Operating Manual

Inductive Conductivity Meter

ILM-4 / ILM-4R

Table of contents

1 Application / Intended use

- Inductive measurement of specific conductivity and concentration of fluid media in the range of 0...1000 mS / cm
- For use in hygienic applications of the food, beverage, and pharmaceutical industries
- Not suitable for use in explosive atmospheres
- Not suitable for safety-related unit parts (SIL)

2 Conformity with standards

The basic safety and health requirements are met through fulfillment of:

- 2014/30/EU Electromagnetic Compatibility
- 1935/2004/EU Consumer Goods Ordinance
- Directive (EU) 10/2011 (Articles in Contact with Food)
- EN 61000-6-2:2005 (Interference Immunity)
- EN 61000-6-4:2007 + A1:2011 (Interference Emissions)

3 Safety instructions

These safety instructions must be followed to

- Avoid endangering persons and the environment.
- Avoid damage to the sensors.
- Prevent faulty batches during production.

The electrical connections may only be performed by persons with the necessary technical skills (e.g. certified electricians or persons with technical training in electrics) and by persons with the necessary authorization from the operator.

The power supply and the control circuit inputs and outputs must be professionally wired. The current state-of-the-art of electrical connections must be adhered to. See also **section 8** "Wiring diagram".

<u>The following details must be noted in particular:</u>

- Safety instructions
- Electrical connection data

1. All persons involved with the setup, commissioning, operation, service, and maintenance of the sensor must be suitably qualified.
2. This operating manual must be followed closely. The operator must ensure that the personnel has read and fully understood the operating manual.
3. All work must be performed with utmost care and may only be executed by authorized and trained personnel. The applicable national regulations regarding opening and repairing of devices must be complied with.
4. We recommend storing the operating manual near the measuring device in an easily accessible location.
5. The sensor must be de-energized prior to alterations and maintenance.
6. The working area of the operator must offer enough space to minimize the risk of injury.
7. The technical data specified in the operating manual and on the type label must be noted.

Warranty coverage shall not be granted for any damage that can be attributed to improper execution of work on the device.

4 Special features / advantages

- The sensor structure is based on a modular device platform which can be tailored to requirements and is easy to exchange if faulty
- Wear-free, inductive measurement procedure
- In contrast to conductive measurement procedures, there are no problems due to electrode deterioration or polarization.
- Hygienic design with Negele weld-in sleeve
- Individual setting/programming via PC or User Interface
- Two configurable LEDs on the display unit

5 Options / Accessories

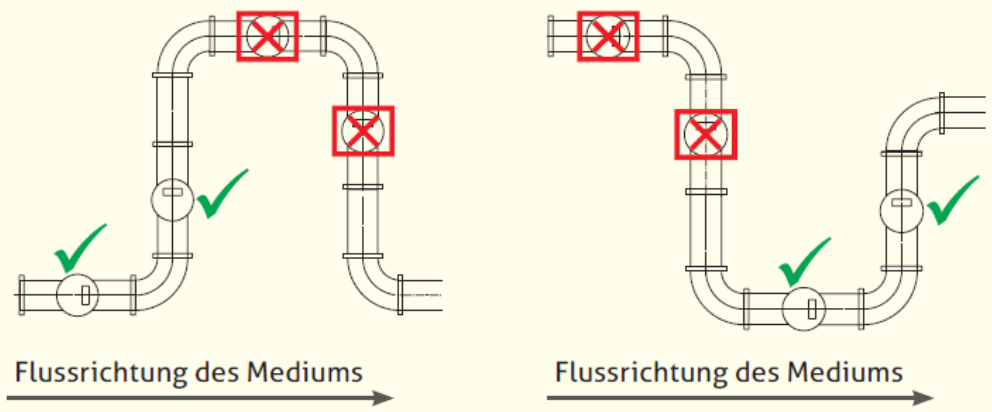
- User Interface with small or large display (retrofittable)
- Programming adapter MPI-200 (PC-based) or IO-Link
- Tool for detaching the signal module
- Pre-assembled PVC cables

6 Installation and Connection

6.1 Mechanical installation

Mechanical connection / installation notes

- The device must be installed such that the submersible body is fully surrounded by the medium and no air bubbles can form in the sensor area. It therefore is advisable to install the device in rising pipes.



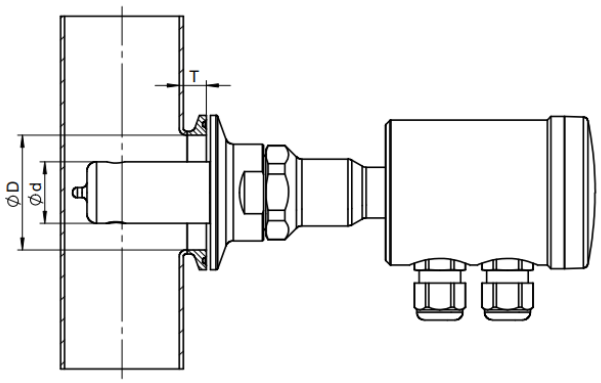
- The device must be aligned such that the lettering "FLOW" is at the bottom of the device in the direction of flow.
- Very strong vibrations can lead to false measurements (e.g. if installed near a pump).
- Use the Negele **CLEANadapt** system to ensure that the measuring point functions properly.
- When installing the device, adhere to the maximum tightening torque of 20 Nm.
- To correctly install **CLEANadapt** weld-in sleeves, use a suitable welding mandrel. Follow the weld-in and installation instructions in the **CLEANadapt** product information.

6.2 Requirements for hygienic installation

Conditions for hygienic installation according 3A and EHEDG

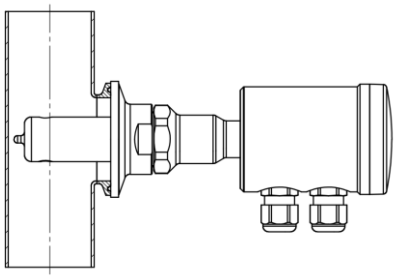
- The ILM-4 / ILM-4R is designed for CIP/SIP cleaning. The sensor can withstand a maximum of 150 °C / 60 min.
- The mounting position must guarantee self-draining properties.
- The mounting position and gasket need to follow the actual 3A or EHEDG standards and guidelines.
- When using Tri-Clamp process connections, observe the requirements of the current 3A and EHEDG regulations regarding installation position, process connections and approved seals.

Recommended dimensions for hygienic installation using Tri-Clamp

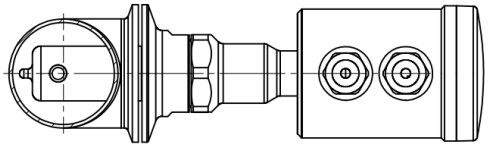


Tri-Clamp: T < (D-d)

Recommended mounting positions

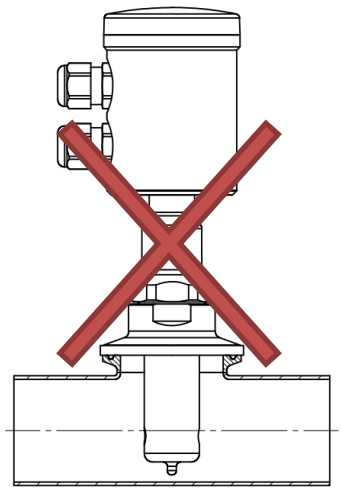


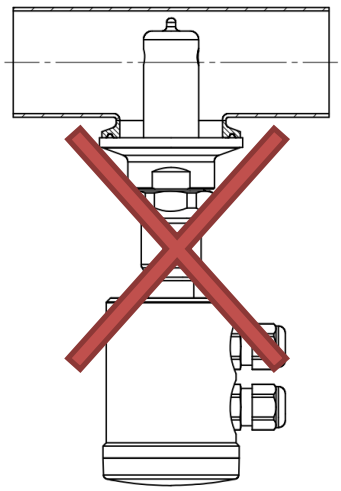
ILM-4 in vertical pipe



ILM-4 in horizontal pipe

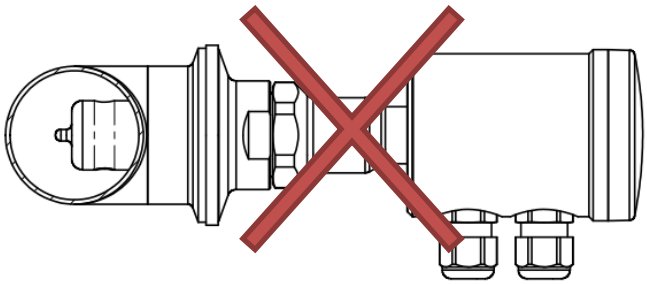
Not permitted mounting positions using Tri-Clamp





Installation from top or from bottom should be avoided.
This can lead to incorrect measurement due to accumulation of air or deposits.

Disregarded flow direction



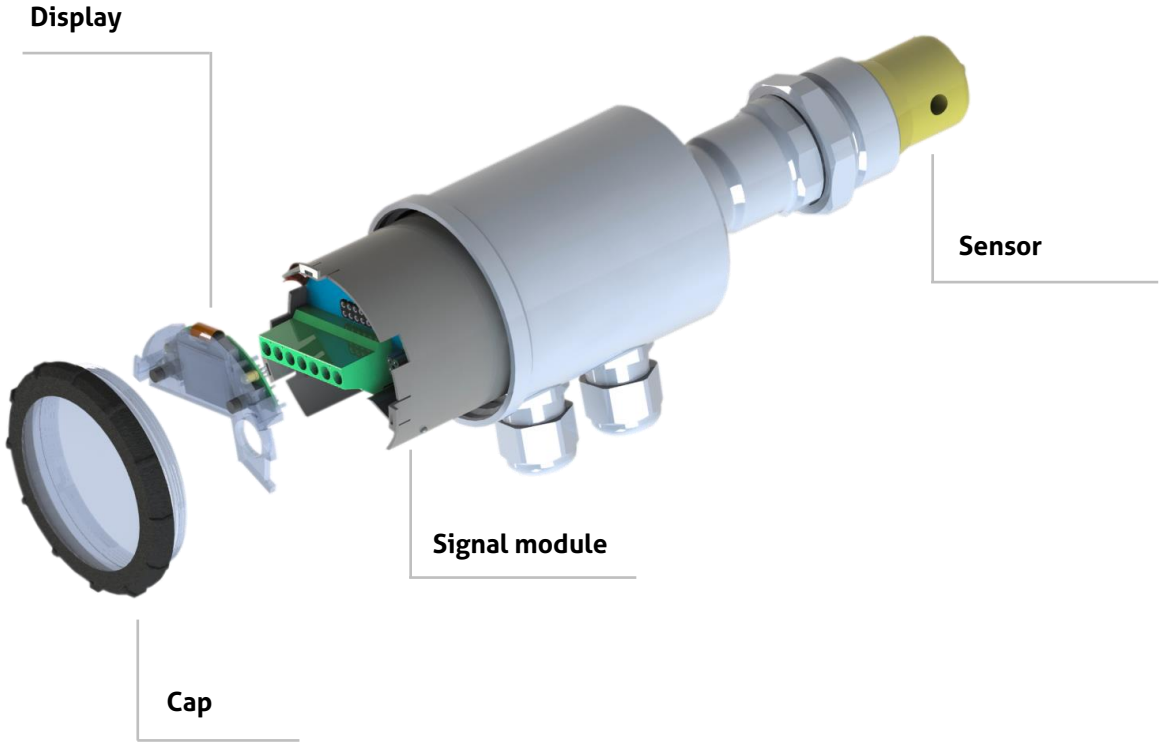
The device should be aligned so that the "FLOW" label on the bottom of the device in the direction of flow.

The ILM-4 inductive conductivity meter is set to operate without requiring special adaptations. In isolated instances, some parameters may need to be adjusted. The parameterization may be changed using the PC-based MPI-200 programming adapter or the User Interface directly on the sensor. This can be performed either directly on location or in the office in a dry simulation.

The parameter list accompanying the sensor contains the sensor settings for analog output 1 (terminals 4 and 5) under **X45** and for analog output 2 (terminals 6 and 7) under **X67**.

The sensor can be parameterized either via the PC-based MPI-200 programming adapter, IO-Link or directly on the sensor using the User Interface with Display

The ILM-4 inductive conductivity meter features a modular design with a "tree structure", which can be tailored to meet requirements and can be easily exchanged in the event of a fault.



This tree structure is also used by the MPI-200 programming adapter software for the PC and the User Interface in the sensor. The software is subdivided into **Display, Electronic (signal interface)** and **Sensor (conductivity measurement)**.

Sensor (conductivity measurement): One or two analog outputs of the sensor for conductivity, concentration and temperature can be freely configured.

Conductivity: Two different conductivities can be set here, independently of one another. The upper range limit can be freely selected. In addition, the customer can freely adjust temperature compensation and damping.

Concentration: Two predefined ranges for common CIP media (NaOH or HNO3) are available for selection. In addition, there is the possibility of entering up to 8 customized media specific points (each for conductivity and concentration). A customer defined range is entered by specifying at least 2 points with values > 0. This customized entry of support points is only possible in the "**Setup**" level or higher. The temperature compensation, damping and upper range limit can also be set.

Temperature: Output of the medium temperature measured at the tip of the PEEK part on the sensor. The temperature unit and response time can be adjusted here.

The table below shows possible sensor settings and corresponding ID number.

Parameter	ID Number	Adjustable settings
Sensor		
Sensor Settings		
Temperature Compensation Unit	013021	%/K, %/°F
Conductivity 1		
Temperature Compensation 1	013031	0...100 %/K
Damping Conductivity 1	013041	inactive, 2.5 s, 5 s, 10 s, 20 s
Upper Range Value of Conductivity 1	013091	0.5...1000 mS/cm (in increments of 0.5)
Concentration		
Temperature Compensation	013032	0...100 %/K
Damping Concentration	013042	inactive, 2.5, 5 , 10 , 20 s
Media	013061	NaOH 0...10%, HNO3 0...20% or customer-specific concentration
Upper Range Value of Concentration	013092	1...100 %
(+) Customer-specific points, X-Conductivity, Y-Concentration		Up to 8 support points for conductivity and concentration
Conductivity 2		
Temperature Compensation 2	013033	0...100 %/K
Damping Conductivity 2	013043	inactive, 2.5, 5, 10, 20 s
Upper Range Value of Conductivity 2	013093	0.5...1000 mS/cm (in increments of 0.5)
Temperature		
Unit Temperature	013144	°C or °F
Response Time	013145	Normal or rapid
Analog Output (X45a)		
Signal selection	330031	Conductivity 1, Concentration, Conductivity 2, Temperature
4mA Setpoint in % of URV	330111	-50.0 ... 150.0 %
20mA Setpoint in % of URV	330191	-50.0 ... 150.0 %
Underrange Limit	330141	2.40, 3.20, 3.40, 3.60, 3.80, 3.95, 4.00 mA
Overrange Limit	330211	20.00, 20.05, 20.50, 21.00, 21.20, 21.40, 21.60, 21.80, 22.00 mA
Warning-Signal: No Media	330121	2.40, 3.20, 3.40, 3.60, 3.80, 3.95, 4.00 mA
Warning-Signal: Outside of Specification	330221	2.40, 3.20, 3.40, 3.60, 3.80, 3.95, 4.00 mA
Error-Signal: Global Failure	330131	20.00, 20.05, 20.50, 21.00, 21.20, 21.40, 21.60, 21.80, 22.00 mA
Digital Input (x3)		
Active State	330821	active high, active low

The table below shows possible display settings and corresponding ID number.

Parameter	ID Number	Adjustable settings
Display		
Settings Display		
Language	451010	English, German
LED 1 (left)		
Signal Selection	330034	Conductivity 1, Concentration, Conductivity 2, Temperature
Warning-Signal: No Media	331191	No effect, Fast Blinking, Slow blinking, On, Off
Warning-Signal: Outside of Specification	331201	No effect, Fast Blinking, Slow blinking, On, Off
Error-Signal: Global Failure	331231	No effect, Fast Blinking, Slow blinking, On, Off
LED 2 (right)		
Signal Selection	330035	Conductivity 1, Concentration, Conductivity 2, Temperature
Warning-Signal: No Media	331192	No effect, Fast Blinking, Slow blinking, On, Off
Warning-Signal: Outside of Specification	331202	No effect, Fast Blinking, Slow blinking, On, Off
Error-Signal: Global Failure	331232	No effect, Fast Blinking, Slow blinking, On, Off

Signaling interface:

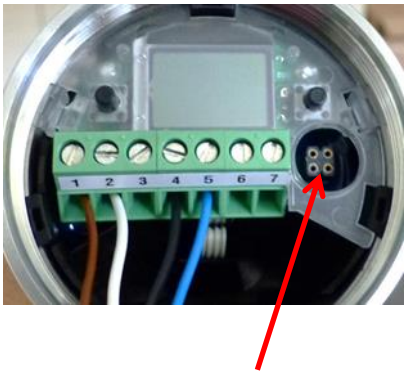
- **Signal selection for the 4...20 mA signal:** Selection between conductivity 1 or 2, concentration and temperature
- **Set value for 4 or 20 mA signal:** By default, the lower range limit is used for the 4 mA signal and the upper range limit for the 20 mA signal. This can be adjusted as necessary.
- **"No Media" warning signal:** Current loop signal when the sensor is not immersed in a medium → dry running.
- **"Outside Spec." warning signal:** Current loop signal if an operating state is outside of the specified range. The measurement accuracy can no longer be guaranteed.
- **"Global Failure" error signal:** Current loop signal if a malfunction occurs, for example if the device fails.
- **Signal limit for under range and over range:** Lower or upper limit of the current loop signal that is still valid and linear when output below 4 mA or above 20 mA.
- **"Underflow/overflow" error signal:** Current loop signal is below or above the under range or over range limit.
- **Signaling Simulation**: Simulates the current loop signal, where the entered parameter value briefly replaces the source value.
- **LED configuration:** These two LEDs can be configured as required.

A list of the parameters set in the conductivity sensor is included with the delivery. These parameter values, as well as those changed by the users themselves, can be printed out using the MPI-200 programming adapter and the PC software or using IO-Link.

When making the settings, note the help texts in the MPI software for each parameter. They provide useful information on changing the selected parameter.

6.3 Settings using the MPI-200 programming adapter

The MPI-200 programming adapter is connected to the ILM-4 conductivity meter via the external MPI-200-F adapter. It must be ensured that the ILM-4 conductivity meter is permanently connected to the supply voltage while the parameters are being set.



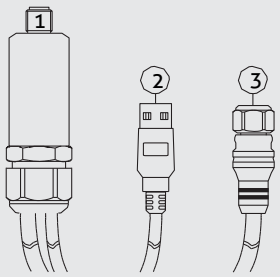
Connection plug for the MPI-200-F adapter as an intermediate plug between the ILM-4 electronics and the MPI-200 connection 3 (see the next figure).

Connection of the MPI-200 programming

1: not needed

2: USB port for connecting to a PC

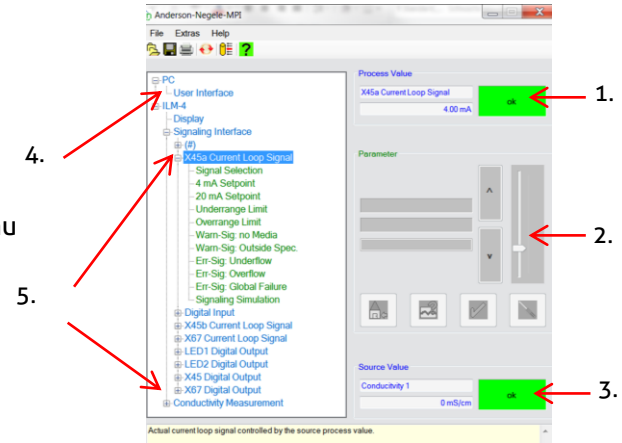
3: Connection cable to adapter for ILM-4



After the sensor is connected to the PC and the user software is opened, the following window appears:

1. Information on the current process value
2. Buttons for changing the parameter setting
3. Information on the current source value
4. Adjustable PC parameters
5. Adjustable sensor parameters

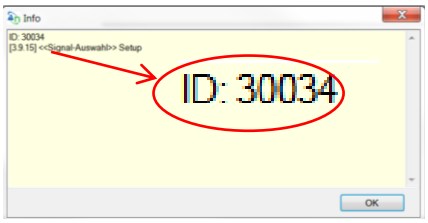
Clicking on the + in the menu opens a submenu in which parameters can be adjusted.



Note:
For further settings, please see also the description in the MPI-200 product information.

To set or change parameters directly in the sensor (see section 6.2 **"Settings using the Simple User Interface"**), you need the ID codes contained in the table below. This table only lists the most important ID codes.

Further ID codes can be found in the user software. To view these, right-click on "Info" by the parameter name. An info box appears with the respective ID (see graphic below):



Because the search number must have 6 digits, an additional digit is always added in front of the five-digit ID (30034 in the graphic above). This digit depends on the node as follows:

4 for changes to the **display**
3 for changes to the **signal module** (signal interface)
0 for changes to the **sensor** (conductivity measurement)

Because the signal selection is in the single interface, the ID code for the "Signal selection" example above is: 330034.

A list of all ID codes can be printed out via the PC user interface. To do so, click on **File → Parameter Data → Print** to open the corresponding window and print out the complete list of ID codes.

6.4 Settings using the User Interface

The software structure of the User Interface is like the structure of the PC version.

The system is operated using two control buttons to the left and right or below the display. These two buttons can be used to navigate through the tree structure of the User Interface to change parameters. The button functions are as follows:

Button	Press briefly	Press and hold
R (right)	Jump to next node, parameter	Edit a node, parameter
L (left)	Jump back to previous node, parameter	Leave editing mode without saving, return to next higher level
R/L	Scroll up and down	
R and L simultaneously		Press both buttons for 10 seconds: the menu jumps back to the beginning (attention: this is not a reset)

Note:

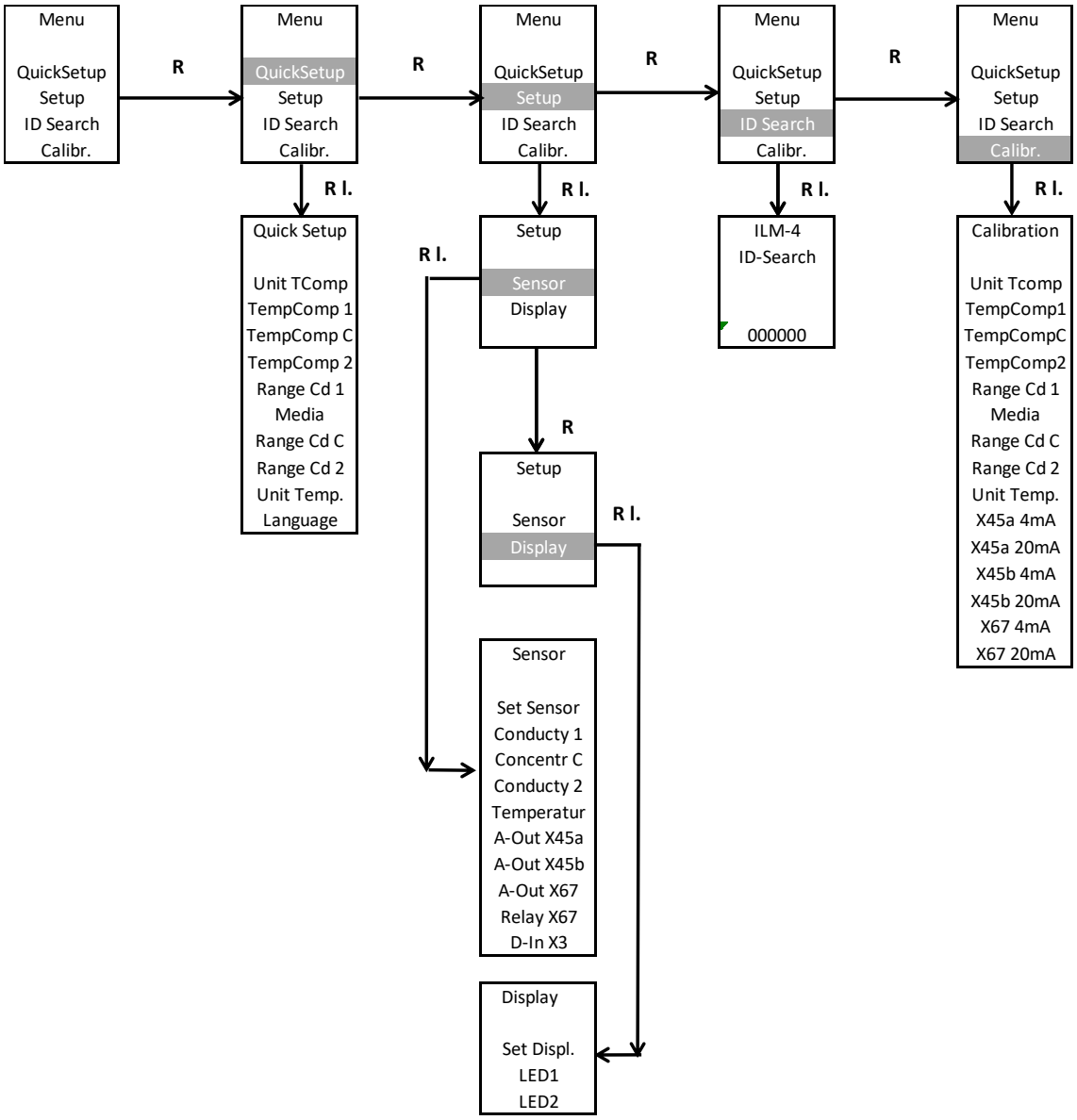
Explanation for the programming example shown on the next page.

1) Briefly press the right button.
2) Press and hold the right button, select the required mode (e.g. Setup) and scroll through the menu using the right/left buttons and confirm the selection by pressing and holding the right button.
3) Press and hold the right button and then enter the ID number from right to left. Proceed as follows:
   a.) Select the desired position (navigation with the right/left buttons, press the left button: Change the position to the left, press the right button, change the position to the right).
   b.) At the desired position, press and hold the right button until the field becomes gray. Then enter the numerical value using the right / left buttons and confirm by pressing and holding the right button until the gray area disappears. Then enter the next digit.
   c.) After all digits have been entered, move all the way to the left with the left button until the field become gray.

   Then press and hold the right button. The system jumps to the selected parameter, which can now be entered or changed in the same manner. Start by pressing and holding the right button.

   For some system-related parameters, you are asked to confirm that you really wish to make the change. Do this by pressing the left or right button.
   - Press the right button to change the parameter or save the change.
   - Press the left button to leave the setting without making a change.

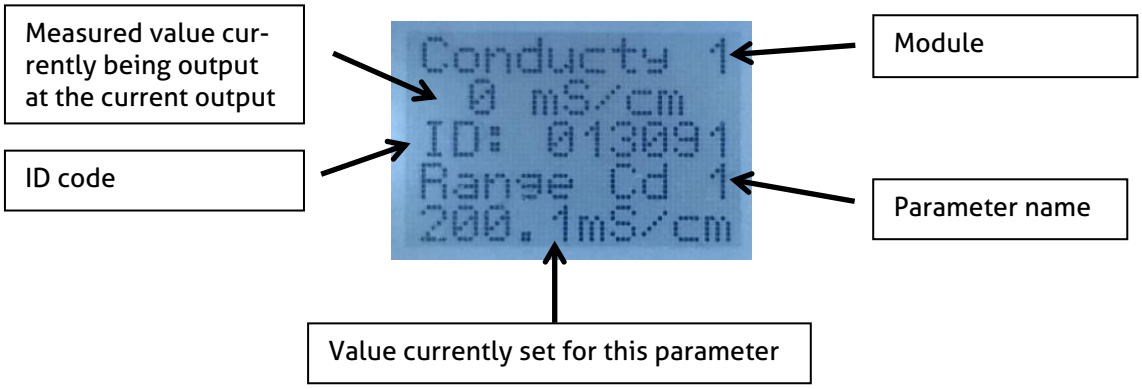
Menu Structure



R : Right button
R l. : Right button (long)
L : Left button
L l. : Left button (long)

6.4.1 Screen display

After the sensor parameters have been adapted/changed, or after the sensor is switched on and no change is made, the sensor shows the current measurement value. By pressing the right button, different measurement values will be shown. After pressing the left button long, the default measurement will be displayed.



To leave the display mode and create settings on the sensor, press one of the two buttons on the left and right next to the display. The sensor then displays the start page, from where the settings can be created.

6.4.2 LED Configuration

The display unit features two LEDs that can be individually configured. These can be used to visually indicate faults directly on-site. The LED to the left of the display is LED 1 while the one to the right is LED 2.

The following options can be selected when setting the LEDs:

- **Signal Selection:** The following signals can be selected: conductivity 1 and 2, temperature and concentration.
- Output function, direction of action, switch point entry method, switch point, hysteresis
- **Switch ON Delay, Switch OFF Delay:** The digital output is switched on or off with the delay set here. Values can be set between 0...30 s.
- **Warn-S: no Media, Warn-S: Outside Spec., Err-Sig: Underflow, Err-Sig: Overflow, Err-Sig: Global Failure:** The effect of each parameter on the LED display can be set. The following can be selected: "No Effect on Output", Output Fast Blinking" (0.4 s interval), "Output Slowly Blinking" (1 s interval), "Output ON" (LED on continuously) and "Output OFF". "Output" refers to the LED here.
- **Signaling Simulation:** the entered parameter value briefly replaces the source value. The following situations can be simulated: "Output OFF", "Output ON", "Output Slowly Blinking" and "Output flashes rapidly". "Output" refers to the LED here.

7 Settings of Sensor

7.1.1 Default Settings for LED

During normal operation, both LEDs are switched off. The LEDs will indicate different status of the sensor

	LED 1 (left side) **Indication of Warning**	**LED 2 (right side)** **Indication of Error**
Flashing slowly	Warning because of no media	Error because of range overflow
Flashing rapidly	Warning because current measurement accuracy can't be guaranteed because sensor is outside of specification.	General device error indicated as global failure.

7.1.2 Default Settings of mA Output

During normal operation, the sensor will transmit the results of the measurment on the analog output in the range of 4...20 mA. In case of specific situations, the senor will indicate the status in the factory settings using 3,95 mA; 20.05 mA or 22.00 mA.

Description of Status	**mA Value**	**Category**
Underrange limit	3.95mA	Warning
Overrange limit	20.05mA	Warning
No Media	3.95mA	Warning
Outside Specification	3.95mA	Warning
Underflow	3.95mA	Error
Overflow	20.05mA	Error
Global Failure	22.00mA	Error

7.1.3 Default settings of Ranges

The sensor is delivered with the following default settings.

Analog Output 1 (X45 on terminals 4 and 5)
Conductivity 1 with measurement range 0...200 mS/cm

Analog Output 2 (X67 on terminals 6 and 7)
Temperature with measurement range 0...150 °C

Digital Input (X3 on terminal 3)
Active high

7.2 Examples of sensor settings

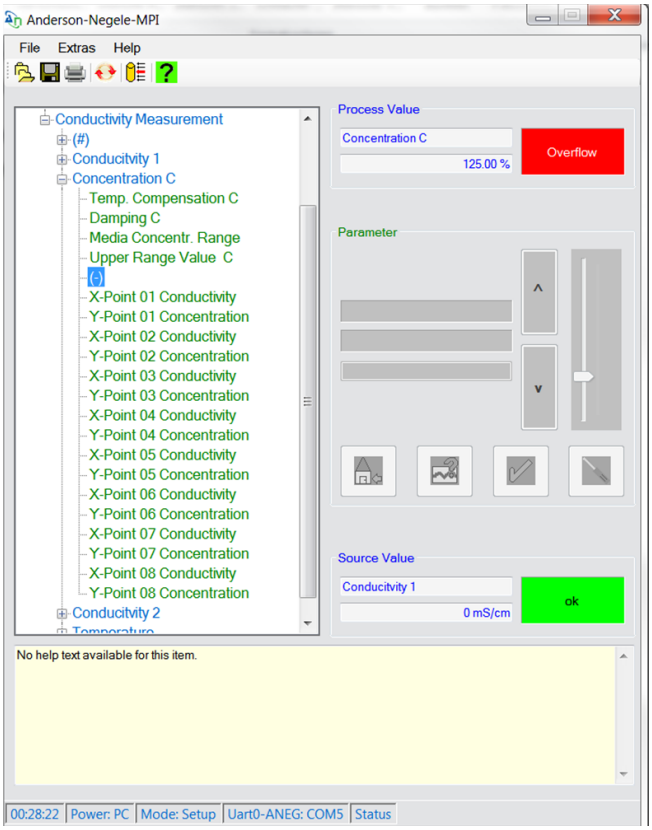
Several examples of settings that can be created on the Simple User Interface or on the user interface of the PC follow (setting of a customized conductivity 1, the associated temperature coefficient and the concentration curve).

7.2.1 Setting of customer-specific concentration curve via MPI-200 software

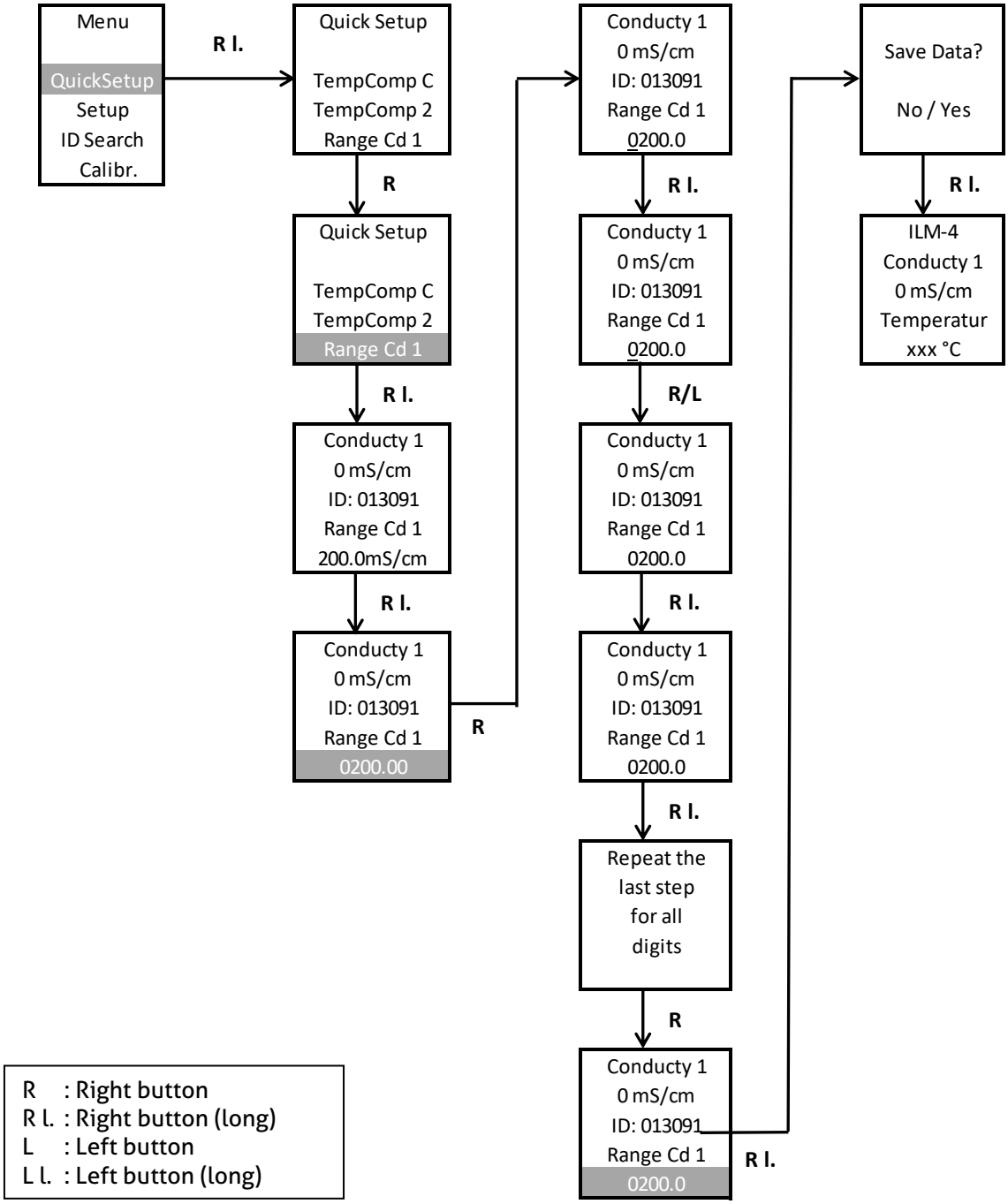
After the PC software is started, a customer-specific curve for the concentration can be entered via the following node: Conductivity Measurement → Concentration C → (+). Values need to be entered for at least two X and Y points. Up to 8 support points for X and the associated Y values can be entered to establish the relationship between conductivity (X) and concentration (Y). The Y values together with the associated X values form coordinates that act as support points for the linearization curve. If 0 is entered for any of these points, that support point is deactivated.

X-Point 01 up to X-Point 08 (Conductivity): This parameter is used to define the customer-specific measurement range of the conductivity. Values can be entered from 0...1000 mS/cm.

Y-Point 01 up to Y-Point 08 (Concentration): This parameter is used to define the customer-specific measurement range of the concentration. Values can be entered from 0...100%.



7.2.2 Example for setting conductivity 1 using the display



Alternatively, to entering the measurement range as described above, the measurement range can also be adjusted by entering an ID code.

To do so, go to "**YES**" on the ID search page and enter the ID code using the buttons. After the code is confirmed, the sensor display shows the menu in which the parameter can be adjusted.

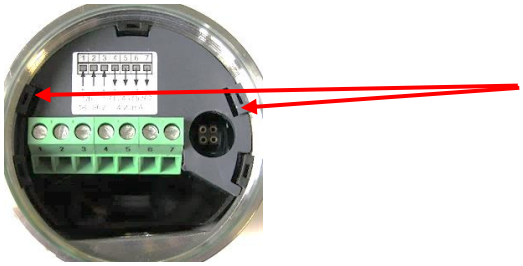
8 Installation of the „Large User Interface" (LUI)

1. Remove the complete signal module in case a small display (SUI) is mounted (cont. 4)
2. Remove the small display unit from the signal module
3. Install the signal module in the sensor head
4. Mount large display interface

Hot-plug function: The large display can be installed while the sensor is energized, but this requires the usual precautionary measures when working with electronic components.

If the display is being installed while energized, it is necessary to press both buttons simultaneously for > 10 s after the display is installed to activate the display.

8.1 Retrofitting the display if a display was not yet installed



Remove the plastic cover: To do so, bend the tabs slightly inwards with a screwdriver to be able to remove the cover easily.

In case the connection unit is hidden by a plastic cover, please remove the plastic cover. The large display can be inserted in the head of the sensor. The tabs (Fig. 2) must be inserted in the appropriate openings on the puck (Fig. 1). Then the display can be easily pressed onto the puck. No wiring is required.

Note: After the Large User Interface is mounted, the sensor can only be operated on this display since the display conceals the connector for the MPI-200 adapter. If operating the sensor using the programming software is preferred, the display must be removed. Then the connector of the programming adapter can be plugged in.

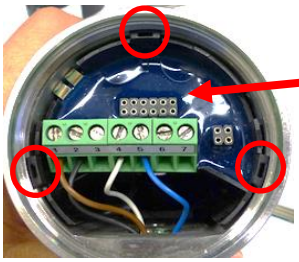


Fig. 1

Fig. 2

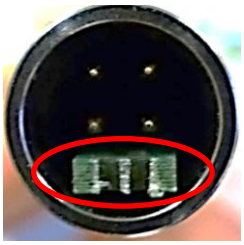


Fig. 3

Attention: The connector of the programming adapter (Fig. 3) must be connected in the correct direction → the green spacer must face the cable exit (M12 connector or PG).

8.2 Retrofitting the display if a small display (SUI) was already installed

First the puck with the mounted display needs to be removed using the puck puller tool (Fig. 4). To do so, detach the wires from the cable terminal. Then insert the five arms of the puck puller in the plastic tabs of the puck (Fig. 5).

Fig. 4

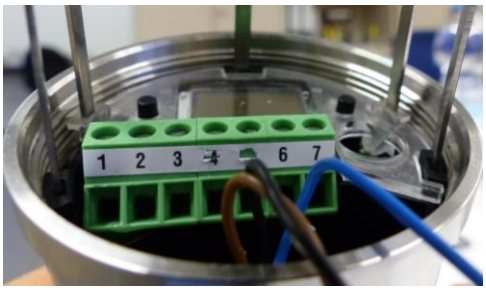
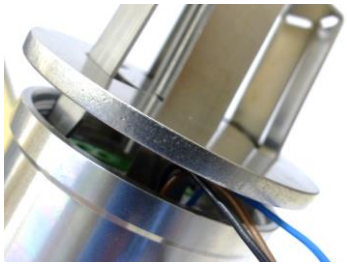


Fig. 5

Push the puck puller all the way into the sensor head and push the disk as far as possible toward the sensor head so that the arms of the puck puller firmly grasp the puck.
Pull the puck with the display out of the sensor housing and pull the small display off the puck.



Now the puck without the display can be properly positioned and installed back in the sensor head and the wiring can be reconnected to the cable terminal. Then the large display can be mounted → see "**Retrofitting the display if a display was not yet installed**".

8.3 Using the large display

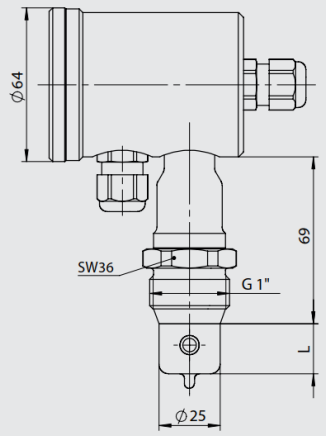
The large display (LUI) is operated in the same way as the small display (SUI). It is operated using two operating buttons below the display:

After the sensor is started, the screen saver appears in which the process values of the sensor are displayed one after the other. To reach the start page from here, press one of the two buttons briefly. Further information on operating the display can be found in the quick start manual and in the operating manual.

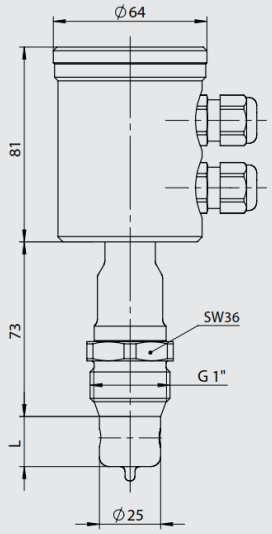
9 Dimensions

For all process connections, the conductivity sensor can be ordered with a submersion length of L20 (20 mm) or L50 (50 mm).

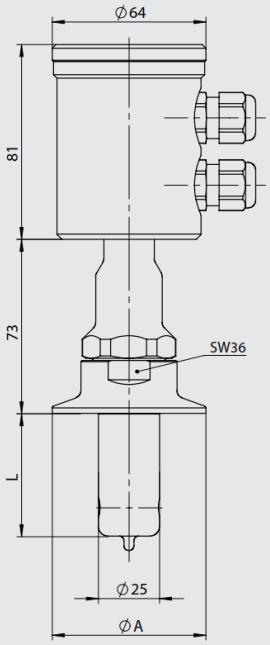
ILM-4 / G1" horizontal



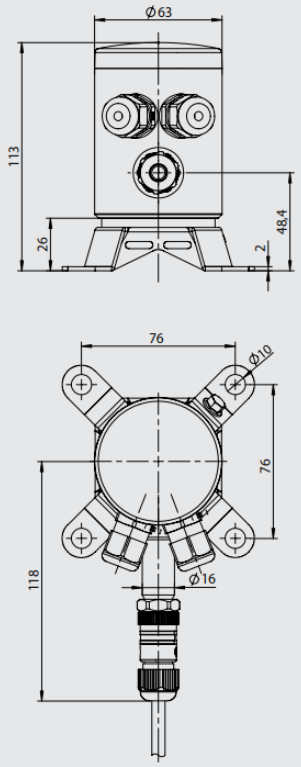
ILM-4 / G1" vertical



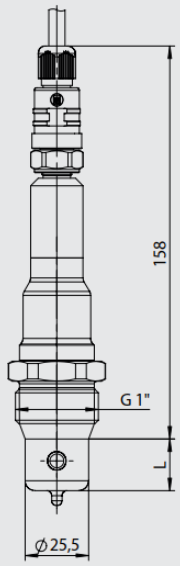
ILM-4 / Tri-Clamp vertical



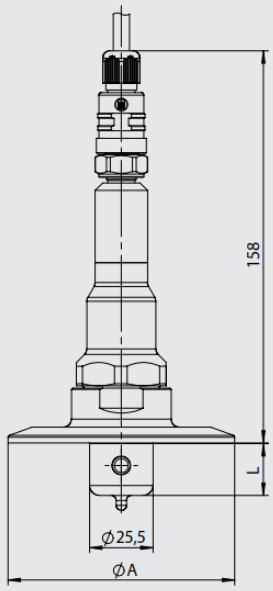
HUR / Head Unit Remote Version



ILM-4S / G1" CLEANadapt



ILM-4S / Tri-Clamp

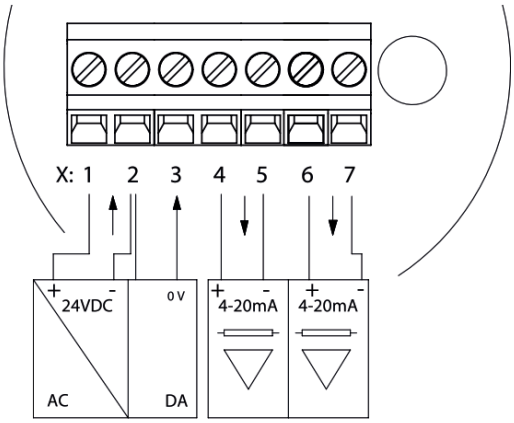


Submersion length	
Type	**L**
ILM-4 / L20	20 mm
ILM-4 / L50	50 mm

Tri-Clamp size	
Type	**Ø A**
TC1	50.5 mm
TC2	64 mm
T25	77.5 mm
TC3	91 mm

10 Electrical Connection Analog Signal Modules

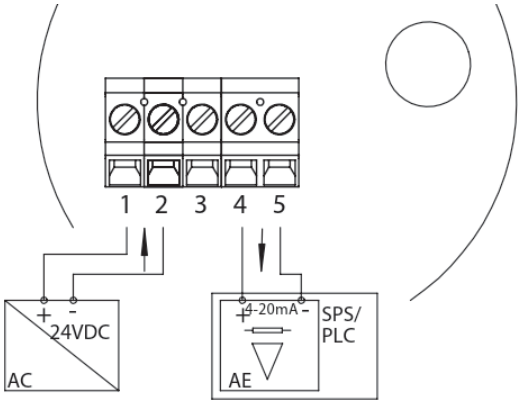
10.1 Terminal Block of A5x/A6x Series



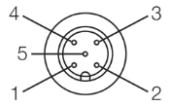
A52	A53	A62	A63	X
Power Supply +		Power Supply +		X1
Power Supply -		Power Supply -		X2
Not assigned	Digital Input X3	Not assigned	Digital Input X3	X3
Analog Output X45 +		Analog Output X45 +		X4
Analog Output X45 -		Analog Output X45 -		X5
Relay Output X67		Analog Output X67 +		X6
Relay Output X67		Analog Output X67 -		X7

10.2 Terminal Block of A4x Series

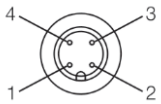
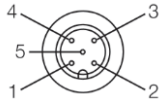
A42	X
Power Supply +	X1
Power Supply -	X2
Not assigned	X3
Analog Output X45 +	X4
Analog Output X45 -	X5

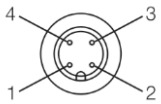
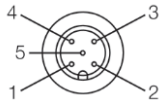


10.3 M12 Connector Cables Color

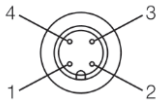
M12 Connector	Pin	Standard Color	Anderson Color
	1	Brown	Red
	2	White	Black
	3	Blue	Green
	4	Black	Not assigned
	5	Grey	White

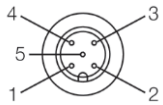
10.4 M12 connectors for A6x/A5x series

Electrical Connection „N"						
M12 Connector		**Signal Module**				
Connector	**Pin**	**A52**	**A53**	**A62**	**A63**	**X**
	1	Analog Output X45 +		Analog Output X45 +		X4
	2	Relay Output X67		Analog Output X67 +		X6
	3	Relay Output X67		Analog Output X67 -		X7
	4	Analog Output X45 -		Analog Output X45 -		X5
	1	Power Supply +		Power Supply +		X1
	2	Not assigned		Not assigned		-
	3	Not assigned		Not assigned		-
	4	Power Supply -		Power Supply -		X2
	5	Not assigned	Digital Input X3	Not assigned	Digital Input X3	X3

Electrical Connection „A"						
M12 Connector		**Signal Module**				
Connector	**Pin**	**A52**	**A53**	**A62**	**A63**	**X**
	1	Analog Output X45 -		Analog Output X45 -		X5
	2	Analog Output X45 +		Analog Output X45 +		X4
	3	Power Supply +		Power Supply +		X1
	4	Power Supply -		Power Supply -		X2
	1	Relay Output X67		Analog Output X67 +		X6
	2	Not assigned		Not assigned		-
	3	Not assigned		Not assigned		-
	4	Relay Output X67		Analog Output X67 -		X7
	5	Not assigned	Digital Input X3	Not assigned	Digital Input X3	X3

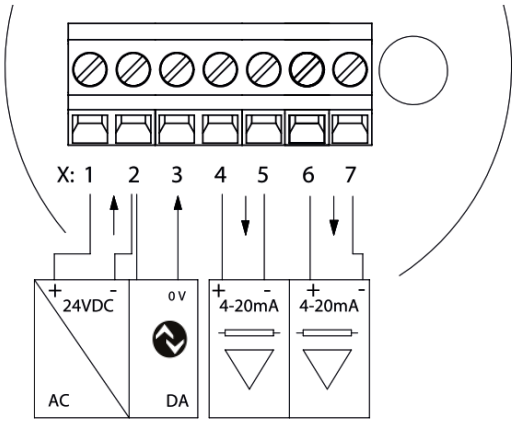
10.5 M12 Connectors for A4x series

Electrical Connection „M“			
M12 Connector		**Signal Module**	
Connector	**Pin**	**A42**	**X**
	1	Power Supply +	X1
	2	Analog Output X45 +	X4
	3	Analog Output X45 -	X5
	4	Power Supply -	X2

Electrical Connection „L“			
M12 Connector		**Signal Module**	
Connector	**Pin**	**A42**	**X**
	1	Power Supply +	X1
	2	Power Supply -	X2
	3	Analog Output X45 -	X5
	4	Not assigned	-
	5	Analog Output X45 +	X4

11 Electrical Connection Digital Signal Modules

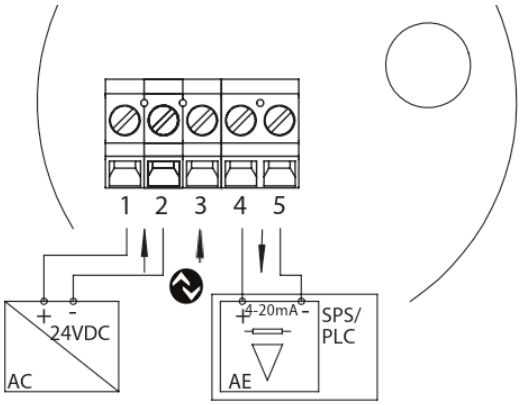
11.1 Terminal Block of I5x/I6x Series



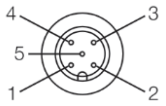
I52	I53	I62	I63	X
Power Supply +		Power Supply +		X1
Power Supply -		Power Supply -		X2
IO-Link	IO-Link / Digital Input X3	IO-Link	IO-Link / Digital Input X3	X3
Analog Output X45 +		Analog Output X45 +		X4
Analog Output X45 -		Analog Output X45 -		X5
Relay Output X67		Analog Output X67 +		X6
Relay Output X67		Analog Output X67 -		X7

11.2 Terminal Block of I4x Series

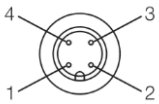
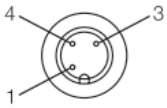
I42	X
Power Supply +	X1
Power Supply -	X2
IO-Link	X3
Analog Output X45 +	X4
Analog Output X45 -	X5



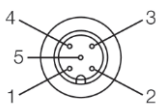
11.3 M12 connector cables color

M12 Connector	Pin	Standard Color	Anderson Color
	1	Brown	Red
	2	White	Black
	3	Blue	Green
	4	Black	Not assigned
	5	Grey	White

11.4 M12 connectors for I6x/I5x series

Electrical Connection „R"						
M12 Connector		Signal Module				
Connector	Pin	I52	I53	I62	I63	X
	1	Analog Output X45 +		Analog Output X45 +		X4
	2	Relay Output X67		Analog Output X67 +		X6
	3	Relay Output X67		Analog Output X67 -		X7
	4	Analog Output X45 -		Analog Output X45 -		X5
IO-Link 	1	Power Supply +		Power Supply +		X1
	3	Power Supply -		Power Supply -		X2
	4	IO-Link	IO-Link / Digital Input X3	IO-Link	IO-Link / Digital Input X3	X3

11.5 M12 Connector of I4x Series

Electrical Connection „C"			
M12 Connector		Signal Module	
Connector	Pin	I42	X
IO-Link 	1	Power Supply +	X1
	2	Analog Output X45 -	X5
	3	Power Supply -	X2
	4	IO-Link	X3
	5	Analog Output X45 +	X4

12 ILM-4 IO-Link Device Identity

13 ILM-4 IO-Link User Interface

Maintenance (User Role)

Parameter	Device	Edit
Process Data		
Process value		
Conductivity 1	0.20 mS/cm	
Temperature	**26.60 °C**	
Concentration	4.48 %	
Conductivity 2	249.00 mS/cm	
Product Text	Conductivity Measurement	
Serial Number	00000	
Hardware Version	1.05	
Firmware Version	V01.017	
Parameters		
General		
Temperature Compensation Unit »	%/K	Write
Display Language »	Deutsch	Write
Conductivity 1		
Upper Range Value 1 »	11.0 mS/cm	600 Write
Temperature Compensation 1 »	2.0 %	0.0 .. 100.0 Write
Conductivity 2		
Upper Range Value 2 »	999.9 mS/cm	0.5 .. 1 000.0 Write
Temperature Compensation 2 »	99.9 %	0.0 .. 100.0 Write
Concentration		
Upper Range Value Concentration »	50.00 %	1.00 .. 100.00 Write
Temperature Compensation of Concentration »	99.9 %	0.0 .. 100.0 Write
Media Concentration Range »	NaOH 0...10 %	Write
Temperature		
Unit Temperature »	°C	Write

14 ILM-4 IO-Link Process Data Description

Name	Description	Data type	Bit length	Bit offset	Value range	Gra-dient	Off-set	Unit
Conductivity 1	Measurement Value of Conductive 1	Float 32	32	0	0-1000	1	0	ms
Temperature	Temperature Measurement Value	Float 32	32	32	0-150 °C	1	0	°C/°F
Concentration	Media Concentration in Percentage	Float 32	32	64	0-125 %	1	0	%
Conductivity 2	Measurement Value of Conductive 2	Float 32	32	96	0-1000	1	0	ms

Value of Conductivity 1 (Bits 0-31)

Value of Temperature (Bits 32-63)

Value of Media Concentration (Bits 63-95)

Value of Conductivity 2 (Bits 96-127)

On PLC-Input side use data type Float 32 as data type for each process value.

IO-Link Eventlist

Measurement Events

Event Code	Event Type	Event Name (EN)	Event Name (DE)
36285	Warning	Outside specification: Conductivity 1. Currently the sensor is not able to perform a reliable measurement	Außerhalb der Spezifikation: Leitfähigkeit 1. Derzeit ist der Sensor nicht in der Lage, eine zuverlässige Messung durchzuführen
36286	Warning	Underrange: Conductivity 1	Untersteuerungsgrenze: Leitfähigkeit 1
36287	Warning	Overrange: Conductivity 1	Übersteuerungsgrenze: Leitfähigkeit 1
36288	Error	Underflow: Conductivity 1	Unterlauf: Leitfähigkeit 1
36289	Error	Overflow: Conductivity 1	Überlauf: Leitfähigkeit 1
36290	Warning	No Media: Conductivity 1. Currently the sensor cannot detect any medium	Kein Medium: Leitfähigkeit 1. Der Sensor kann derzeit kein Medium erkennen
36291	Error	Fail: Conductivity 1. The sensor indicates a general error	Fehler: Leitfähigkeit 1. Der Sensor meldet einen allgemeinen Fehler
36292	Warning	Outside specification: Temperature. Currently the sensor is not able to perform a reliable measurement	Außerhalb der Spezifikation: Temperatur. Derzeit ist der Sensor nicht in der Lage, eine zuverlässige Messung durchzuführen
36293	Warning	Underrange: Temperature	Untersteuerungsgrenze: Temperatur
36294	Warning	Overrange: Temperature	Übersteuerungsgrenze: Temperatur
36295	Error	Underflow: Temperature	Unterlauf: Temperatur
36296	Error	Overflow: Temperature	Überlauf: Temperatur
36297	Warning	No Media: Temperature. Currently the sensor cannot detect any medium	Kein Medium: Temperatur. Der Sensor kann derzeit kein Medium erkennen
36298	Error	Fail: Temperature. The sensor indicates a general error	Fehler: Temperatur. Der Sensor meldet einen allgemeinen Fehler.
36299	Warning	Outside specification: Concentration. Currently the sensor is not able to perform a reliable measurement	Außerhalb der Spezifikation: Konzentration. Derzeit ist der Sensor nicht in der Lage, eine zuverlässige Messung durchzuführen

36300	Warning	Underrange: Concentration	Untersteuerungsgrenze: Konzentration
36301	Warning	Overrange: Concentration	Übersteuerungsgrenze: Konzentration
36302	Error	Underflow: Concentration	Unterlauf: Konzentration
36303	Error	Overflow: Concentration	Überlauf: Konzentration
36304	Warning	No Media: Concentration. Currently the sensor cannot detect any medium	Kein Medium: Konzentration. Der Sensor kann derzeit kein Medium erkennen
36305	Error	Fail: Concentration. The sensor indicates a general error	Fehler: Konzentration. Der Sensor meldet einen allgemeinen Fehler
36306	Warning	Outside specification: Conductivity 2. Currently the sensor is not able to perform a reliable measurement	Außerhalb der Spezifikation: Leitfähigkeit 2. Derzeit ist der Sensor nicht in der Lage, eine zuverlässige Messung durchzuführen
36307	Warning	Underrange: Conductivity 2	Untersteuerungsgrenze: Leitfähigkeit 2
36308	Warning	Overrange: Conductivity 2	Übersteuerungsgrenze: Leitfähigkeit 2
36309	Error	Underflow: Conductivity 2	Unterlauf: Leitfähigkeit 2
36310	Error	Overflow: Conductivity 2	Überlauf: Leitfähigkeit 2
36311	Warning	No Media: Conductivity 2. Currently the sensor cannot detect any medium	Kein Medium: Leitfähigkeit 2. Der Sensor kann derzeit kein Medium erkennen
36312	Error	Fail: Conductivity 2. The sensor indicates a general error	Fehler: Leitfähigkeit 2. Der Sensor meldet einen allgemeinen Fehler

Device Events

36341	Error	No Sensor connected	Kein Sensor angeschlossen
36342	Error	General Error	Gerätefehler
36343	Error	Reference Error	Referenzfehler
36344	Error	Over-Temperature	Übertemperatur
36345	Error	Coil Break Receiver	Spulenbruch Empfängerseite
36346	Error	Coil Break Sender	Spulenbruch Senderseite
36347	Error	X-Y Parameter Error	X-Y Parameterfehler
36348	Error	Bootloader active	Bootloader aktiv

15 Repair and maintenance

The conductivity sensor described here is maintenance-free. However, if it should become necessary to calibrate the sensor, the offset (zero point) and the span of the sensor can be set with MPI-Tool (Calibration mode) or using IO-Link.

For this purpose, navigate to the following window via the user interface (for example, for conductivity 1): **"Conductivity Measurement → Conductivity 1 → Offset Conductivity 1"** (for offset) or **"Conductivity Measurement → Conductivity 1 → Slope Conductivity"** (for span).

For the offset, the set value is added to the calibrated conductivity value set at the factory. For the span, the set factor is multiplied with the calibrated conductivity value set at the factory. This method can also be applied to concentration, conductivity 2 and temperature (offset only).

The adjustable ranges are:

- Offset conductivity: half of the set measurement range, e.g. -50...50 mS / cm in measurement range 0...200 mS / cm
- Slope Conductivity: 75 %...125 %.

The setting can also be made via the Simple User Interface directly on the sensor using the ID codes 013071 for the zero-point conductivity and 013081 for the conductivity slope.

We recommend always using a reference solution and a reference device for calibration.

16 Technical data

Submersion length	Product-contacting	L20: 20 mm L50: 50 mm
Measurement range	The measurement range is freely adjustable	0...0.5 mS/cm to 0...1000 mS/cm in 0.5 steps
Process connection	Thread Tri-Clamp Varivent	CLEANadapt G1" Tri-Clamp 1.5", 2", 2.5", 3" DN 25 (type F) DN 40/50 (type N)
Process pressure		Max. 16 bar
Tightening torque		20 Nm (CLEANadapt system)
Materials	Connecting head Threaded connector Submersible body Plastic cover/sight glass	Stainless steel 1.4308 Stainless steel 1.4305 PEEK (FDA number: 21 CFR 177 2415) Polycarbonate
Temperature ranges	Ambient Process CIP/SIP	-10...70 °C -10...130 °C 150 °C max. 60 min
Reproducibility	of conductivity	≤ 1% of measurement value

Resolution/ measurement range	≤ 1 mS / cm ≤ 10 mS/cm ≤ 100 mS / cm ≤ 1000 mS / cm	0,001 mS / cm 0,01 mS / cm 0,1 mS / cm 1 mS / cm
Accuracy	Slope Offset	± 2% of measurement value ± 20 µS/cm
Long-term stability		≤ 0.5% of upper range limit
Accuracy of temperature output	≤ 100°C 100...150°C	Max. 0.5 °C Max. 1.0 °C
Electrical connection	Cable gland Cable connection Supply voltage Protection class	2 x M16 x 1.5 2 x M12 connector 18...36 V DC max. 190 mA IP 69K
Communication	Analog Digital	2x Analog output 4...20 mA, short circuit proof 1x Digital input (24 V DC) IO-Link v1.1
Weight		850 g

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Anderson Instrument Company Inc. | 156 Auriesville Road | Fultonville, NY 12072 | Phone: +1 518-922-5315 | Fax: +1 518-922-8997