OPTIFLUX 4040 C

Supplementary instructions

Ex addendum

KROHNE

1.1 Safety instructions from the manufacturer

1.1.1 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.

1.1.2 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.

1.1.3 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.

1.1.4 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.

1.1.5 Manufacturer

The instrument is developed and manufactured by:

KROHNE Altometer
Kerkeplaat 12
3313 LC Dordrecht
The Netherlands

For information, maintenance or service please contact your nearest local KROHNE representive.

1.2 Safety instructions for the operator

WARNING!

- *Do not change the device. Unauthorized changes affect the explosion safety of the devices.*
- *The prescriptions and regulations as well as the electrical data described in the EC type examination certificate must be obeyed.*
- *Beside the instructions for electrical installations in non-hazardous locations according to the applicable national standard (equivalent to HD 384 or IEC 60364, e.g. VDE 0100), especially the regulations in EN 60079-14 "Electrical installations in hazardous locations", equivalent national standard (e.g. DIN VDE 0165 Part 1) or dust hazardous areas such as EN 61241-14 must be complied with!*
- *Installation, establishment, utilization and maintenance are only allowed to be executed by personnel with an education in explosion safety!*

These additional instructions are an extension to the handbook. All technical information as described in the handbook is applicable, when not specifically excluded, completed or replaced by the instructions in these additional instructions.

1.3 Approval

The OPTIFLUX 4040 C-EEx electromagnetic compact flowmeter in 2-wire technology is in accordance with European Directive 94/9/EC (ATEX 100a) and approved for hazardous classified areas of Zone 1 and 2 under:

KEMA 01 ATEX 2200 X

INFORMATION!
All type examination certificates can be downloaded from the website.

1.4 General description

The OPTIFLUX 4040 C-EEx flowmeter consists of the IFC 040 signal converter unit, which is screwed on top of the flow sensor. The flowmeter is marked with one of the codes below:

EEx marking:

Nominal diameter	**EEx e and d connection compartment,** II 2 GD
10...20	EEx dme [ib] IIC T6...T3
25...150	EEx de [ib] IIC T6...T3

1.4.1 Flow sensor

The flow sensor contains two field coils and two electrodes.

Protection category

Nominal diameter	Type of protection
10...20	Housing: Encapsulation "m" according to EN 50028 and increased safety "e" according to EN 50019
	Electrodes: Intrinsic safety "ib" according to EN 50020
25...150	Housing: Flameproof enclosure "d" according to EN 50018
	Electrodes: Intrinsic safety "ib" according to EN 50020

INFORMATION!
The intrinsically safe electrode circuits are only internal circuits and not accessible for the customer.

1.4.2 Signal converter

The IFC 040 signal converter consists of a cylindrical housing of die-casted aluminum, which has two separate compartments, divided from each other by an integrated wall with casted flameproof terminal feed-through. The neck at the bottom of the housing contains a flameproof cable feed-through. The signal converter housing is on both ends closed by a cylindrical threaded cover with O-ring sealing. The housing has an ingress protection degree of at least IP 67 conform to EN 60529.

Electronics compartment
The electronics compartment accomodates the pre-certified IFC 040 electronics unit with approval number PTB 00 ATEX 2213 U. The compartment is designed with type of protection flameproof enclosure "d" according to EN 50018. It is closed by a flameproof display cover with glass window.

Terminal compartment
The terminal compartment has seven terminals for all connections. There are two versions possible with a different explosion protection according to the European Standards, which is dependent on the safety-technical maximum voltage Um of the mains power supply system to which the flowmeter is connected.

Version A: terminal compartment "EEx de [ib]" with U_m = 60 V
The connections of the output circuits can be configured by the customer in one of the folllowing types of explosion protection:

- EEx [ib]: intrinsic safety, category "ib"
- EEx e: increased safety
- EEx d: flameproof enclosure (note warning below)

Version B: terminal compartment "EEx de" with U_m = 250 V
The connections of the output circuits can be configured by the customer in one of the folllowing types of explosion protection:

- EEx e: increased safety
- EEx d: flameproof enclosure (note warning below)

Cable or conduit entries

WARNING!
The used cable entries (glands and/or blind plugs) must be ATEX certified. The OPTIFLUX 4040 C-EEx is delivered with an EEx e cable gland and EEx e blind stop. The cable gland and blind stop are suitable for connections in EEx e and EEx ib, but not for EEx d.

When connection is planned in EEx d, special EEx d certified conduits, glands or blind stops must be used. ATEX approved EEx d cable glands, screw threaded adapters as well as blind plugs are no integral part of the delivery and must be purchased by the customer or can be ordered as special part. Note that for a correct choice of the EEx d cable gland the precise cable type and cable dimensions (e.g. outside diameter) must be given.

1.5 Nameplates

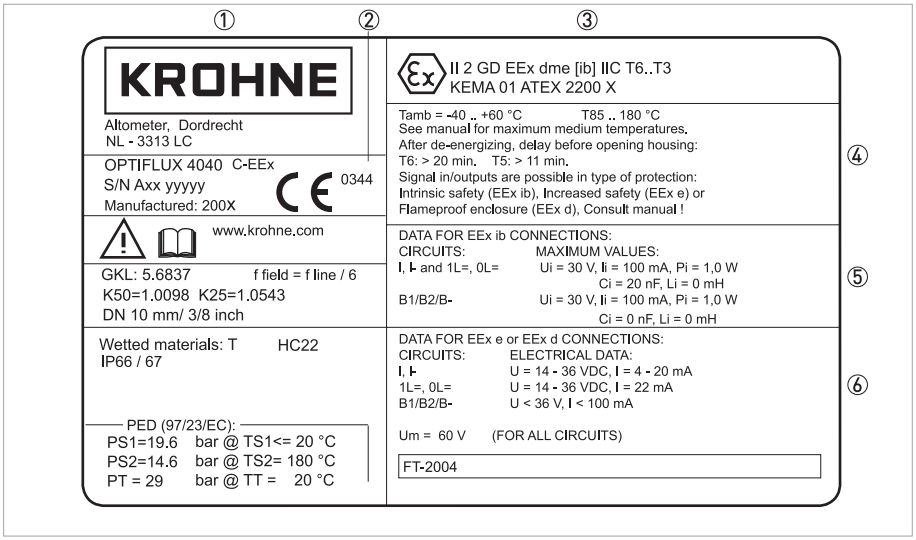

Figure 1-1: Example of a nameplate

① Name and address of the manufacturer.
② CE sign with number (s) of notified body / bodies.
③ Specific sign for explosions, protection, Ex codes and number of EC type exmination certificate.
④ Explosion safety notes.
⑤ Data for EEx ib connection.
⑥ Data for EEx e or EEx d connection.

2.1 Temperatures

The OPTIFLUX 4040 C-EEx compact flowmeter is designed for ambient temperatures in the range of -40...+60°C.

The allowed process liquid temperature is among others limited by the combustible atmosphere that (possibly) surrounds the apparatus, which again is determined by the temperature class of the atmosphere.

Temperature classification DN10...20

Temperature (for gasses)	Max. surface temperature (for dusts)	Maximum process liquid temperature		
		$T_a \leq 40°C$	$T_a \leq 50°C$	$T_a \leq 60°C$
T6	T85°C	75°C	70°C	70°C
T5	T100°C	95°C	90°C	75°C
T4	T135°C	130°C	115°C	75°C
T3	T180°C	150°C	115°C	75°C

Temperature classification DN25...150

Temperature (for gasses)	Max. surface temperature (for dusts)	Maximum process liquid temperature		
		$T_a \leq 40°C$	$T_a \leq 50°C$	$T_a \leq 60°C$
T6	T85°C	70°C	70°C	70°C
T5	T100°C	85°C	85°C	85°C
T4	T135°C	120°C	120°C	115°C
T3	T180°C	180°C	180°C	115°C
Use heat-resistant cables		No	No	Yes

3.1 Equipotential bonding system

The flowmeter must be incorporated into the equipotential bonding system through the internal or external PE-clamp. The external clamp is suitable for wires up to 4 mm^2 cross section. Disconnection from the equipotential bonding system is only allowed when the flowmeter is not in contact with power supplies or ground voltages outside the hazardous area.

3.2 Terminal arrangment

To connect external devices to the signal output terminals, the wiring requirements for the type of protection of the compartment must also be conform to the international or national standard involved (e.g. EN 60079-14). The terminal arrangment is shown by the following figure.

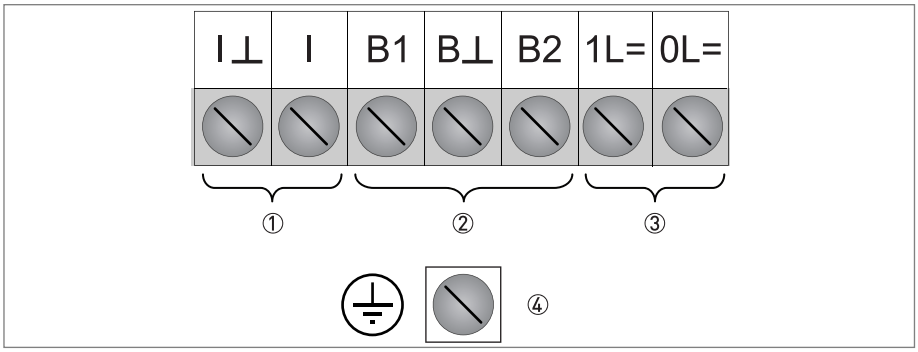

Figure 3-1: Terminals OPTIFLUX 4040 C

① Current output
② Binary outputs
③ Power booster (additional power supply)
④ PE (Protective Earth) / FE (Functional Earth)

The following outputs are available for connection to external circuits:

Current output
This circuit constitutes a passive 4...20 mA current loop and includes the HART protocol of the communication device (choice of polarity free).

Additional power supply or power booster
These terminals are connected to provide the 2x2 wire mode (choice of polarity free).

Binary outputs
Terminals B1 and B_{gnd} can be configured as pulse or status output through software.
Terminals B2 and B_{gnd} can be configured as pulse or status output to NAMUR.

Galvanical separation of circuits
The internal electrode circuit with type of protection "EEx ib" is galvanically connected to the aluminum signal converter housing (i.e. PE potential). The current output, the additional power supply and the internal field current circuit are galvanically connected to each other.

3.3 Description of the output circuits

The terminal compartment of the OPTIFLUX 4040 C-EEx is, with respect to the explosion protection, available in two versions. The version can be identified by the information that is listed on the data plate, which is mounted on the signal converter housing.

Version A: terminal compartment "EEx de [ib]" with U_m = 60 V

The customer can decide in which type of explosion protection the output circuits - current output, additional power supply and binary outputs (i.e. pulse and/or status outputs) - can be driven: in type of protection "EEx ib", "EEx e" or "EEx d".
If type of protection EEx e or EEx d is used, the markings for "Intrinsically safe" - that are blue o-ring around the cable gland and the blue sticker in the connection compartment - should be removed.
The safety-technical maximum voltage U_m (maximum effective AC or DC voltage) of the mains power supply system for the terminal compartment in type of protection EEx de [ib] is restricted to 60 V. With this maximum voltage it is guaranteed that the protective components on which the intrinsic safety of these circuits depends are not overloaded. This condition is met if the mains power supply system satisfies the PELV requirements in accordance with IEC 364 / IEC 536.

WARNING!
It is not allowed to mix two different types of protection (e.g. current output in type of protection "EEx ib" and pulse/status outputs in "EEx e" or "EEx d").

INFORMATION!
It is allowed to change the type of protection of the terminal compartment afterwards, if it is garuanteed that the maximum voltage U_m of the mains power supply system is always limited at 60 V!

Version B: terminal compartment "EEx de" with U_m = 250 V

This version is intended for applications where the mains power supply system provides a maximum safety-technical voltage of U_m = 250 V. The terminals can either be provided with type of protection increased safety "EEx e" according to EN 50019 or flameproof enclosure "EEx d" conform to EN 50018. Type of protection intrinsical safety "EEx ib" is not allowed for this version.

Important notes (applicable for versions A and B)

- The intrinsically safe "EEx ib" internal electrode circuit is supplied by the IFC 040-EEx signal converter electronics unit inside the electronics compartment. This circuit is separated from all other circuits up to a maximum voltage of U_m = 250 V according to EN 50020. The internal electrode circuit with type of protection intrinsic safety "ib" is galvanically connected with the PE (housing potential).
- The current output (terminals I, I_{gnd}) and the additional power supply (terminals 1L=, 0L=) must be galvanically separated from each other. To avoid voltage or current summation, at least one of the two circuits must be isolated from earth potential. It is not allowed to drive both circuits at the same time with grounded zener barriers. Both current circuits, including all connection cables, must be galvanically separated at all times according to the valid regulations.
- Also in case of non-intrinsically safe connections, it is absolutely necessary to maintain a galvanic separation between the current output circuits and the additional power supply connections.

- A safe connection of the IFC 040-EEx signal converter electronics with the equipotential bonding system is achieved through the zinc-plated mounting frame, which must be securely screwed to the aluminum signal converter housing (PE potential) by means of two long-shafted screws. To access the two long-shafted screws it is necessary to unscrew the display unit and fold it aside. The screws must be tightly secured with a torque of 1.3 Nm (a 2 Pt. Phillips screwdriver is recommended).

3.4 Safety-technical data

CAUTION!
The functional-technical data must also be regarded, please see the standard documentation.

Safety-technical data of output circuits

Terminal designation	Function	Electrical data (per circuit)	
		Type of protection "EEx ib"	Type of protection "EEx e"
Circuit 1 I, I_{gnd}	Current output, passive (2-wire connection) 4...20 mA, HART® is possible.	Maximum values: U_i = 30 V, I_i = 100 mA, P_i = 1.0 W C_i = 20 nF, L_i = 0, U_m = 60 V	U_n = 14...36 VDC I_n = 4...20 mA U_m = 250 V
Circuit 2 1L=, 0L=	Additional power supply or power booster (4-wire connection). Additional to Circuit 1 (option).		U_n = 14...36 VDC I_n = 22 mA U_m = 250 V
Circuit 3 B1, B_{gnd} B2, B_{gnd}	Passive pulse/status output 1 / 2	Maximum values: U_i = 30 V, I_i = 100 mA, P_i = 1.0 W C_i = 0, L_i = 0, U_m = 60 V	Maximum values: U = 36 VDC I = 100 mA U_m = 250 V

3.5 Connection examples

In the following sections examples for connection of the OPTIFLUX 4040 C-EEx compact flowmeter are described for operation in the 2-wire mode as well as in the 2x2-wire mode.

3.5.1 Example of OPTIFLUX 4040 C-EEx in 2-wire mode

The diagram shows an OPTIFLUX 4040 C-EEx with the terminal compartment in version A (EEx de [ib] with U_m = 60 V). The flowmeter is connected through a transmitter power supply ("EEx i" approved) in 2-wire mode. If data communication with the flowmeter through the HART® protocol is required, the transmitter power supply unit must be HART compatible. Terminals I, I_{gnd} are not polarity sensitive.
The entity parameters of the "EEx i" approved transmitter power supply, including the cable capacitances and inductances, must fit the entity parameters of the OPTIFLUX 4040 C-EEx compact flowmeter, namely U_i = 30 V, I_i = 100 mA, C_i = 200 nF, L_i = 0. Suitable HART® compatible transmitter power supplies that can be used in combination of the OPTIFLUX 4040 C-EEx are:

- Phoenix PI/Ex-ME-RPSS-I/I
- CEAG 6/420

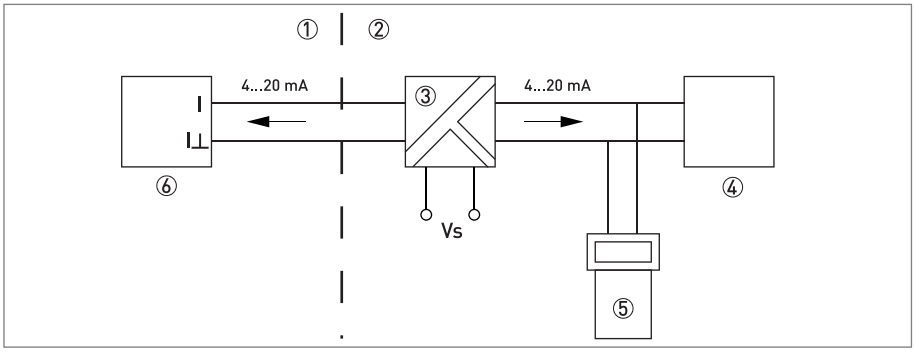

Figure 3-2: Connection example in 2-wire mode

① Hazardous area
② Safe area
③ Transmitter power supply (EEx i)
④ Process / display unit
⑤ Hand held terminal
⑥ OPTIFLUX 4040 C-EEx

3.5.2 Example of OPTIFLUX 4040 C-EEx in 2x2-wire mode (4-wire)

The diagram shows an example of the connection of the OPTIFLUX 4040 C-EEx in 2x2-wire mode. As in the previous example, the terminal compartment is again version A.
The additional power supply (terminals 1L=, 0L=) of the OPTIFLUX 4040 C-EEx is supplied by an external power supply unit through an "EEx i" zener barrier with a linear output load.
The connection of the current output (terminals I, I_{gnd}) and the additional power supply (terminals 1L=, 0L=) is insensitive for polarity reversal.

Important notes

- Only one of the two connected circuits of the OPTIFLUX 4040 C-EEx, namely the "currrent output" or the "additional power supply" may be earthed to maintain the required galvanic separation between the two circuits!
- It is strictly interdicted to use the IMoCOM adapter with the IFC 040-EEx unit!

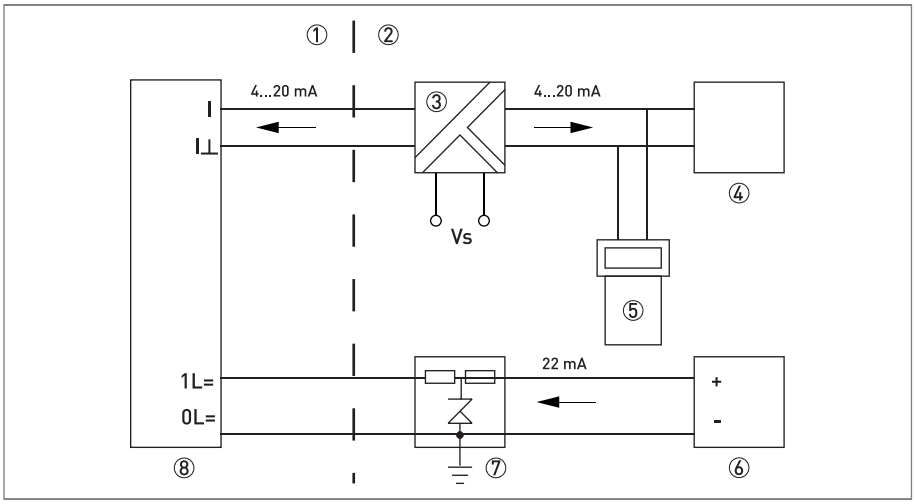

Figure 3-3: Connection example in 4-wire mode

① Hazardous area
② Safe area
③ Transmitter power supply (EEx i)
④ Process / display unit
⑤ Hand held terminal
⑥ External power supply
⑦ Zener barrier
⑧ OPTIFLUX 4040 C-EEx

The voltage of the external power supply unit must be carefully chosen to keep it within the allowed limits. The upper limit is determined by the maximum working voltage of the zener barrier, which in general lies a few volts below the maximum open voltage value U_o of the used zener barrier. The lower limit is determined by the sum of the minimum working voltage of the additional power supply of the OPTIFLUX 4040 C-EEx flowmeter of 14 V and the voltage drop over the zenerbarrier caused by the end-to-end resistance of the barrier and (if not neglectable) the serie cable resistance. This voltage drop can be significant. The above described determination of the external power supply voltage is explained by the following example.

Example with typical parameters:

Zener barrier data:	U_o	= 28 V
	I_o	= 93 mA
Maximum working voltage		= 25.5 V
End-to-end resistance		340 Ω

The voltage drop across the end-to-end resistance of the zener barrier is 22 mA x 340 Ω = 7.5 V

This means that the external power supply must supply an output voltage to the zener barrier that lies in the range somewhere between 21.5...25.5 V. The voltage over the terminals of the additional power supply of the OPTIFLUX 4040 C-EEx is in that case between the required 14.0...18.0 V

The OPTIFLUX 4040 C can be programmed in the hazardous area with a bar magnet, without opening the flameproof housing of the converter. Consult the standard manual for a description of the software menu.

5.1 Maintenance

The flowmeters are maintenance free with respect to the flowmetering properties. Within the scope of periodic inspections required for electrical equipment installed in hazardous areas it is recommended to check the housing for signs of damage or corrosion. This concerns the converter housing and the flow sensor housing.

5.2 Replacement of electronics unit

WARNING!
the following instructions must always be carefully followed, if the housing of the signal converter has to be opened respectively closed again.

Before opening:

- Make absolutely sure that there is no explosion hazard!
- Gas-free certificate!
- Make sure that all connecting cables are safely isolated from all external sources!

When these instructions are strictly followed, the display cover (with the glass window) can be removed.

Removal of the electronics unit

- Raise the latch of the interlocking device by loosening the hexagon socket head cap screw size 3, until the cover can rotate freely.
- Unscrew the cover with the special plastic wrench that is supplied with the device.
- Unscrew the two screws of the display unit and turn it carefully aside.
- Carefully disconnect the 12 pin connector (for field coil and electrode circuits connection) from the electronics unit.
- Unscrew the two mounting screws of the electronics unit, which fixes the metal frame to the back of the signal converter housing. A crosshead screwdriver type 2 Pt. Philips is most suitable.
- Carefully remove the electronics unit of the converter housing. Do not damage any connecting cables!

Insertion of the electronics unit

- Insert the electronics unit in the converter housing
- Tighten the two mounting screws of the electronics unit.
- The metal frame of the electronics unit must be securely screwed to the housing (back-end of electronics compartment) by the two non-removable fastening screws. Screw them with a tightening torque of 1.3 Nm.

WARNING!
These two screw connections also establish the safety-technical connection of the electronics unit to the signal converter housing and equipotential bonding system.

- Connect the 12-pin connector.
- Mount the display-unit.
- Before the cover is screwed back into the housing, the screw-thread must be clean and well greased with an acid and resin-free grease, e.g. silicone grease.

- Screw the display cover as tight as possible into the housing by hand, so that the gasket of the cover must be clamped to provide the required ingress protection (IP) degree.
- Tighten the hexagon socket head cap screw of the interlocking device.

INFORMATION!
Refer to the standard installation and operating instructions for detailed information about resetting and reprogramming the new electronics unit after replacement.

KROHNE product overview

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

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