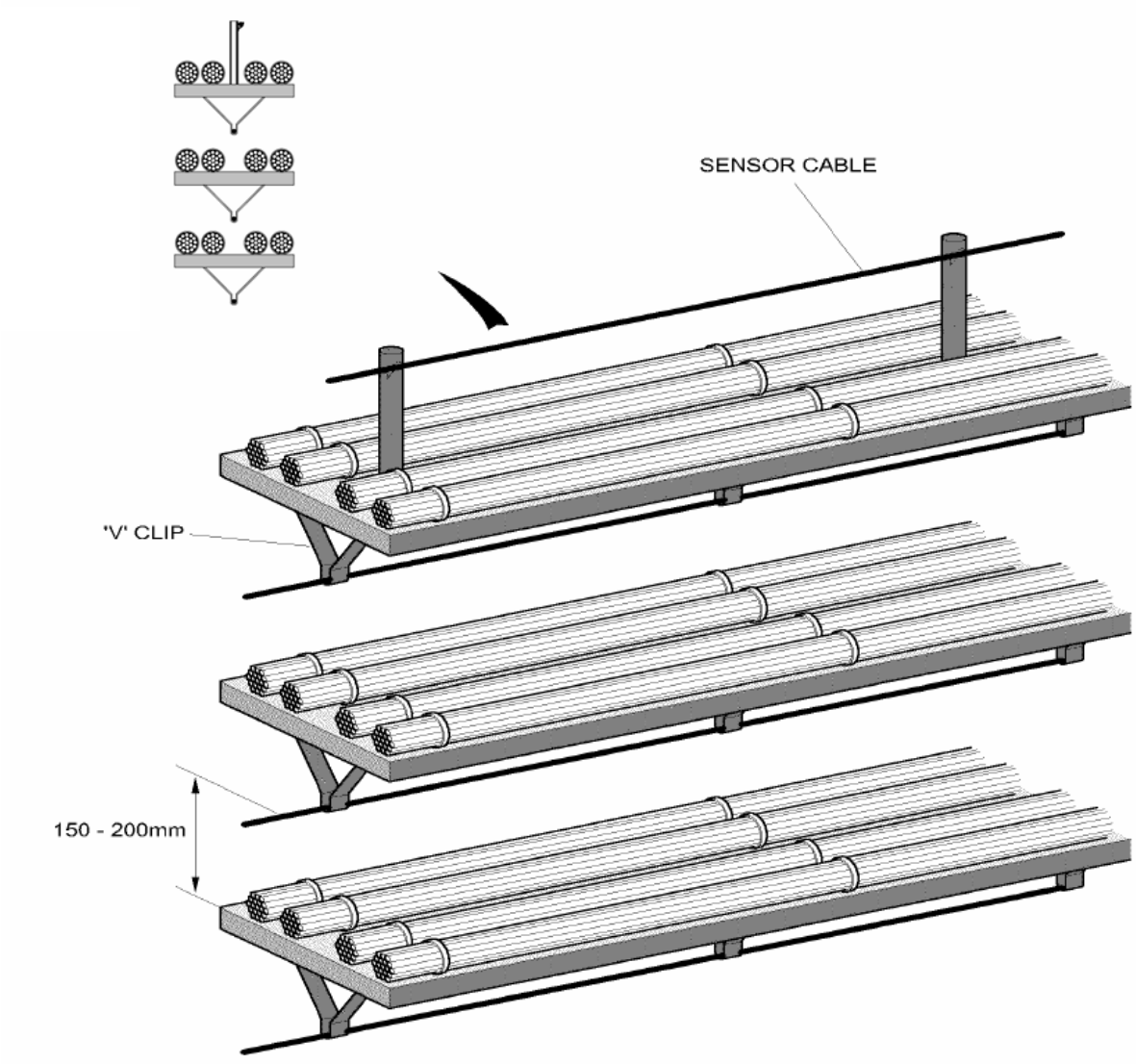
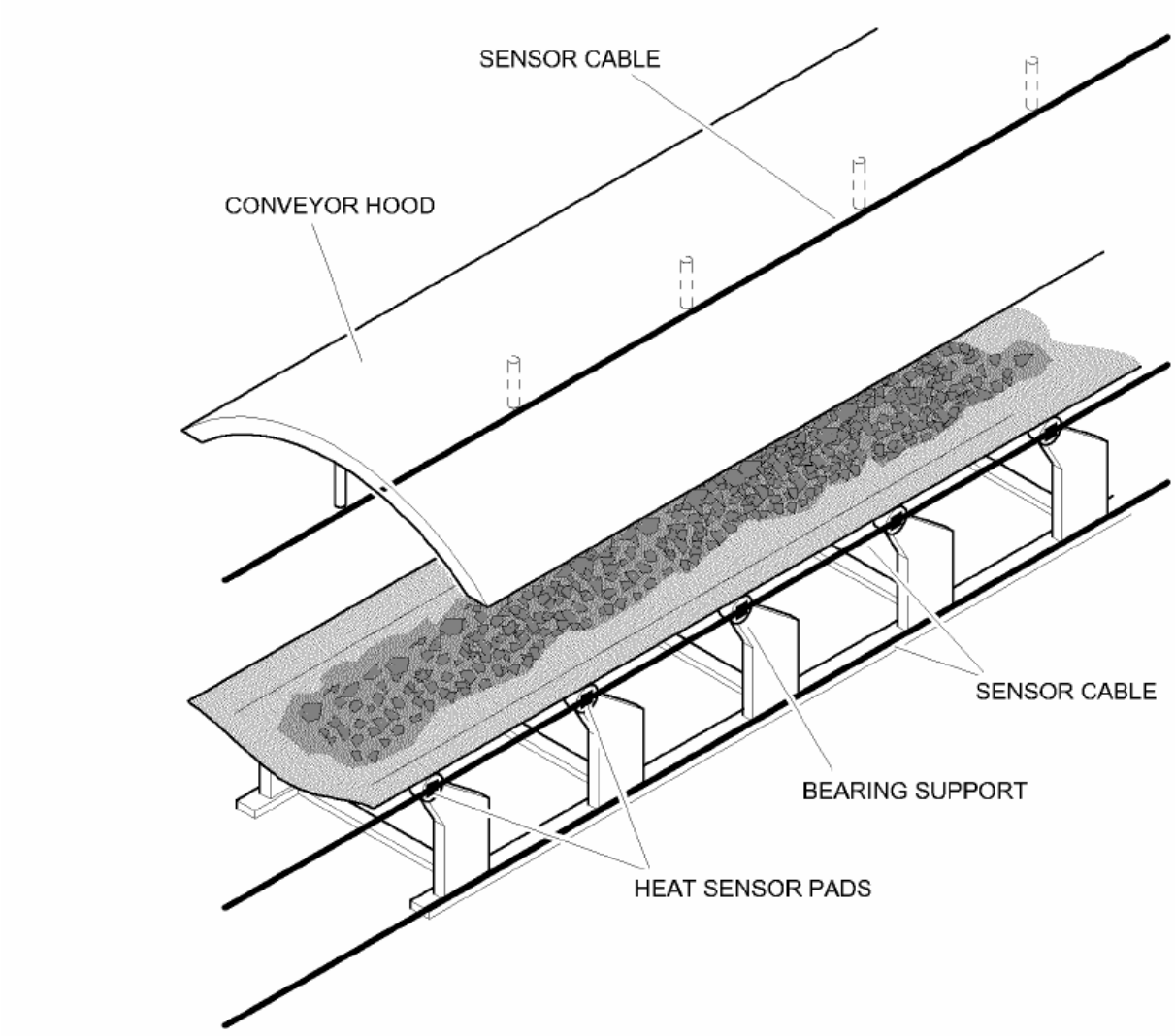


