

## Installation and Operating Instructions

# ACM 500



**KROHNE** CE

Duesseldorf Germany

Type: ACM 500 PG

Pg: 16 bar

Tp: -20...+130 °C

U: 18...36 V DC

I<sub>sc</sub>: 4...20 mA, max. 5000 Ω

Range: 0...1000 m<sup>3</sup>/dm<sup>3</sup>

I<sub>sc</sub>: 4...20 mA, max. 500 Ω

Range: -20...+100 °C

SN: 01001

PCC: V-GPG 100040

Variable area flowmeters

Vortex flowmeters

**Flow controllers**

Electromagnetic flowmeters

Ultrasonic flowmeters

Mass flowmeters

Level measuring instruments

Communications technology

Engineering systems & solutions

Switches, counters, displays and recorders

Heat metering

Pressure and temperature

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## Safety information

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Please read this manual carefully, and also take note of country-specific installation standards (e.g. the VDE regulations in Germany) as well as prevailing safety regulations and accidents prevention rules. For safety and warranty reasons, any internal work on the instruments, apart from that involved in normal installation and electrical connection, must be carried out only by qualified KROHNE personnel.

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## System description

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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..20mA loop) or digital (e.g. Profibus PA) means.

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## Items includes with supply

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- Measuring instrument
- Hygienic adapter
- Installation and operating instructions

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## Product liability and warranty

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Responsibility for suitability and intended use of these instruments rests solely with the operator. Improper installation and operation of the instruments may lead to loss warranty.

In addition, the "General conditions of sale" forming the basis of the purchase contract are applicable.

If instruments need 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.

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## CE / EMC / Standards/ Approvals

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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

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## 1 Installation

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### 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 cleansability. 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 1" process sleeve is easy to weld into tanks or pipes. The arrow mark points to the positional centre of the cable glands or M12 plugs. This form of assembly allows hygienic installation (in conformity with EHEDG, FDA).

Various hygienic adapter sleeves are available for fitting to other process connections (see Accessories). A variant with extended measuring head is available for longer necks (see Parts ordering code).

The device can be installed in any position.



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## 2 Electrical connection

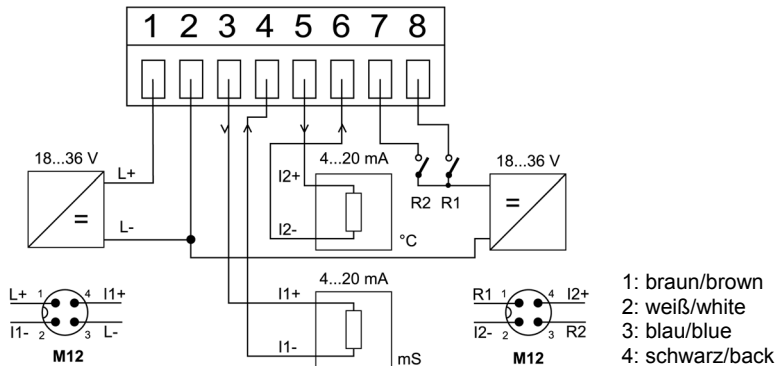
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Terminals 1(+) and 2(-) are used for supplying a DC voltage of 18...36V. Terminal 2 is connected to the housing via a protective diode. The maximum power consumption is 180 mA. This value should be taken into account for the recommended fuse. An active 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 parameterisation 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

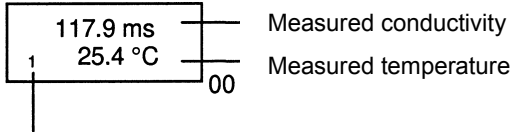
For a description of the respective menu screens please follow the two-digit numbering in these Instructions. The second digit indicates whether the display menu (x0) or the relevant submenu/setting menu (x1) is meant.

00	Display	1	117.9 ms 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

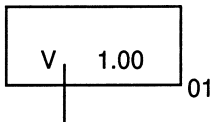
### 3.2 Measured data/version indication 0

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.



External meas. Range option 1 ... 4



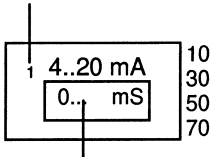
Software version

Submenu 01 indicates the implemented software version.

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

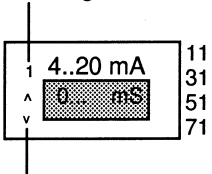
The measuring ranges 1...4 selected via control inputs R2 and R1 are indicated and set here, referred to the current output range of 4...20 mA.

Meas. range No.



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

Meas. range No.



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

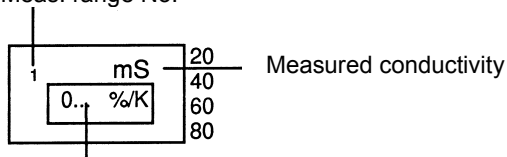
Ranges set in as-delivered condition:

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

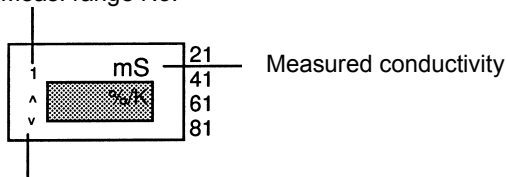
Each measuring range is assigned its own setting for temperature compensation. The range is adjustable between 0%/K (no compensation) and max. 5%/K. The compensation calculator operates linearly on the basis of a reference temperature of 25°C. When supplied, the setting for all ranges is 2%/K.

Meas. range No.



Setting temperature coefficient

Meas. range No.



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

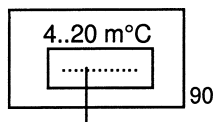
### Directions for setting the temperature compensation:

- 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.

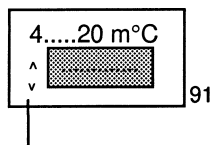
### 3.5 Measuring range setting, temperature 9

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

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## 4 Maintenance / Error handling

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### 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.

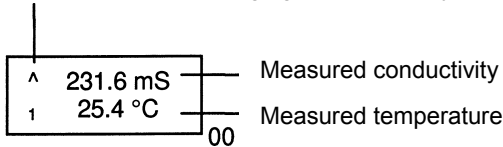
This can be remedied by selecting a larger measuring range.



**Note:**

Please also note that at temperatures below 25°C the temperature compensation will always calculate larger conductivity values.

Current output: overranging of conductivity

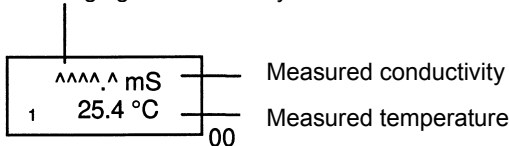


#### 4.1.2 Overranging of ADC conductivity

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.

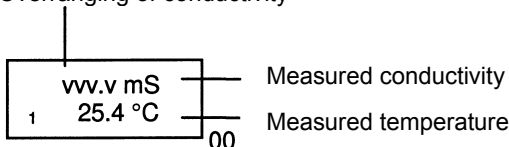
Overranging of conductivity



#### 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.

Overranging of conductivity



#### 4.1.4 Overranging of the ADC for temperature

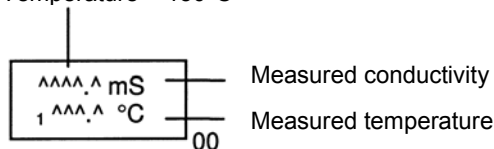
Independent of the measuring range setting for temperature, this is always measured in the –20...150°C range. Outside these limits the device will go into error condition. Since conductivity can no longer be compensated, the current output for conductivity will also indicate the error condition with 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.



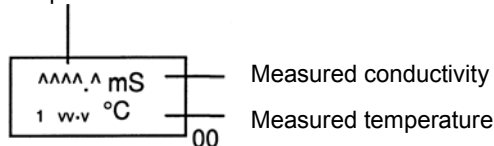
**Note:**

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

Temperature > 150°C



Temperature < -20°C

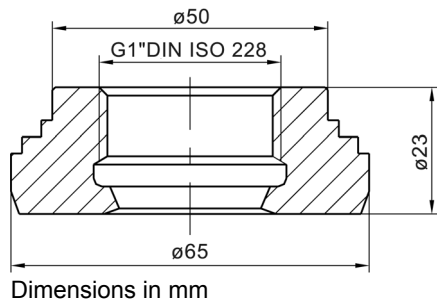
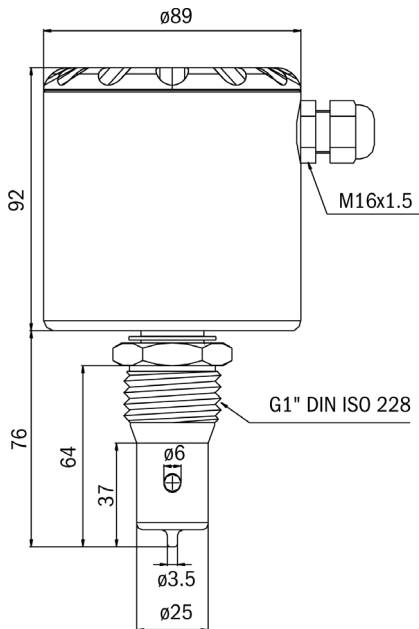


## 5 Technical data

### 5.1 Table of technical data

Temperature range	-20...+130 °C, 140 °C < 60 min.
Operating pressure	max. 10 bar
Inputs	2 x 24-V control input (pnp); 18 V ... 36 V
Outputs	2 x 4...20 mA active galv. sep.; load max. 500 Ohm
Repeatability, cond.	< ±1% of full-scale range
Accuracy, temp.	< ±0.2 °C (0...50 °C), ≤ ±0.5 °C (-20...150 °C)
Response time, temp.	T 90 < 3 s
Voltage supply	18...36 V DC; 180 mA max.

## 5.2 Dimensions



## 6 Type code

### 6.1 Ordering code

VGP0	1	0	0	0	4	0
VGP0	1	0	0	0	4	2

ACM 500 with M 16 screwed cable gland

ACM 500 with M 12 plug

VGP0	1	0	0	0	4	4
VGP0	1	0	0	0	4	6

ACM 510 (ext. sensor 84 mm) with M 16 screwed cable gland

ACM 510 (ext. sensor 84 mm) with M 12 plug

## 6.2 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

## 6.3 Accessoires

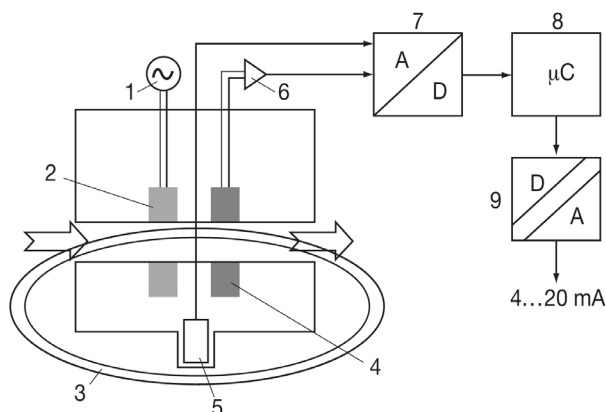
Designation	Type
Weld in sleeve HWN 500	VGP7000100
Varivent flange version N	VGP7000C00
Sanitary pipe assembly kit DN 50	VGP7000B00
Tri-Clamp flange DN 32, DN 40, 2"	VGP7000D00

## 7 Product description

### 7.1 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).

### 7.2 Functional principle



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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 digitised (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) revolutionises the classic functional principle and offers you maximum accuracy and reliability.

### 7.3 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.

### 7.4 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

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

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

Due to statutory regulations concerning protection of the environment 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 it is accompanied by a certificate in line with the following model 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 neutralizing, 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 then flushed out or neutralized are obtainable from KROHNE on request.)
- to enclose a certificate with the instrument confirming that the instrument is safe to handle and stating the liquid used.

KROHNE regret that they cannot service your instrument unless it is accompanied by such a certificate.

<b>SPECIMEN certificate</b>
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Company: ..... Address: .....

Department: ..... Name: .....

Tel. No.: .....

The enclosed instrument

Type: .....

KROHNE Order No. or Series No .....

has been operated with the following liquid: .....

Because this liquid is  
water-endangering \* / toxic \* / caustic \* / flammable \*  
we have

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

(\* delete if not applicable)

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

Date: ..... Signature: .....

Company stamp: