

Operating Manual

Probe LMK / LMP

LMK 306, LMK 307, LMK 307T, LMK 309, LMK 358, LMK 358H, LMK 382, LMK 382H, LMK 387, LMK 387H, LMK 806, LMK 807, LMK808, LMK 809, LMK 858, LMP 305, LMP 307, LMP 307i, LMP 307T, LMP 308, LMP 308i, LMP 808



LMP 308

**READ THOROUGHLY BEFORE USING THE DEVICE
KEEP FOR FUTURE REFERENCE**

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1. General and safety-related information on this operating manual

This operating manual enables safe and proper handling of the product. It is a part of the device and should be kept in close proximity to the place of use, accessible for staff members at any time.

All persons entrusted with the mounting, installation, putting into service, operation, maintenance, removal from service, and disposal of the device must have read and understood the operating manual and in particular the safety-related information.

Complementary to this operating manual the current data sheet has to be adhered to.

Download the data sheet by accessing www.bdsensors.com or request it: info@bdsensors.de | Phone: +49 (0) 92 35 / 98 11 0

In addition, the applicable accident prevention regulations, safety requirements, and country-specific installation standards as well as the accepted engineering standards must be observed.

1.1 Symbols used

	- Type and source of danger - Measures to avoid the danger
Warning word	
Warning word	Meaning
	- Imminent danger! - Non-compliance will result in death or serious injury.
	- Possible danger! - Non-compliance may result in death or serious injury.
	- Hazardous situation! - Non-compliance may result in minor or moderate injury.

NOTE - draws attention to a possibly hazardous situation that may result in property damage in case of non-compliance.

✓ Precondition of an action

1.2 Staff qualification

Qualified persons are persons that are familiar with the mounting, installation, putting into service, operation, maintenance, removal from service, and disposal of the product and have the appropriate qualification for their activity.

This includes persons that meet at least one of the following three requirements:

- They know the safety concepts of metrology and automation technology and are familiar therewith as project staff.
- They are operating staff of the measuring and automation systems and have been instructed in the handling of the systems. They are familiar with the operation of the devices and technologies described in this documentation.
- They are commissioning specialists or are employed in the service department and have completed training that qualifies them for the repair of the system. In addition, they are authorized to put into operation, to ground, and to mark circuits and devices according to the safety engineering standards.

All work with this product must be carried out by qualified persons!

1.3 Intended use

The probes have been developed for continuous level measurement.

The devices are used to convert the physical parameter of pressure into an analogue or digital electric signal.

The user must check whether the device is suited for the selected use. In case of doubt, please contact our sales department (info@bdsensors.de) | Phone: +49 (0) 92 35 / 98 11 0).

BD|SENSORS assumes no liability for any wrong selection and the consequences thereof!

Permissible media are gases or liquids (no solids and frozen media), specified in the data sheet. In addition, it has to be ensured, that this medium is compatible with the media wetted parts.

The specifications listed in the current data sheet are binding and must absolutely be complied with. If you do not have the data sheet to hand, please request it or download it from our homepage: <http://www.bdsensors.com>

	Danger through incorrect use - In order to avoid accidents, use the device only in accordance with its intended use.
WARNING	

1.4 Limitation of liability and warranty

Failure to observe the instructions or technical regulations, improper use and use not as intended, and alteration of or damage to the device will result in the forfeiture of warranty and liability claims.

1.5 Safe handling

NOTE - Do not use any force when installing the device to prevent damage of the device and the plant!

NOTE - Treat the device with care both in the packed and unpacked condition!

NOTE - The device must not be altered or modified in any way.

NOTE - Do not throw or drop the device!

NOTE - The device is state-of-the-art and is operationally reliable. Residual hazards may originate from the device if it is used or operated improperly.

1.6 Scope of delivery

Please verify that all listed parts are undamaged included in the delivery and check for consistency specified in your order:

- probe
- mounting instructions
- with option SIL2 version:
Functional Safety Manual, Functional Safety Data Sheet®

1.7 UL approval (for devices with UL marking)

The UL approval was effected by applying the US standards, which also conform to the applicable Canadian standards on safety.

Observe the following points so that the device meets the requirements of the UL approval:

- The device must be operated via a supply with energy limitation (acc. to UL 61010) or an NEC Class 2 energy supply.
- Maximum operating range: see data sheet

2. Product identification

The identification label with order code is used to identify the device. The most important data can be taken from this.

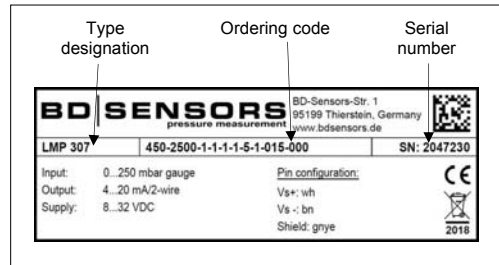


Fig. 1 Manufacturing label

NOTE - The manufacturing label must not be removed!

3. Mounting

3.1 Mounting- and safety instruction

	Danger of death from airborne parts, leaking fluid, electric shock - Improper installation may result in electric shock! - Always mount the device in a depressurized and de-energized condition!
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NOTE - If there is increased risk of damage to the device by lightning strike or overvoltage, increased lightning protection must additionally be provided!

NOTE - Install the probe such that any rubbing or bumping of the sensor head (sensor element), e.g. against a container wall, is excluded. Observe the operating conditions such as, for example, flow conditions. This applies in particular to probes equipped with cable outlet and to devices with tube extensions of a length over 2.8 m.

NOTE - Do not remove the packaging or protective caps of the device until shortly before the mounting procedure, in order to exclude any damage to the diaphragm and the threads! Protective caps must be kept! Dispose of the packaging properly!

NOTE - Treat any unprotected diaphragm with utmost care; this can be damaged very easily.

3.2 Mounting steps for probes

Usually, the probe has been delivered without mounting accessories. For different mounting demands, BD SENSORS offers as accessories mounting clamps, terminal clamps and mounting flanges.

NOTE - Always immerse the device slowly into the fluid to be measured! If the probe strikes the liquid surface, the diaphragm could be damaged or destroyed.

NOTE - Fasten the probe properly according to your requirements.

NOTE - Free-hanging probes with FEP cables should not be used if effects of highly charging processes can be expected.

3.3 Mounting steps for flange version (LMK 382 / LMK 382H)

- ✓ The mounting thread is clean and undamaged.
- ✓ The O-ring is undamaged and seated in the designated groove at the probe end.

1. Screw the mounting thread of the probe into the probe flange by hand.
2. Tighten the device using an open-end wrench. (approx. 25 Nm)
3. Mount the flange according to your requirements.

If you need a new probe flange, this can be ordered from BD|SENSORS as an accessory.

3.4 Removal of protective cap (if necessary)

For the protection of the diaphragm, some of the probes have a plugged-on protection cap. If the device shall be used in high-viscosity media such as sludge, a removal of the cap before start-up is necessary. Thus, the sensor becomes flush and the medium will attain quickly to the diaphragm.

Removal by hand

1. Hold the probe in a way that the protection cap points upwards.
2. Hold the probe with one hand on the sensor section (1).
3. Remove the protection cap (2) with the other hand.

Removal with a tool (recommended)

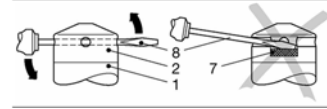


Fig.2 Removal of protection cap

1. Hold the probe in a way that the protection cap points upwards.
2. Slide a small tool such as a screwdriver (8) straight through two opposite drill holes in the protective cap (2).
3. Lever it off by moving up the handle of the screwdriver.

NOTE - Make sure that the sensor (7) under the protection cap will not be damaged!

3.5 Cable protection (optional)

According to order, the probe was supplied with cable protection; if the probe was prepared for mounting by means of a stainless steel or PVC tube (optional), the customer must affix a cable protection themselves.

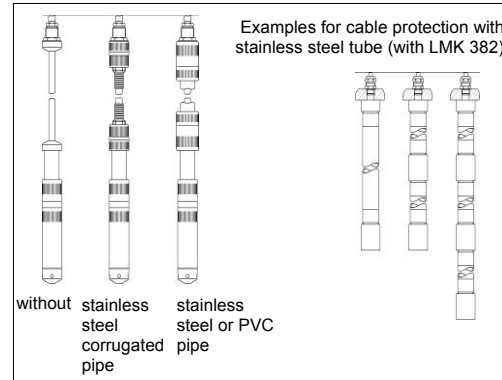


Fig. 3: Cable protection variants

4. Electrical connection

4.1 Connection and safety instructions

	Danger of death from airborne parts, leaking fluid, electric shock - Improper installation may result in electric shock! - Always mount the device in a depressurized and de-energized condition!
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NOTE - When routing the cable, the following minimum bend radii must be observed:

Cable without air hose:
fixed installation: 5-fold cable diameter
flexible use: 10-fold cable diameter

Cable with air hose:
fixed installation: 10-fold cable diameter
flexible use: 20-fold cable diameter

NOTE - In case of integrated ventilation hose, the PTFE filter located at the cable end on the relative pressure hose must neither be damaged nor removed!

NOTE - Use a shielded and twisted multicore cable for the electrical connection.

NOTE - If a transition is desired from a cable with relative pressure hose to a cable without relative pressure hose, we recommend using the terminal box KL 1 or KL 2.

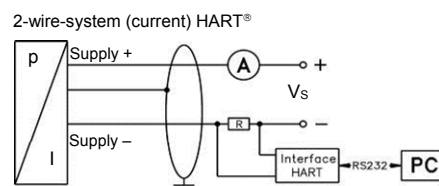
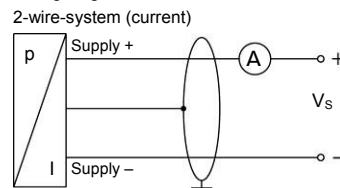
4.2 Electrical installation

Connect the device electrically according to the information specified on the manufacturing label, the following table, and the wiring diagram.

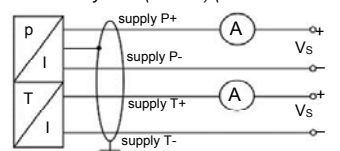
Pin configuration:

Electrical connections	cable colours (IEC 60757)
Supply +	wh (white)
Supply -	bn (brown)
Signal + (with 3-Leiter)	gn (green)
with Option Pt 100:	
Supply T+	ye (yellow)
Supply T-	gy (grey)
Supply T-	pk (pink)
Shield	gn/ye ((yellow/green)
LMK 307T and LMP 307T	
cable colours (IEC 60757)	
Supply P+	wh (white)
Supply P-	bn (brown)
Supply T+	gy (grey)
Supply T-	pk (pink)
Shield	ye/gn (yellow/green)

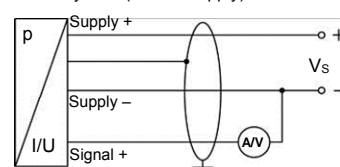
Wiring diagrams:



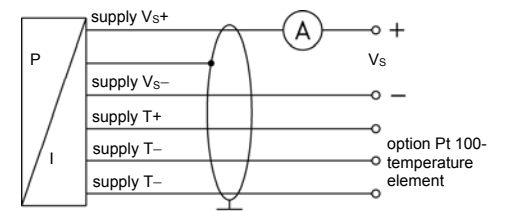
2x2-wire-system (current) (LMK307T / LMP307T)



3-wire system (current/supply)



2-wire-system HART® (pressure) / 3-wire-system (temperature Pt 100)



NOTE - In the case of relative pressure gauges, the cable contains a ventilation hose for pressure equalization. Route the end of the cable into an area or suitable connection box which is as dry as possible and free from aggressive gases, in order to prevent any damage.

NOTE - Devices with TPE-cable: application in water with a temperature > 70°C destroys the cable; applications at media temperatures > 70°C have to be clarified with BD|SENSORS in advance.

NOTE - Usually, the required cable is included in the scope of delivery. If it is although necessary to connect an existing or special cable, the total resistance will increase. For applications, where this additional resistance of the connecting cable could cause problems, this cable has to be checked with the following calculation.

$$R_c = \frac{\rho \cdot 2 \cdot l}{A}$$

with R_c : resistance of connecting cable in Ω
 ρ : specific resistance in $\Omega \text{ mm}^2/\text{m}$
 l : cable length in m
 A : cross section of conductor in mm^2

$$V_{tot} = (R_{c1} + R_{c2} + \dots + R_{load}) \cdot 0.02 A$$

with V_{tot} : total voltage drop
 R_{load} : load resistance (to be taken out of the current data sheet)

the following condition has to be fulfilled:

$$V_s > V_{tot} + V_{smin}$$

with V_s : planned supply voltage
 V_{smin} : minimal supply voltage (to be taken out of the current data sheet)

5. Characteristic

5.1 HART® communication (in H-devices)

The analogue output signal is overridden by an additional signal according to the HART®-specification. The device can be configured via a HART®-communication device. Therefore, we suggest our programming kit CIS G (available as accessory). It consists of HART®-modem, connecting cables as well as configuration software and allows a simple and time-saving configuration of all parameters. (The software is compatible with all Windows®-systems from Windows 98 and higher.)

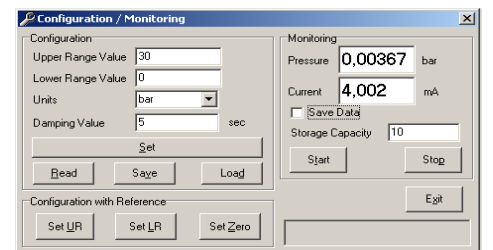


Fig. 4 Configuration software

✓ for trouble-free operation, the following requirements are fulfilled

maximal cable length between device and power supply:

$$L_{max} = \frac{65 \cdot 10^3}{R_v \cdot C_v} - \frac{40 \cdot 10^3}{C_v}$$

whereas L_{max} : maximum length of cable in [m]
 R_v : resistance of the cable together with the load resistance in Ω
 C_v : capacity of the cable in [pF/m]

resistance R:

$$R = \frac{U - 12}{0.024} \Omega$$

whereas U : power supply in [V_{DC}]
The resistance must be at least 240 Ω .

5.2 Separable probes

In order to facilitate stock keeping and maintenance, the probe head is plugged to the cable assembly with a connector and can be easily changed. The following probes are separable: LMK 358, LMK 358H, LMK 808, LMK 858, LMP 308, LMP 308i and LMP 808

Disassembly

1. Hold the probe on the sensor section (2) with one hand and turn the nut (4) carefully to the left with the other hand. Prevent torsion of the cable section (3) against the housing!
2. While screwing and pulling off the sensor section (2) from the cable section (3), hold it straight to prevent damages on the plugs.

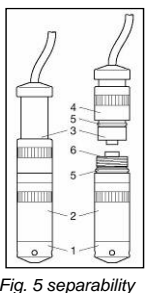


Fig. 5 separability

Assembly

- ✓ O-rings are not damaged (5, 6) or damaged O-rings have been replaced
- ✓ Radial O-rings (5) have been greased with Vaseline or O-ring grease
- ✓ Any grease residues have been removed from the axial O-ring (6).

1. Plug the cable section (3) straight into the plug of the sensor section (2).
2. Hold the probe onto the sensor section (2) with one hand. Screw on and tighten the nut (4) carefully with the other hand. Prevent torsion of the cable section (3) against the housing!

Pin configuration

Electrical connections	Binder series 723 (5-pin)	Binder series 723 (7-pin)
2-wire system		
Supply +	3	3
Supply -	1	1
Shield	5	2
3-wire system		
Supply +	3	3
Supply -	4	1
Signal +	1	6
Shield	5	2
Communication interface		
RxD	-	4
TxD	-	5
GND	-	7



6. Commissioning

- ✓ The device has been installed properly.
- ✓ The device does not have any visible defect.
- ✓ The device is operated within the specification. (see data sheet)

In case of highly precise devices with an accuracy of 0.1 % FSO, a microcontroller-controlled electronic system is used for signal processing. This electronic system is used for signal improvement. Due to the principle, the processing of measured values requires a longer time than with purely analogue sensors, which only comprise amplification circuitry. Due to the longer processing time, the output signal follows the measured value not continuously but in jumps. In case of relatively stable and slowly changing measured values, this property plays a minor role. Compare this with the information on the adjusting time in the data sheet.

In the case of i-devices with optional communication interfaces can also be configured by these electronics. Offset, span and damping are programmable within the limits given in the data sheet. For configuring the device, the programming kit CIS G consisting of Adapt 1, Windows® compatible programming software, power supply and connecting cable is necessary. This can be ordered additionally from BD SENSORS.

7. Maintenance

 DANGER	<p>Danger of death from airborne parts, leaking fluids, electric shock</p> <ul style="list-style-type: none"> - Always service the device in a depressurized and de-energized condition!
 WARNING	<p>Danger of injury from aggressive fluids or pollutants</p> <ul style="list-style-type: none"> - Depending on the measured medium, this may constitute a danger to the operator. - Wear suitable protective clothing e.g. gloves, safety goggles.


If necessary, clean the housing of the device using a moist cloth and a non-aggressive cleaning solution.

The cleaning medium for the device may be gases or liquids which are compatible with the selected materials. Observe the permissible temperature according to the data sheet.

Deposits or contamination may occur on the diaphragm in case of certain media. Depending on the quality of the process, suitable maintenance intervals must be specified by the operator. As part of this, regular checks must be carried out regarding corrosion, damage to the diaphragm and signal shift. If the diaphragm is calcified, it is recommended to send the device to BD SENSORS for decalcification.

NOTE – Wrong cleaning or improper touch may cause an irreparable damage on the diaphragm. Therefore, never use pointed objects or pressured air for cleaning the diaphragm

8. Troubleshooting

 DANGER	<p>Danger of death from airborne parts, leaking fluids, electric shock</p> <ul style="list-style-type: none"> - If malfunctions cannot be resolved, put the device out of service (proceed according to chapter 9 up to 11)
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In case of malfunction, it must be checked whether the device has been correctly installed mechanically and electrically. Use the following table to analyse the cause and resolve the malfunction, if possible.

Fault: no output signal	
Possible cause	Fault detection / remedy
Connected incorrectly	Checking of connections
Conductor/wire breakage	Checking of <u>all</u> line connections.
Defective measuring device (signal input)	Checking of ammeter (miniature fuse) or of analogue input of your signal processing unit



Fault: analogue output signal too low	
Possible cause	Fault detection / remedy
Load resistance too high	Checking of load resistance (value)
Supply voltage too low	Checking of power supply output voltage
Defective energy supply	Checking of the power supply and the supply voltage being applied to the device

Fault: slight shift of the output signal	
Possible cause	Fault detection / remedy
Diaphragm of measuring cell is severely contaminated, calcified or crusted	Recommendation: Have the decalcification or cleaning performed by BD SENSORS

Fault: large shift of the output signal	
Possible cause	Fault detection / remedy
Diaphragm of sensor is damaged (caused by overpressure or mechanically)	Checking of diaphragm; when damaged, send the device to BD SENSORS for repair

Fault: wrong or no output signal	
Possible cause	Fault detection / remedy
Cable damaged mechanically, thermally or chemically	Checking of cable; pitting corrosion on the stainless-steel housing as a result of damage on cable; when damaged, send the device to BD SENSORS for repair

9. Removal from service

 DANGER	<p>Danger of death from airborne parts, leaking fluids, electric shock</p> <ul style="list-style-type: none"> - Disassemble the device in a depressurized and de-energized condition!
 WARNING	<p>Danger of injury from aggressive media or pollutants</p> <ul style="list-style-type: none"> - Depending on the measured medium, this may constitute a danger to the operator. - Wear suitable protective clothing e.g. gloves, goggles.

NOTE - After dismounting, a delivered protection cap has to be used.

10. Service / repair


Information on service / repair:

- www.bdsensors.com
- info@bdsensors.de
- service phone: +49 (0) 92 35 / 98 11 0

10.1 Recalibration

The offset value or range value may shift during the life of the device. In this case, a deviating signal value in relation to the set lower or upper measuring range value is output. If one of these two phenomena occurs after extended use, a recalibration in the factory is recommended.

10.2 Return

 WARNING	<p>Danger of injury from aggressive media or pollutants</p> <ul style="list-style-type: none"> - Depending on the measured medium, this may constitute a danger to the operator. - Wear suitable protective clothing e.g. gloves, goggles.
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For every return shipment, whether for recalibration, decalcification, alteration or repair, the device must be cleaned thoroughly and packed in a break-proof manner. A return declaration with a detailed fault description must be added to the defective device. If your device has come into contact with pollutants, a declaration of decontamination is additionally required.

Appropriate templates can be found on our homepage. Download these by accessing www.bdsensors.com or request them by e-mail or phone:

- info@bdsensors.de
- service phone: +49 (0) 92 35 / 98 11 0

In case of doubt regarding the fluid used, devices without a declaration of decontamination will only be examined after receipt of an appropriate declaration!

11. Disposal

 WARNING	<p>Danger of injury from aggressive media or pollutants</p> <ul style="list-style-type: none"> - Depending on the measured medium, this may constitute a danger to the operator. - Wear suitable protective clothing e.g. gloves, goggles.
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The device must be disposed of according to the European Directive 2012/19/EU (waste electrical and electronic equipment). Waste equipment must not be disposed of in household waste!



NOTE - Dispose of the device properly!

12. Warranty terms

The warranty terms are subject to the legal warranty period of 24 months, valid from the date of delivery. If the device is used improperly, modified or damaged, we will rule out any warranty claim. A damaged diaphragm will not be accepted as a warranty case. Likewise, there shall be no entitlement to services or parts provided under warranty if the defects have arisen due to normal wear and tear.

13. EU declaration of conformity / CE

The delivered device fulfils all legal requirements. The applied directives, harmonised standards and documents are listed in the EC declaration of conformity, which is available online at: <http://www.bdsensors.com>. Additionally, the operational safety is confirmed by the CE sign on the manufacturing label.