GB

Operating instructions
Inductive conductivity sensor hygienic G1/2
LDL220

11394632 / 00 05 / 2022

Contents

1 Preliminary note

You will find instructions, technical data, approvals and further information using the QR code on the unit / packaging or at www.ifm.com.

1.1 Symbols used

✓	Requirement
▶	Instructions
▷	Reaction, result
[...]	Designation of keys, buttons or indications
→	Cross-reference
	Important note Non-compliance may result in malfunction or interference.
	Information Supplementary note

2 Safety instructions

- The unit described is a subcomponent for integration into a system.
  - The system architect is responsible for the safety of the system.
  - The system architect undertakes to perform a risk assessment and to create documentation in accordance with legal and normative requirements to be provided to the operator and user of the system. This documentation must contain all necessary information and safety instructions for the operator, the user and, if applicable, for any service personnel authorised by the architect of the system.
- Read this document before setting up the product and keep it during the entire service life.
- The product must be suitable for the corresponding applications and environmental conditions without any restrictions.
- Only use the product for its intended purpose (→ Intended use).
- If the operating instructions or the technical data are not adhered to, personal injury and/or damage to property may occur.
- The manufacturer assumes no liability or warranty for any consequences caused by tampering with the product or incorrect use by the operator.
- Installation, electrical connection, set-up, operation and maintenance of the product must be carried out by qualified personnel authorised by the machine operator.
- Protect units and cables against damage.
- Only use the product for permissible media (→ Technical data).
- The unit complies with the standard EN 61000-6-4 and is a class A product. The unit may cause radio interference in domestic areas. If interference occurs, the user must take appropriate actions.

3 Intended use

The unit detects the conductivity and the temperature of liquids in pipes and tank systems. The unit is designed for direct contact with the medium.

3.1 Application area

- Food and hygienic areas
- Electrically conductive media (e.g. water, milk, CIP liquids).

Application examples:

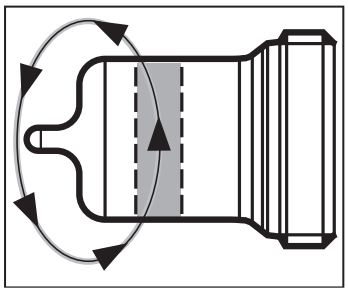
- Detection of rinsing processes in a process system.
- Product monitoring
- Detection of a change of medium
- Phase separation
- Use in CIP cleaning processes

3.2 Restriction of the application area

- Use the unit only for media to which the wetted materials are sufficiently resistant (→ Technical data sheet).
- The unit is not suitable for liquids with a low electrical conductivity (e.g. oils, greases, highly purified water).
- The unit is not suitable for applications where the probe is subjected to permanent and high mechanical stress (e.g. abrasive media or fast flowing media containing solid particles).
- Not suited for media prone to formation of deposit.
- Do not expose the probe tip to direct sun radiation (UV radiation).

4 Function

4.1 Measuring principle



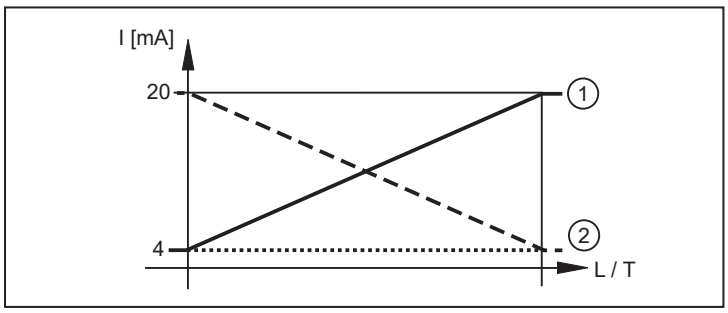
The unit operates on the inductive measuring principle. It measures the electrical conductivity of the medium to be monitored by means of an induced current flow in a measuring channel through which the medium flows.

To compensate the influence of the temperature, the process temperature is detected by a temperature probe in the sensor tip.

