
Installation and Operating Instructions

ACM 500



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Items supplied

- Measuring instrument
- Hygienic adapter
- Installation and operating instructions

System description

Inputting physical quantities into an SPC or PLC control or other computer and control systems requires accurate and reliably working sensors. The sensor is a detecting element that converts physical quantities, such as temperature, level, pressure, conductivity, turbidity and flow, into an electrical signal. Locally further processed, usually with an integrated microcontroller, the measuring signal can be transmitted by analogue (e.g. 4..20 mA loop) or digital (e.g. Profibus PA) means.

Product liability and warranty

Responsibility as to suitability and intended use of this instrument rests solely with the operator. Improper installation and operation of the instrument / system may lead to loss of warranty.

In addition, all claims are subject to the "General terms and conditions of sale" under which this instrument was purchased.

If a meter or instrument needs to be returned to KROHNE, please note the information given on the last-but-one page of these Instructions.

KROHNE regrets that it cannot repair or check your instruments unless accompanied by a fully completed Service and Repair sheet.

CE / EMC / Standards / Approvals

The product bears the CE marking on account of compliance with and application of the following standards:

EMCG (89/336/EEC)

EN 50081-1	EN 55022 Class B
EN 61000-6-2	EN 61000-4-2 ESD 4/8 kV
	EN 61000-4-3 RF radiated 10 V/m
	EN 61000-4-4 Burst 4 kV
	EN 61000-4-5 Surge 1 kV sym., 2 kV unsym.
	EN 61000-4-6 RF cable 10 V

1 Installation

1.1 Mechanical installation

Use only the recommended sleeves or adapters. When installed with foreign adapters, no guarantee can be given for proper functioning or leak-tightness.

Do not use Teflon or paper gaskets.

When installing in pipes, it is advisable to align the bore at the sensor in the direction of flow. This will ensure good exchange of the medium and good cleanability. The display unit is then positioned at right angles to the pipe. It is not possible to turn the display relative to the channel bore!

Carefully introduce the measuring head straight into the sleeve. Hold the correctly aligned measuring head firmly and screw down the union nut with a tightening torque between 20 and 50 Nm.

Correction inputs as a factor of the diameter are not necessary when installing in pipes.

1.2 Process connection

The hygienic ½" process sleeve is easy to weld in into tanks or pipes. The kind of assembly allows installation in conformity with standards of hygiene (to EHEDG, FDA). The G1/2" and G1" connections can be mounted in any counter thread acc. to ISO 228.

Various hygienic adapter sleeves (refer to chapter "Accessories") are available for fitting to other process connections. For more information refer to data sheet "Accessories".

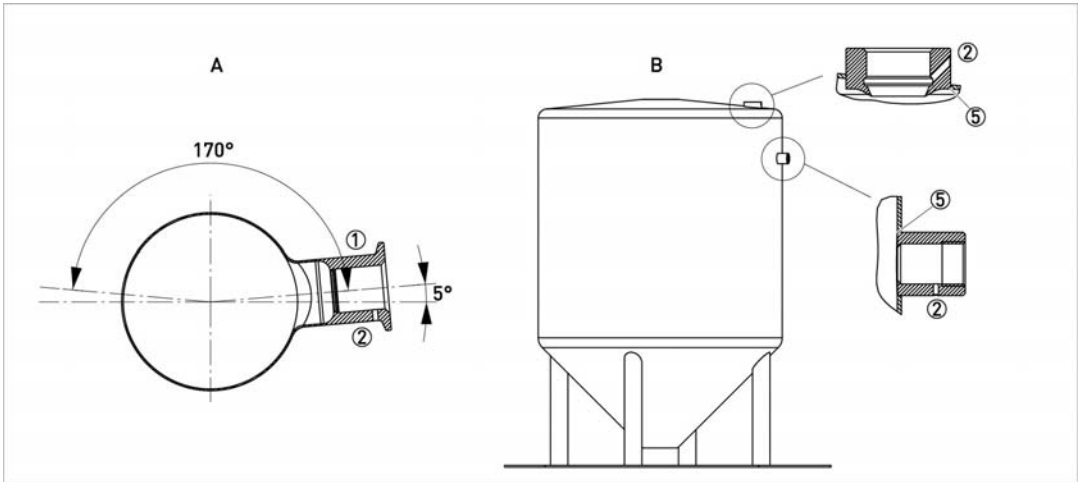
1.3 Mounting of 3A marked products

The 3A mark is valid only when the product is mounted in a 3A marked counterpart and installed acc. to the installation manual. Use also a 3A marked O-ring or gasket if relevant.

The 3A marked products conforms to the 3A sanitary standards criteria. Materials and surfaces fulfil the FDA demands and are certified by EHEDG.

EPDM O-rings supplied with 3A marked products are conform to sanitary standards class II (8% milk fat).

- 1) Use only 3A approved counterparts
- 2) The inspection hole should be visible and drained. Face it downwards that leaking can be observed.
- 3) Mount the device in a self-drained position.
- 4) Level the inner surface of the pipe with the counterpart.
- 5) Weld from the inside of the tank, if possible. Welds shall be free from cracks, crevices and grooves. Weldings should be grinded to $Ra=0.8$



Mounting of 3A products in pipe installations (A) or tank installations (B)

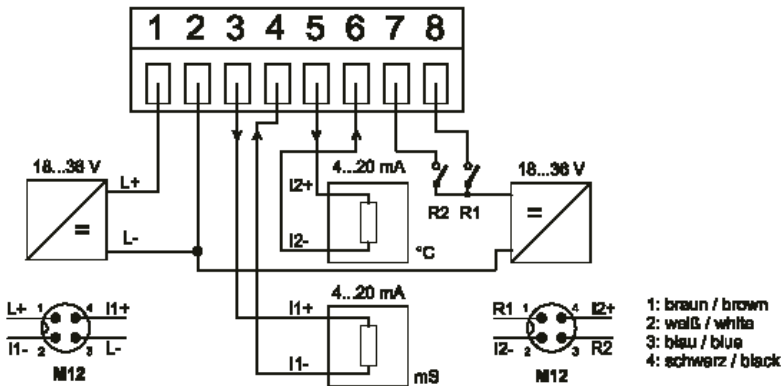
2 Electrical connection

Terminals 1(+) and 2(-) are used for supplying a DC voltage of 18...36V. Terminal 2 is connected to the housing via a protective diode. The maximum power consumption is 180 mA. This value should be taken into account for the recommended fuse. An active 4...20 mA current output, galvanically isolated from the supply voltage, is available at each of terminals 3 and 4, and 5 and 6. Terminal pair 3/4 supplies the conductivity signal, terminal pair 5/6 the temperature value. The negative terminals of current outputs 4 and 6 are connected to each other internally. 24-V control signals (pnp) can be connected to terminals 7 (R2) and 8 (R1) for external selection of one of the four adjustable measuring ranges. The ground reference is connected to terminal 2; an open terminal signifies 0 V.

Meas. Range	R2	R1
1	0 V	0 V
2	0 V	24 V
3	24 V	0 V
4	24 V	24 V

Please note currently valid installation regulations.

2.1 Connection plan:



2.2 Start-up

- Check that the display unit is correctly aligned; it should where possible be perpendicular to the direction of flow (for pipes).
- Check the leak-tightness at the sleeve.
- Make sure that the cable glands are tight and the M12 plugs are properly bolted.
- Without selection of the measuring range and without parameter assignment by user, the device after connection to the supply voltage will operate in the measuring range 0...200 mS, 0...150°C und 2%/K.
- Make sure that the housing cover is screwed down tight.

2.3 Operator control

- The back-lit LC display generally indicates conductivity in millisiemens per centimetre (mS/cm) and temperature in degrees Celsius (°C).
- For simple parameterization of the measuring ranges and temperature coefficients, use the rotary button with touch function (jog shuttle). Turn it to the right (or left) to move forwards (backwards) in the menu structure and increase (decrease) parameter values. Press the button to get to the submenu or setting menu for the respective parameter, or back again simultaneously with confirmation of the input.

3 Setting the parameters

3.1 Menu structure

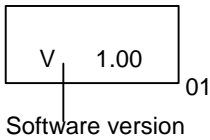
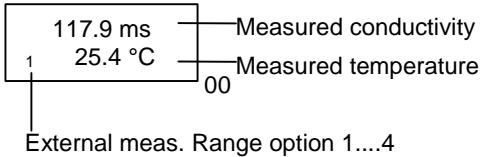
For a description of the respective menu screens please follow the two-digit numbering in these Instructions. The second digit indicates whether the display menu (x0) or the relevant submenu/setting menu (x1) is meant.

00	Display	117.9 ms 1 25.4 °C	01	Software version	V 1.00
10	Meas. Range 1	1 4...20 mA 0...200 mS	11	Meas. Range 11	1 4...20 mA ↕ 0...200 mS
20	TC 1	1 117.9 ms 2.00%/K	21	Temp. Setup 21	1 117.9 ms ↕ 2.00%/K
30	Meas. Range 2	2 4...20 mA 0...20 mS	31	Meas. Range 31	1 4...20 mA ↕ 0...200 mS
40	TC 2	2 10.79 mS 2.50%/K	41	Temp. Setup 41	1 117.9 ms ↕ 2.00%/K
50	Meas. Range 3	3 4...20 mA 0...2 mS	51	Meas. Range 51	1 4...20 mA ↕ 0...200 mS
60	TC 3	3 1.567 mS 1.50%/K	61	Temp. Setup 61	1 117.9 ms ↕ 2.00%/K
70	Meas. Range 4	4 4...20 mA 0...0.5 mS	71	Meas. Range 71	1 4...20 mA ↕ 0...200 mS
80	TC 4	4 0.335 mS 0...0.00%/K	81	Temp. Setup 81	1 117.9 ms ↕ 2.00%/K
90	Temp. Range	4...20 m°C 0...150	91	Temp. Range	4...20 m°C ↕ 0...150

3.2 Measured data/version indication 0

Standard indication of conductivity and temperature. If no input is made, automatic return to measured data indication after 60 seconds.

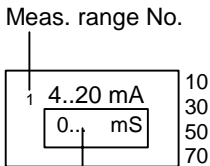
The bottom left digit indicates the measuring range 1...4 that has been selected via control inputs R2 and R1.



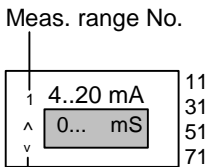
Submenu 01 indicates the implemented software version.

3.3 Range setting, conductivity 1, 3, 5, 7

The measuring ranges 1...4 selected via control inputs R2 and R1 are indicated and set here, referred to the current output range of 4...20 mA.



Setting meas. range conductivity for 4...20 mA



Setting meas. range conductivity for 4...20 mA (with Jog Shuttle)

Adjustable measuring ranges conductivity:

No.	Range	Resolution
1	0... 0.5 ms	0.001 ms
2	0... 1 ms	0.001 ms
3	0... 2 ms	0.010 ms
4	0... 3 ms	0.010 ms
5	0... 5 ms	0.010 ms
6	0... 10 ms	00.10 ms
7	0... 20 ms	00.10 ms
8	0... 30 ms	00.10 ms
9	0... 50 ms	00.10 ms
10	0...100 ms	000.1 ms
11	0...200 ms	000.1 ms
12	0...300 ms	000.1 ms
13	0...500 ms	000.1 ms
14	0...999 ms	000.1 ms

