



LS 6600 Handbook

Switch for level detection and dry-run protection

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1.1 Intended use

The LS 6600 is a level switch for level detection and dry-run protection for liquids and solids. The device measures liquids such as water and beer and well as viscous and sticky products such as honey or toothpaste. Even dry medias can be measured such as sugar or flour.

The measurement is precise and not affected by the mounting position.

Coating of the sensor or condensate are not detected.



DANGER!

For devices used in hazardous areas, additional safety notes apply; please refer to the Ex documentation.

1.2 Certifications

CE marking



The device fulfils the statutory requirements of the following EC directives:

- EMC specification acc. to EN 61326
- Vibration specification acc. to IEC 68-2-6, GL test 2

The manufacturer certifies successful testing of the product by applying the CE marking.

1.3 ATEX approval

The LS 6600 is approved for the use in hazardous areas in accordance with the current EC directives with the following classifications:

- Ex ia IIC T5, ATEX II 1G (in preparation)
- Ex nA II T5, ATEX II 3G (in preparation)
- Ex ta IIIC T100 Da, ATEX II 1D (in preparation)



INFORMATION!

For further information refer to Electrical connection data for use in hazardous areas on page 14.

1.4 Safety instructions from the manufacturer

1.4.1 Copyright and data protection

The contents of this document have been created with great care. Nevertheless, we provide no guarantee that the contents are correct, complete or up-to-date.

The contents and works in this document are subject to copyright. Contributions from third parties are identified as such. Reproduction, processing, dissemination and any type of use beyond what is permitted under copyright requires written authorisation from the respective author and/or the manufacturer.

The manufacturer tries always to observe the copyrights of others, and to draw on works created in-house or works in the public domain.

The collection of personal data (such as names, street addresses or e-mail addresses) in the manufacturer's documents is always on a voluntary basis whenever possible. Whenever feasible, it is always possible to make use of the offerings and services without providing any personal data.

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We hereby expressly prohibit the use of the contact data published as part of our duty to publish an imprint for the purpose of sending us any advertising or informational materials that we have not expressly requested.

1.4.2 Disclaimer

The manufacturer will not be liable for any damage of any kind by using its product, including, but not limited to direct, indirect or incidental and consequential damages.

This disclaimer does not apply in case the manufacturer has acted on purpose or with gross negligence. In the event any applicable law does not allow such limitations on implied warranties or the exclusion of limitation of certain damages, you may, if such law applies to you, not be subject to some or all of the above disclaimer, exclusions or limitations.

Any product purchased from the manufacturer is warranted in accordance with the relevant product documentation and our Terms and Conditions of Sale.

The manufacturer reserves the right to alter the content of its documents, including this disclaimer in any way, at any time, for any reason, without prior notification, and will not be liable in any way for possible consequences of such changes.

1.4.3 Product liability and warranty

The operator shall bear responsibility for the suitability of the device for the specific purpose. The manufacturer accepts no liability for the consequences of misuse by the operator. Improper installation and operation of the devices (systems) will cause the warranty to be void. The respective "Standard Terms and Conditions" which form the basis for the sales contract shall also apply.

1.4.4 Information concerning the documentation

To prevent any injury to the user or damage to the device it is essential that you read the information in this document and observe applicable national standards, safety requirements and accident prevention regulations.

If this document is not in your native language and if you have any problems understanding the text, we advise you to contact your local office for assistance. The manufacturer can not accept responsibility for any damage or injury caused by misunderstanding of the information in this document.

This document is provided to help you establish operating conditions, which will permit safe and efficient use of this device. Special considerations and precautions are also described in the document, which appear in the form of underneath icons.

1.4.5 Warnings and symbols used

Safety warnings are indicated by the following symbols.



DANGER!

This information refers to the immediate danger when working with electricity.



DANGER!

This warning refers to the immediate danger of burns caused by heat or hot surfaces.



DANGER!

This warning refers to the immediate danger when using this device in a hazardous atmosphere.



DANGER!

These warnings must be observed without fail. Even partial disregard of this warning can lead to serious health problems and even death. There is also the risk of seriously damaging the device or parts of the operator's plant.



WARNING!

Disregarding this safety warning, even if only in part, poses the risk of serious health problems. There is also the risk of damaging the device or parts of the operator's plant.



CAUTION!

Disregarding these instructions can result in damage to the device or to parts of the operator's plant.



INFORMATION!

These instructions contain important information for the handling of the device.



LEGAL NOTICE!

This note contains information on statutory directives and standards.



• **HANDLING**

This symbol designates all instructions for actions to be carried out by the operator in the specified sequence.

➔ **RESULT**

This symbol refers to all important consequences of the previous actions.

1.5 Safety instructions for the operator



WARNING!

*In general, devices from the manufacturer may only be installed, commissioned, operated and maintained by properly trained and authorized personnel.
This document is provided to help you establish operating conditions, which will permit safe and efficient use of this device.*

2.1 Scope of delivery



INFORMATION!

Inspect the cartons carefully for damages or signs of rough handling. Report damage to the carrier and to the local office of the manufacturer.



INFORMATION!

Do a check of the packing list to make sure that you have all the elements given in the order.



INFORMATION!

Look at the device nameplate to ensure that the device is delivered according to your order. Check for the correct supply voltage printed on the nameplate.

The following items are supplied with the device:

- Measuring device
- Hygienic adapter
- Product documentation

2.2 System description

Inputting physical quantities into an SPC or PLC 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 by an integrated microcontroller, the measuring signal can be transmitted by analogue (e.g. 4...20 mA loop). The LS 6600 is designed to detect the level of liquids or for pump protecting purposes.

2.3 Nameplate



INFORMATION!

Look at the device nameplate to ensure that the device is delivered according to your order. Check for the correct supply voltage printed on the nameplate.

The important technical values are engraved on the device body.

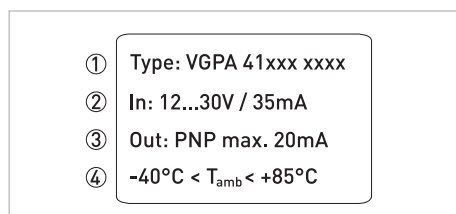


Figure 2-1: Example of engraved technical values

- ① Device type
- ② Electrical data for input
- ③ Electrical data for output
- ④ Operating temperature limits

3.1 General notes on installation

**INFORMATION!**

Inspect the cartons carefully for damages or signs of rough handling. Report damage to the carrier and to the local office of the manufacturer.

**INFORMATION!**

Do a check of the packing list to make sure that you have all the elements given in the order.

**INFORMATION!**

Look at the device nameplate to ensure that the device is delivered according to your order. Check for the correct supply voltage printed on the nameplate.

3.2 Installation requirements

- For the hygienic version, use only the recommended sleeves or adapters. If other systems are used, no guarantee can be given for proper functionality or leak-tightness.
- The connection thread must have direct electrical contact with the threaded sleeve and the metal tank or pipe.
- At the hygienic connection G $\frac{1}{2}$ do not use Teflon or paper gaskets between switch and hygienic adapter. The PEEK sensor together with the Stainless Steel adapter will perform a hygienic tightening. Assumed that the requirements have been followed.
- The tightening torque for the sleeve should be 25...30 Nm.

3.3 Process connection

The hygienic $\frac{1}{2}$ " process sleeve is easy to weld into tanks or pipes. This kind of assembly allows installation in conformity with standards of hygiene (to EHEDG, FDA). The G $\frac{1}{2}$ 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".

The sensor can be installed in any desired position.

3.4 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 $R_a = 0.8$

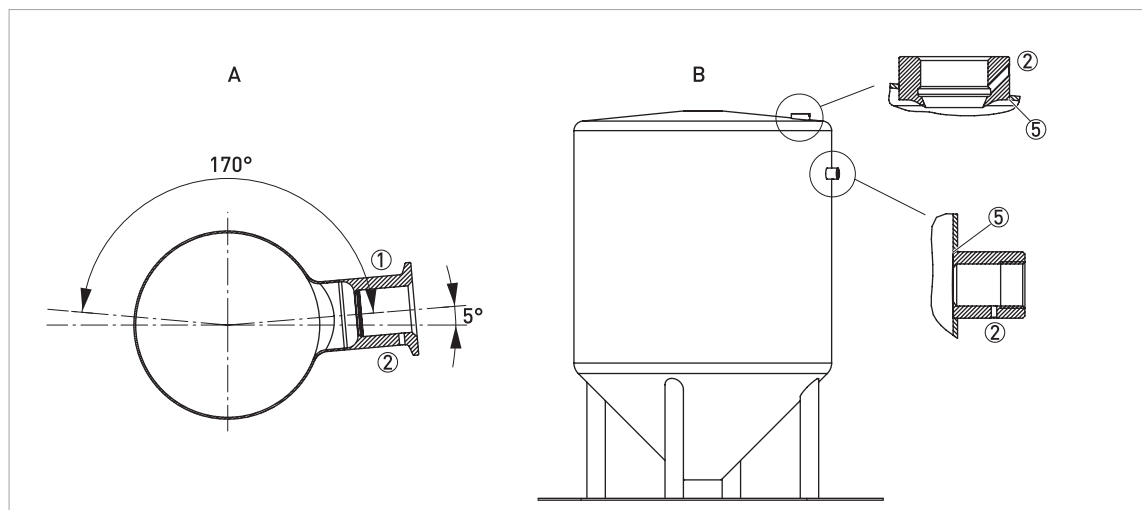


Figure 3-1: Mounting of 3A products in pipe installations (A) or tank installations (B)

4.1 Safety instructions

**DANGER!**

All work on the electrical connections may only be carried out with the power disconnected. Take note of the voltage data on the nameplate!

**DANGER!**

Observe the national regulations for electrical installations!

**DANGER!**

For devices used in hazardous areas, additional safety notes apply; please refer to the Ex documentation.

**WARNING!**

Observe without fail the local occupational health and safety regulations. Any work done on the electrical components of the measuring device may only be carried out by properly trained specialists.

**INFORMATION!**

Look at the device nameplate to ensure that the device is delivered according to your order. Check for the correct supply voltage printed on the nameplate.

4.2 Description of electrical connection

Pin 1 and 3 are used for supplying a DC voltage of 12...30 V. According to polarity, the output will switch to active or inactive when the sensor is immersed (refer to connection diagram). The terminal wired to the negative pole is connected via an internal protective diode to the housing.

The maximum power consumption is 35 mA (excluding load switched). This value should be taken into account in connection with the recommended use of a fuse. An active switching output (Pin 4) is available. The switching voltage is a minimum of 1 V below the supply voltage. The maximum output current is 20 mA. At higher loads, the current is limited accordingly. Damage through shorting cannot occur.

4.3 Electrical connection diagrams

Description of normally open (NO) and normally closed (NC)

Normally open	Normally closed
<p>① 0 mA ② 20 mA ③ LED</p>	<p>① 20 mA ② 0 mA ③ LED</p>

PNP

Normally open	Normally closed

NPN

Normally open	Normally closed

M12 plug

1: brown; 2: white; 3: blue; 4: black

4.4 Electrical connection data for use in hazardous areas

Ex ta IIIC T100 Da, ATEX II 1D (in preparation)

The LS 6600 must be installed in accordance with prevailing guidelines for zone 20 **without** a barrier.

Supply range: 12...30 VDC; max. 100 mA

Temperature class: T100; $-40^{\circ}\text{C} < T_{\text{amb}} < 85^{\circ}\text{C}$ / $-40^{\circ}\text{F} < T_{\text{amb}} < 185^{\circ}\text{F}$

Ex nA II T5, ATEX II 3G (in preparation)

The LS 6600 must be installed in accordance with prevailing guidelines for zone 2 **without** a barrier.

Supply range: 12...30 VDC; max. 100 mA

Temperature class: T1...T5; $-40^{\circ}\text{C} < T_{\text{amb}} < 85^{\circ}\text{C}$ / $-40^{\circ}\text{F} < T_{\text{amb}} < 185^{\circ}\text{F}$

Ex ia IIC T5, ATEX II 1G (in preparation)

The LS 6600 must be installed in accordance with prevailing guidelines for zone 0 **with** a barrier. A certified Ex ia or isolation barrier with the max. values

$L_i \leq 10 \mu\text{H}$;

$C_i \leq 43 \text{ nF}$;

$U \leq 30 \text{ VDC}$;

$I \leq 0.1 \text{ A}$;

$P \leq 0.75 \text{ W}$

must be used.

Supply range: 24...30 VDC

Temperature class:

T1...T4: $-40^{\circ}\text{C} < T_{\text{amb}} < 85^{\circ}\text{C}$ / $-40^{\circ}\text{F} < T_{\text{amb}} < 185^{\circ}\text{F}$;

T1...T5: $-40^{\circ}\text{C} < T_{\text{amb}} < 74^{\circ}\text{C}$ / $-40^{\circ}\text{F} < T_{\text{amb}} < 165.2^{\circ}\text{F}$

4.5 Configuration tool

The configuration tool can be ordered optionally to configure the LS 6600 switches.

Scope of delivery:

- Interface unit
- CD with software and product drivers (DTM)
- USB cable
- Cable with M12 connector

The configuration tool connects the LS 6600 with a computer. With the corresponding software, it is possible to get an online communication with the LS 6600.

By using this tool, device information like serial number, switching point range and tag numbers are displayed on the computer. Settings as switching point and damping can be changed.

Self-learning function for the contact output is possible as well as reset function to the default values of the switching point.

By fine-tuning of the switching point settings, LS 6600 could differentiate between various products which are covering the sensor. In other words, the device could be set to trigger on a specific product and ignore a second product. Basis for this would be a different ϵ_r value of the two products.



DANGER!

Disconnect the power supply before connecting the configuration tool to the switch!

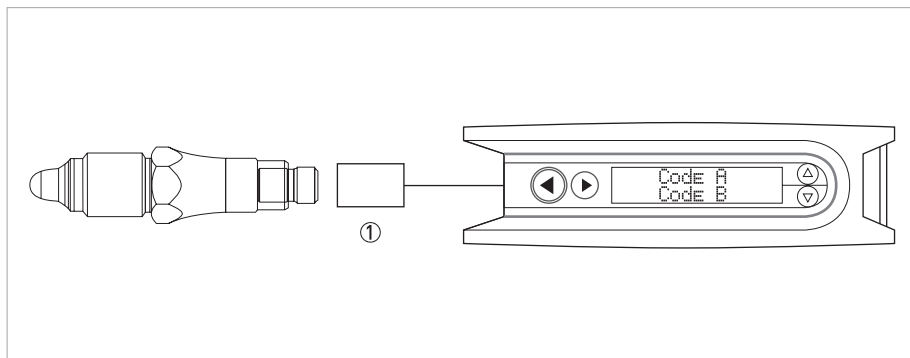


Figure 4-1: Electrical connection of configuration tool

① M12 plug



INFORMATION!

Ambient temperature range is 0...+50°C / +32...+122°F.



DANGER!

The configuration tool cannot be connected to the LS 6600 within the hazardous area. For programming, remove the device out of this area.

5.1 Start-up

Before connecting to power, please check that the system has been correctly installed. This includes:

- The device must be mechanically safe and mounted in compliance with the regulations.
- Check the leak-tightness at the sleeve.
- Make sure that the M12 plug is properly connected.
- The power connections must have been made in compliance with the regulations.
- Check that the electrical operating data of the power supply are correct.



- Switching on the power.
- Check for correct switching function.

5.2 Fault diagnosis and corrective action

Fault	Cause	Action / elimination
LED not "on"	Sensor cap not in contact with liquid product	-
	Supply voltage < 12 V, permittivity too low	Measure voltage at pin 1 and 3
No switching output	Cable break	Check continuity of cables
	Incorrect polarity of supply	Reverse terminal 1 and 3
	Short-circuit	Check wiring

6.1 Availability of services

The manufacturer offers a range of services to support the customer after expiration of the warranty. These include repair, maintenance, technical support and training.



INFORMATION!

For more precise information, please contact your local sales office.

6.2 Spare parts and accessories

This device contains no replaceable parts. In case of malfunction the device must be returned to the manufacturer. Refer also to chapter "Returning the device to the manufacturer".

Accessories

Designation	Type
Weld-in sleeve	HWN 200
Liquiphant adapter sleeve G1", shape "G"	HLM 200
Liquiphant assembly kit Rd 52, shape "F"	HLS 210
Varivent flange version N	HVF 250
Sanitary pipe assembly kit DN25	HMT 225
Sanitary pipe assembly kit DN50	HMT 250
Tri-Clamp flange 2", DN50 DIN 32676, ISO 40/51 mm	HTC 250

6.3 Returning the device to the manufacturer

6.3.1 General information

This device has been carefully manufactured and tested. If installed and operated in accordance with these operating instructions, it will rarely present any problems.



CAUTION!

Should you nevertheless need to return a device for inspection 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, manufacturer may only handle, test and repair returned devices that have been in contact with products without risk to personnel and environment.*
- *This means that the manufacturer can only service this device if it is accompanied by the following certificate (see next section) confirming that the device is safe to handle.*



CAUTION!

If the device has been operated with toxic, caustic, flammable or water-endangering products, you are kindly requested:

- *to check and ensure, if necessary by rinsing or neutralising, that all cavities are free from such dangerous substances,*
- *to enclose a certificate with the device confirming that is safe to handle and stating the product used.*

6.3.2 Form (for copying) to accompany a returned device

Company:		Address:	
Department:		Name:	
Tel. no.:		Fax no.:	
Manufacturer's order no. or serial no.:			
The device has been operated with the following medium:			
This medium is:	water-hazardous		
	toxic		
	caustic		
	flammable		
	We checked that all cavities in the device are free from such substances.		
	We have flushed out and neutralized all cavities in the device.		
We hereby confirm that there is no risk to persons or the environment through any residual media contained in the device when it is returned.			
Date:		Signature:	
Stamp:			

6.4 Disposal



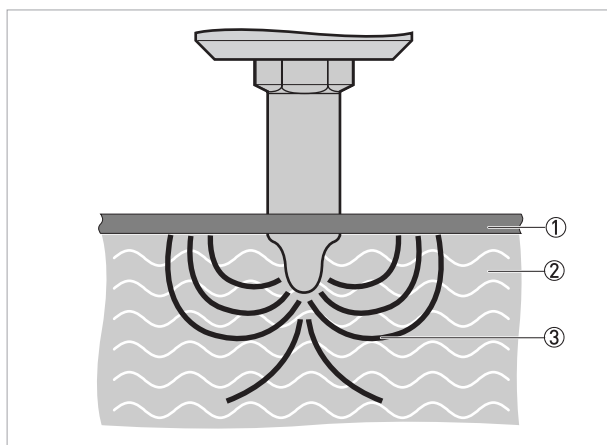
CAUTION!

Disposal must be carried out in accordance with legislation applicable in your country.

7.1 Measuring principle

A high frequency signal sweep is radiated from the sensor tip into the tank / pipe. The medium will act as a virtual capacitor, which together with a coil in the sensor head, will form a circuit creating the switching point signal. This virtual capacity will depend of the dielectric value of the medium and it is well defined for most media.

The measurement is precise and unaffected by the mounting position.



- ① Tank wall / pipe wall
- ② Medium
- ③ Line of electric flux

7.2 Technical data



INFORMATION!

- The following data is provided for general applications. If you require data that is more relevant to your specific application, please contact us or your local sales office.
- Additional information (certificates, special tools, software,...) and complete product documentation can be downloaded free of charge from the website (Download Center).

Measuring system

Measuring principle	Electromagnetic wave, 100..180 MHz
Application range	Level detection, dry-run protection and media separation of liquids and solids.

Design

Construction	The measurement system consists of a measuring sensor and the electronic unit which is available in a compact version. The switching point is signalled by a blue LED indication at the neck of the M12 connector.
Options	Teach-In function for applications where the medium is hard to detect.
Accessories	Comprehensive range of adapters and process connections for hygienic installation. Please refer to the specific data sheet "Accessories".

Measuring accuracy

Resolution	$\pm 1 \text{ mm} / \pm 0.04''$
Hysteresis	$\pm 1 \text{ mm} / \pm 0.04''$
Reference conditions acc. to EN 60770	
Temperature	$+20^\circ\text{C} \pm 5^\circ\text{C} / +70^\circ\text{F} \pm 10^\circ\text{F}$
Pressure	$1013 \text{ mbar abs.} \pm 20 \text{ mbar} / 14.69 \text{ psig} \pm 0.29 \text{ psig}$
Relative air humidity	$60\% \pm 15\%$

Operating conditions

Temperature	
Ambient temperature (T_{amb})	$-40\dots+85^\circ\text{C} / -40\dots+185^\circ\text{F}$
Process temperature	$-40\dots+115^\circ\text{C} / -40\dots+239^\circ\text{F}$ (refer to separate diagram) $130^\circ\text{C} / 266^\circ\text{F} < 1 \text{ hour}, T_{\text{amb}} < 40^\circ\text{C} / 104^\circ\text{F}$
Pressure	
Ambient pressure	Atmosphere
Process pressure	Max. 100 bar / 1450 psi
Other conditions	
Ingress protection (acc. to EN 60529)	IP67 equivalent to NEMA 4X

Installation conditions

Installation	In any position. For detailed information refer to chapter "Installation".
Dimensions and weights	For detailed information refer to chapter "Dimensions and weights".

Materials

Sensor housing	Stainless Steel 1.4404 / 316L
Process connection	
Sensor insulation	Virgin PEEK, FDA conform
Electrical connection	Plug M12

Process connections

Standard	Hygienic G $\frac{1}{2}$; standard G $\frac{1}{2}$; G1 and reverse G $\frac{1}{2}$
Other	For other hygienic process connections, e. g. Tri-clamp, 11851, Varivent see data sheet "Accessories".

Electrical connections

Power supply	Non-Ex / Ex nA / Ex ta: 12...30 VDC, 35 mA max.
	Ex ia: 24...30 VDC
Power consumption	1.1 W
Power-up time	< 2 s
Reaction time	Max. 0.2 s
Damping	0...10 s
Cable entry	M12 (4 pole Lumberg)

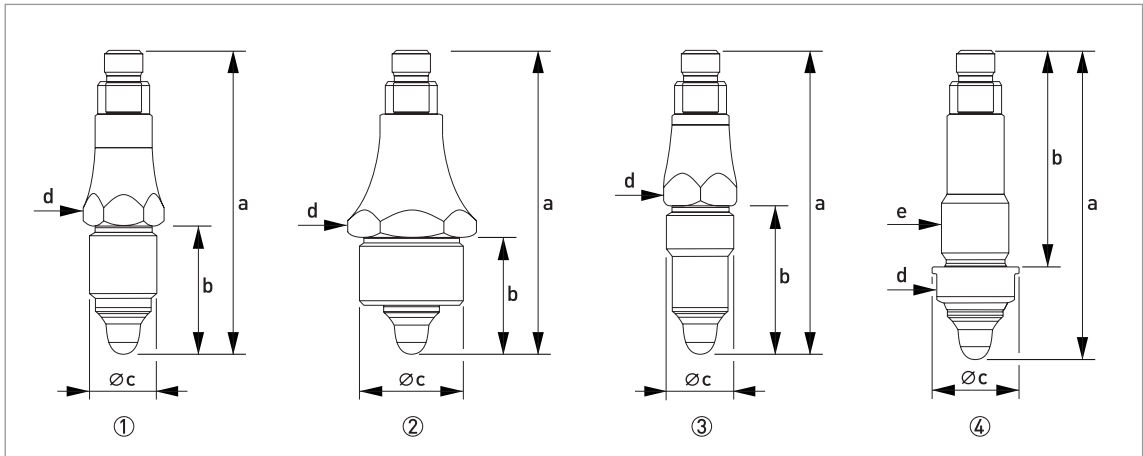
Output

Output (active)	Max. 20 mA, short-circuit and high-temperature protected
Output type	PNP or NPN
Output polarity	See drawing in chapter "Electrical connection".
Active "Low"	NPN; (-VDC + 1.5 V) \pm 0.5 V; R _{load} = 10 kOhm
Active "High"	PNP; (VDC - 1.5 V) \pm 0.5 V; R _{load} = 10 kOhm
Factory settings	Measure: $\epsilon_r > 2$; damping: 0.1 s
Off leak current	\pm 100 μ A max.

Approvals and certifications

CE	This device fulfils the statutory requirements of the EC directives. The manufacturer certifies successful testing of the product by applying the CE marking.
ATEX	Ex ia IIC T5, ATEX II 1G (in preparation)
	Ex nA II T5, ATEX II 3G (in preparation)
	Ex ta IIIC T100 Da, ATEX II 1D (in preparation)
Other standards and approvals	
Electromagnetic compatibility (EMC)	EN 61326
Vibration resistance	IEC 60068-2-6, GL test 2
Hygiene	3A for hygienic G $\frac{1}{2}$, FDA conform materials

7.3 Dimensions and weights



- ① Standard G $\frac{1}{2}$ version
- ② G1 version
- ③ Hygienic G $\frac{1}{2}$ version
- ④ Reverse G $\frac{1}{2}$ version

	Dimensions		Approx. weight without adapter	
	[mm]	[inch]	[kg]	[lb]
Standard G$\frac{1}{2}$ version				
a	97	3.82	0.1	0.22
b	41	1.61		
c	G $\frac{1}{2}$ ISO 228/1			
d	WS 22	WS 0.87		
G1 version				
a	97	3.82	0.15	0.33
b	38	1.50		
c	G1 ISO 228/1			
d	WS 36	WS 1.41		
Hygienic G$\frac{1}{2}$ version				
a	97	3.82	0.1	0.22
b	48	1.89		
c	G $\frac{1}{2}$ ISO 228/1			
d	WS 22	WS 0.87		
Reverse G$\frac{1}{2}$ version				
a	97	3.82	0.1	0.22
b	68	2.68		
c	$\varnothing 27$	$\varnothing 1.06$		
d	WS 24	WS 0.94		
e	G $\frac{1}{2}$ A ISO 228/1			

7.4 Temperature limits

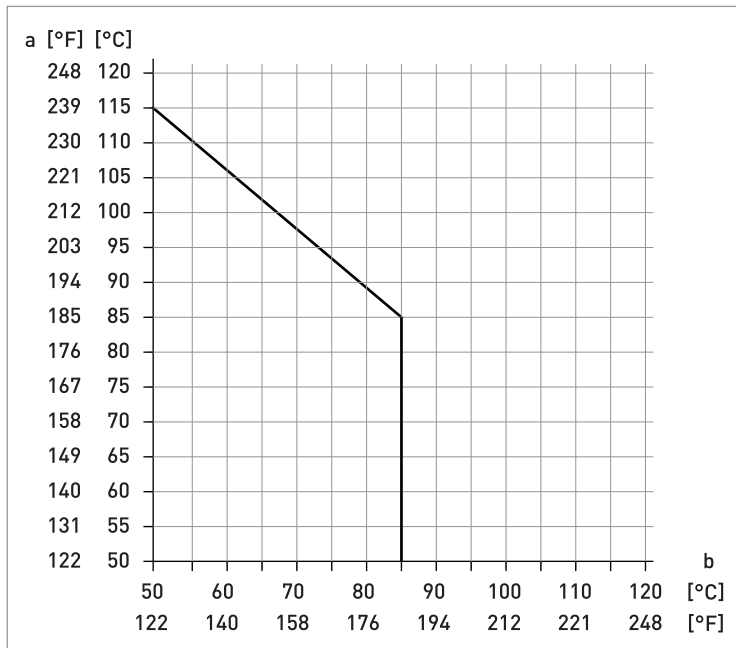
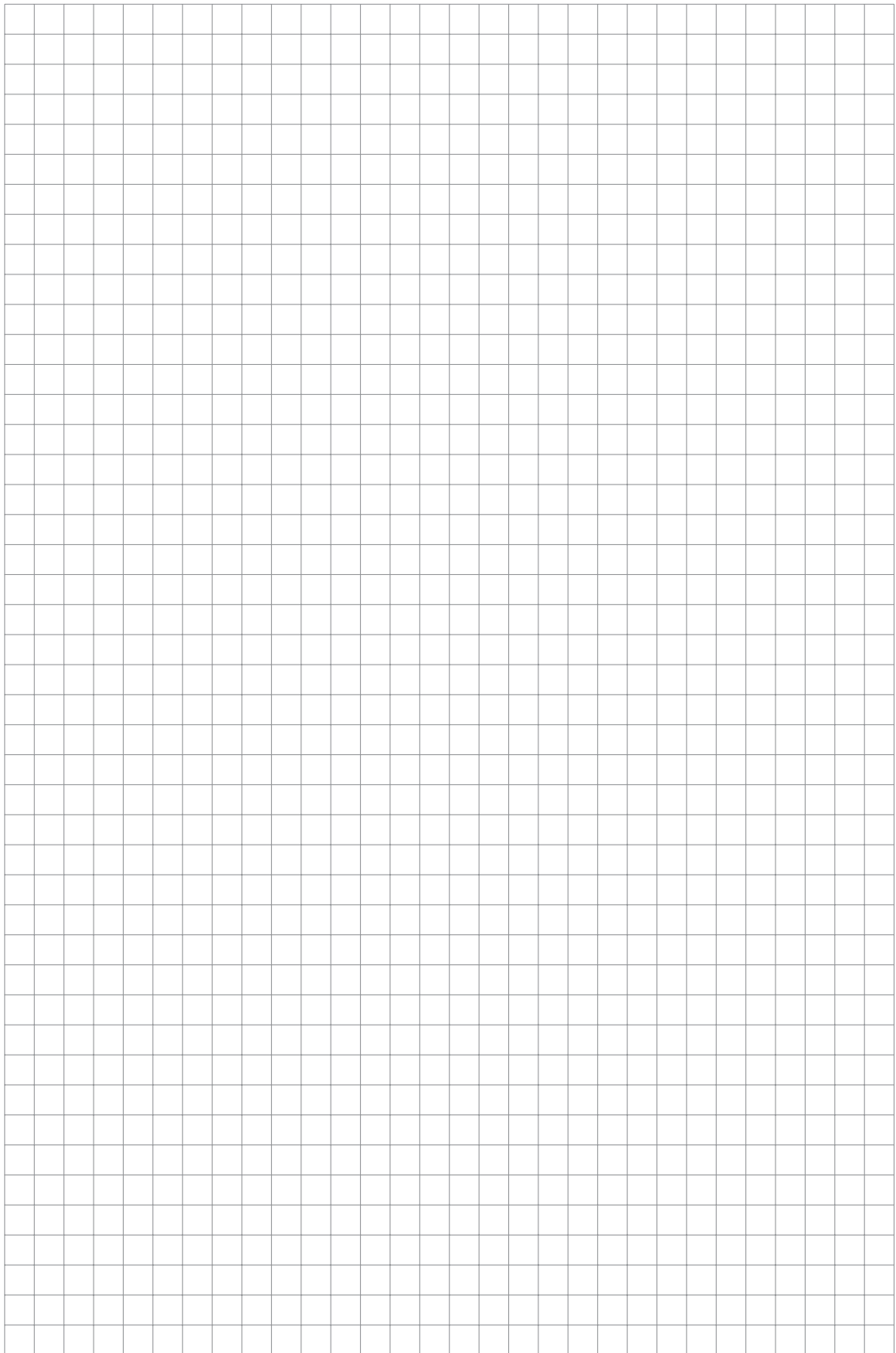


Figure 7-1: Media temperature versus ambient temperature

a: media temperature in [°C] or [°F]
 b: ambient temperature in [°C] or [°F]

CIP: 130°C / 266°F < 1 hour ($T_{amb} < 40°C / 104°F$)









KROHNE product overview

- Electromagnetic flowmeters
- Variable area flowmeters
- Ultrasonic flowmeters
- Mass flowmeters
- Vortex flowmeters
- Flow controllers
- Level meters
- Temperature meters
- Pressure meters
- Analysis products
- Products and systems for the oil & gas industry
- Measuring systems for the marine industry

Head Office KROHNE Messtechnik GmbH
Ludwig-Krohne-Str. 5
47058 Duisburg (Germany)
Tel.: +49 (0)203 301 0
Fax: +49 (0)203 301 10389
info@krohne.de

The current list of all KROHNE contacts and addresses can be found at:
www.krohne.com

KROHNE