Figure 3.1 shows the installation of the "Alarmline" sensor cable in a cable tray. The sensor

cable is mounted within a short distance above the cable trays. This allows a fairly simple installation and a quick heat-up of the sensor cable by the monitored cables underneath.

Conveyor belts

Fig. 3.2: Installation of the „Alarmline“ sensor cable at conveyor belts



Stainless steel braided sensor cable is recommended as this provides better protection against possible mechanical damage. Fig. 3.2 shows Alarmline sensor cable installed directly at the support roller bearings location. This is to monitor what has been independently proven to be the greatest risk - an overheated condition generated by friction igniting the build up of material spilled from the belt. Alarmline sensor cable can be installed directly over the conveyor to detect a fire/overheat on a stationary conveyor. The distance should not exceed 2 m or directly installed underneath a ceiling if it exists. Mounting clips should be installed every 0.5 m and a distance of 1 cm between the sensor cable and heat-conducting materials need to be kept. The Alarmline sensor cable should be run down both sides of the conveyor belt. To give better protection against build up of material under the bed of the conveyor Alarmline can be installed under the conveyor.

Floating roof tank

The installation of the “Alarmline” sensor cable along the circumference of the rim seal of the floating tank roof guarantees an effect of fast response by permanent supervision of the temperature fluctuations on the complete length and not only at certain restricted points. The installation of the sensor cable must be carried out above the rim seal and fixing of the sensor cable should be done in regular distances (max. 0.5 - 1 m) with special brackets (max. sag 12 mm). These supports are clamped onto the retaining wall of the floating roof. The retaining wall has the task of keeping the discharged foam above the rim seal.

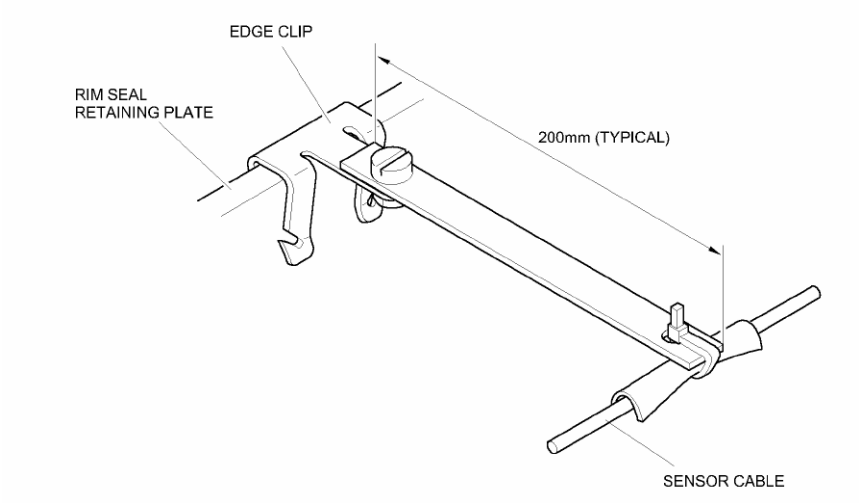
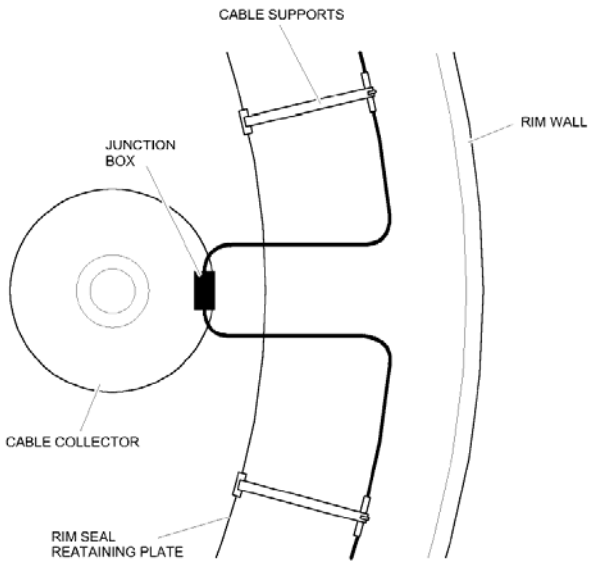


Fig. 3.3: Support above the rim seal



A connection box Ex(i) installed on the floating roof forms the connection point for both ends, for the "open end" of the sensor cable as well as for the supply cable, which must have sufficient length to be able to follow all movements of the tank roof. The use of a retractable cable is recommended.

Fig. 3.4: Installation on the floating roof

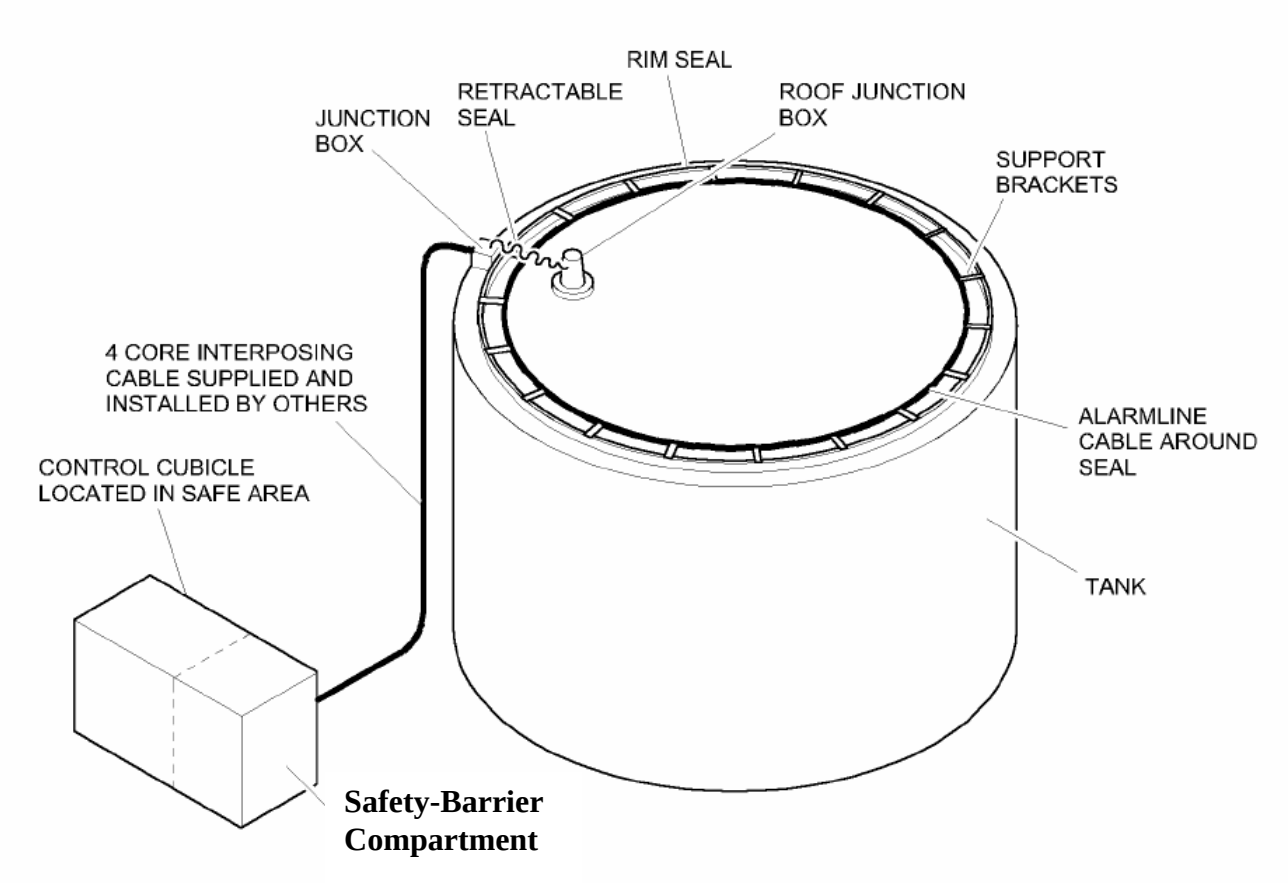


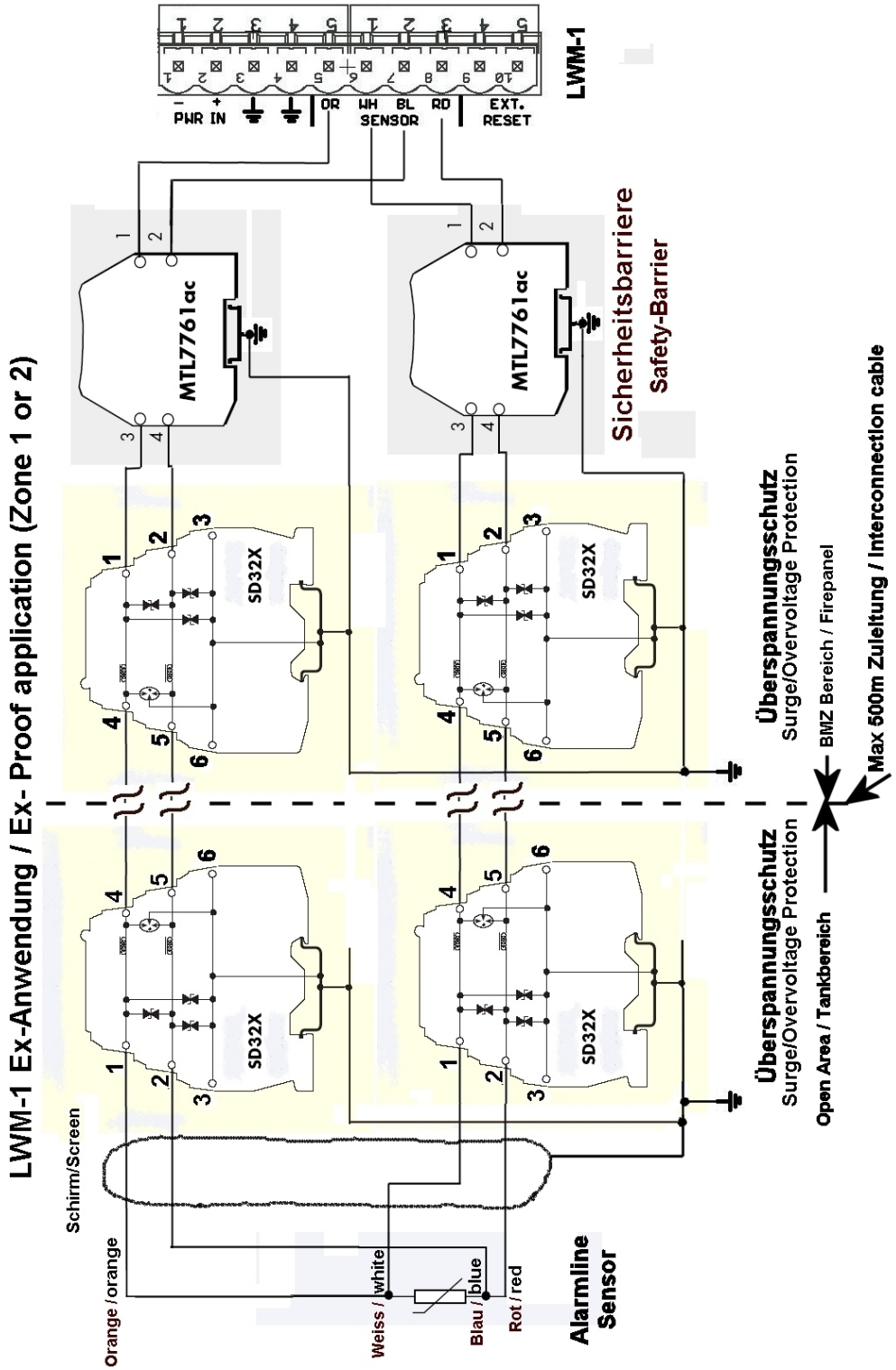
Fig. 3.5: Alarmline-Installation on the floating roof tank

Another connection box Ex (i) has to be attached for the connection of the retractable cable to the interconnecting cable in the upper area of the tank wall. The interconnecting cable is installed along an approved marked-out route to the control room, which is located in a "safe area". Here it is connected via over-voltage protection elements and safety barriers (e.g. type MTL 7761 AC from the company Measurement Technology, see chap. 3.3.1) to the Alarmline control unit LWM-1. The length of the interconnecting cable between sensor cable and control unit can be up to 500 m.

The wiring of the system has to be carried out in accordance with the following illustration.

The temperature setting of the Alarmline control unit (calibrating switch) has to be carried out in accordance with our current guidelines for installation. For a floating roof tank plant in Central Europe an environmental temperature of max. 65 °C is to be expected at the tank. Accordingly at tanks with more than 140 m circumference sub-zones must be formed because a maximum length of 140 m cable can be connected to the control unit (see nomogram). The sensor cables of the individual segments should overlap by at least 1 m.

Fig. 3.6: Alarmline LWM-1 wiring for application in Ex-classified areas



3.2.2 Room/Area Protection

The area-coverage installation is used for the protection of rooms. Typical applications are:

- Compost plants
- Waste disposal sites
- Other applications, e. g. in underground car parks,
  if point detectors cannot be used due to climatic conditions (for example high humidity).

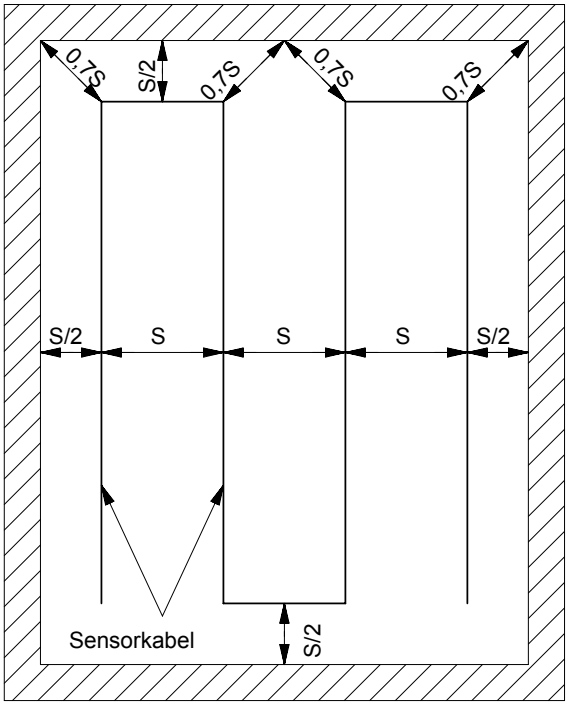


Fig. 3.7: Installation of the "Alarmline" sensor cable for room protection

The spacing layout for area protection is shown in figure 3.7, where distance "S" is 6 meters max. Reduction of spacing is permitted. Minimum distance between walls and sensor is 1.5 m.

The fixing of the sensor cable should be placed every 0.5 m whereby it has to be paid attention to a minimum distance of the sensor cable to the ceiling of 1 cm.

The room to be protected may have a ceiling height of max. 7.5 m. A special approval for ceiling heights greater than 7.5 m can be requested.

Ceiling protrusions and installations up to 20 cm need not to be considered. Nevertheless, a minimum distance of 0.5m should be kept if sensor cable is installed parallel to these installations.

Ceiling protrusions greater than 20 cm need to be viewed as a wall. This means, the distance from the sensor cable to the protrusion (running in parallel) must be min. 1.5 m and max. 3 m. If the distance between protrusions is too short, then the sensor cable must be installed in the centre.

A minimum length of 10m of sensor cable must be installed in a ceiling area which is limited by ceiling protrusions with more than 20cm but less than 80cm height if this area is >18m^2. If this area is ≤18m^2 the 10m sensor cable can be distributed to different ceiling areas but the total surface of these areas must not be greater than 36m^2.

A minimum length of 10 m of sensor cable must be installed in a room which is limited by walls and/or ceiling protrusions with more than 80 cm of height.

If you need further advice to plan similar applications, please contact KIDDE-DEUGRA.

3.3 Installation

The installation of the "Alarmline" sensor cable must be carried out at temperatures above 0° C to avoid a break of the cable coating during bending. During the installation, in any case a minimum bend radius of 2.5 cm must be kept.

3.3.1 Ex classified zones

In explosion proof areas (zone 1 and zone 2 or zone 21 and 22) safety barriers (MTL 7761 AC of Measurement Technology) must be installed between the sensor cable and the control unit to ensure the intrinsic safety of the system (see fig. 3.6, page 24). Two safety barriers are needed per sensor cable. The safety barriers must be placed outside the hazardous area nearby the control unit in a separate housing.

3.3.2 Fixings

The fixing of the „Alarmline“ sensor cable should be installed every 0.5 m.
Suitable fastening elements are offered by a variety of manufacturers. Due to the construction of the sensor cable no special regulations need to be adhered to for the fixing except for that the fastening elements must not damage the sensor cable. The fixing clamps should not be tightened too firm. Furthermore the fixings should not be less robust than the sensor cable and ensure the minimum distance of 10 mm between ceiling and cable.
The minimal bending radius of the sensor cable is 10 mm and should be expanded to at least 20 mm to 25 mm at a fixing point.

Some fixings are suggested as shown in the following example.

A recommended fixing clamp for ceilings is the GREIF-ISO-clamp from OBO Bettermann (order no. 2105012) (see fig 3.8.) Please be aware, that its acid and solvent resistance is limited.

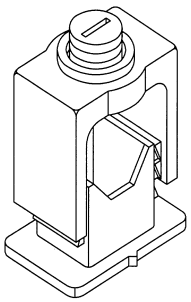


Fig. 3.8: GREIF-ISO-clamp (type 3040/LGK)

In order to monitor large areas (e.g. underground car parks) very long lengths of sensor cables must be installed (several km). Since a fixing is to be set every 0.5 m, the application can require a high amount of fixings.

KIDDE PRODCTS excludes any liability for assembly and operation of this drilling device !

With the drilling device as shown in figure 3.9, a very fast and effective way of generating fixing holes is possible. It has to be taken into account that the length of the used boards should be a little shorter than the ceiling height of the room (typically 2 m to 2.5 m for underground car parks).
Furthermore the spacer of the drill should be adjusted so, that the holes will be drilled only 30 mm deep. This ensures, that if the assembly base FTH 20 of RICHCO PLASTIC (see fig. 3.10) is used, the sensor cable keeps the specified minimum distance of 10 mm to the ceiling.

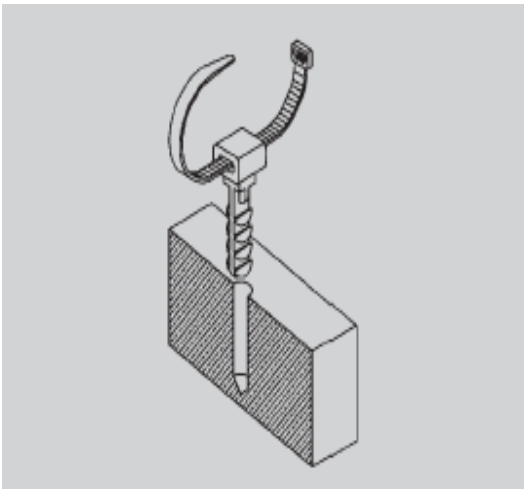


Fig. 3.10: Assembly base for cable fixings (FTH 20)

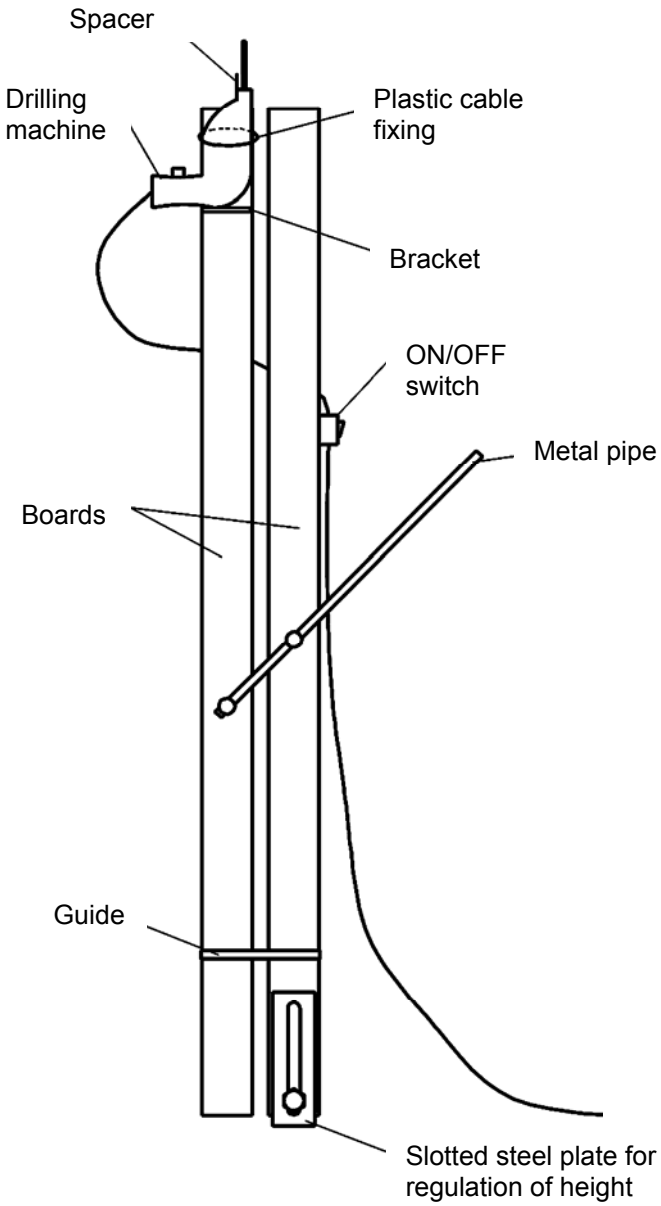
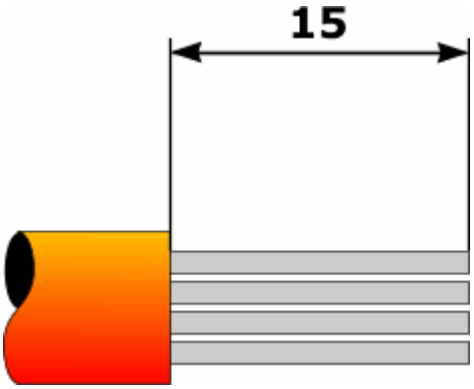


Fig. 3.9: Assembly drawing of drilling device

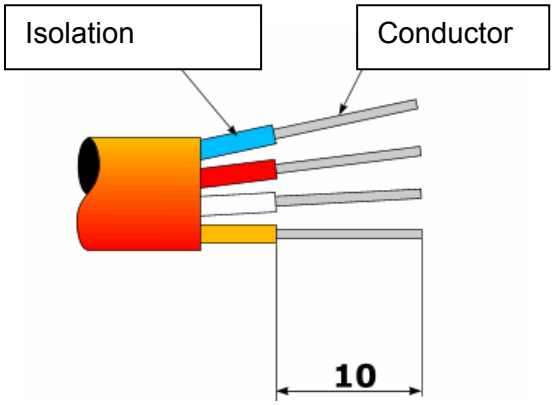
3.3.3 End-of-line termination

CAUTION: Do not cut the insulation of the four inner cores

a) Remove the outer insulation for 15 mm

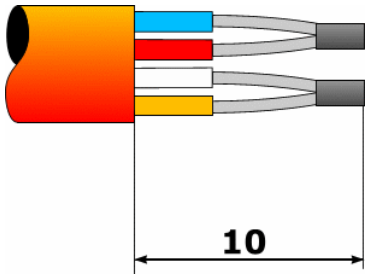


b) Remove the inner insulation (coloured: orange, white, red and blue) for 10 mm from each of the four cores.

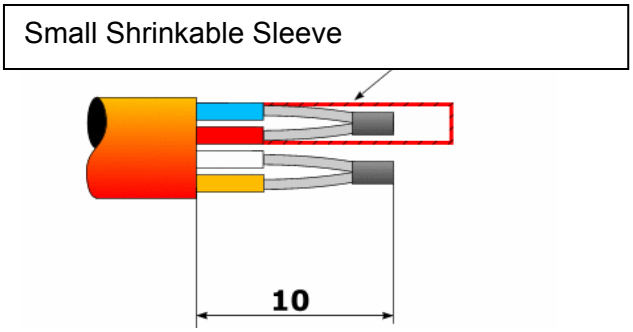


c) Twist the exposed wires from the WHITE and ORANGE cores together and solder.

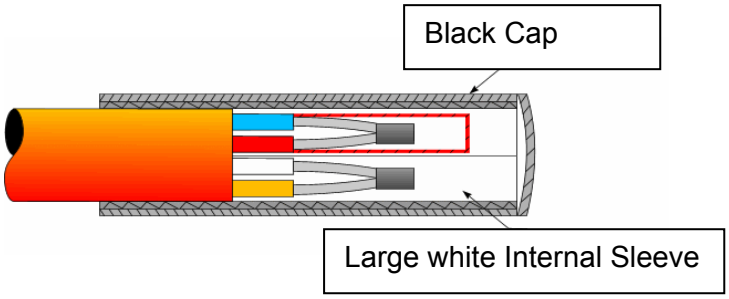
d) Twist the exposed wires from the RED and BLUE cores together and solder.



e) Insulate both of the soldered joints with the small shrink sleeves provided; apply a temperature of between 120 and 150°C (preferably via an industrial heat gun or similar device).



f) Place the large clear shrink sleeve and then the black end cap over all four cable ends and shrink firmly into position applying the same temperature, refer to step (e).

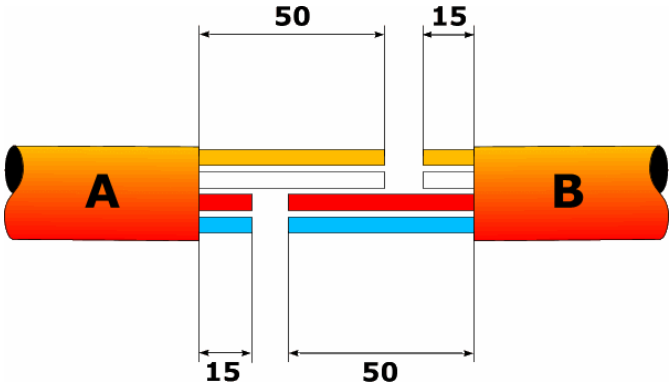


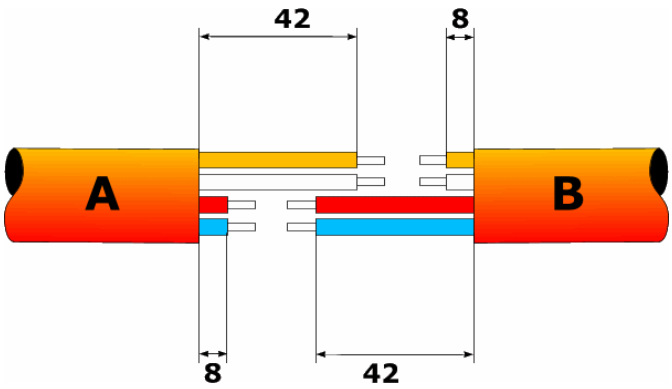
3.3.4 In-line jointing

CAUTION Do not damage the insulation of the inner cores.

a) Remove the outer insulation from both cables A and B for 50 mm.
b) On cable A, cut back the RED and BLUE cores to a lengths of 15 mm.
c) On cable B, cut back the ORANGE and WHITE cores to a length of 15 mm.
d) Remove the inner insulation (coloured: orange, white, red and blue) from both cable A and B for 8 mm from each of the four cores.

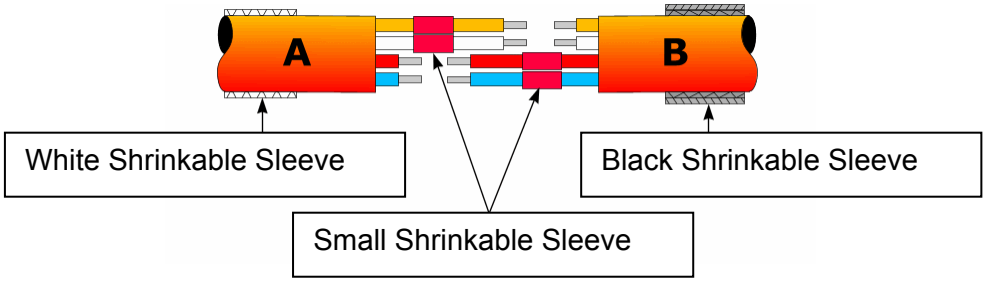
CAUTION The polyester enamel coating on conductor 1 (ORANGE) and conductor 3 (RED) should be removed before proceeding further.



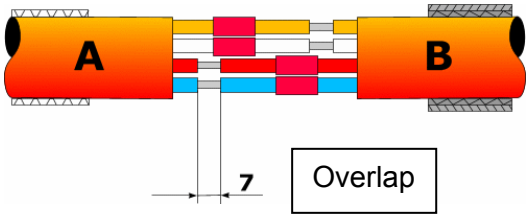


e) Slide the WHITE shrink sleeve over cable A.
f) Slide the BLACK shrink sleeve over cable B.

g) Slide a RED shrink sleeve over each of the ORANGE and WHITE cores of cable A, and each of the RED and BLUE cores of cable B.



h) Twist and solder the individual conductors of cable A to those of cable B. Ensure that the colours of both cables coincide.



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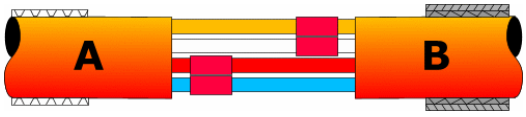
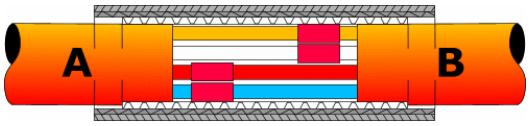
i) Slide each of the RED shrink sleeves over the soldered connections and shrink into position applying a temperature of between 120 and 150°C.



j) Slide the white shrink sleeve over the four joints and shrink into position applying the same temperature, refer to step (i).

k) Slide the black shrink into position using the same temperature; refer to step (i).



4 Wiring

4.1 Control unit and Fire Alarm Panel

For the wiring of the alarm and fault signals to the FAP (Fire Alarm Panel) the corresponding potential-free contacts of the LWM-1 control unit have to be used. It has to be taken into account that the fault-relay is active in the normal operation (energised) and the contact between terminals 8 and 9 'above' is closed.

If only one alarm relay is used to connect to the fire alarm panel, the configuration dip-switch „MAX+DIFF" (ref. to chap. 2.2, pg. 9 in Installation Manual) must be set to "ON". This ensures that both alarm relays will be activated simultaneously independent of the type of alarm (Max- or Diff-alarm).

The reset of the control unit is carried out by
- interruption of the power supply of at least 6 seconds
- pressing the RESET switch
- using a reset relay, which has to be configured as described below.

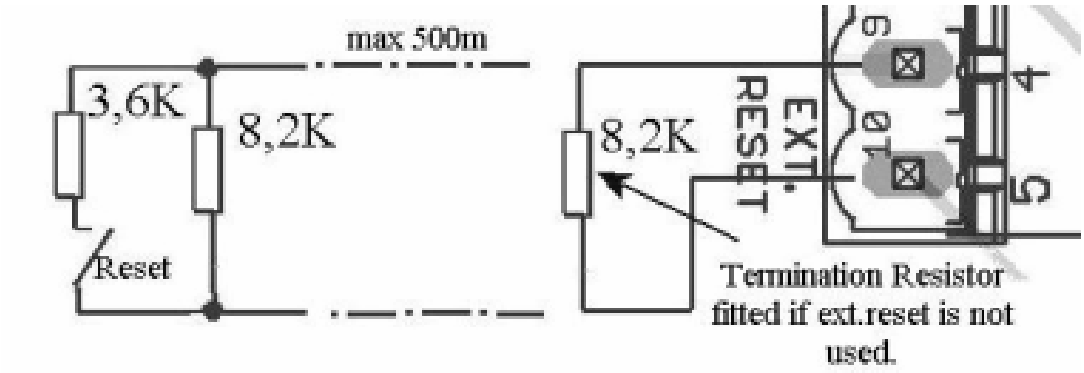


Fig. 4.1: Configuration of reset relay

4.2 Sensor cable and control unit

The four cores of the sensor cable are to be connected to the terminals '5-8 downside' of the control unit (see chapter 2.2). Particular attention has to be paid to the correct sequence (orange, white, blue, red).

For some applications it may not be practical or possible to connect the sensor cable directly to the LWM-1 unit. In these cases the sensor cable can be wired to a standard four-core fire-alarm cable (2 x 2 x 0.8), which forms the connection to the

LWM-1 unit by using an in-line box (protection class IP 65 minimum). Furthermore, it is also possible to divide the sensor cable into different sections with the help of in-line boxes and four-core interconnecting cables (total length of the interconnecting cable max. 500 m).

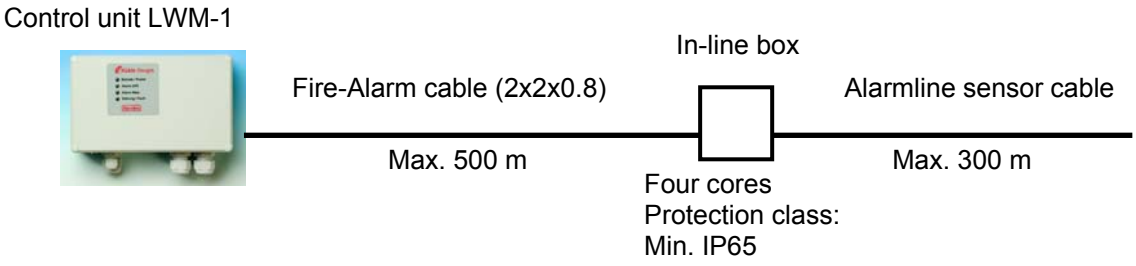


Fig. 4.2: Alarmline LWM-1 with interconnecting cable

5 *Maintenance and Commissioning*

The regular maintenance of the “Alarmline“ system includes a visual inspection of the sensor cable and the activation of the test buttons of the control unit.

Do not heat up sensor cable with a hot air pistol!

Alarm activation by heat-up of the sensor cable is not necessary since the thermal conducting capabilities of the cable are inherent in the system. Loss of this feature can only result from a mechanical damage of the cable or a permanent overheat condition outside the specified operating range.

In the control unit there are two test buttons, one for fault and one for alarm. The buttons must be pressed for at least 2 seconds to trigger the corresponding signal. If they are pressed simultaneously for at least 2 seconds, a LED test is carried out. The actual fault or alarm can take up to 15 seconds after the activation of the button, as the control unit will finish the current measurement first before it starts the test.

By setting the configuration switch 'Isolate' to 'on' (see chapter 2.2, page 9) the activation of the alarm relay(s) connected to the supervising fire panel can be suppressed. This will cause a fault condition to be generated.

6 *Chemical resistance of the nylon coated Alarmline sensor cable (black)*

The nylon extruded sensor cable has good resistance to bases and salt solutions, to salt water and marine atmosphere, to oils, greases and petroleum products. The resistance to mineral and organic acids varies with the chemical group involved and caution must also be observed in uses involving phenols and chlorinated solvents.

The resistance in the following table is for the sensor cable within the liquid at 20°C. In practise, the sensor cable will be installed at the ceiling. Correspondingly the cable will only suffer from damage if the steam pressure of the liquid is high and a significant amount of dew is deposited on it. These circumstances will usually not be in occupied areas.

Mineral Bases	**Concentration**	**Resistance**
Sodium	to 50 %	good
Potassium	to 50 %	good
Ammonium hydroxide	concentrated	good
Ammonia	liquid/gas	good

Inorganic Acids	**Concentration**	**Resistance**
Hydrochloric acid	to 10 %	good
Sulphuric acid	to 10 %	good
Phosphoric acid	to 50 %	good
Nitric acid	all concentrations	poor
Chromic acid	10 %	poor
Sulphur trioxide	10 %	limited

Other Inorganic Materials	Concentration	Resistance
Water		good
Sea water		good
Bleach solution		limited
Hydrogen peroxide	to 20 %	good
Oxygen		good
Hydrogen		good
Ozone	to 10 %	limited
Fluorine		poor
Chlorine		poor
Bromine		poor
Agricultural spraying-mixture		good
Potassium permanganate	5 %	poor
Concentrated Salt solutions		gut

Organic Bases	Concentration	Resistance
Aniline	pure	limited
Pyridine	pure	limited
Urea		good
Diethanolamin	20 %	good

Hydrocarbons	Concentration	Resistance
Methane		good
Propane		good
Butane		good
Acetylene		good
Benzene		good
Toluene		good
Xylene		good
Styrene		good
Cyclohexane		good
Naphthalene		good
Freon 12		good
Freon 22		good
Hexane		good

Alcohols	Concentration	Resistance
Methanol		good
Ethanol		good
Butanol		good
Glycerine		good
Glycol		good
Benzyl alcohol		limited

Aldehydes und Ketones	Concentration	Resistance
Acetone		good
Acetaldehyde		good
Cyclohexanone		good
Methylethylketone		good
Methylisobuthylketone		good
Benzaldehyde		good

Halogenized Solvents	Concentration	Resistance
Methyl bromide		good
Methyl chloride		good
Trichloroethylene		good
Perchlorethylene		good
Carbon tetrachloride		poor
Trichlorethane		limited

Various Organic Compounds	Concentration	Resistance
Phenol		poor
Salt		good
Ester		good
Ether		good
Tetrahydrofurane		good
Ethylene chlorhydrin		poor
Ethylene oxide		good
Carbon disulphide		good
Furfuryl alcohol		good
Diacetone alcohol		good
Glucose		good
Dimethyl formamide		good

Various Products	Concentration	Resistance
Coal gas		good
Oil		good
Grease		good
Beer		good
Wine		good
Fruit juice		good
Normal petrol		good
High octane petrol		good
Kerosene		good
Crude petroleum oil		good
Milk		good
Mustard		good
Soap solution		good
Vinegar		good
Peanut oil		good

7 *Trouble shooting*

Error indication	Reason	Action
The yellow Fault LED flashes	Sensor cable faulty	Measure the resistance of the sensor cable between red and blue respectively between white and orange = below 100 Ω, resistance between blue and white = typically in the range of MΩ at 20 °C. If the measuring differs, check the next two causes.
	Protective enamel coating of the red and orange-coloured sensor cable not removed	Scrape off the coating
	The end-connections of the sensor cable are faulty	Solder again
	Calibrating switch MAX on "0"	Adjust calibrating switches correctly for Max- and Diff-alarm within the specifications of this manual.
	Isolate "ON"	Set dip-switch for ‘Isolate’ to “off” (see fig. 2.2, page 9).
	Ext. Reset-connection not terminated correctly	Terminate the ext. Reset connection (see fig. 4.1, page 33) with an 8.2 kΩ resistor.
Green LED 'normal operation' does not lit-up	Voltage supply insufficient respectively + and – have been interchanged.	Check with a multimeter whether the voltage between pin 1 = - and pin 2 = + is between 10 and 30 V.
Fire panel shows Fault and LWM-1 not or the other way around	Wiring fault	The Fault-relay of the LWM-1 control unit is active in the normal operation state. The terminating resistor of the fire panel line must be put between the terminals CM and NO of the Fault relay.
LWM-1 shows alarm, but the fire panel does not	Isolate dip switch "ON"	Set the Isolate dip-switch to ”off”.
	Wiring fault	Set dip-switches 'MAX+DIFF alarm combined' to “on” and connect the control panel line to an alarm relay.