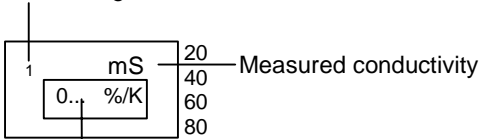
Ranges set in as-delivered condition:

Meas. range	mS
1	0...200
2	0...20
3	0...2
4	0...0.5

3.4 Setting of temperature compensation 2, 4, 6, 8

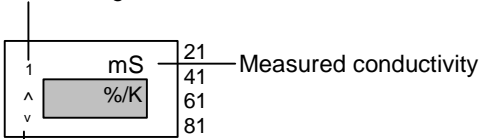
Each measuring range is assigned its own setting for temperature compensation. The range is adjustable between 0%/K (no compensation) and max. 5%/K. The compensation calculator operates linearly on the basis of a reference temperature of 25°C. When supplied, the setting for all ranges is 2%/K.

Meas. range No.



Setting temperature coefficient

Meas. range No.



Setting for TC 0...5.0 %/K
(with Jog Shuttle)

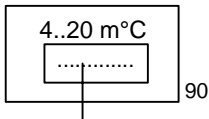
Directions for setting the temperature compensation:

- The actual conductivity measured is indicated in the setting menu. This allows easy laboratory determination of the temperature coefficient (TC) of a liquid:
 - Dip the device measuring head in the sample liquid (making sure there are no gas bubbles in the channel bore).
 - Heat the sample to exactly 25.0°C, if possible.
 - Note down the indicated conductivity (ensure adequate modulation, adjust measuring range if necessary).
 - Heat the liquid to a minimum of 60°C.
 - Set the TC in the setting menu to indicate the same conductivity as at 25°C. Bear in mind that a higher TC value will give a lower conductivity indication.
- Do not use the TC setting to adjust a measured value. The device is precisely calibrated and requires no further adjustment. Should you establish variations in the laboratory, please check whether there are any gas bubbles in the channel bore. If so, dip the device at an incline or move it quickly in the liquid.
- If there is no movement of the liquid, there may be slight warming in the channel bore by way of the device which can lead to a slightly falsified indication. Move the device slightly in the sample liquid if you wish to obtain very accurate reference measurements.

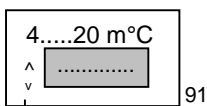
3.5 Measuring range setting, temperature 9

This is used for setting the current output of the measured temperature, based on 4...20 mA. This setting is provided only once and cannot be changed externally. In as-delivered condition, the range selected is 0...150°C. The current output follows under- and overranging of the selected measuring range up to 10%, i.e. from 2.4 mA to 21.6 mA within the limits of -20°C...150°C.

The selected setting has no effect on temperature indication.



Setting meas. range temperature for 4...20 mA



Setting meas. range temperature for 4...20 mA (with Jog Shuttle)

Adjustable measuring ranges temperature:

No.	Range	Resolution
1	0...150 °C	0.001 °C
2	-20...130 °C	0.001 °C
3	0...100 °C	0.001 °C
4	-20...80 °C	0.001 °C
5	0...50 °C	0.001 °C
6	-10...40 °C	0.001 °C
7	-20...150 °C	0.001 °C

4.1 Error displays

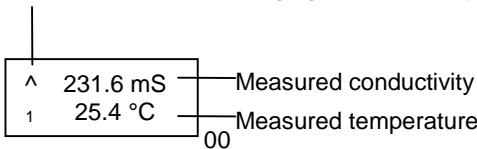
The measuring device is self-monitoring for errors and plausibility. The indication in the display supplies information about possible error conditions. The current outputs, too, are controlled in the event of an error.

4.1.1 Overranging of the conductivity measuring range

Up to 21.6 mA, the current output follows linearly to the measured value (overrange). Therefore, if the measured conductivity exceeds the set measuring range by more than 10%, the current output remains within the limits.

This can be remedied by selecting a larger measuring range. Please also note that at temperatures below 25°C the temperature compensation will always calculate larger conductivity values.

