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Operating instructions
Inductive conductivity sensor
hygienic G1-sealing cone

LDL210

Contents

UK

1 Preliminary note

1.1 Key to the symbols

▶   Instruction

>   Reaction or 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

- 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 (→ Functions and features).

- Only use the product for permissible media (→ Technical data).

- 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.

- 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.

- Protect units and cables against damage.

3 Items supplied

- LDL210 conductivity sensor
- Operating instructions

In addition, the following is necessary for installation and operation:

- Mounting material (→ 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

4 Functions and features

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.

> ⓘ A PC with USB IO-Link master or a programmed memory plug or a configured IO-Link environment is required to set the parameters (→ 5.4) and (→ 8).

4.1 Applications

- Food and hygienic areas (→ 6.3) (→ 6.4)
- 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

4.2 Restriction of the application area

- Use the product 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).

5 Function

5.1 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 (Fig. 5-1).

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

Fig. 5-1
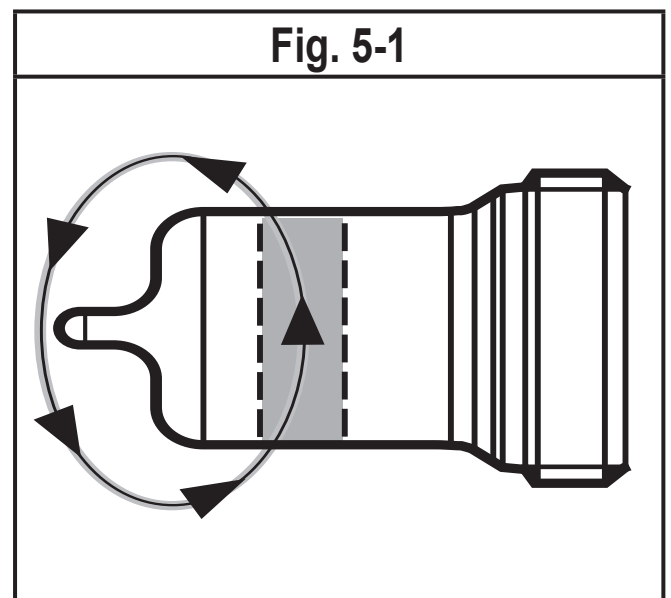
5.2 Analogue function

The unit provides an analogue signal proportional to the conductivity or (as option) the temperature.The analogue output (OUT2) can be configured (→ 8.4).

Curve of the analogue signal (factory setting):
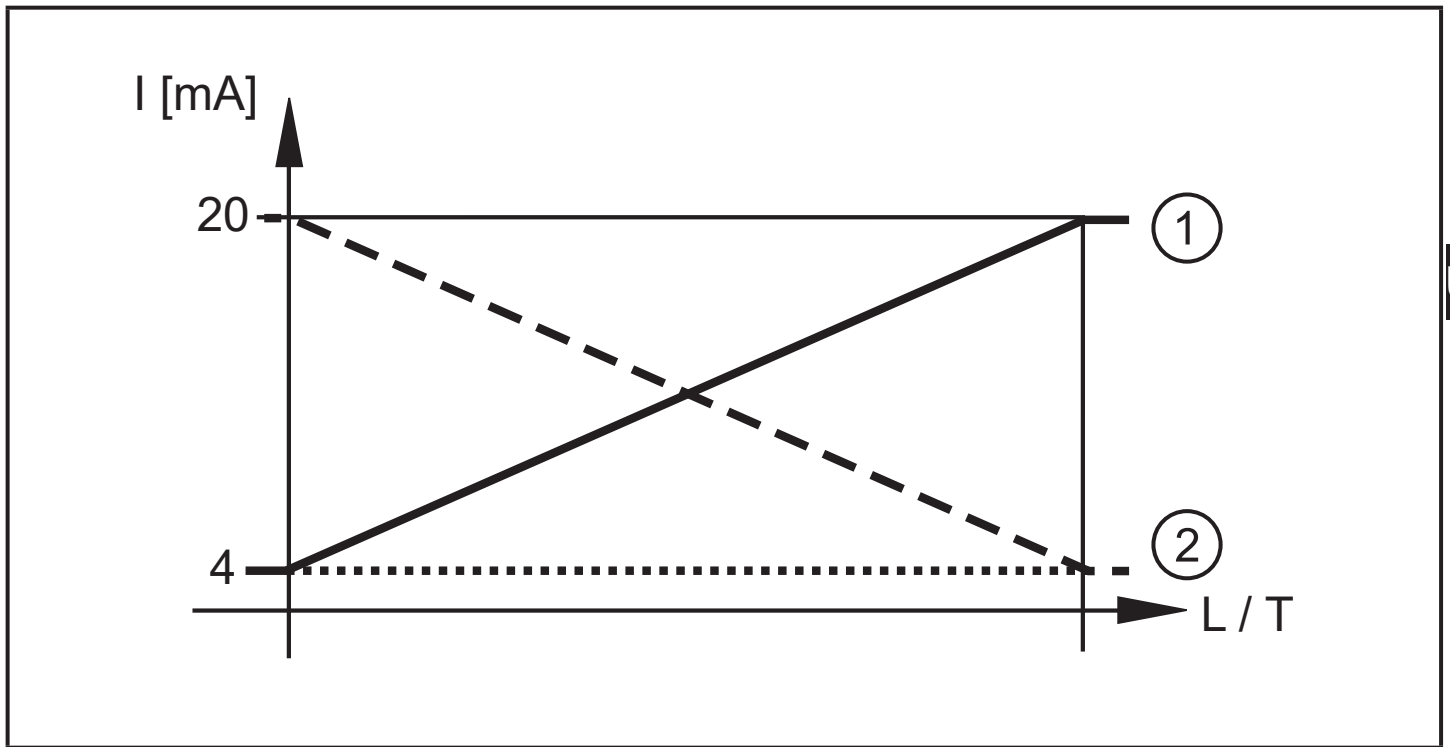
Curve of the analogue signal (measuring range scaled):
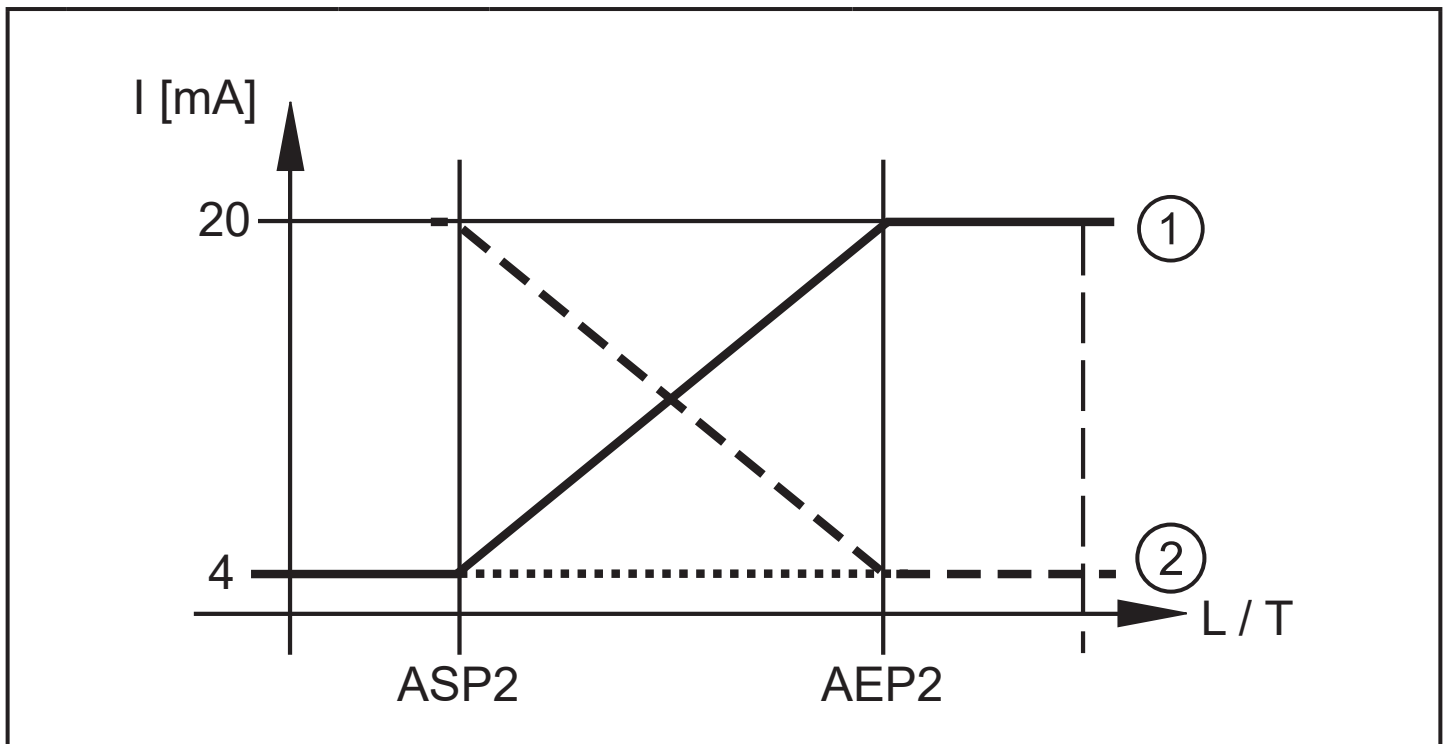
L:	conductivity:	[ASP2]:	analogue start point	(1):	[ou2] = [I]
T:	temperature	[AEP2]:	analogue end point	(2):	[ou2] = [InEG]

Additional information about the analogue output: (→ 9.3)

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5.3 Defined state in case of a fault

If a device fault is detected or if the signal quality drops below a minimum value, the analogue output passes into a defined state according to Namur recommendation NE43 (→ 9.3). For this case, the response of the output can be set via the parameter [FOU2] (→ 8.4).

5.4 IO-Link

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

The IO-Link interface enables direct access to the process and diagnostic data and provides the possibility to set the parameters of the unit during operation.

In addition, communication is possible via a point-to-point connection with a USB IO-Link master.

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.

6 Installation

[!] Before installing and removing the unit:

▶ Make sure that no pressure is applied to the system and that it is free from media.

▶ Note dangers related to machine / medium temperatures.

6.1 Installation location / environment

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

▶ For applications in hygienic areas: (→ 6.3) (→ 6.4).

[!] Orientation of the measurement channel:

▶ Depending on the application, the measurement channel (1) must be aligned vertically or horizontally. Observe the marking at the sensor housing (→ 6.1).

Fig. 6-1
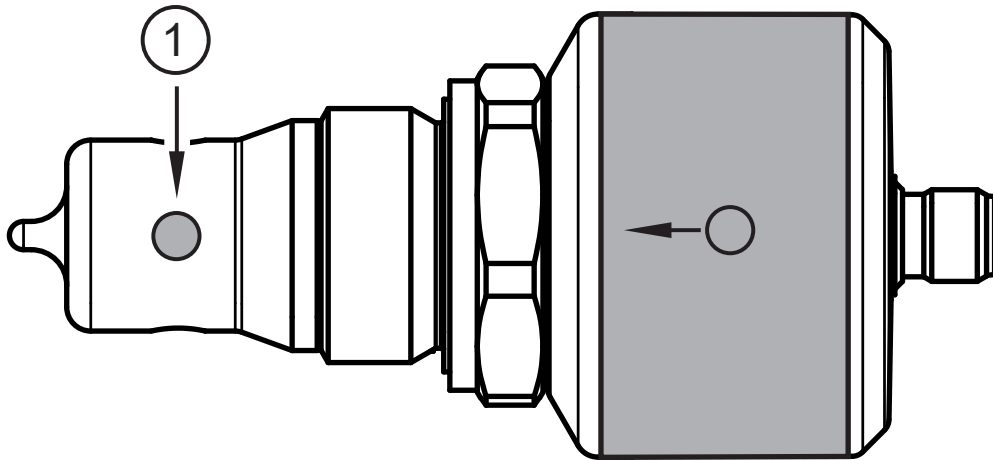
6.1.1 Installation in tanks

▶ For a correct functioning, the measurement channel (1) must be aligned vertically (→ 6.2).

> Medium can run off, air inclusions and deposits are avoided.

Fig. 6-2
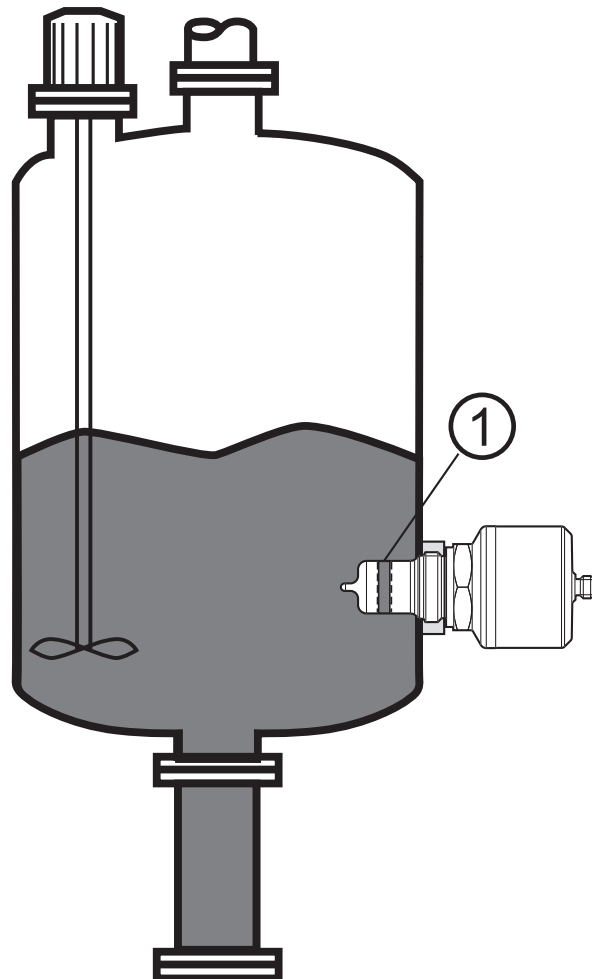
6.1.2 Installation in pipes

! ▶ For correct functioning, the measurement channel (1) must be aligned in the direction of the flow (Fig. 6-3).

> Continuous flow of the medium. Deposits and formation of air inclusions in the sensor are avoided.

Fig. 6-3
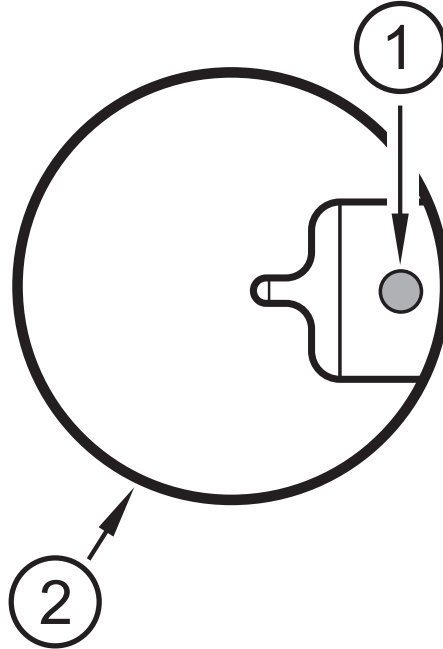
! ▶ Sensor and measurement channel (1) must completely reach into the pipe (2).

> Unhindered flow through the measurement channel is ensured.

▶ Recessed installation (e.g. on a T connection piece) is not allowed.

▶ Installation preferably before or in rising pipes.

▶ Provide for inlet and outlet pipe lengths (5 x DN).
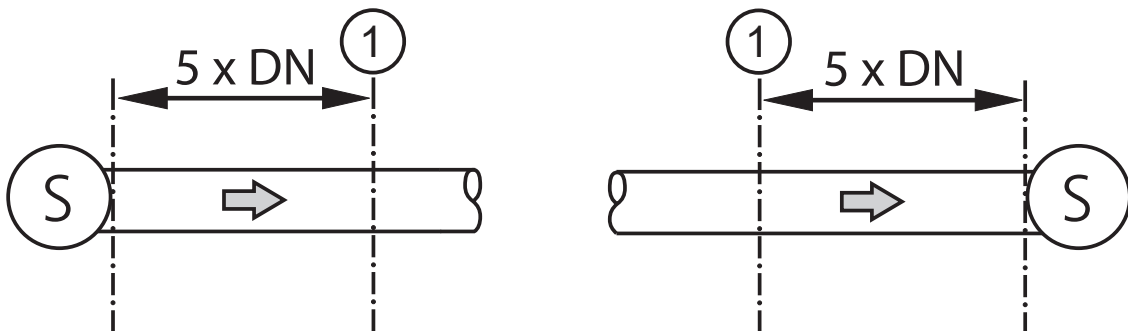
S = sources of interference; DN = pipe diameter; 1 = sensor

> Disturbances caused by bends, valves or pipe reductions, etc. are then eliminated.

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6.2 Installation procedure

The unit is installed using an adapter with G1 sealing cone (→ Accessories).

6.2.1 Installation procedure of the adapter

▶ Observe the installation 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.

▶ Weld or screw the adapter into the tank / pipe. For welding adapters make sure that the adapter does not warp during the welding process.

6.2.2 Installation procedure of the sensor

▶ Slightly 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 (→ 6.1) and hold the device in this position.

▶ Tighten the coupling nut. Max. tightening torque: 25 Nm.

▶ After installation, check the tank / pipe for ingress resistance.

6.3 Notes on the use in accordance with EHEDG

| ! | The unit 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 unit 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.

▶ In case of structures 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.

▶ To avoid dead space: Install the sensor in an inline housing. Minimum pipe diameter: 38 mm

(1) Leakage port

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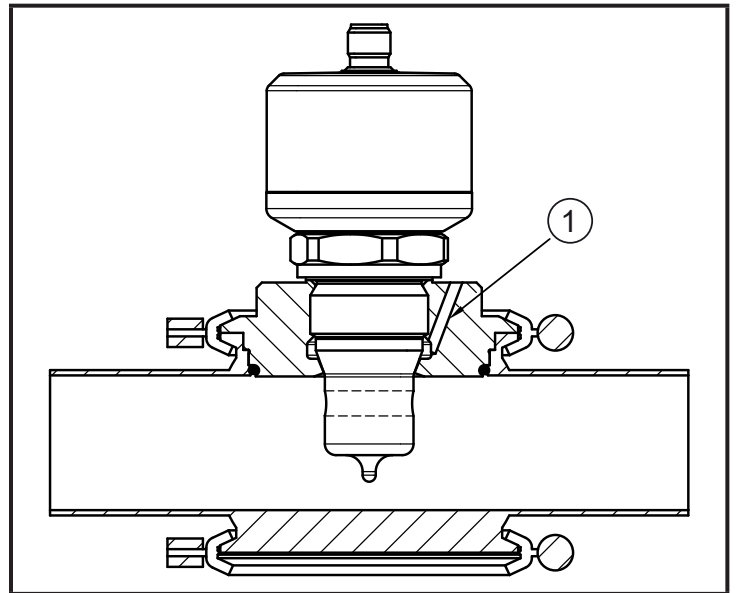
6.4 Notes on the use according to 3-A

▶ Make sure that the sensor is integrated into the system according to 3-A.

▶ Use only adapters with 3-A certification and marked with the 3-A symbol (→ Accessories).

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 use where the criteria for paragraph E1.2/63-03 of the 3-A standard 63-03 have to be met.

7 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.
>
> Voltage supply according to EN 50178, SELV, PELV.

▶ Disconnect power.

▶ Connect the unit as follows:

Core colours	
BK	black
BN	brown
BU	blue
WH	white

	OUT1: IO-Link
	OUT2: analogue output
	Colours to DIN EN 60947-5-2

7.1 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 ed., 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
*   Maximum relative humidity 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.

8 Parameter setting

A PC with USB IO-Link master (→ 8.1) or a programmed memory plug (→ 8.2) or a configured IO-Link environment (→ 8.3) is required to set the parameters.

> [!] Changing parameters during operation can influence the function of the plant.
>
> ▶ Make sure that there will be no malfunctions or dangerous operation in your plant.

8.1 Parameter setting via PC and USB IO-Link master

▶ Prepare PC, software and master → Observe the operating instructions of the respective units / software (→ 5.4).

▶ Connect the unit to the USB IO-Link master (→ Accessories).

▶ Follow the menu of the IO-Link software.

▶ Set the parameters; adjustable parameters (→ 8.4).

▶ Check if the parameter setting was accepted by the unit. If necessary, read sensor again.

▶ Remove USB IO-Link master and put the unit into operation (→ 9).

8.2 Parameter setting via memory plug

Via a memory plug (→ Accessories), a parameter set can be written/transferred to the unit (→ 5.4).

▶ Load suitable parameter set (e.g. using a PC) to the memory plug → observe the operating instructions of the memory plug.

▶ Make sure that the sensor has the original factory settings.

▶ Connect the memory plug between sensor and socket.

> When voltage is supplied, the parameter set is transferred from the memory plug to the sensor.

▶ Remove the memory plug and put the unit into operation (→ 9).

The memory plug can also be used to save the current parameter setting of a unit and to transfer it to other units of the same type.

8.3 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.

8.4 Adjustable parameters

8.4.1 Basic settings

Restore 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 the 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.

8.4.2 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; enter the simulation time Setting range: 1...60 min
S.On	Simulation; status of the simulation: [OFF] = simulation OFF [On] = simulation ON

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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
Device 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.

8.4.3 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.

8.5 Temperature influence and temperature coefficient

8.5.1 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 (→ 8.6).

> ⚠ 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.

8.6 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.

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

3. 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

4. Calculate the change of the conductivity in percent.The conductivity has increased by 300 µS/cm.The percentage change is 300/500 = 60 %.

5. Calculate the temperature coefficient tempco: The tempco is calculated from the change in percent and the temperature change:Tk = 60% / 20 K = 3 % / K

6. 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.

9 Operation

9.1 Function check

After power-on the device is in the operating mode. It carries out its measurement and evaluation functions and generates output signals according to the set parameters.

▶ Check whether the unit operates reliably.

9.2 Operating and diagnostic messages via IO-Link

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

9.3 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 [ou2] setting
Fault	process value invalid	< 3.6 mA at [FOU2] = [OFF] > 21 mA at [FOU2] = [On] no change if [FOU2] = [OU]

*) process value via IO-Link

10 Technical data and scale drawing

ℹ️ Technical data sheet and scale drawing at: → www.ifm.com

11 Maintenance / Transport

▶ 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]) (→ 8.4).

▶ It is not possible to repair the unit.

▶ After use dispose of the device in an environmentally friendly way in accordance with the applicable national regulations.

▶ In case of returns ensure that the unit is free from soiling, especially of dangerous and toxic substances.

▶ For transport only use appropriate packaging to avoid damage of the unit.

12 Factory setting

	Factory setting	User setting
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	20,0 (°C)	
S.CND	500 (µS/cm)	

More information at www.ifm.com