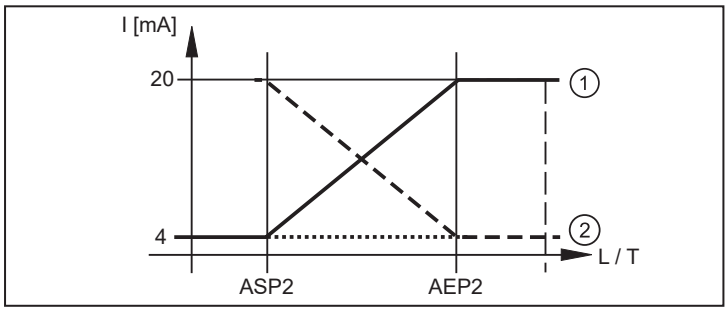
4.2 Analogue function

The unit provides an analogue signal proportional to the conductivity or (as option) the temperature. The analogue output (OUT2) can be configured.

Curve of the analogue signal (factory setting):



Curve of the analogue signal (measuring range scaled):



L: conductivity:
T: temperature
1: [ou2] = [I]
2: [ou2] = [InEG]
ASP2: analogue start point
AEP2: analogue end point

4.3 Defined state in case of a fault

If a fault is detected or if the signal quality is below a minimum value, the output OUT2 passes into a defined state according to Namur recommendation (NE43).

For this case, the response of the output can be set via the parameter [FOU2].

4.4 IO-Link communication interface

The device has an IO-Link communication interface which requires an IO-Link-capable module.

The IO-Link interface allows:

- direct access to process and diagnostic data,
- parameter setting of the unit outside the plant via the IO-Link interface,
- parameter setting of the unit via the IO-Link master during operation.

The IODDs necessary for the configuration of the unit, detailed information about process data structure, diagnostic information, parameter addresses and the necessary information about the required IO-Link hardware and software can be found at www.ifm.com.

5 Installation

CAUTION

If the medium temperature is above 50 °C (122 °F) parts of the housing can increase in temperature to over 65 °C (149 °F).

▷ Risk of burns

▶ Do not touch the unit.

▶ Protect the housing against contact with flammable substances and unintentional contact.

▶ Allow the unit and process adapter to cool down before maintenance.

Before installing and removing the unit:

▶ Make sure that no pressure is applied to the system and there is no medium in the pipe or tank. Also always take into account the potential dangers related to extreme machine and medium temperatures.

The sensor is supplied without installation / connection accessories.

Only use accessories from ifm electronic gmbh! The optimum function is not ensured when using components from other manufacturers.

Available accessories: www.ifm.com.

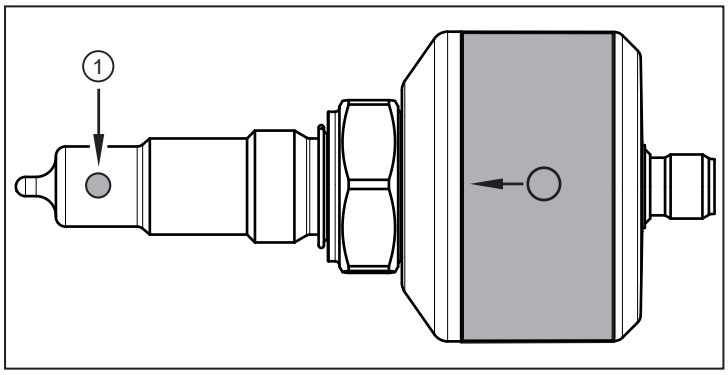
5.1 Installation location / environment

A correct fit and function of the unit and ingress resistance of the connection are only ensured using ifm adapters.

▶ Observe the following for applications in hygienic areas:
Notes on the use according to EHEDG (→ 🗋 10), Notes on the use according to 3-A® (→ 🗋 11).

Orientation of the measurement channel:

▶ Depending on the application, the measurement channel must be aligned vertically or horizontally. Observe the marking on the sensor housing.



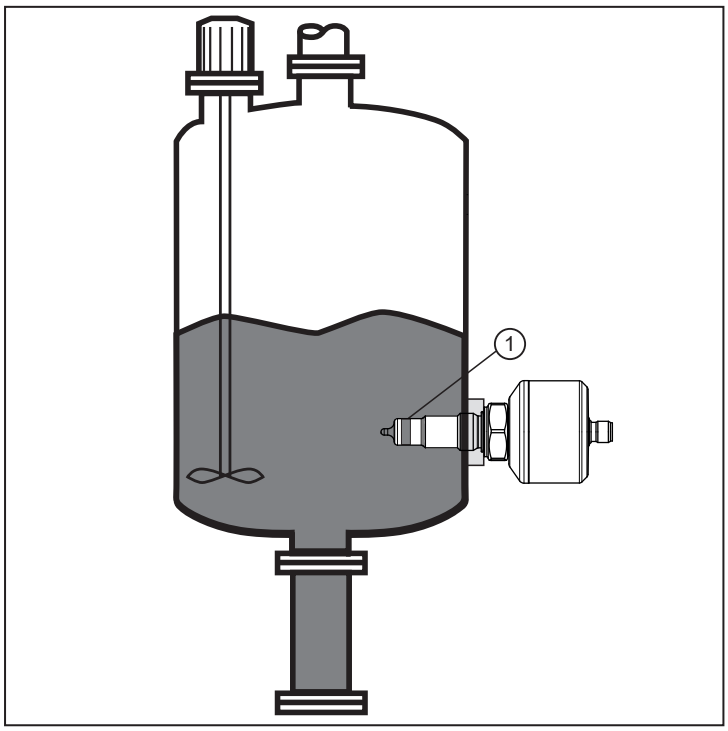
1: measurement channel

5.1.1 Installation in tanks

Align the measurement channel:

▶ Align the measurement channel vertically for correct function.

▷ The medium can run off, air inclusions and deposits are avoided.



1: measurement channel

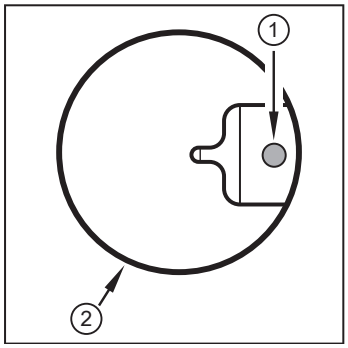
5.1.2 Installation in pipes

Align the measurement channel:

▶ For correct functioning, align the measurement channel in the direction of the flow.

▷ Continuous flow of the medium.

▷ Deposits and formation of air inclusions in the sensor are avoided.

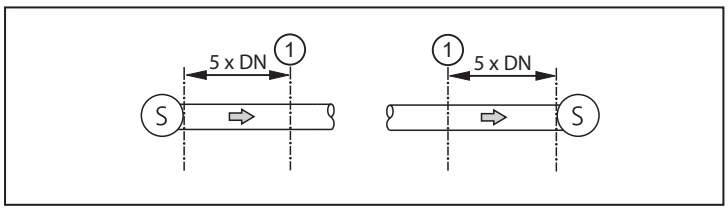


1: measurement channel
2: pipe

Sensor and measurement channel must completely reach into the pipe.

▷ Unhindered flow through the measurement channel is ensured.

- ▶ Avoid installation in a clamp adapter as this does not guarantee optimum flow through the measurement channel. If installation in a clamp adapter cannot be avoided: adhere to the dimensions, see: Notes on the use according to EHEDG (→ 🗋 10)
- ▶ Installation preferably before or in rising pipes.
- ▶ Provide for inlet and outlet pipe lengths (5 x DN).
- ▷ Disturbances caused by bends, valves or pipe reductions, etc. are then eliminated.



S: disturbance
DN: pipe diameter
1: sensor

5.2 Installation procedure

The unit is installed by means of a G 1/2 adapter (→ Accessories).

5.2.1 Installation procedure of the adapter

- ▶ Observe the operating instructions of the adapter used.
- ▶ Ensure cleanliness of the sealing areas.
- ▶ Remove protective packaging only just before mounting.
- ▶ In case of damaged sealing areas replace the unit or the adapter.

5.2.2 Installation procedure of the sensor

- ▶ Lightly grease the thread of the sensor using a lubricating paste which is suitable and approved for the application.

Only use adapters from the ifm accessories. With these adapters the unit directly seals PEEK to metal (→ Technical data sheet).

- ▶ Loosely screw the sensor into the process connection.
- ▶ Align the measurement channel on the basis of the marking and hold the device in this position. See: Installation location / environment (→ 🗋 8)
- ▶ Screw the sensor into the respective process connection and tighten it.
  Tightening torque: 20 Nm
- ▶ After installation check the tank / pipe for ingress resistance.

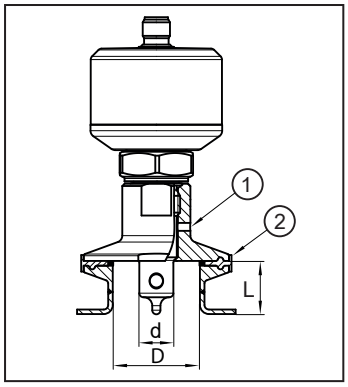
5.3 Notes on the use according to EHEDG

In case welded adapters are used, the food contact surface must be smooth (surface roughness Ra < 0.8 µm) and the welding has to be done according to EHEDG Guideline 9 and 35.

The device is suited for CIP (cleaning in process) when installed correctly.

- ▶ Observe the application limits (temperature and material resistance) according to the data sheet.

- ▶ Ensure that the installation of the device in the system complies with EHEDG guidelines.
- ▶ Use self-draining installation.
- ▶ Only use process adapters permitted according to EHEDG with special seals required by the EHEDG position paper.
- ▶ When mounted in a tank, the installation must be flush mount. If not possible then direct water jet cleaning and cleaning of dead spaces must be possible.
- ▶ Leakage ports must be clearly visible and must be installed facing downwards for vertical pipes.



1: Leakage port
2: Seal

- ▶ To avoid dead space adhere to the dimensions: L < (D - d).

5.4 Notes on the use according to 3-A®

- ▶ Make sure that the sensor is integrated into the system according to 3-A.
- ▶ Use only adapters with 3-A qualification and marked with the 3-A symbol. Available accessories: www.ifm.com.

The process connection must be provided with a leakage port. This is ensured when installed using adapters with 3-A approval.

- ▶ Leakage ports must be clearly visible and must be installed facing downwards for vertical pipes.

For use according to 3-A, special regulations apply for cleaning and maintenance.

Not suitable for systems that have to meet the criteria of E9.2 of the 3A standard 63-04.

6 Electrical connection

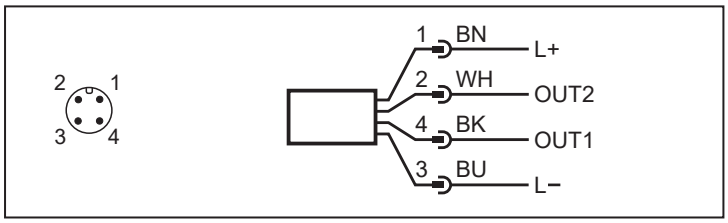
The unit must be connected by a qualified electrician.

The national and international regulations for the installation of electrical equipment must be adhered to.

Supply voltage to EN 50178, SELV, PELV according to the technical data sheet.

▶ Disconnect power.

▶ Connect the unit as follows:



Pin	Core colour	
1:	BN	brown
2:	WH	white
3:	BU	blue
4:	BK	black
OUT1: • IO-Link		
OUT2: • analogue output		
Colours to DIN EN 60947-5-2		

6.1 For the cULus scope of validity

The electrical supply must only be made via SELV/PELV circuits.
A class 2 power supply can also be used and is not excluded.
The device must be supplied via a limited energy circuit according to section 9.4 of UL standard 61010-1, 3rd issue, or equivalent.
The external circuits connected to the device must be SELV/PELV circuits.
The device is designed to be safe at least under the following conditions:

- Indoor use
- Altitude up to 2000 m
- Relative air humidity up to max. 90%, non condensing
- Pollution degree 3
- Use UL-certified approved cables of category PVVA or CYJV with data suitable for the application.
- No special treatment is needed for cleaning the device.

7 Parameter setting

A PC with USB IO-Link master or a configured IO-Link environment is required to set the parameters.

If you change parameters during operation, this will influence the function of the plant.

- ▶ Make sure that there will be no malfunctions or dangerous operation in your plant.
- ▶ Note the potential dangers related to extreme plant conditions.

7.1 Parameter setting using PC and USB IO-Link master

- ▶ Preparing the PC, software and master. Observe the → Operating instructions of the respective units / software.
- ▶ Connect the unit to the USB IO-Link master (→ Accessories).
- ▶ Follow the menu of the IO-Link software.
- ▶ Set the parameters; adjustable parameters(→ Parameters).
- ▶ Check if the unit has accepted the parameter settings. If necessary, read sensor again.
- ▶ Remove the USB IO-Link master and put the unit into operation.

7.2 Parameter setting during operation

Parameter setting during operation is only possible with an IO-Link-capable module (master).

Setting parameters can be directly adjusted via the controller.
Example: Media-specific parameters such as temperature coefficient [T.Cmp] can be adjusted to improve accuracy.

Recipes and settings can be stored in the controller during operation.

By parameter setting via the controller, a check of the units via a bit in parameter setting is ensured.

7.3 Adjustable parameters

7.3.1 Basic settings

Reset to factory settings	Restore the factory settings (button to activate the system command)
rEF.T	Standard temperature (25 °C) = reference temperature for measuring the conductivity. The standard temperature can be adjusted by the user, if necessary. Setting range: 15...35 (°C)
T.Cmp	Temperature compensation. The conductivity is determined according to the standard temperature ([rEF.T]) when the temperature coefficient (medium-specific characteristic value) is entered. Setting range: 0...5 %
uni.T	Selection of temperature unit [°C] = temperature is displayed in °C (degrees Celsius) [°F] = temperature is displayed in °F (degrees Fahrenheit)
CGA	Calibration gain (cell constant correction factor) With this factor the sensor can be adapted to a present system, or optimised to a certain conductivity value, or corrected.

7.3.2 More settings

ou2	Output configuration for analogue output (OUT2): [I] = measuring range is provided as 4...20 mA [InEG] = measuring range is provided as 20...4 mA [OFF] = output OFF (high impedance)
SEL2	Assignment of the analogue output to the process value: [COND] = conductivity [TEMP] = temperature
ASP2-TEMP	Analogue start point temperature; Setting range: -25...115 °C hysteresis of AEP2-TEMP > 20 % of AEP2-TEMP, min. 35 °C
AEP2-TEMP	Analogue end point temperature; Setting range: 10...150 °C hysteresis of ASP2-TEMP > 20 % of ASP2-TEMP, min. 35 °C
Offset TEMP	Zero-point calibration (calibration offset) / temperature; Setting range: +/- 5 K
ASP2-COND	Analogue start point conductivity; Setting range: 0...500,000 µS/cm. AEP2-COND must be at least two times ASP2-COND.
AEP2-COND	Analogue end point conductivity; Setting range: 500...1,000,000 µS/cm. AEP2-COND must be at least two times ASP2-COND.
Lo.T	Minimum value memory for the temperature
Hi.T	Maximum value memory for the temperature
Reset [Hi.T] and [Lo.T]	Reset maximum and minimum value memory (button to activate the system command)
Lo.C	Minimum value memory for conductivity
Hi.C	Maximum value memory for conductivity
Reset [Hi.C] and [Lo.C]	Reset maximum and minimum value memory (button to activate the system command)
FOU2	Response of OUT2 in case of a fault: [OU] = analogue output reacts according to process value, if possible. Otherwise: analogue output goes to [OFF]. [On] = analogue output switches to value > 21 mA in case of a fault [OFF] = analogue output switches to value < 3.6 mA in case of a fault
dAP	Damping of the measured signal. Setting range: 0...20 s
S.Tim	Simulation; entering the simulation time Setting range: 1...60 min
S.On	Simulation; status of the simulation: [OFF] = simulation OFF [On] = simulation ON
Start simulation	Start simulation (button to activate the system command)
Stop simulation	Stop simulation (button to activate the system command)
S.TMP	Simulation; selection of the temperature value to be simulated Setting range: -25...150 (°C)
S.CND	Simulation; selection of the conductivity value to be simulated Setting range: 0... 1,000,000 µS/cm
Unit temperature	Current temperature of the unit Measuring range: -40...80 (°C)

For further information, please refer to the IODD description (www.ifm.com) or to the context-specific parameter descriptions of the used parameter setting software.

7.3.3 Example parameter setting

- ▶ Set the temperature compensation (parameter [T.Cmp]) to a medium with the temperature coefficient 3.0 %/K. Example: [T.Cmp] = [3.0].
- ▶ Make all other settings.
- ▶ Transfer the sensor data to the unit.

7.4 Temperature influence and temperature coefficient

7.4.1 Influence of the medium on the temperature

The conductivity depends on the temperature. When the temperature increases, the conductivity changes. This temperature influence depends on the respective medium and can be compensated by the unit if the temperature coefficient (tempco) of the medium is known. The temperature compensation is set via the parameter [T.Cmp]. Then the temperature-compensated conductivity value corresponds to the conductivity at standard temperature (25 °C; factory setting of the parameter [rEF.T]).

For medium that is not changed the same tempco value has to be set for all sensors (unit-independent characteristic value). There is no further dependence on the measuring principle, the lot or the manufacturer of the sensors.

If the temperature coefficient of the medium is not known, it can be determined.
See: Determination of the temperature coefficient tempco (→ 15)

In an IO-Link environment, existing tempcos of the media can be stored as recipe in the controller so that the accuracy of the values to be detected is improved.

7.5 Determination of the temperature coefficient tempco

1. Set the parameters [T.Cmp] and [dAP] to zero: [T.Cmp] = [0], [dAP] = [0].

▶ Write the changed values to the sensor.

1. Adjust the medium to 25 °C, for example, and take down the value of the conductivity after 2 min.
2. Heat up the medium to 45 °C, for example, and take down the value of the conductivity after 2 min.

Example of values taken down:
Medium at 25°C = 500 µS/cm; medium at 45°C = 800 µS/cm
Temperature change = 20 K

1. Calculate the change of the conductivity in percent.
   The conductivity has increased by 300 µS/cm.
   The percentage change is 300/500 = 60 %.
2. Calculate the temperature coefficient tempco: The tempco is calculated from the change in percent and the temperature change: Tk = 60 % / 20 K = 3 % / K
3. The calculated tempco can now be adopted into the parameter [T.Cmp].
   Example: [T.Cmp] = [3]. If necessary, set the damping (parameter [dAP]) again.

▶ Write values to the sensor.

8 Operation

8.1 Function check

After power-on the device is in the operating mode. It carries out its measurement and evaluation functions and generates process data (via IO-Link) according to the set parameters.

▶ Check whether the unit operates correctly.

8.2 Operating and diagnostic messages via IO-Link

IODD and IODD descriptive text as a PDF file at: www.ifm.com

8.3 Output response in different operating states

	OUT1 *)	OUT2
Initialisation	process value invalid	OFF
Normal operation	process value according to conductivity / temperature	according to conductivity / temperature and setting [ou2]
Fault	process value invalid	< 3.6 mA at [FOU2] = [OFF] > 21 mA at [FOU2] = [On] no change at [FOU2] = [OU]

*) process value via IO-Link

9 Maintenance, repair, transport and disposal

- ▶ Avoid the formation of deposits and soiling at the sensor element.
- ▶ To avoid damage to the sensor, no hard or sharp objects must be used when cleaning the sensor manually.

When the medium is changed, it may also be necessary to adapt the unit settings for a higher accuracy (parameter [T.Cmp]).

- ▶ It is not possible to repair the unit.
- ▶ After use dispose of the unit in an environmentally friendly way in accordance with the applicable national regulations.
- ▶ In case of return shipment, ensure that the unit is free from soiling, especially from dangerous and toxic substances.
- ▶ For transport only use appropriate packaging to avoid damage of the unit.

10 Factory setting

	Factory setting	User settings
rEF.T	25 (°C)	
T.Cmp	2 (%)	
uni.T	°C	
CGA	100 (%)	
ou2	I	
SEL2	COND (conductivity)	
ASP2-TEMP	0 (°C)	
AEP2-TEMP	150 (°C)	
Offset TEMP	0 (K)	
ASP2-COND	0 (µS/cm)	
AEP2-COND	1,000,000 (µS/cm)	
Lo.T	---	
Hi.T	---	
Lo.C	---	
Hi.C	---	
FOU2	OFF	
dAP	1 (s)	
S.Tim	3 min	
S.On	OFF	
S.TMP	20 (°C)	
S.CND	500 (µS/cm)	