Current output: overranging of conductivity

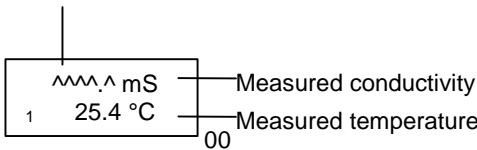


4.1.2 Overranging of ADC conductivity

At high temperatures and a high temperature coefficient it is possible that the ADC will overrange, in which case the current output will output an error value of 21.6 mA.

In such a case, select a measuring range from the next-higher decade.

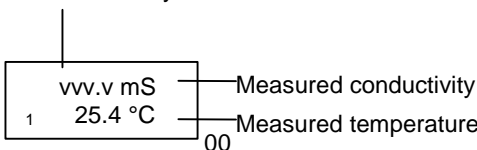
Overranging of conductivity



4.1.3 Error in conductivity measurement

At temperatures above 130°C, the device may in certain circumstances not be able to measure conductivity any more. The current output then goes to the error value of 2.4 mA. Should this condition occur at lower temperatures, this means that the device has an internal defect.

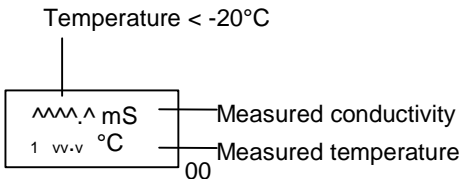
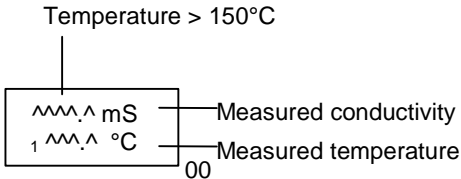
Conductivity error



4.1.4 Overranging of the ADC for temperature

Independent of the measuring range setting for temperature, this is always measured in the –20...150°C range. Outside these limits the device will go into error condition. Since conductivity can no longer be compensated, the current output for conductivity will also indicate the error condition with 2.4 mA. The current value for temperature will, depending on whether under- or overranging has occurred, go to 2.4 mA and 21.6 mA, resp.

If this error occurs within the permissible temperature range, this would suggest that the temperature sensor is defective.



5 Safety information

Before putting the device into operation, please read through this product description. Make sure that the product is unconditionally suitable for the application in question.

Disregard of application directions or technical details can lead to personal injury and/or damage to property.

In all applications, make sure the materials of construction (see Technical Data) are compatible with the media to be measured.

For start-up and operation, please pay regard to the following information. In addition, consult national installation regulations and the safety and accident prevention regulations applicable to the respective application.

7 Type code

7.1 Ordering code

Ordering code	Length of measuring head from edge of sleeve 37 mm
	Electrical connection
	0 Cable gland M16
	4 Plug M12
	Length of measuring head from edge of sleeve 84 mm
	Electrical connection
4 Cable gland M16	
6 Plug M12	
V GP0 10004	

7.2 Spare parts

Should a replaceable part of the probe be lost or damaged, replacements can be ordered on the basis of the part number.

Designation	Type
Housing lid	KMD.016.090.010
Cable gland M16	KVV.M16.010.008
Connector inlet	KVV.100.004.000
connector	KVK.086.210.018

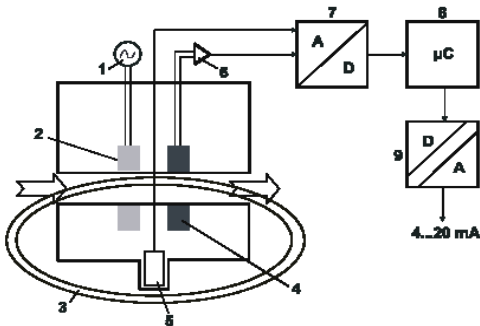
7.3 Accessories

Designation	Type
Weld in sleeve HWN 500	VGP7000100
Varivent flange version N	VGP7000C00
Sanitary pipe assembly kit DN 50	VGP7000B00
Tri-Clamp flange DN 32, DN 40, 2"	VGP7000D00

8.1 Range of application

The compact inductive conductivity sensor allows determination of the electrical conductivity of liquids. The small size of the measuring head allows installation in pipes sized DN40 and higher. The high-sensitivity resolution of $1 \mu\text{S}/\text{cm}$ together with a fast response time ensures reliable detection of media even with only minor differences in conductivity (e.g. beer – beer).

8.2 Functional principle



Inductive conductivity measurement is based on the principle of two series-connected toroidal-core transformers. The primary side of the first transformer (2) is controlled by an AC voltage generator (1).

The link between the secondary side of the first transformer and the primary side of the second transformer (4) is formed by the conductor loop, which in turn is formed by the liquid flowing through the channel bore in the measuring head (3). The better the conductivity of the liquid, the greater is the measurable current on the secondary side of the second transformer. This signalling current is processed by a measuring amplifier (6), is digitized (7), further processed by a microcontroller (8), and forwarded to the digital-to-analogue converter of the galvanically isolated current output stage (9).

The fast-response precision temperature sensor (5) in the tip of the measuring head is used for computational compensation of the heavily temperature-dependent conductivity of liquids.

The specially developed signal processing unit (patent applied for) revolutionizes the classic functional principle and offers you maximum accuracy and reliability.

8.3 Configuration

The associated weldable sleeve of stainless steel ensures installation conforming to hygiene standards. The evaluation electronics are fully integrated in the stainless steel connection head. It supplies a 4...20-mA signal, galvanically isolated from supply, for the measured values of conductivity and temperature. The integrated display unit, together with the jog-shuttle (control button with turn and touch function), allows simple local assignment of parameters. Measured data can be read at all times through the viewing window in the screw-down cover.

8.4 Features

- Compact design with stainless steel housing
- Integrated electronics
- 4 measuring ranges, user-definable via BCD code, external changeover facility
- Temperature compensation, separately adjustable for each measuring range
- Fast response time
- Insensitive to polarization and soiling
- Heat-resistant up to 130°C, for short times up to 140°C
- Integral display unit for measured data indication and parameter assignment
- Easy to operate with jog-shuttle
- Hygienic adapter sleeves for various process connections

9 Notes

If you need to return a device for testing or repair to KROHNE

Your instrument has been carefully manufactured and tested. If installed and operated in accordance with these operating instructions, it will rarely present any problems. Should you nevertheless need to return an instrument for servicing or repair, please pay strict attention to the following points:

Due to statutory regulations on environmental protection and safeguarding the health and safety of our personnel, KROHNE may only handle, test and repair returned instruments that have been in contact with liquids if it is possible to do so without risk to personnel and environment.

This means that KROHNE can only service your instrument if accompanied by the following certificate confirming that the instrument is safe to handle. If the instrument has been operated with toxic, caustic, flammable or water-endangering liquids, you are kindly requested

- to check and ensure, if necessary by rinsing or neutralising, that all cavities in the instrument are free from such dangerous substances.
(Directions on how you can find out whether the primary head has to be opened and flushed out or neutralised are obtainable from KROHNE on request.)
- to attach a certificate to the instrument confirming that the instrument is safe to handle and stating the liquid used.

We cannot service your instrument unless accompanied by such a certificate.

Specimen certificate

Company: _____ Address: _____
Department: _____ Name: _____
Tel. No.: _____ Fax No.: _____

The enclosed instrument

Type: _____ .:

KROHNE Order No. or Series No

has been operated with the following process liquid

Because this process liquid is water-hazardous toxic caustic flammable
*

we have

- checked that all cavities in the instrument are free from such substances *
 flushed out and neutralised all cavities in the instrument *

We confirm that there is **no** risk to humans or environment through any residual liquid contained in the instrument.

Date: Signature

.....
Company stamp: