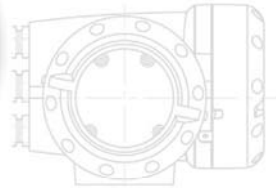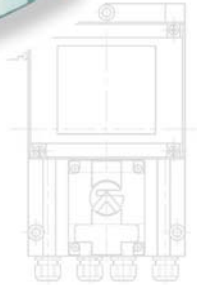# Handbook

KROHNE

FH & JZ

IFC 300
signal converter

**for electromagnetic
flowmeters**

**for volumetric flow measurement
of electrically conductive liquids**

**OPTIFLUX flowmeters are delivered ready
for operation!**

Switch on and measure.

Software Version 1.1.0

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

Contents

CE / EMC / Standards / Approvals

The electromagnetic flowmeters from KROHNE described in this handbook meet the following safety requirements:

• **EMC Directive 89 / 336 / EEC** and **93 / 68 / EEC**
  in conjunction with **EN 61326-1 (1997**) and **A1 (1998), A2 (2001)**

• **Low-Voltage Directives 73 / 23 / EEC** and **93 / 68 / EEC**
  in conjunction with **EN 61010-1: 2001**

• **Pressure Equipment Directive 97 / 23 / EC**

• **Ex Directive 94 / 9 / EC (ATEX 100a)** for versions designed for use in hazardous areas

• All devices bear the **CE marking** and meet the requirements of

• **NAMUR Guideline NE 21 / 04** with IFC 300 signal converter.

Safety information

Please read these operating instructions and observe applicable national standards, safety requirements and accident prevention regulations.
Installation and operation of the measuring device may only be carried out by qualified personnel.

	Warning sign: electric shock hazard	**WARNING!** Electric shock is dangerous and can cause severe burns and critical injuries!
	Separate manuals available for hazardous-duty equipment!	**CAUTION!** Special regulations apply to use of equipment in hazardous areas, and these must be observed without fail in order to ensure safe operation in such areas. Wiring, installation, operation and maintenance may only be carried out by qualified personnel trained in explosion protection.
	WARNING! CAUTION!	**WARNING!** Indicates activities or occurrences which, if ignored, can lead to serious personal injury, hazardous situations, faulty operation or destruction of the device. **CAUTION!** Indicates activities or occurrences which, if ignored, can lead to personal injury and faulty operation of the device.
	Info	**Information and tips**

System description

Electromagnetic flowmeters are precision instruments designed for linear flow measurement of liquid products.

The process liquids must be electrically conductive, ≥ 1 µS/cm (depending on the sensor);
for cold demineralized water: ≥ 20 µS/cm.

The full-scale range $Q_{100\%}$ can be set as a function of the sensor meter size (primary head) in keeping with the flow velocity between v = 0.3 – 12 m/s, see flow table in Sect. 5.3.

Product liability and warranty

Electromagnetic flowmeters from KROHNE are designed solely for measuring the flow rate and the conductivity of electrically conductive process liquids.

Such flowmeters are also available for use in hazardous areas.
Special regulations apply in this case, which are given in the special EEx directions,
see separate operating instructions.

Responsibility as to suitability and intended use of these electromagnetic flowmeters rests solely with the operator.

Improper installation and operation of the flowmeters (systems) may lead to loss of warranty.

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

If flowmeters need to be returned to KROHNE, please note the information given on the last-but-one page of these Instructions. KROHNE regret that they cannot repair or check your flowmeter(s) unless they are accompanied by the completed form sheet.

Items included with supply

- **Signal converter** in the version as ordered.
- **Signal cable** (only for remote versions F and W) in the version and length as ordered (Standard: signal cable A, length 5 m)
- **Report on factory settings**
- **Calibration report**
- **Quick Start directions,** in the language ordered, for installation, electrical connection, start-up and operator control of the signal converter.
- **CD-ROM** with manuals for the sensors and the signal converter.

Signal converter versions and device nameplates

Your measuring device is delivered in ready-to-operate condition. Operating data have been factory-set to your order. The signal converter is equipped as standard with a local display, operator control elements and with a **HART**® interface

IFC 300 C **Compact flowmeter**,
signal converter mounted directly on the flow sensor

IFC 300 F **Signal converter in field housing, remote version,**
electrical connection to the flow sensor via field current and signal cables

IFC 300 W **Signal converter in wall-mounted housing, remote version,**
electrical connection to the flow sensor via field current and signal cables

IFC 300 R **Signal converter in 19" rack, remote version,**
electrical connection to the flow sensor via field current and signal cables (in preparation)

C and **F** (option) These versions available for use in hazardous areas.

Please check against the **device nameplates** that the device supplied is in the correct version,
see following examples. The nameplate for inputs/outputs is illustrated in Sect. 2.2.

Examples for nameplates

1   Electrical connection: Power supply

1.1   Location and important notes on installation   PLEASE NOTE !

- **Electrical connection in conformity with VDE 0100** "Regulations for electrical power installations with line voltages up to 1000 V" or **equivalent national regulations.**

- **Use separate entry fittings** (PG screwed cable entries) for power supply, field current and signal cables, and for outputs and inputs.

- Protect signal converter against direct **solar radiation**, install a sunshade if necessary.

- **Signal converters installed in switchgear cabinets** require adequate cooling, e.g. by fan or heat exchanger.

- Do not expose signal converters to intense **vibration.**
  KROHNE OPTIFLUX are tested at vibrational level to IEC 68-2-34:
  broadband vibration test: f_1 = 20 Hz / f_2 = 2000 Hz / t = 90 min. / Test in all three axes (directions),
  spectral acceleration density ASD = 0.01 g^2 / Hz ($a_{eff.}$ = 4.5 g).

- **Dimensions of the signal converter,** see Sect. 5.5.

For separate systems / remote signal converters only (F and W versions)

- **Mounting of the remote signal converter**

- **Mounting of the IFC 300 W:**
  Remove mounting plate from rear of signal converter, and attach to wall or standpipe. Replace signal converter. Position lock washers and nuts on the housing bolts, tighten nuts slightly. Align housing, tighten nuts firmly.
  Dimensions, further information (minimum distances between signal converters): see Sect. 5.5, Dimensions and weights

- **Mounting the IFC 300 F:**
  Mount IFC 300 F with mounting plate on wall or standpipe.
  Dimensions, further information (minimum distances between signal converters): see Sect. 5.5, Dimensions and weights

- **Keep distance between flow sensor and signal converter** as short as possible, observe max. allowed length of signal and field current cables, see Sect. 1.3.3 and 1.3.5.

- Use the supplied **KROHNE signal cable A** (type DS 300, standard) **or B** (type BTS 300, bootstrap, optional), standard length 5 m / 15 ft.

- Generally use bootstrap signal cables B (type BTS 300) for **OPTIFLUX 5000 F** and **OPTIFLUX 6000 F flow sensors**, meter sizes DN 2.5 - 15 and $^1/_{10}$" – $^1/_2$", and for contaminated liquids which tend to form electrically insulating deposits.

- **Always calibrate** flow sensor and signal converter **together**! Also install together and make sure **settings of the primary constant GK / GKL** are identical, see device nameplates and report on settings for the signal converter.
  If components are supplied separately, or in the case of a "mixed" installation, the signal converter must be set to the DN size and GK / GKL of the sensor; see Sect. 4.

- **Construction of the various housing versions**

IFC 300 C (compact) and
IFC 300 F (remote)
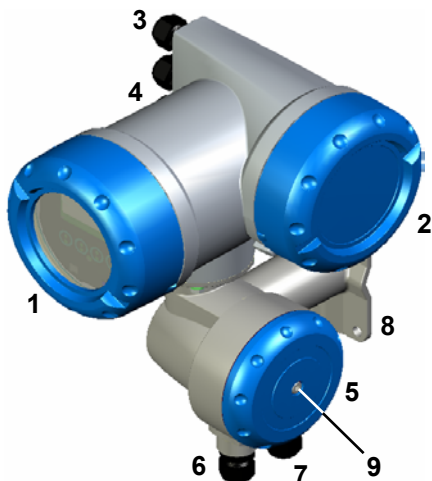
The terminal compartments are accessible after unscrewing cover 2
(and 5, for F Version only).

1 Cover, electronics compartment

2 Cover, terminal compartment for power supply and inputs/outputs

3 Cable entry for power

4 Cable entry for inputs/outputs

for F Version only (remote)
5 Cover, sensor terminal compartment

6 Cable entry for field current cable

7 Cable entry for signal cable

8 Attachment plate for wall or pipe mounting

9 Locking screw for cover of sensor terminal compartment(**5**)

The display of the IFC 300 C and IFC 300 F can be turned in steps of 90°.
To do this, unscrew the cover of the electronics compartment and remove the two metal clips to the left and right of the display using a screwdriver or similar tool. The display between the metal clips can then be pulled off and re-inserted in the required position. Before pushing the clips together with the display into the electronics compartment, make sure not to kink the display´s flat ribbon cable more than absolutely necessary. Replace cover and tighten down by hand.
**Cover threads to be protected from dirt and well greased at all times;
particularly important for hazardous-duty (Ex) versions!**

IFC 300 W (remote)
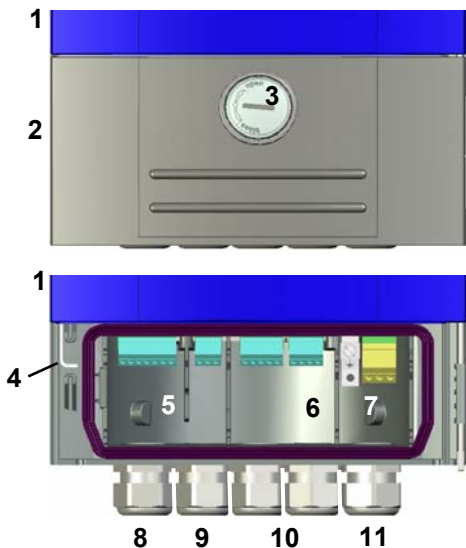
1 Cover, electronics compartment

2 Cover for the three separate terminal compartments for power, sensor connection and inputs/outputs

3 Locking screw, $^1/_2$ turn left/right to open/close cover (**2**)

4 Safety lever to open cover (**1**)

5 Sensor terminal compartment, open separate cover

6 Terminal compartment, outputs/inputs

7 Power terminal compartment, open separate shock-hazard protection cover

8 Entry fitting for signal cable

9 Entry fitting for field current cable

10 Two cable entries for outputs/inputs

11 Cable entry for power supply

1.2 Connection to power for IFC 300 versions C, F and W

PLEASE NOTE !

- **Degree of protection** IP 65 and 67 to IEC 529 / EN 60529, equivalent to NEMA 4 / 4X and 6, dependent on the version.

- **Rated values:** The housings of the flowmeters, which are designed to protect the electronic equipment from dust and moisture, should be kept well closed at all times. Creepage distances and clearances are dimensioned to VDE 0110 and IEC 664 for pollution severity 2. Supply circuits are designed for overvoltage category III and the output circuits for overvoltage category II.

- **Fuse protection, disconnecting device:** Fuse protection ($I_N \leq 16$ A) for the infeed power circuit, and also a disconnecting device (switch, circuit breaker) to isolate the signal converter must be provided.

100-230 Volt AC (tolerance range -15% / +10%)

- **Note the data on the nameplate,** power supply voltage and frequency range (50 - 60 Hz).

- The **protective ground conductor PE** of the power supply **must be connected** to the separate terminal in the terminal compartment of the signal converter.

- **Connection diagrams I - II** for the power supply and the electrical connection between flow sensor (primary head) and signal converter: see Sect. 1.3.6.

12 - 24 Volt DC (tolerance range -25% / +30%)

- **Note the data on the instrument nameplate!**

- For reasons to do with the measurement process, connect a **functional ground FE** to the separate U-clamp terminal in the terminal compartment of the signal converter.

- When connecting to functional extra-low voltages, provide a facility for **protective separation (PELV)** (VDE 0100 / VDE 0106 and/or IEC 364 / IEC 536 or relevant national regulations).

- **Connection diagrams I - II** for the power supply and the electrical connection between flow sensor and signal converter: see Sect. 1.3.6.

Connection to power (applies to all versions / housing versions)

Power consumption
• for AC = 22 VA
• for DC = 12 W
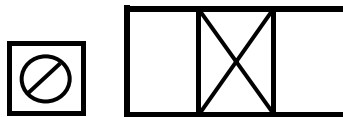
AC: 100 - 230 V (-15% / +10%)   PE   N   L

DC: 12 - 24 V (-25% / +30%)   FE   L-   L+

The power terminals in the terminal compartments are protected by additional hinged lids against accidental contact.

	Warning: Signal converter must be properly grounded to avoid personnel shock hazard. All directions, operating data and connection diagrams do not apply to devices used in hazardous areas; in such cases, read the **special "Ex" operating instructions without fail**!

1.3 Electrical connection of remote sensors (primary heads)

1.3.1 General information on signal cables A and B and field current cable C

Proper functioning is ensured by the **KROHNE signal cables A and B** with double or triple foil shielding.
However, when other signal cables are used, please note the following electrical data!

Electrical safety to EN 60811 (low-voltage directives) or equivalent national standards.	Test voltage
	Signal wire / inner shield 500 V
	Signal wire / signal wire 1000 V
Capacitance of signal wire	Signal wire / outer shield 1000 V
wire / wire < 50 pF/m or 15 pF/ft	Twisting of signal wires
wire / shield < 150 pF/m or 45 pF/ft	minimum 10× per meter or 3× per feet,
Isolation resisance >100 GΩ × km or >60 GΩ × mile	important when screening magnetic fields
Voltage rating < 24 V / Current rating < 100 mA	

- Lay signal cables as a fixed installation, underwater and underground laying possible.
- Connection of **shields:**   - **inner** (1) via drain wire to normal connecting terminal
                                    - **outer** (60) via braid to U-clamp terminal
- Insulating material is flame-retardant to EN 50625-2-1,IEC 60322-1.
- The low-halogen, unplasticized signal cables remain flexible at low temperatures.

Signal cable A (type DS 300), with double shielding

1 **Stranded drain wire, inner shield**, 1.0 mm² Cu / AWG 17 (not insulated, bare)

10 **Inner shield** (see stranded drain wire 1)

2 **Insulated conductor**, 0.5 mm² / AWG 20 (marking = 2)
3 **Insulated conductor**, 0.5 mm² / AWG 20 (marking = 3)

6 **Stranded drain wire, outer shield**, 0.5 mm² Cu / AWG 20 (not insulated, bare)
60 **Outer shield** (see stranded drain wire 6)
Outer sheath, dia. approx. 8 mm / 0.3" (marking = DS 300)

Signal cable B (type BTS 300) with triple shielding (bootstrap line)

1 **Stranded drain wire, inner shield**, 1.0 mm² Cu / AWG 17 (not insulated, bare)
10 **Inner shield** (see stranded drain wire 1)
2 **Insulated conductor**, 0.5 mm² / AWG 20 (marking = 2)
20 **Stranded drain wire for individual shield of conductor 2**
3 **Insulated conductor**, 0.5 mm² / AWG 20 (marking = 3)
30 **Stranded drain wire for individual shield of conductor 3**

6 **Stranded drain wire, outer shield**, 0.5 mm² Cu / AWG 20 (not insulated, bare)
60 **Outer shield** (see stranded drain wire 6)
Outer sheath, dia. approx. 12 mm / 0.5" (marking = BTS 300)

In the bootstrap method, the individual shields (20 and 30) are always controlled by the signal converter to exactly the same voltage that is present at signal wires (2 and 3). Because for that reason there is no voltage difference between the individual shields (20 and 30) and the signal wires (2 and 3), no current flows via the line capacitances between 2 / 20 or 3 / 30. The line capacitance is apparently "zero".
This allows greater cable lengths when the electrical conductivity of the process product is low.

Field current cable C
Cross-section dependent on required length of cable, see Table in Sect. 1.3.3.

1.3.2 Stripping (preparation) of signal cables A and B

Please note:
- The **figures** in tables and drawings **identify** the **shields**, **stranded drain wires** and **wires** of signal cables A and B, see Sect. 1.3.1.
- The following tables and drawings indicate the dimensions (**a - d**) for stripping the signal cables.

Customer-supplied materials

W	Insulation tubing (PVC), dia. 2.0-2.5 mm / approx. 0.1"
X	Heat-shrinkable tubing or cable sleeve
Y	Wire end ferrule to DIN 41 228: E 1.5-8
Z	Wire end ferrule to DIN 41 228: E 0.5-8

Signal cable A (Typ DS 300)
approx. Length in mm / inch

dimen-sion	Sensor	Signal converter	
		IFC 300 **F**	IFC 300 **W**
a	60 / 2.4"	90 / 3.5"	90 / 3.5"
b	10 / 0.4"	10 / 0.4"	10 / 0.4"
c	8 / 0.3"	8 / 0.3"	8 / 0.3"
60	connect	connect	**do not** connect

Signal cable B (Typ BTS 300)
approx. Length in mm / inch

dimen-sion	Sensor	Signal converter	
		IFC 300 **F**	IFC 300 **W**
a	60 / 2.4"	90 / 3.5"	90 / 3.5"
b	10 / 0.4"	10 / 0.4"	10 / 0.4"
c	8 / 0.3"	8 / 0.3"	8 / 0.3"
d	-	25 / 1.0"	25 / 1.0"
60	connect	connect	**do not** connect
20 / 30	**do not** connect	connect only in the IFC 300	

Signal cable A (type DS 300), with double shielding

a

c   b

Signal cable **A** bending radius ≥ 50 mm / ≥ 2.0"

Z

Y   W

Z

2   1   3

60 (Slip shield over outer sheath and connect up.)

Signal cable B (type BTS 300), with triple shielding (bootstrap)

a

d

c   b

Signal cable **B** bending radius ≥ 50 mm / ≥ 2.0"

Z   W 30

Z   X

Y   W

Z   X

Z   W 20   2 3   1
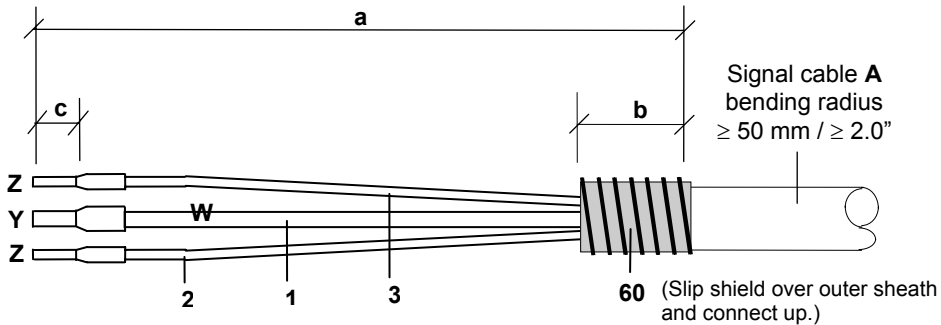
60 (Slip shield over outer sheath and connect up.)
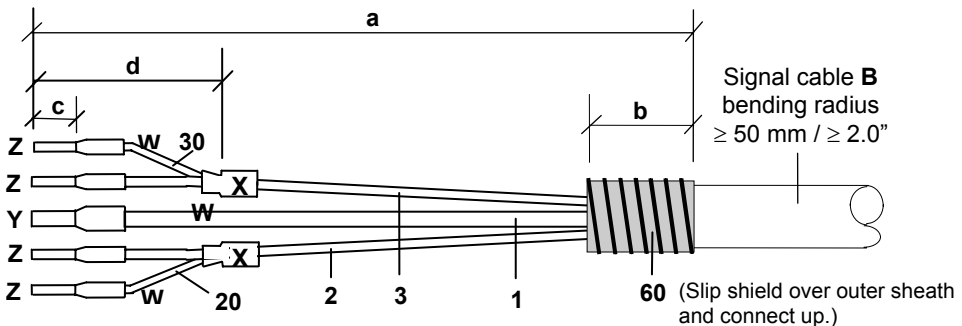
1.3.3 Type, length and preparation of the field current cable C

Length and cross-section, field current cable C

Length		Cross-section A_F (Cu)
0 – 150 m	0 - 500 ft	3 x 0.75 mm² Cu 3 x AWG 18
150 – 300 m	500 - 1000 ft	3 x 1.50 mm² Cu 3 x AWG 14
300 – 600 m	1000 - 2000 ft	3 x 2.50 mm² Cu 3 x AWG 12

Cu = copper cross-section

For the **IFC 300** W the terminals are designed for the following cable cross-sections:
• flexible cable: $\leq$ 1.5 mm² / $\leq$ AWG 14
• solid cable: $\leq$ 2.5 mm² / $\leq$ AWG 12

Preparation

90 mm / 3.5"

e

10 mm
0.4"

Field current
cable C
bending radius
50 mm / 2"

Wire end ferrules,
Size and dimension **e**
dependent on dia. of cable

Only if using a shielded
field current cable: cut back, slip
shield over the outer sheath and
connect up **only in the sensor
connection box.**
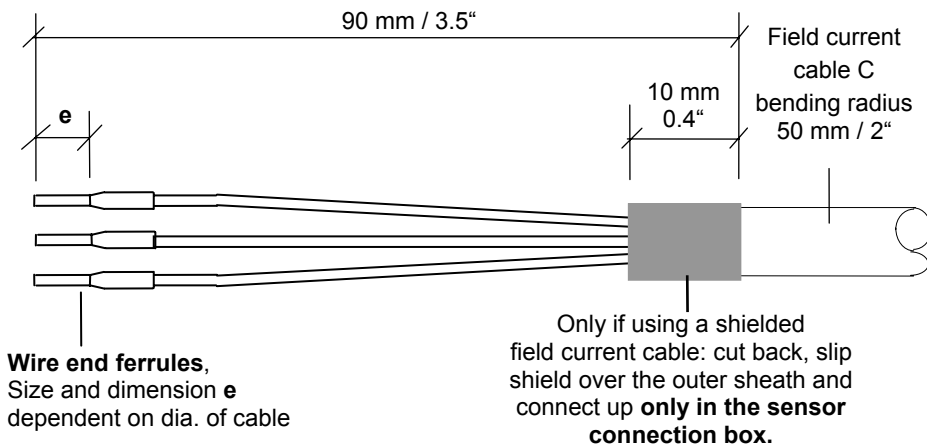
1.3.4 **Grounding of sensors** (primary heads)

- The sensor must be properly connected to ground.
- The grounding cable should not transmit any interference voltages.
- Do not use the grounding cable to connect more than one device to ground.
- In hazardous areas, grounding is used at the same time for equipotential bonding. Special grounding instructions are contained in the "Ex-installation instructions", which are only supplied together with hazardous-duty equipment.
- The sensors are connected to ground by means of a **functional grounding conductor FE.**
- Special grounding instructions for the various sensors are contained in the separate **installation instructions for the sensors.**
- These instructions also contain detailed descriptions on how to use grounding rings and how to install the sensors (primary heads) in metal or plastic pipes or in pipes which are coated on the inside.

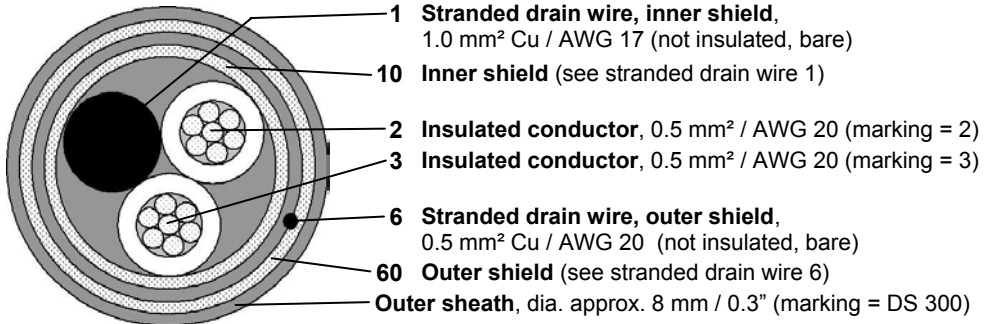|	**Warning:** The signal converter must be properly grounded to avoid personnel shock hazard. All diections, operating data and connection diagrams do not apply to devices used in hazardous areas; in such cases, **read the special "Ex" operating instructions without fail.**

1.3.5 Length of signal cable
max. distance between signal converter and sensor (primary head)

Abbreviations and explanatory notes
for the following table, diagram and connection diagrams

A Signal cable A / type DS 300, double shielding, max. length: see diagram below

B Signal cable B / type BTS 300, triple shielding, max. length: see diagram below

C Field current cable, cross-section and length: see Sect. 1.3.3

σ Electrical conductivity of process liquid

Sensor primary head	Meter size				Min. elec.- conductivity	Curve for signal cable	
	DN mm		inches		µS / cm	**A**	DN mm
OPTIFLUX 1000 F	10	- 150	$^3/_8$	- 6	5	**A 1**	**B 2**
OPTIFLUX 2000 F	25	- 150	1	- 6	20	**A 1**	**B 3**
	200	- 2000	8	- 80	20	**A 2**	**B 4**
OPTIFLUX 4000 F	2.5	- 6	$^1/_{10}$	- $^1/_6$	10	**-**	**B 1**
	10	150	$^3/_8$	- 6	1	**A 1**	**B 3**
	200	- 2000	8	- 80	1	**A 2**	**B 4**
OPTIFLUX 5000 F	2.5		$^1/_{10}$		10	**-**	**B 1**
	4	- 15	$^1/_6$	- $^1/_2$	5	**-**	**B 2**
	25	- 100	1	- 4	1	**A 1**	**B 3**
	150	- 250	6	- 10	1	**A 2**	**B 4**
OPTIFLUX 6000 F	2.5	- 15	$^1/_{10}$	- $^1/_2$	10	**-**	**B 1**
	25	- 150	1	- 6	1	**A 1**	**B 3**
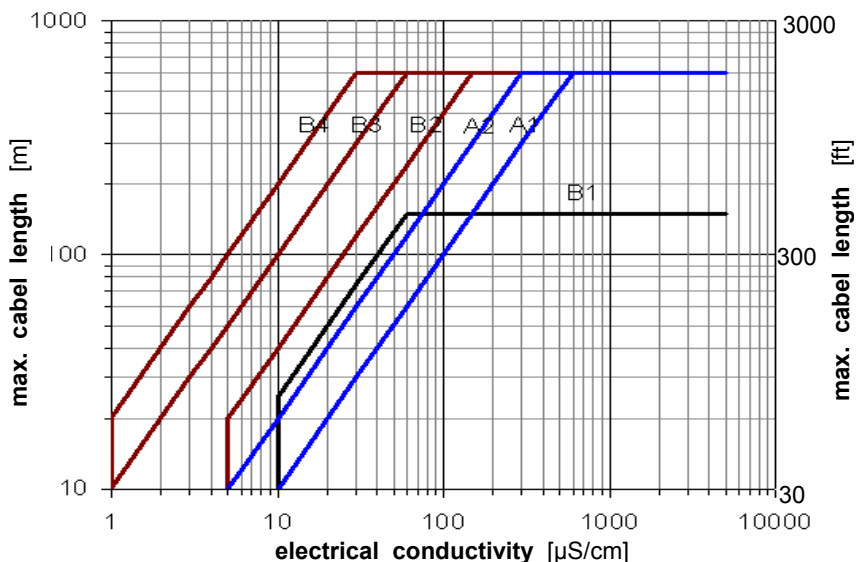
Please note !
For process temperatures above 150°C, special cables and a through-box ZD are required. Optionally available, incl. modified circuit diagrams.

1.3.6 Connection diagrams (I and II) for power supply and sensors

Important notes for connection diagrams   PLEASE NOTE !

> **Warning:** Signal converter must be properly grounded to avoid personnel shock hazard. All directions, operating data and connection diagrams do not apply to devices used in hazardous areas; in such cases, **read the special "Ex" operating instructions without fail**!

- The figures in brackets identify the shields, stranded drain wires and cores of signal cables A + B, see sectional drawings of signal cables in Sect. 1.3.1.

- **Electrical connection to VDE 0100** "Regulations governing heavy-current installations with line voltages up to 1000 V"

- **Power supply 12 - 24 V DC:**   Functional extra-low voltage with safety separation (PELV) to VDE 0100/VDE 0106 and/or IEC 364/IEC 365, or equivalent national regulations.

- **Systems used in hazardous areas** are subject to special regulations concerning electrical connections (see separate manual).

- **Terminal 4 / 40:**   assigned only when sensors have 4 electrodes (special version)

- **PE** = protective conductor   **FE** = functional ground

| **I** | **Signal cable A / Type DS 300** |
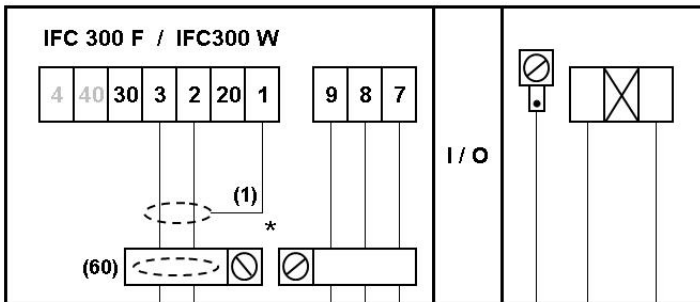
Power consumption
- for AC = 22 VA
- for DC = 12 W
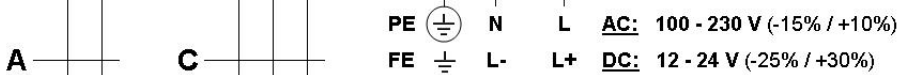
PE ⏚ N   L   **AC:** 100 - 230 V (-15 % / +10%)
FE ⏚ L-   L+   **DC:** 12 - 24 V (-25% / +30%)

* These two cable terminals are **not provided in** the housing of the **IFC 300 W,** therefore, **do not connect up the outer shield of cables A and C!**
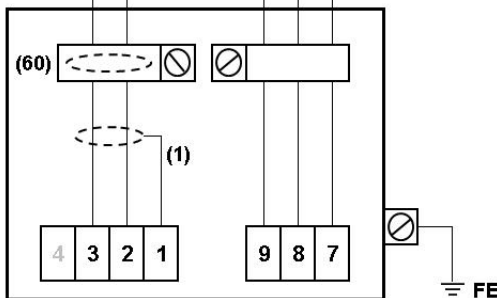
Sensor / primary head

For IFC 300 F !

- IFC 300 F has separate terminal compartments for power supply,
  flow sensor and for outputs and inputs.
- Connect the two overall shields for signal cables A and B in the sensor outlet box **and**
  in the signal converter-sensor terminal compartment:
  inner shield (10) by way of the stranded drain wire (1), and
  outer shield (60) by way of the braid.
- **There should be no difference in potential between the sensor and the housing
  of the signal converter!**

For IFC 300 W !

- IFC 300 W has 1 cover for the separate terminal compartments for power supply, sensor and
  for outputs and inputs. The power terminal compartment has an additional hinged flap for
  shock-hazard protection.
- The outer overall shield (60) of signal cables A and B can only be connected up in the sensor
  outlet box!

II   **Signal cable B / Type BTS 300**
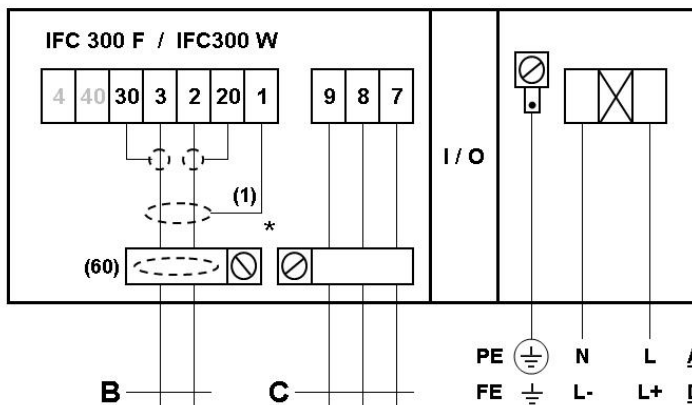
Power consumption
- for AC = 22 VA
- for DC = 12 W
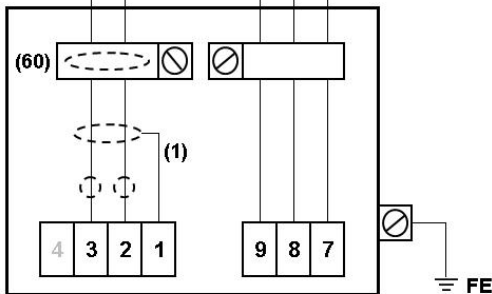
PE ⏚ N L **AC:** 100 - 230 V (-15% / +10%)
FE ⏚ L- L+ **DC:** 12 - 24 V (-25% / +30%)

* These two cable
terminals are **not
provided in** the housing
of the **IFC 300 W,**
therefore, **do not
connect up the
outer shield of**
cables B and C!

Sensor / primary head

2 Electrical connection: outputs and inputs

2.1 Important information for outputs and inputs   PLEASE NOTE !

- The **output / input groups are galvanically separated from each other** and from all other input and output circuits.
- **Active mode:**   The signal converter supplies the power for operation (activation) of receiver instruments; observe max. operating data.
- **Passive mode:**   Operation (activation) of receiver instruments requires an external power supply **(U$_{ext}$)**; observe max. operating data.
- **Connection diagrams** of outputs and inputs are shown in Sect. 2.7.
- For **operating data** of outputs and inputs, refer to Sect. 2.7 and 5.1.

2.2 I / O assemblies for the outputs and inputs

IFC 300 is available with a choiceof output/input assemblies:
- The **Basic I/O** has one mA, one pulse and 2 status outputs. The pulse output can be set as a status output, and one of the status outputs as a control input (see **Basic I/O table**).
- The **Modular I/O** can be equipped with different output modules, depending on the task (see **Modular I/O table**).
- For **hazardous areas,** all I/O variants are available for the IFC 300 C (compact) and IFC 300 F (remote) with terminal compartment in **EEx - d** (flameproof enclosure) or **EEx - e** (increased safety) protection.
- The **Bus - System I/O** allows intrinsically safe and non-intrinsically safe bus interfaces in combination with further modules (see **Bus - System I/O table**).
- **The last 3 places of the CG No.** indicate the assigned terminals, see examples below.
- **Abbreviations used** are explained in the small table on the next but one page.

Examples of **CG No.** to identify the electronic module and the I/O variants:

$$\underline{\textbf{CG30}}\textbf{*} \_ \_ \underline{\textbf{4}} \_ \_ \qquad \text{(see sticker inside cover of terminal compt)}$$

General **type designation**

Power
Display version

I/O version identified by this place
(here: Modular I/O), fixed assignment of terminals C+D
(according to the 1st place of the CG No.)

1st option module for terminal **A**

2nd option module for terminal **B**
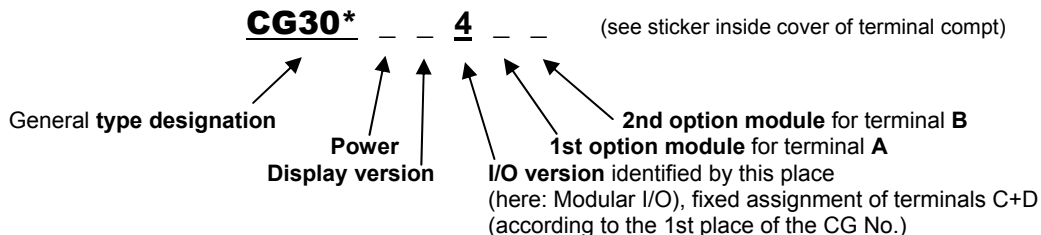
CG No. (examples)

CG 300 11 **100**   100-230 V AC & Standard Display **/ Basic I/O:**
I$_a$ or I$_p$ & S$_p$/C$_p$ & S$_p$ & P$_p$/S$_p$
(see Tabele and Nameplate on the next page)

CG 300 11 **7FK**   100-230 V AC & Standard Display **/ Modular I/O:**
I$_a$ & P$_n$/S$_n$ and option module P$_N$/S$_N$ & C$_N$
(see Tables on the next but one page)

CG 300 81 **4EB**   24 V DC & Standard Display **/ Modular I/O:**
I$_a$ & P$_a$/S$_a$ and option module P$_p$/S$_p$ & I$_p$
(see Tables on the next but one page)

Fixed, unalterable I/Os (input/output versions)

I/Os	CG-No.	D-	D	C-	C	B-	B	A-	A	A+
					Terminals					
Basic Standard	1 0 0	P_p / S_p (changeable)		S_p		S_p / C_p (changeable)		I_p + HART® / or (reverse term.) / I_a + HART®		
EEx - i Option	2 0 0	P_N / S_N NAMUR (changeable)		I_a + HART® active						
	3 0 0	P_N / S_N NAMUR (changeable)		I_p + HART® passive						
	2 1 0	P_N / S_N NAMUR (changeable)		I_a + HART® active		P_N / S_N / C_N NAMUR (changeable)		I_a		
	3 1 0	P_N / S_N NAMUR (changeable)		I_p + HART® passive		P_N / S_N / C_N NAMUR (changeable)		I_a		
	2 2 0	P_N / S_N NAMUR (changeable)		I_a + HART® active		P_N / S_N / C_N NAMUR (changeable)		I_p		
	3 2 0	P_N / S_N NAMUR (changeable)		I_p + HART® passive		P_N / S_N / C_N NAMUR (changeable)		I_p		
PA - Bus **PROFIBUS** (EEx-i) Option	D 0 0	Term PA- / Term PA+ FISCO Device		Term PA- / Term PA+ FISCO Device						
	D 1 0	Term PA- / Term PA+ FISCO Device		Term PA- / Term PA+ FISCO Device		P_N / S_N / C_N NAMUR (changeable)		I_a		
	D 2 0	Term PA- / Term PA+ FISCO Device		Term PA- / Term PA+ FISCO Device		P_N / S_N / C_N NAMUR (changeable)		I_p		
FF - Bus **Foundation** **Field-Bus** (EEx-i) Option	E 0 0	Term V/D- / Terrm V/D+ FISCO Device		Term V/D- / Terrm V/D+ FISCO Device						
	E 1 0	Term V/D- / Terrm V/D+ FISCO Device		Term V/D- / Terrm V/D+ FISCO Device		P_N / S_N / C_N NAMUR (changeable)		I_a		
	E 2 0	Term V/D- / Terrm V/D+ FISCO Device		Term V/D- / Terrm V/D+ FISCO Device		P_N / S_N / C_N NAMUR (changeable)		I_p		

Nameplate inputs/outputs

Example of CG No., here:
BASIC I/O

POWER	PE (FE)	⚠ 📖	CG30*__100 7.12345.XX.00
	L(L+) N(L-)	A = Active P = Passive NC = Not connected	
INPUT / OUTPUT	D - / D	P / P	PULSE OUT / STATUS OUT Imax = 100 mA@f<=10 Hz; = 20 mA@f<=12 kHz Uo = 1,5 V @ 10 mA; Umax = 32 VDC
	C - / C	P / P	STATUS OUT Imax = 100 mA; Umax = 32 VDC
	B - / B	P / P	STATUS OUT / CONTROL IN Imax = 100 mA Uon > 19 VDC; Uoff < 2,5 VDC; Umax = 32 VDC
	A + / A - / A	A / P / A/P	CURRENT OUT (HART) Active (Terminals A & A+); RL max = 1 k ohm Passive (Terminals A & A-); Umax = 32 VDC

Alterable I/Os (input/output versions)

- The grey boxes denote freely selectable option modules for terminals A and B.
- Terminal **A+** functions only for the Basic I/O.
- For **hazardous areas,** all I/O variants for IFC 300 C and IFC 300 F are available with terminal compartment in **EEx - d** (flameproof enclosure) or **EEx - e** (increased safety) protection.

I/Os	CG-No.	Terminals								
		D-	**D**	**C-**	**C**	**B-**	**B**	**A-**	**A**	**A+**
Modular Option	**4** _ _	P_a / S_a (changeable)		I_a + HART® active		max. 2 option modules for term. B + A: I_a or P_a / S_a or C_a				
	8 _ _	P_a / S_a (changeable)		I_p + HART® passive		max. 2 option modules for term. B + A: I_p or P_a / S_a or C_a				
	6 _ _	P_p / S_p (changeable)		I_a + HART® active		max. 2 option modules for term. B + A: I_a or P_p / S_p or C_p				
	B _ _	P_p / S_p (changeable)		I_p + HART® passve		max. 2 option modules for term. B + A: I_p or P_p / S_p or C_p				
	7 _ _	P_N / S_N NAMUR (changeable)		I_a + HART® active		max. 2 option modules for term. B + A: I_a or P_N / S_N or C_N				
	C _ _	P_N / S_N NAMUR (changeable)		I_p + HART® passve		max. 2 option modules for term. B + A: I_p or P_N / S_N or C_N				
PA - Bus **PROFIBUS** Option	**D** _ _	Term PA-	Term PA+	Term PA-	Term PA+	max. 2 option modules for term. B + A: I_a or P_a / S_a or C_p				
FF - Bus **Foundation Field-Bus** Option	**E** _ _	Term V/D-	Terrm V/D+	Term V/D-	Terrm V/D+	max. 2 option modules for term. B + A: I_a or P_a / S_a or C_p				
DP - Bus **PROFIBUS** Option	**F** _ 0	RxD/TxD N	RxD/TxD P	RxD/TxD N	Termin. N	RxD/TxD P	Termin. P	max. 1 option module for term. A: see table below for selection		

Option modules

Abbreviation	Description	Ident for CG No.
I_a	Active current output	**A**
I_p	Passive current output	**B**
P_a / S_a	Active pulse, frequency, status output or limit switch	**C**
P_p / S_p	Passive pulse, frequency, status output or limit switch	**E**
P_N / S_N	Pulse, frequency, status output or limit switch to NAMUR	**F**
C_a	Active control input	**G**
C_p	Passive control input	**K**
C_N	Control input to NAMUR	**H**
-	No module installed	**8**
-	No further module possible	**0**

2.3   Current output

ℹ️	• **Depending on the** version, the **outputs and inputs to be connected passively or actively and / or to NAMUR EN 60947-5-6!** The tables in Sect. 2.2 show which I/O version and which inputs and outputs are installed in your signal converter, see also the sticker inside the cover of the terminal compartment.

- All **current outputs are galvanically separated** from each other and from all other circuits.

- Depending on the version, **up to 3 current outputs in parallel** can be built in, **one always with HART$^®$ communication** (except for Foundation Fieldbus and PROFIBUS).

- **Factory-set data and functions** are given in the enclosed report on settings.

- **All operating data and functions are settable,** see Sect. 4.4.

- **Passive mode**   external power supply $U_{ext} ≤ 32$ V DC bei $I ≤ 22$ mA
- **Active mode**   load impedance $R_L ≤ 1$ kΩ at $I ≤ 22$ mA
                          (not applicable to EEx-i, see separate Ex – operating instructions)

- **Self-monitoring**   - interruption of mA loop or
                          - load impedance too high in mA loop

- **Error message via status output** (see Fct. C 2.x.01).

- **Current value for error identification** adjustable, see Fct. C 2.x.03 (current output).

- **Range change,** automatically by status output or manually by control input, see Sect. 4.4, Fct. C 2.x.11 and C 2.x.12 (for current output) and Fct. C 2.x.01 (for status output or control input).

  Setting range threshold between 5 - 80% of $Q_{100\%}$, ± 0 - 5% hysteresis
  (appropriate ratio from low to high range of 1:20 to 1:1.25).

  The active range is signalled via a status output.

- **Forward / reverse flow measurement** (F/R mode) is possible, see Fct. C 2.x.07 (current output) and Fct. C 2.x.01 (status output).

- **Connection diagrams,** see Sect. 2.7

⚠️	**Warning!**	All directions, operating data and connection diagrams do not apply to devices used in hazardous areas; in such cases, **read the special "Ex" operating instructions without fail!**

2.4 Pulse and frequency output

<table>
<tr><td>📖ℹ️</td><td>• Depending on the version, outputs and inputs to be connected passively or actively and/or to NAMUR EN 60947-5-6. The tables in Sect. 2.2 show which I/O version and which inputs and outputs are installed in your signal converter. See also the sticker inside the cover of the terminal compartment.
• The pulse or frequency output can be set under Fct. C 2.1 Hardware.</td></tr>
</table>

- All **pulse / frequency outputs are galvanically separated** from all other circuits and from each other.

- Depending on the version, **several pulse / frequency outputs** can be installed **in parallel**.

- **Factory-set data and functions** will be found in the enclosed report on factory settings.

- **All operating data and functions are adjustable,** see Sect. 4.4.

- **Passive mode**   requires external power source: $U_{ext} \leq$ 32V DC U_o 1.5V @ 10 mA: $I \leq$ 20 mA at $f \leq$ 10 kHz (overflow up to $f_{max} \leq$ 12 kHz) $I \leq$ 100 mA at $f \leq$ 100 Hz

- **Active mode**   uses internal power source: U_{nom} 24 V DC U_o 1.5V @ 10 mA $I \leq$ 20 mA at $f \leq$ 10 kHz (overflow up to $f_{max} \leq$ 12 kHz) $I \leq$ 100 mA at $f \leq$ 100 Hz

- **NAMUR mode**   passive to EN 60947-5-6, $f \leq$ 10 kHz, $f_{max} \leq$ 12 kHz

- **Scaling**   <u>Frequency output: in pulses per unit time</u> (e.g. 1000 pulses/s at $Q_{100\%}$ <u>Pulse output: in pulses per unit volume</u> (e.g. 100 pulses/m³).

- **Pulse width**   <u>symmetrical</u>, pulse duty factor 1:1, independent of output frequency, <u>automatic</u>, with fixed pulse width, duty factor approx. 1:1 at $Q_{100\%}$, or <u>pulse width von 0.01-2 s</u> adjustable as required for correspondingly low output frequency.

- **Forward / reverse flow measurement** (F/R mode) is possible, see Fct. C 2.x.06 or 07 Polarity (frequency/pulse output) and Fct. C 2.x.01 Mode (status output).

- **Connection diagrams** see Sect. 2.7

<table>
<tr><td>⚠️</td><td>Warning!</td><td>All directions, operating data and connection diagrams do not apply to devices used in hazardous areas; in such cases,
read the special "Ex" operating instructions without fail!</td></tr>
</table>

2.5 Status output and limit switches

[i]	• **Depending on the version,** the **outputs and inputs to be connected passively or actively and/or to NAMUR EN 60947-5-6!** The tables in Sect. 2.2 show which I/O version and which inputs and outputs are installed in your signal converter. See also the sticker inside the cover of the terminal compartment. • **Status output or limit switch** can be **set under Fct. C 2.1 Hardware.**

- All **status outputs / limit switches are galvanically separated** from all other circuits and from each other.

- Depending on the version, **several status outputs / limit switches** can be installed **in parallel**.

- **The output stages of the status outputs / limit switches** in simple active or passive mode **act in the same way as relay contacts** and can be connected with any polarities.

- **Factory-set data and functions** are given in the enclosed report on settings.

- **All operating data and functions are adjustable,** see Sect. 4.4.

- **Passive mode**   requires external power source:
  $U_{ext} \leq$ 32V DC: U_o 1.5V @ 10 mA $I \leq$ 100 mA
- **Active mode**   uses the internal power supply:
  U_{nom} 24 V DC U_o 1.5V @ 10 mA: $I \leq$ 100 mA
- **NAMUR mode**   passive in conformity with EN 60947-5-6

- **Status output** (adjustable to following operating states, see, Fct. C 2.x.01):

- Application error	- output A	Fct. C 2.x.02 appears only
- Uncertain measurement	- output B	when output A - D set under
- Polarity, flow (F/R mode/measurement)	- output C	Fct. C 2.x.01:
- Overrange, flow	- output D	
- Counter 1 preset value	- off	- sign
- Counter 2 preset value		- overrange
- Empty pipe		- automatic range

- **Limit switches** (adjustable to following operating states, see Fct. C 2.x.01):

- Flow velocity	- Conductivity
- Volume flow	- Coil temperature
- Mass flow	

- Setting of limit value and hysteresis	Fct. C 2.x.02
- Polarity of measured value	Fct. C 2.x.03
- Time constant	Fct. C 2.x.04

- **Connection diagrams,** see Sect. 2.7

⚠	**Warning!**	All directions, operating data and connection diagrams do not apply to devices used in hazardous areas; in such cases, **read the special "Ex" operating instructions without fail!**

2.6 Control input

	Depending on the version, the outputs and inputs to be connected passively, actively and/or to NAMUR EN 60947-5-6. The tables in Sect. 2.2 show which I/O version and which inputs and outputs are installed in your signal converter. See also the sticker inside the cover of the terminal compartment.

- All **control inputs are galvanically separated** from all other circuits and from each other.

- Depending on the version, **two control inputs** can be installed **in parallel**.
  If two are installed, these have to be set to different functions.

- In the passive mode, the **control inputs** can be operated with any polarity.

- **Factory-set data and functions** are given in the enclosed report on settings.

- **All operating data and functions are adjustable,** see Sect. 4.4.

- **Passive mode**   requires external power source:
  $U_{ext} \leq 32V$ DC: U_{on} 19 V DC U_{off} 2.5 V DC

- **Active mode**   uses the internal power supply:
  U_{nom} 24 V DC I_{nom} 16 mA

- **NAMUR mode**   to EN 60947-5-6
  (Control input active in accordance with NAMUR EN 60947-5-6:
  open-circuit and short-circuit monitoring to EN 60947-5-6 (NAMUR) can only be done from the infeeding device. Due to the principle involved, only monitoring of control input C_N takes place in the signal converter.)

- **Status output** (adjustable to following operating states, see Fct. C 2.x.01):
  - off   - zero output + stop Cnt. (not display)
  - stop all counters   - all outputs zero (not display, not counters)
  - stop counter 1 or 2   - output A, B, C or D zero
  - reset all counters   - hold all outputs (not display, not counters)
  - reset counter 1 or 2   - hold output A, B, C or D
  - error reset   - range change

- **Connection diagrams,** see Sect. 2.7

	Warning!	All directions, operating data and connection diagrams do not apply to devices used in hazardous areas; in such cases, **read the special "Ex" operating instructions without fail!**

Notes

2.7 Connection diagrams of outputs and inputs

> ⚠ • **Please note:** Depending on the version, connect the outputs and inputs passively, actively and/or to NAMUR EN 60947-5-6.
>
> • The tables in Sect. 2.2 show which I/O version and which outputs and inputs are installed in your signal converter. **Please note the operating data!**
>
> • The following **connection diagrams and operating data do not apply to hazardous-duty equipment (EEx)**; refer to separate operating instructions for such equipment.
>
> • **Active mode:** The IFC 300 supplies the power for operating (driving) the receiver instruments; note max. operating data.
>
> • **Passive mode:** An external power source (U_{ext}) is required to operate (drive) the receiver instruments.
>
> • **All groups** are **galvanically separated** from each other and from all other input and output circuits.
>
> • **Terminals that are not used** should not have any conductive connection to other electrically conductive parts.

I_a	I_p	Current output active or passive
P_a	P_p	Pulse / frequency output active or passive
P_N		Pulse / frequency output passive to NAMUR EN 60947-5-6
S_a	S_p	Status output / limit switch active or passive
S_N		Status output / limit switch passive to NAMUR EN 60947-5-6
C_a	C_p	Control input active or passive
C_N		Control input **active** to NAMUR EN 60947-5-6: open-circuit and short-circuit monitoring in accordance with EN 60947-5-6 (NAMUR) can only be done from the infeeding device. Due to the principle involved, only monitoring of control input C_N takes place in the signal converter.

Milliammeter
0 - 20 mA or 4 - 20 mA and others

Counter
• electronic (EC) or
• electromechanical (EMC)

Button, N/O contact or similar

DC voltage source (U_{ext})
external power supply, any connection polarity
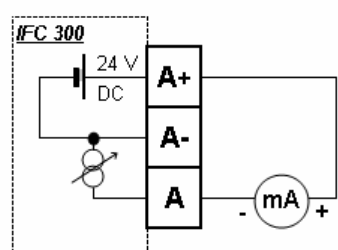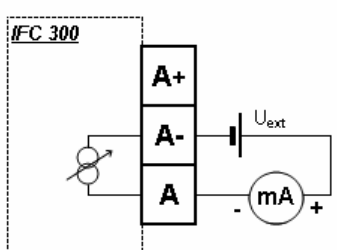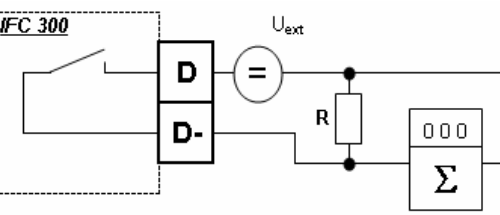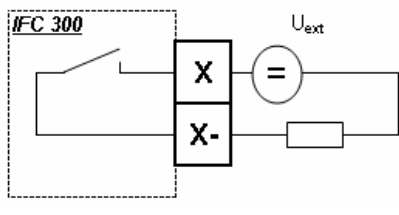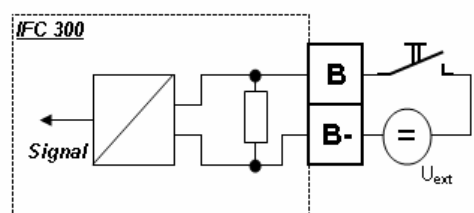
DC voltage source (U_{ext})
Connection polarity as shown in the diagrams
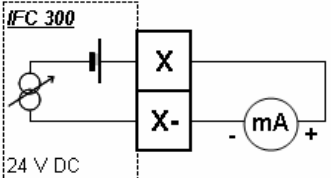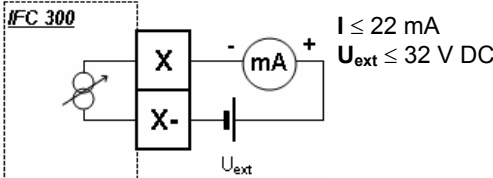
> ⚠ **Warning!** All directions, operating data and connection diagrams do not apply to devices used in hazardous areas; in such cases, **read the special "Ex" operating instructions without fail!**
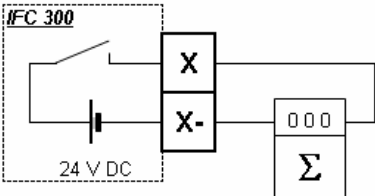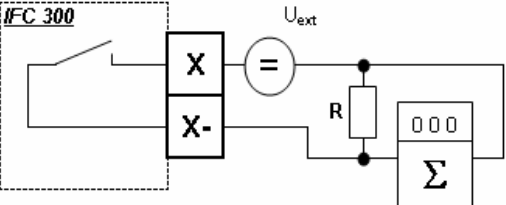
1 **Current output active I_a HART®**	**2** **Current output passive I_p HART®**

$I \leq 22$ mA
$R_L \leq 1$ kΩ

HART® connection to Diagr. 16

$I \leq 22$ mA
$U_{ext} \leq 32$ V DC

HART® connection to Diagr. 17

3 **Pulse / frequency output passive P_p**	**4** **Status output / limit switch passive S_p**

$\underline{f \leq 10 \text{ kHz:}}$ $I \leq$ 20 mA
$\underline{f \leq 100 \text{ Hz:}}$ $I \leq 100$ mA

U_0 1.5 V @ 10 mA
$U_{ext} \leq 32$ V DC

R = 1.2 kΩ / 0.5 W, only necessary when using electronic totalizer with internal resistance of $R_i > 5$ kΩ

can also be set as status output, in which case electrical connection is acc. to Diagram 4

U_0 1.5 V @ 10 mA

$U_{ext} \leq 32$ V DC
$I \leq 100$ mA

X = terminals **B** or **D**

5 **Control input passive C_p**	

$U_{on} > 19$ V DC
$U_{off} < 2.5$ V DC

$U_{ext} \leq 32$ V DC
I_0 16 mA @ 24 V

can also be set as status output, in which case electrical connection acc. to Diagram 4
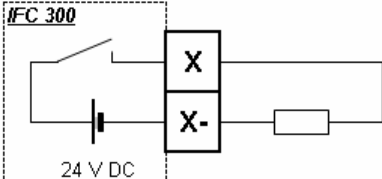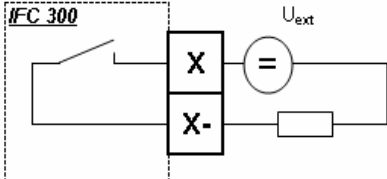
X marks the terminals A, B, C or D, depending on the version of the IFC 300,
see tables in Sect. 2.2.

i	For electrical connection of the Bus Systems, please consult the separate manuals for Foundation Fieldbus, PROFIBUS PA oder DP.

6 Current output active I_a (HART[®])	**7** Current output passive I_p (HART[®])

$I \leq 22$ mA
$R_L \leq 1$ kΩ

$I \leq 22$ mA
$U_{ext} \leq 32$ V DC

i	**Please note:** Only the current output module for terminals C / C- has **HART capability**, see Diagrams 16 and 17!

8 Pulse / frequency output active P_a	**9** Pulse / frequency output passive P_p

$\underline{f \leq 10 \text{ kHz:}}$ $I \leq$ 20 mA
$\underline{f \leq 100 \text{ Hz:}}$ $I \leq 100$ mA

U_0 1.5 V @ 10 mA

U_{nom} 24 V DC

$\underline{f \leq 10 \text{ kHz:}}$ $I \leq$ 20 mA
$\underline{f \leq 100 \text{ Hz:}}$ $I \leq 100$ mA

U_0 1.5 V @ 10 mA

$U_{ext} \leq 32$ V DC

R = 1.2 kΩ / 0.5 W, only necessary when using electronic totalizer with internal resistance of $R_i > 5$ kΩ

10 Status output / limit switch active S_a	**11** Status output / limit switch passive S_p

U_0 1.5 V @ 10 mA

$I \leq 100$ mA
U_{nom} 24 V DC

U_0 1.5 V @ 10 mA

$U_{ext} \leq 32$ V DC
$I \leq 100$ mA

12 **Control input active C_a**	**13** **Control input passive C_p**
I$_{nom}$ 16 mA **U**$_{nom}$ 24 V DC	U_{on} > 19 V DC U_{off} < 2.5 V DC **U**$_{ext}$ ≤ 32 V DC **I**$_{nom}$ 16 mA
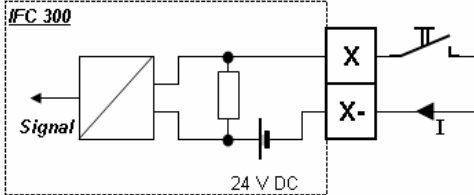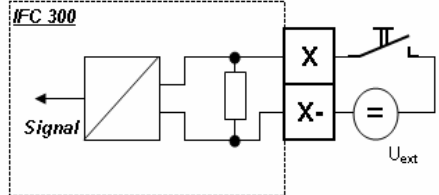
14   **Pulse, frequency and status output / limit switch   passive P_N / S_N**
       to NAMUR   EN 60947-5-6
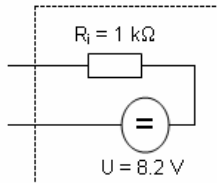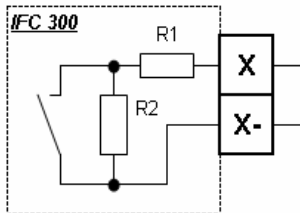
Switching amplifier to NAMUR with internal voltage source

15   **Control input   active C_N**
       to NAMUR   EN 60947-5-6
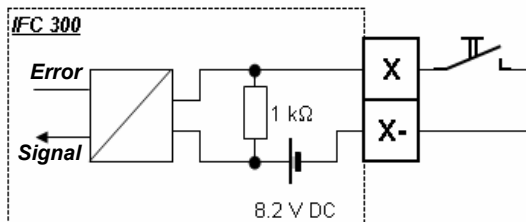
	• In the **Basic I/O,** the current output at terminals A+ / A- / A is always HART capable!
	• In the **Modular I/O,** only the current output module for terminals C / C - is HART-capable!

---

16 I_a **HART**® **connection active**

A+	A

only with **Basic I/O** terminals A+ / A

C	C-

only with **Modular I/O** terminals C / C-

R — to HART Communicator

$R \geq 230 \ \Omega$

---
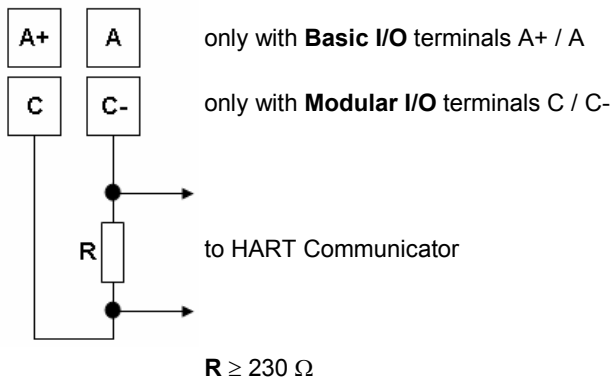
17 I_p **HART**® **connection passive**

A	A-
C	C-

only with **Basic I / O** terminals A / A-

only with **Modular I/O** terminals C / C-

C	C-

to next HART® device

I U_{ext} I

R — to HART Communicator

I:	$I_{0\%} = 4$ mA
Multidrop I:	$I_{fix} = 4$ mA
$U_{ext} \leq 32$ V DC	$R \geq 230 \ \Omega$
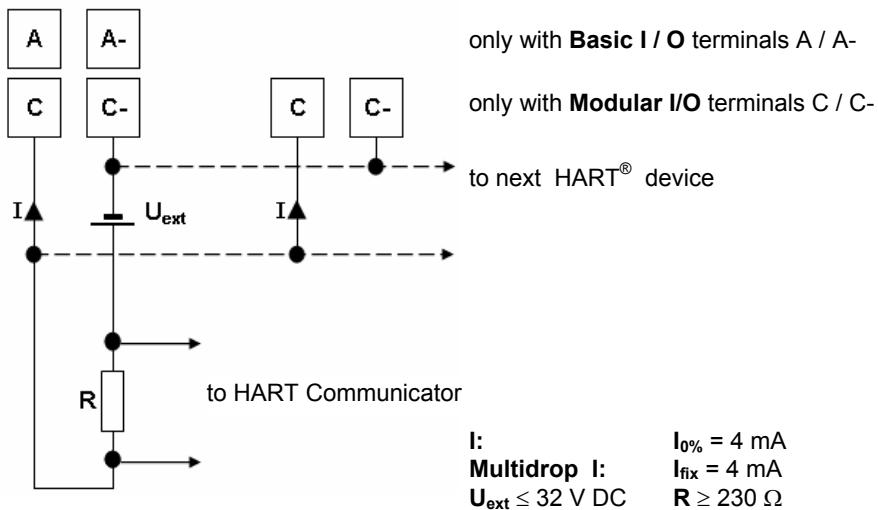
3   Start-up

- Before connecting to power, please check that the system has been correctly installed in accordance with Sect. 1 and 2.

- The flowmeter, comprising sensor (primary head) and signal converter, is delivered in ready-to-operate condition. All operating data have been factory-set according to your order specifications, see supplied report on settings.

- After switching on the power, a self-test is carried out,
  after which the flowmeter immediately starts flow measurements and the display indicates the current measured values.

- Alternating between the 1st and 2nd measured value window and – if provided - the list of status messages is carried out by actuating key ↑ or ↓. Possible status messages, their meaning and possible cause are listed in the Status Table in Sect. 4.8.

- The display of the IFC 300 C and IFC 300 F can be turned in steps of 90°.
  Unscrew the cover of the electronic compartment and remove the two metal clips to the left and right of the display using a screwdriver or similar tool. The display between the metal clips can then be pulled off and re-inserted in the required position. Before pushing the clips together with the display into the electronic compartment, make sure not to kink the display`s flat ribbon cable more than absolutely necessary.
  Replace cover and tighten by hand.

  Cover threads to be protected from dirt and well greased at all times;
  This is particularly important for hazardous-duty (Ex) versions.

4 Operator control of the signal converter

4.1 Display, operating and control elements
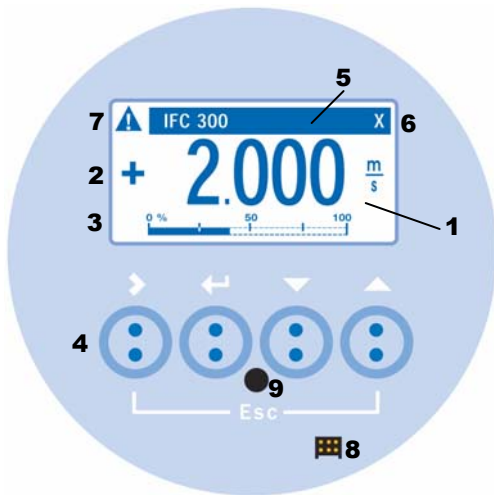
1 **Graphics display**, backlit (white)

2 **1st and 2nd display line** to indicate different measured variables,
shown here in large format for only one measured variable

3 **3rd display line**, shown here as bar graph

4 **Optical keys** for operating the signal converter without opening the housing

5 **Blue bar** indicates …
• the tag no. in the measuring mode
• the menu/ function name in the setting mode

6 **X** indicates actuation of a key

D) indicates IR transmission in operation; the 4 optical keys then have no function

7 ⚠ signals a status message in the status list

8 **Socket** for connection to the KROHNE GDC bus

9 **Optical interface** for wireless transfer of data (input / output)

• Display –
for selection of menu and functions

1 ⚠ indicates status messages, if any
2 Marker indicates position in the menu/function lists
3 Higher-level menu (with No. in Setup Menu only)
4 Indicate beginning and end of menu/function lists
5 Current menu, open with →
6 Not indicated in Menu Mode
7 Next selectable menu
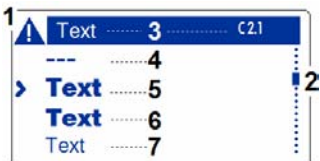
• Display –
for setting of data, functions, etc.

8 Current menu/function (with No. only in Setup Menu)
9 Indicator for factory settings
10 Factory setting (for info only, unalterable) of current (sub-) function to be changed
11 Current (sub-) function, open with →
12 Currently set value, unit or function (when selected, shown as white characters on blue background)
13 Indicator for allowable range of values
14 Allowable range of values, only in case of numerical values or next function

• Display after data, functions, etc.
have been changed

15 Indicator for changing a (sub-) function; allows simple check of changed data when scrolling through the (sub-) function lists.

4.2   Function of keys

Keys	Meas. mode	Menu mode	Function mode	Data mode
▼ ▲	Alternate between display measured value pages 1 + 2 and status list(s), if provided	Select menu	Select function or (sub) function	Blue cursor … • change <u>number</u> • change <u>unit</u> • change <u>property</u> • change <u>decimal point</u>
>	Switch from measuring mode to menu mode, press key for 2.5 s, then "Quick-Start" menu displayed	Entry into selected menu displayed, then 1st function of menu displayed	Entry into displayed, selected function or subfunction	For numerical values, move cursor (blue) one place to the right
↵	-	Return to measuring mode, preceded by query whether changed data to be accepted	Press 1 - 3 times, return to menu mode **with** data acceptance	Return to function or subfunction **with** acceptance of data
Esc (> ▲)	-	-	Return to menu mode **without** data acceptance	Return to function or subfunction **without** data acceptance

Time-out function

• <u>in Operator Control mode</u>
  After **5 minutes** without key op.,
  return to meas. mode, without
  acceptance of prev. changed data.

• <u>in Test Menu mode</u>
  after **60 minutes** without key op.,
  return to meas. mode without
  acceptance of prev. changed data.

• <u>with GDC IR-Interface mode</u>
  After the IR-Interface has been activated
  in Fct. 4.7.06, the interface must be
  correctly positioned and affixed with the
  suction cups on the pane of the housing
  within **60 seconds.**

Mounting: GDC IR - Interface
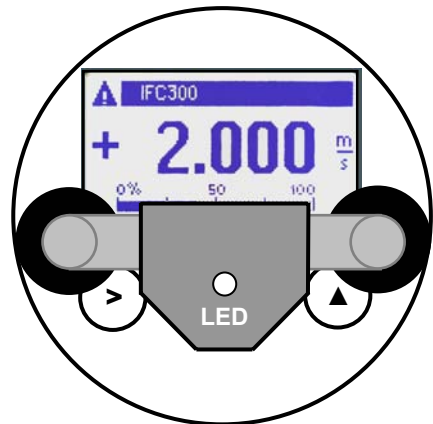
Optical IR-Interface for PC-supported
communication with the signal converter;
adapter for the optical interface option:
see Sect. 4.4, Fct. 4.7.06.

⚠ **Please note:**   The operating point of the 4 optical keys is located directly behind the glass pane. The most reliable way is to actuate the keys perpendicular to the front. Actuation from the side can lead to inadvertent wrong operation.

4.3 Structure of KROHNE program for EMFs

Meas. mode	Select menu	Select function and / or subfunction	Set data

↵ > actuate for 2.5 s

A Quick Setup

A 1 Language	
A 2 Measuring point (tag)	
A 3 Error reset	
A 4 Unit	
A 5 Measuring range	only for current output with HART®, connection to terminals A or C
A 6 Time constant	
A 7 Low flow cutoff	
A 8 Unit for pulse value	only for pulse output connection to terminals D
A 9 Value per pulse	
A10 GDC IR interface	

B Test

B 1 Flow velocity
B 2 Volume rate of flow
B 3 - B 6 Outputs to terminals A - D
B 7 Operating hours
B 8 - B 13 act. flow velocity, electronics temp. coil temp., conductivity, noise, flow profile

C Setup

C 1 Process input	**1.1** Calibration
	1.2 Filter
	1.3 Self-test
	1.4 Information
	1.5 Simulation
C 2 I / O	**2.1** Hardware
	2.x Current output
	2.x Freq. output
	2.x Pulse output
	2.x Status output
	2.x Limit switch
	2.x Control input
	2.6 Counter 1
	2.7 Counter 2
C 3 Communication	**3.1** HART
C 4 Device	**4.1** Device info
	4.2 Display
	4.3 M.V. page 1
	4.4 M.V. page 2
	4.6 Special function
	4.7 Units

Function of keys in and between the columns

> ↵ ▼ ▲   > ↵ ▼ ▲   > ↵ ▼ ▲   ▼ ▲ >

4.4 Table of settable functions

- For your guidance, all menus and functions in the following tables
  are marked with letters and numbers.
- **NOTE!** These markings appear in the display only in **Setup Menu C**.

A   Quick Setup - Level

No.	Text displayed	Description and settings	
A 1	**Language**	Description as for C 4.2.01	
A 2	**Measuring point**	Description as for C 4.1.01	
A 3	**Error reset**	Description as for C 4.6.01	
A 4	**Unit**	Description as for C 4.7	
A 5	**Measuring range**	Description as for C 2.x.06	Settings act only on the HART® capable current output conn. to Term. A or C (x = terminal for current output: 2 = Term. A, 4 = Term. C)
A 6	**Time constant**	Description as for C 2.x.10	
A 7	**Low flow cutoff**	Description as for C 2.x.09	
A 8	**Unit for pulse value**	Description as for C 2.5.05	Settings act only on the pulse output conn. to Term. D
A 9	**Value per pulse**	Description as for C 2.5.06	
A 10	**GDC IR interface**	Description as for C 4.6.06	

B   Test - Level

⚠ **CAUTION!**
In this mode, outputs indicate the test values, not the measured values. Therefore, if receiver instrumentation connected up, observe plant safety regulations!
Switch off alarms, set regulators to manual control, etc.

No.	Text displayed	Description and settings
B 1	**Flow velocity**	
	Simulation of flow	• **Set value** confirm with ↵ and set value Range: -12.00 … +12.00 m/s, confirm with ↵ • **No** • **Yes** select and confirm or start test with ↵ , Value is indicated - Terminate test with ↵ ··· • **Cancel** Exit test function with ↵
B 2	**Volume flow**	Same as B1 above but with selected vol. unit, see Fct. C 4.7.01
		In the following descriptions of outputs/inputs, "**x**" stands for one of the 4 terminals A, B. C or D (Fct. No. B 3 - B 6)
B x	**Current output x**	For control of these test functions see B 1 "flow velocity" above, but with appropriate physical unit:: • current output in mA, • frequency output in Hz, • pulse output in pulses/unit. The set value is present at the output.. Note that max. frequency is 10 Hz (pulses) for electromechanical counters!
B x	**Frequency output x**	
B x	**Pulse output x**	
B x	**Status output x**	Simulation A, B, C or D: • **off** • **cancel** • **on** select and confirm with ↵ • **No** • **Yes** confirm or start simulation with ↵ , Status is indicated: 0 = off / 1 = on - Terminate test with ↵
B x	**Limit switch x**	
B x	**Control input x**	
B 7	**Operating hours**	Indicate the current value, Exit display with ↵
B 8 B 9 B 10 B 11 B 12 B 13	**Act. flow speed Act. coil temp. Electron. temp. Act. conductivity * Act. electr. noise * Act. flow profile ***	**"current measured values"** indication (***** only visible when Fct. C 1.3.01, C 1.3.13 and C 1.3.10 activated) Terminate indication(s) with ↵

C   Setup - Level

<table>
<tr><td>⚠</td><td>CAUTION!
When set functions and values are changed, output values and displayed values can change abruptly. Therefore if receiver instrumentation connected up, observe plant safety regulations! Switch off alarms, set regulators to manual control, etc.</td></tr>
</table>

No.	Text displayed	Description and settings
C 1	**Process input**	
C 1.1	**Calibration**	
C 1.1.01	**Zero calibration**	Display of current zero value, continue with →, Query: calibrate zero? <u>Select with ↑ or ↓</u> : • **Cancel** return with ↵ . • **Automatic** continue with ↵, time counts down, measurement of current flow velocity for new zero value. • **Standard** press ↵ to set to factory-set zero value. • **Manual** continue with ↵, display of last set value, use → ↑ ↓ to set new value (range -1 m/s < zero < +1 m/s), *(preferably use "Automatic",* *Before calibration, set "zero" flow in the pipeline!)*
C 1.1.02	**Size**	<u>Select from table:</u> • **DN 2.5 - 3000 mm** [= 0.1 - 120 inch]
C 1.1.03	**GK selection**	<u>Select:</u> • **GK + GKL** • **GK** • **GKL** • **GKH** Set acc. to sensor nameplate.
C 1.1.04	**GK**	C 1.1.04, 05 or 06 will appear, depend. on selection in Fct. C 1.1.03
C 1.1.05	**GKL**	<u>Set value:</u> • **0.5 ≤ value ≤ 12 (20)**
C 1.1.06	**GKH**	Set value(s) given on nameplate of connected sensor.
C 1.1.07	**Coil resistance Rsp.**	• **xxx.xx Ohm** (setting range 10 ohms < value < 220 ohms at 20°C)
C 1.1.08	**Calib. coil temp.**	Calibration of field coil temperature indicator, Continue with →, **"Set coil temp."**, <u>select with ↑ or ↓</u> : • **Cancel** return with ↵ . • **Automatic** continue with ↵, display of current coil temperature, Set with → ↑ ↓ (range -40.0…+200 °C / -40…+390 °F). • **Standard** press ↵ to set to standard value = 20°C <u>Display "Enter resistance", select with ↑ or ↓</u> : • **Cancel** return with ↵ • **Automatic** continue with ↵, measure and set to current coil resistance, continue with ↵ • **Standard** press ↵ to set to value from Fct. C 1.1.07 (see above)
C 1.1.09	**Density**	To calculate mass flow at constant density of product • **x.xxxx kg/l** (setting range 0.1 kg/l < value < 5.0 kg/l equivalent to 0.8 lb/gal < value < 4.2 lb/gal)
C 1.1.10	**Target conductivity**	Set reference value for calibration, range 1.000 … 9999 µS/cm
C 1.1.11	**EF electr. factor**	For conductivity indication "calibrate EF?" (values can be changed!) <u>Select:</u> • **Cancel** • **Automatic** • **Standard** • **Manual** (accept with ↵) • **xx.xx mm** (setting range 0.10 mm ≤ value ≤ 30.00 mm equivalent to 0.004" ≤ value ≤ 01.20 ")
C 1.1.12	**Number of electrodes**	<u>Select:</u> (see sensor nameplate for details) • **2 electrodes** (standard) • (optional) **3** or **4 electrodes**
C 1.1.13	**Field frequency**	= line frequency × value (from following list), <u>Select</u> (see sensor nameplate) • **2** • $^4/_3$ • $^2/_3$ • **½** • **¼** • $^1/_6$ • $^1/_8$ • $^1/_{12}$ • $^1/_{18}$ • $^1/_{36}$ • $^1/_{50}$
C 1.1.14	**Select settling** (for special applications)	<u>Select:</u> • **Standard** (fixed allocation) • **Manual** (settling time field current) enter time manually
C 1.1.15	**Settling time**	only when "Manual" selected under C 1.1.14: • **xxx.x ms** (setting range 1 ms ≤ value ≤ 250 ms)
C 1.1.16	**Line frequency**	<u>Select:</u> • **Automatic** • **50 Hz** • **60 Hz**

	CAUTION
⚠	When set functions and values are changed, output values and displayed values can change abruptly. Therefore if receiver instrumentation are connected up, observe plant safety regulations. Switch off alarms, set regulators to manual control, etc.

No.	Text displayed	Description and settings
C 1.2	**Filter**	

C 1.2.01	limitation	All flow values (incl. peaks) limited to set value, before smoothing by time constant
		• - xxx.x m/s … + xxx.x m/s (1st value < 2nd value)
		Setting range 1st value: - 100.0 m/s $\leq$ value $\leq$ - 0.001 m/s
		                2nd value: + 0.001 m/s $\leq$ value $\leq$ + 100.0 m/s
		  equivalent to 1st value: - 328.1 ft/s $\leq$ value $\leq$ - 0.001 ft/s
		                2nd value: + 0.001 ft/s $\leq$ value $\leq$ + 328.1 ft/s

C 1.2.02	**Flow direction**	Define polarity of flow values <u>Select:</u> • **normal direction** (= direction of arrow on sensor) • **opposite direction**
C 1.2.03	**Time constant**	• **xxx.x s** (setting range 000.0 s < value < 100.0 s) acts on all flow displays and outputs
C 1.2.04	**Pulse filter**	<u>Select:</u> • **off** • **on** (suppresses noise due to solids, air/gas bubbles and sudden changes in pH)
C 1.2.05	**Pulse width**	Appears only when Fct. C 1.2.04 activated! • **xxx.x s** (setting range 0.01 s < value < 10 s) length of interference/delays to be suppressed on sudden changes in flow.
C 1.2.06	**Pulse limitation**	Appears only when Fct. C 1.2.04 activated! • **xxx.x m/s** (setting range 0.01 s < value < 100 m/s) dynamic limitation from one measured value to the next
C 1.2.07	**Noise filter**	<u>Select:</u> • **off** • **on** (suppresses noise at low conductivity, high solids contents, many air/gas bubbles and chemically inhomogeneous media)
C 1.2.08	**Noise level**	Appears only when Fct. C 1.2.07 activated! • **x.xxx m/s** (define noise range: 0.010 m/s < value 10.00 m/s equivalent to 0.032 ft/s < value 32.81 ft/s)
C 1.2.09	**Noise suppression**	Appears only when Fct. C 1.2.07 activated! • **1 … 10** set noise suppression factor
C 1.2.10	**Low flow cutoff**	• **x.xxx m/s ±x.xxx m/s** (setting range 0.000 m/s < value < 10.00 m/s) 2nd value (= hysteresis) $\leq$ 1st value / acts on all outputs

⚠	**CAUTION** When set functions and values are changed, output values and displayed values can change abruptly. Therefore, if receiver instrumentation is connected up, observe plant safety regulations. Switch off alarms, set regulators to manual control, etc.

No.	Text displayed	Description and settings
C 1.3	**Self test**	

C 1.3.01	**Empty pipe**	• **OFF**
		• **Conductivity** (conductivity measurement ON)
		• **Cond.+empty pipe [A]** (cond.meas. and empty pipe indication)
		                    Error category "Application":
		                    Flow indication "zero" when pipe empty
		• **Cond.+empty pipe [U]** (cond.meas. and empty pipe indication)
		                    Error category "uncertain measurement":
		                    Flow indication "not zero" when pipe empty

C 1.3.02	**Limit empty pipe**	Appears only when "Cond. + empty pipe [..]" activated in Fct. C 1.3.01 • **xxx.x µS/cm** (setting range 0.0 µS/cm < value < 9999 µS/cm) Here, set max. 50% of the lowest conductivity occurring in operation, "Empty pipe" is indicated when conductivity drops below set value in the measuring mode
C 1.3.03	**Act. conductivity**	Display of current conductivity (only when Fct. C 1.3.01 is activated)
C 1.3.04	**Full pipe**	• **off** • **on** by way of electrode impedance measurement (see Fct. C 1.1.08) **Note:** Fct.C1.3.03+04 only with special sensor version - 4 electrodes!
C 1.3.05	**Limit full pipe**	Appears only when "full pipe" activated in Fct. C 1.3.04 • **xxx.x µS/cm** (setting range 0.000 µS/cm ≤ value ≤ 9999 µS/cm)
C 1.3.06	**Linearity**	• **off** • **on** Linearity test with 2 field currents, (appears only when GK and / or GKL set, see Fct. C 1.1.03)
C 1.3.07	**Act. linearity**	Display of current linearity (only when Fct. C 1.3.06 activated)
C 1.3.08	**Gain**	• **off** • **on** (cyclic test incl. analog preamplifier)
C 1.3.09	**Coil current**	• **off** • **on** (cyclic test of field current)
C 1.3.10	**Flow profile**	• **off** • **on** (test of flow profile via inhomogeneous magnetic field)
C 1.3.11	**Limit flow profile**	Appears only when "flow profile" activated in Fct. C 1.3.10 • **xx.xxx** (setting range: 0.000 ≤ value ≤ 10.000) This value determines the degree of distortion for an error message
C 1.3.12	**Act. flow profile**	Display of the current value (only when Fct. C 1.3.10 activated)
C 1.3.13	**Electrode noise**	• **off** • **on** (test of electrode voltage noise)
C 1.3.14	**Limit noise**	• **xxx.x m/s** (setting range: 0.000 m/s ≤ value ≤ 12.000 m/s equivalent to 0.000 ft/s ≤ value ≤ 39.370 ft/s)
C 1.3.15	**Act. electr. noise**	Display of the current noise reading (only when Fct. C 1.3.13 activated)
C 1.3.16	**Settling of field**	• **off** • **on**
C 1.4	**Information**	
C 1.4.01	**Liner**	Select from list, set according to details on sensor nameplate
C 1.4.02	**Electr. material**	Select from list, set according to details on sensor nameplate
C 1.4.04	**Serial no. sensor**	Setting as indicated on sensor nameplate
C 1.4.05	**V No. sensor**	Setting as indicated on sensor nameplate
C 1.5	**Simulation**	
C 1.5.01	**Flow speed**	Sequence, see Test Level Menu, Fct. B 1 above
C 1.5.02	**Volume flow**	Sequence, see Test Level Menu, Fct. B 2 above

No.	Text displayed	Description and settings
C 2	**I / O**	
C 2.1	**Hardware**	
C 2.1.01	**Terminals A**	Assignment of terminals A - D dependent on IFC 300 version:
C 2.1.02	**Terminals B**	Outputs: • **current** • **frequency** • **pulse** • **status** • **limit value**
C 2.1.03	**Terminals C**	Input: • **control**
C 2.1.04	**Terminals D**	• **off** (input and/or output switched off)
		In the following descriptions of the current output, "**x**" denotes the <u>terminals</u>: C 2.**2** = <u>A</u> C 2.**3** = <u>B</u> C 2.**4** = <u>C</u>
C 2.x	**Current output X**	
C 2.x.01	**Range 0% … 100%**	• **xx.x … xx.x mA** (setting range 0.00 mA $\leq$ value $\leq$ 20.0 mA) **0 mA $\leq$ 1st value $\leq$ 2nd value $\leq$ 20 mA**
C 2.x.02	**Extended range**	• **xx.x … xx.x mA** (setting range 3.5 mA $\leq$ value $\leq$ 21.5 mA) **0 mA $\leq$ 1st value $\leq$ 2nd value $\leq$ 21.5 mA**
C 2.x.03	**Error current**	• **xx.x mA** (setting range 0.00 mA $\leq$ value $\leq$ 22.0 mA) **0 mA $\leq$ value $\leq$ 25 mA** (outside the overrange)

C 2.x.04	**Error condition**	• **Application fault** • **fault in device** • **uncertain measurement**
		  condition for fault current: fault in the selected and in higher
		                   fault categories, see Sect. 4.10

C 2.x.05	**Measurement**	• **Volume flow rate** • **mass flow rate** • **coil temperature** • **flow velocity** • **conductivity** • **off**
C 2.x.06	**Range**	**0 … xx.xx** (format and unit dependent on measured variable, see C 2.x.05)
C 2.x.07	**Polarity**	• **both polarities** • **positive polarity** • **negative polarity** • **absolute** choice of meas. value polarity, note flow direction, see C 1.2.02
C 2.x.08	**Limitation**	**± xxx … ± xxx %** (setting range -150 % $\leq$ value $\leq$ +150 %)

C 2.x.09	**Low flow cutoff**	**xx.x ± xx.x %** (setting range**: 0.0 % … 20 %**)
		               1st value = operating point
		               2nd value = hysteresis
		               (condition: 2nd value $\leq$ 1st value)

C 2.x.10	**Time constant**	**xxx.x s** (setting range 000.1 s … 100.0 s)

C 2.x.11	**Special function**	• **OFF** (= switched off)
		• **Automatic range** (= switched on) for indication
		               Activate status output accordingly
		• **External range** (= switched on) for external range change
		               Activate control input accordingly

C 2.x.12	**Range setting**	Appears only when Fct. C 2.x.11 activated, see above.
		Set switching point for automatic range or external range; defines the rangeability
		xx.x ± xx.x % (setting range**: 5.0 % … 80 %**)
		               1st value = operating point
		               2nd value = hysteresis
		               (condition: 2nd value $\leq$ 1st value)

C 2.x.14	**Simulation**	Sequence, see Test Level Menu, Fct. B 1 above

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No.	Text displayed	Description and settings
		In the following descriptions for the frequency output, "**x**" denotes the <u>terminals</u>: C 2.**2** = <u>A</u> C 2.**3** = <u>B</u> C 2.**5** = <u>D</u>
C 2.x	**Frequency output X**	
C 2.x.01	**Pulse shape**	• **automatic** • **symmetrical** • **fixed** approx. pulse width in [ms] **=** pulse duty factor set in Fct. C 500 / (max. pulse rate in [1/s]) approx. 1:1 2.x.02
C 2.x.02	**Pulse width**	Appears only when "fixed" activated in Fct. C 2.x.01 Pulse Shape, see above **xxx.xx ms** (setting range: 0.05 … 2000 ms) (Note: max. setting value T_p [ms] $\leq$ 500.00 / (max. pulse rate [1/s])
C 2.x.03	**100 % Pulsrate**	**xxxxx.x 1/s** (setting range 00000.00 … 10000.0 1/s) limitation at 100% pulse rate $\leq$ **100 / s**: I_{max} $\leq$ **100 mA** limitation ati 100% pulse rate > **100 / s**: I_{max} $\leq$ **20 mA**
C 2.x.04	**Measurement**	• **volume flow** • **mass flow** • **coil temperature** • **flow speed** • **conductivity**
C 2.x.05	**Range**	**0 … 100%** (= unit dependent on measured variable selected)
C 2.x.06	**Polarity**	• **both polarities** • **positive polarity** • **negative polarity** • **absolute** choice of meas. val. polarity, note flow direction, see C 1.2.02
C 2.x.07	**Limitation**	**-xxx … +xxx %** (setting range -150% … +150%)
C 2.x.08	**Low flow cutoff**	**xxxx.x … ±xxxx.x** unit dependent on measured variable selected 1st value $\geq$ 2nd value (hysteresis), values around "0" are set to "0"
C 2.x.09	**Time constant**	**xxx.x s** (setting range 000.0 … 100.0 s)
C 2.x.10	**Invert signal**	<u>Select:</u> • **off** (= switch closes on every pulse, normally open) • **on** (= switch opens on every pulse, normally closed)

C 2.3.11	**Special function**	This function is only available in devices with 2 frequency outputs connected to terminals "B" and "D", see Fct. 2.5.11 below!
		 <u>select:</u> • **off** (= no special function)
		          • **Phase shift to D** (= setting of all functions for
		                              output B via output D)

C 2.5.11	**Phase shift**	This function is only available in devices with 2 frequency outputs connected to terminals B and D, see Fct. 2.3.11 above!
		 <u>Select:</u> • **off** (= no phase shift between output B + D)
		          • **0° shift** (signal inversion possible)
		          • **90° shift** (signal inversion possible)
		          • **180° shift** (signal inversion possible)
		 When Fct. C 2.5.06 Polarity is set to "both polarities", the flow direction is indicated (e.g. +90° or -90°).

C 2.x.13	**Simulation**	For sequence, see Test Level Menu, Fct. B 1 above

No.	Text displayed	Description and settings		
		In the following descriptions for the pulse output, "**x**" denotes the <u>terminals</u>: C 2.**2** = <u>A</u> C 2.**3** = <u>B</u> C 2.**5** = <u>D</u>		
C 2.x	**Pulse output X**			
C 2.x.01	Pulse shape	• **automatic** approx. pulse width in [ms] **=** 500 / (max. pulse rate in [1/s])	• **symmetric** duty factor 1:1	• **fixed** set Fct. C 2.x.02
C 2.x.02	Pulse width	Appears only when "fixed" activated in Fct. C 2.x.01 Pulse Shape, see above **xxx.xx ms** (setting range: 0.05 … 2000 ms) (Note: max. setting value T_p [ms] $\leq$ 500.00 / (max. pulse rate [1/s])		
C 2.x.03	100% pulse rate	**xxxxx.x 1/s** (setting range 00000.0 … 10000.0 1/s, max. 120%) when limited to 100% pulse rate $\leq$ **100 / s**: $I_{max} \leq$ **100 mA** when limited to 100% pulse rate **> 100 / s**: $I_{max} \leq$ **20 mA**		
C 2.x.04	Measurement	• **volume flow** • **mass flow**		
C 2.x.05	Pulse value unit	**Selection of unit** from one of the lists, dependent on measured variable		
C 2.x.06	Pulse p.value	**xxx.xxx** set for volume or mass per pulse lowest settable pulse value meas.range [in l/s or kg/s] (vol. or mass, see Fct. C 2.x.06 for current output) 100% pulse rate [in 1/s] (see Fct. C 2.x.03 for pulse output)		
C 2.x.07	Polarity	• **both polarities** • **positive polarity** • **negative polarity** • **absolute** choice of meas.value polarity, note directionn of flow, see C 1.2.02		
C 2.x.08	Low flow cutoff	**xxxx.x … ±xxxx.x** unit dependent on meas. variable selected 1st value $\geq$ 2nd value (hysteresis), values around "0" are set to "0"		
C 2.x.09	Time constant	**xxx.x s** (setting range 000.0 … 100.0 s)		
C 2.x.10	Invert signal	<u>Select:</u> • **off** (= switch closes on every pulse, normally open) • **on** (= switch opens on every pulse, normally closed)		
C 2.3.11	Special function	This function is only available when devices have 2 frequency outputs connected to terminals "B" and "D", see Fct. 2.5.11 below! <u>Select:</u> • **off** (= no special function) • **Phase shift to D** (= all functions set for output B via output D)		
C 2.5.11	Phase shift	This function is only available when devices have 2 frequency outputs connected to terminals B and D, see Fct. 2.3.11 above! <u>Select:</u> • **off** (= no phase shift between outputs B+D) • **0° shift** (signal inversion possible) • **90° shift** (signal inversion possible) • **180° shift** (signal inversion possible) When Fct. C 2.5.06 Polarity set to "both polarities", flow direction is indicated (e.g. +90° or -90°).		
C 2.x.13	Simulation	Procedure, see Test Level Menu, Fct. B 1 above		

No.	Text displayed	Description and settings	
		In the following descriptions of the outputs/inputs, "**x**" denotes the terminals: C 2.**2** = <u>A</u> / C 2.**3** = <u>B</u> / C 2.**4** = <u>C</u> / C 2.**5** = <u>D</u> (control input connected only to terminals A and B)	
C 2.x	**Status output X**		
C 2.x.01	Mode	• application error • uncertain measurem. • polarity, flow • overrange, flow • empty pipe • counter 1 preset • counter 2 preset	• output A • output B • output C • output D • off
C 2.x.02	"Output or input" Dependent on selection under Fct. 2.x.01, see above	Appears only when "output A, B, C or D" activated in Fct. C 2.x.01 Mode, see above.	
		• **same signal** (only when there are 2 status outputs)	Selection dependent on input or output combination
		• **sign**	
		• **over range**	
		• **automatic range** (appears only if set to current output X in Fct. C 2.x.01, see status output above)	
		• **off**	
C 2.x.03	Invert signal	<u>Select:</u> • **off** (= switch closes on every pulse, normally open) • **on** (= switch opens on every pulse, normally closed)	
C 2.x.05	Simulation	Sequence, see Test Level Menu, "**B x**" above (X depends on terminal)	
C 2.x	**Limit switch X**		
C 2.x.01	Measurement	• **volume flow** • **mass flow** • **coil temperature** • **flow speed** • **conductivity**	
C 2.x.02	Limit	**xxx.x ± x.xxx** (set limit value, hysteresis) format, unit acc. to meas. range selected and its upper range value. 2nd value (= hysteresis) $< 1^{st}$ value	
C 2.x.03	Polarity	• **both polarities** • **positive polarity** • **negative polarity** • **absolute** choice of meas.value polarity, note direction of flow, see C 1.2.02	
C 2.x.04	Time constant	**xx.x s** (setting range 000.0 … 100.0 s)	
C 2.x.05	Invert signal	<u>Select:</u> • **off** (= switch closes on every pulse, normally open) • **on** (= switch opens on every pulse, normally closed)	
C 2.x.07	Simulation	Sequence, see Test Level Menu, "**B x**" above (X depends on terminal)	
C 2.x	**Control input X**	Connected to terminals A and/or B only	

C 2.x.01	Mode	• **off**
		• **stop zero output + cnt.**
		  (not display)
		• **stop all counters**
		• **stop counter 1 or 2**
		• **reset all counters**
		• **reset counter 1 or 2**
		• **error reset**
		
		• **hold all outputs**
		  (not display, not counters)
		• **hold output A, B, C or D**
		• **all outputs zero**
		  (not display, not counters)
		• **output A, B, C or D zero**
		• **range change**
		
		Note! If two control inputs are provided, they should not be set to the same operating mode; if they are, only the control input connected to Term. A is in function!	

C 2.x.02	Invert signal	<u>Select:</u> • **off** • **on**	
C 2.x.04	Simulation	Sequence, see Test Level Menu, "**B x**" above (X depends on terminal)	

No.	Text displayed	Description and settings	
C 2.6 C 2.7	Counter 1 and / or Counter 2	All functions and settings for both counters are the same! In the following descriptions the "**y**" indicates the counter: • Counter **1** = C 2.**6** • Counter **2** = C 2.**7**	
C 2.y.01	Function of counter	• **+ counter** • **- counter** • **sum counter** •**off**	
C 2.y.02	Measurement	<u>Select:</u> • **volume flow** • **mass flow**	
C 2.y.03	Low flow cutoff	**xxxx.x … ±xxxx.x** unit dependent on measured variable selected 1st value ≥ 2nd value (hysteresis), values around "0" are set to "0"	
C 2.y.04	Time constant	**xx.x s** (setting range 000.0 … 100.0 s)	
C 2.y.05	Preset value	**x.xxxxx in the unit selected**, max. 8 places (see Fct. C 4.7.10 or 13), set the status output (see Fct. C 2.x.01) for signalling to counter 1 / 2 preset value	
C 2.y.06	Reset counter	<u>Select:</u> • **yes** • **no**	

C 2.y.07	Set counter	Set initial counter value (overwrites current reading)
		<u>Select:</u> • **cancel** ↵ / return without simulation
		            • **set value** ↵ / set value / ↵ / then query
		            "set counter?" **No - Yes** / select, execute with ↵	

C 2.y.08	Stop counter	<u>Select:</u> • **yes** • **no**	
C 2.y.09	Start counter	<u>Select:</u> • **yes** • **no**	

C 3	Communication		
C 3.1	HART		
C 3.1.01	Address	• **Address range 0-15**, Address 0: current output with normal function. Addresses 1-15: multidrop. Current output fixed at 4 mA	
C 3.1.02	4 mA trimming	**Set 4 mA value** (setting range 3.6 … 5.5 mA)	4 / 20 mA: reset to factory calibration
C 3.1.03	20 mA trimming	**Set 20 mA value** (setting range 18.5 … 21.5 mA)	
C 3.1.04	Message	**Texts of choice can be set** (up to 32 places)	
C 3.1.05	Description	**Texts of choice can be set** (up to 16 places)	

C 4	Device	
C 4.1	Device info	
C 4.1.01	Tag	**Measuring point identifier (Tag No.)**, also applies to HART[®] address (see C .3.1.1) also appears in the display header (up to 8 places)
C 4.1.02	C number	**Electronic unit-No.** (see signal converter nameplate) / unalterable
C 4.1.03	Device serial no.	**Serial No.** of the system / unalterable
C 4.1.04	Electronic serial no.	**Serial No.** of the complete electronic unit
C 4.2	Display	
C 4.2.01	Language	<u>Select:</u> • **English** • **Deutsch** • **Français** • **others in preparation**
C 4.2.02	Contrast	<u>Setting range:</u> **-9 … 0 … +9**
C 4.2.03	Default meas. page	<u>Select:</u> • **1st meas. page** • **2nd meas. page** • **none** • **status page**

No.	Text displayed	Description and settings
C 4.3 C 4.4	1st meas. page 1 and / or 2nd meas. page 2	All functions and settings for the two pages are identical! In the following descriptions "z" characterizes the m.v. page: • page 1 = C 4.3 • page 2 = C 4.4
C 4.z.01	Function	• one line • two lines • three lines
C 4.z.02	Measurement 1st line	• flow speed • coil temperature • volume flow • conductivity • mass flow
C 4.z.03	Range	Unit and format depend on measured quantity selected under C 4.z.02
C 4.z.04	Limitation	**xxx %** (100 % $\leq$ value $\leq$ 999 %)
C 4.z.05	Low flow cutoff	**xxxx.x … ±xxxx.x** unit dependent on measured variable selected 1st value $\geq$ 2nd value (hysteresis), values around "0" are set to "0"
C 4.z.06	Time constant	**xxx.x s** (setting range 000.0 … 100.0 s)
C 4.z.07	Format 1st line	Setting of dec. places acc. to list: • **X** (none) … **X.XXXXXXXX** (8 places)
C 4.z.08	Measurement 2nd line	• flow speed • coil temperature • Operating hours • conductivity • counter 1 • volume flow • counter 2 Selection dependent on • mass flow • bar graph Function C 4.z.01
C 4.z.09	Format 2nd line	Setting of dec. places acc. to list: • **X** (none) … **X.XXXXXXXX** (8 places)
C 4.z.10	Measurement 3rd line	• flow speed • conductivity • counter 1 • volume flow • coil temperature • counter 2 • mass flow • Operating hours
C 4.z.11	Format 3rd line	Setting of dec. places acc. to list: • **X** (none) … **X.XXXXXXXX** (8 places)
C 4.6	Special functions	
C 4.6.01	Error reset	Select: • **No** • **Yes** (reset errors that are not automatically deleted, such as "line failure", "counter overflow", etc.)
C 4.6.02	Save settings	• **Backup 1** • **Backup 2** select, then press ↵ • **No** • **Yes** confirm with ↵ or start Backup • **Cancel** exit Backup function with ↵ With this function, complete device data records can be written into the Backup 1, 2 memories and from there be reloaded (see below)
C 4.6.03	Load settings	• **Factory settings** load settings • **Factory settings** • **Backup 1** • **Backup 1** • **No** • **No**
C 4.6.04	Password Quick Set	Activates **4-character password** for changes in the Quick Setup Menu. **0000** deactivates the password.
C 4.6.05	Password Setup	Activates **4-character password** for changes in the Setup Menu and in the Test Menu. **0000** deactivates the password.

C 4.6.06	GDC IR interface	Select: • **cancel** Press ↵ key, IR-Interface not activated, and
		                              exit this function
		       • **activate** Press ↵ key, IR-Sensor is activated, and
		                              accept all changes made up to now
		
		                         Within the next 60 sec. position the IR-Interface with the suction cups on the pane of the housing. The correct position is indicated by the steady bright red LED of the interface, as soon as the red LED and the IR-Sensor (below the keys on the display) are roughly one above the other, see Fig. in Sect. 4.2.

No.	Text displayed	Description and settings					
C 4.7	**Units**	(units applicable to display and all settings, except for pulse output)					
C 4.7.01	Volume flow	• l/s	• m³/s	• ft³/s	• gal/s	• IG/s	
		• l/min	• m³/min	• ft³/min	• gal/min	• IG/min	
		• l/h	• m³/h	• ft³/h	• gal/h	• IG/h	
		• user-defined unit (free unit)					
C 4.7.02	Text free unit	• appear only when "**free unit**" selected in Fct. C 4.7.01					
C 4.7.03	[m³ / s] ∗ **Factor**	• to set these two functions, see "**free unit**" below					
C 4.7.04	Mass flow	• g/s	• kg/s	• lb/s	• ST/min (= Short Ton)		
		• g/min	• kg/min • t/min	• lb/min	• ST/h		
		• g/h	• kg/h • t/h	• lb/h	• LT/h (= Long Ton)		
		• user-defined unit (free unit)					
C 4.7.05	Text free unit	• appear only when "**free unit**" selected in Fct. C 4.7.04					
C 4.7.06	[kg / s] ∗ **Factor**	• to set these two functions, see "**free unit**" below					
C 4.7.07	Flow speed	• m/s		• ft/s			
C 4.7.08	Conductivity	• µS/cm	• S/m				
C 4.7.09	Temperature	• K	• °C	• °F			
C 4.7.10	Volume	• ml	• l	• hl	• m³	• in³	• ft³ •yd³ • gal • IG
		• user-defined unit (free unit)					
C 4.7.11	Text free unit	• appear only when "**free unit**" selected in Fct. C 4.7.10					
C 4.7.12	[m³] ∗ **Faktor**	• to set these two functions, see "**free unit**" below					
C 4.7.13	Mass	• mg	• g	• kg	• t	• oz • lb • ST (Short Ton) • LT (Long Ton)	
		• user-defined unit (free unit)					
C 4.7.14	Text free unit	• appear only when "**free unit**" selected in Fct. C 4.7.13					
C 4.7.15	[kg] ∗ **Factor**	• to set these two functions, see "**free unit**" below					
C 4.7.16	Density	• kg/m³	• kg/l	• lb/ft³	• lb/gal		
		• user-defined unit (free unit)					
C 4.7.17	Text free unit	• appear only when "**free unit**" selected in Fct. C 4.7.16					
C 4.7.18	[kg / m³] ∗ **Factor**	• To set these two functions, see "**free unit**" below					

Free (user-defined) unit

• Set required texts:
  - for volume rate of flow, mass rate of flow and density:
    max. 3 characters before and max. 3 characters after the slash
  - for volume and mass: max.3 characters
  - characters useable: a…z **/** A…Z **/** 0…9 **/** . , " + - ∗ **/** # @ $ % ~ ( ) [ ]

• Set conversion factor:
  - **wanted unit =** [unit, see above] × conversion factor
  - conversion factor: max. 9 digits
  - shift decimal point with ↑ (to left) and with ↓ (to right)

4.5   To reset counters

Key	Text displayed		Description and settings
→	A	Quick Setup	Countdown from 2.5 s to 0.0 s, then release key
↑ → ↓	C 2	I / O	
→	C 2.1	Hardware	
1× ↑ *or*	2.7	Counter 2	Select counter that is to be reset
2× ↑	2.6	Counter 1	
→	C 2.6.01	Counter function	
4× ↑	C 2.6.06	Reset counter?	
→	C 2.6.06	Reset counter	Select with ↑ or ↓: • **No**
↵	C 2.6.06	Reset counter	Counter has been reset
4× ↵		*Measuring mode*	

4.6   To delete error messages (for list of possible error messages, see Sect. 4.10)

1st Possibility in the "Quick Setup" menu"

Key	Text displayed	Description and settings
→	Quick Setup	Countdown from 2.5 s to 0.0 s, then release key
→	Language	
2× ↑	Reset error	
→	Reset? **No**	
↑	Reset? **Yes**	
↵	Reset error(s)	Errors have been reset
2× ↵	*Measuring mode*	

2nd Possibility in the "Setup" menu

Key	Text displayed		Description and settings
→	A	Quick Setup	Countdown from 2.5 s to 0.0 s, then release key
↑ → ↑ →	C 4	Device	
→	C 4.1	Device info	
↑ (or 6× ↓)	C 4.6	Special functions	
→	C 4.6.01	Reset error(s)?	
→	C 4.6.01	Reset error(s)?	Select with ↑ or ↓: • **No** • **Yes**
↵	C 4.6.01	Reset error(s)	Errors have been reset
4× ↵		*Measuring mode*	

4.7 General directions for special measurements, tasks and diagnostics

4.7.1 Empty measuring tube and electrical conductivity measurement
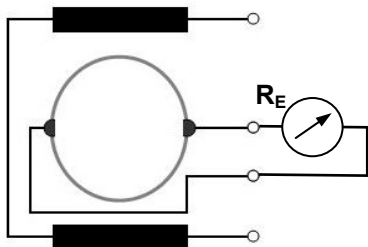
σ	electrical conductivity
R_E	electrode resistance
K	a constant
EF	(d) electrode factor, see Fct. C 1.1.11

$$R_E = \frac{K}{\sigma \times EF}$$

$$\sigma = \frac{K}{R_E \times EF}$$

Empty pipe (filling below level of electrodes)	pipe flowing full
• in theory $\quad R_E \rightarrow \infty\ \Omega \ \| \ \sigma \rightarrow 0\ \mu S/cm$ • in practice (wetted tube wall) R_E = approx. 3× $R_{operation}$ σ = approx. $^1/_3\ \sigma_{operation}$	R_E = ca.1 kΩ ... 10 MΩ σ = ca. $\sigma_{operation}$

4.7.2 Measurement of coil temperature by way of the resistance of the field coils
(dependent on ambient and product temperatures)
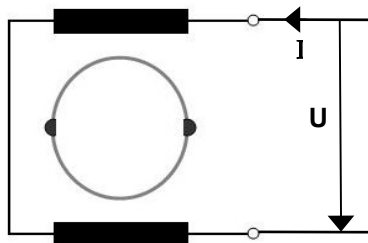
R	measured, current coil resistance
R_{20}	coil resistance at 20°C during calibration
T	current coil temperature
α_{20}	= 0.39%/K tempperature coefficient for copper at 20°C equivalent to 68°F

$$R = U / I$$

$$R = R_{20°C}\ [\ 1 + \alpha_{20}\ (T - 20\ °C)\ ]$$

$$T = \frac{R - R_{20}}{\alpha_{20} \times R_{20}} + 20\ °C$$

4.7.3 To measure and identify the flow profile
(empty meas. tube / deposits / defective liner / improper installation / etc.)
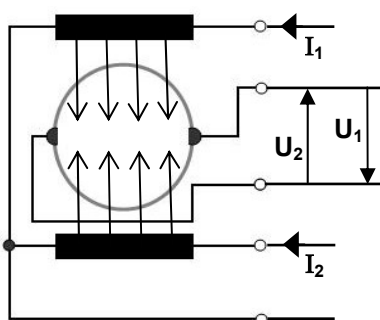
I_1	field current, upper coil
U_1	electrode voltage resulting from I_1
I_2	field current, lower coil
U_2	electrode voltage resulting from I_2

I_1 and I_2 generate opposing magnetic fields in the upper and lower half of the tube. The resultant voltages U_1 and U_2 can be picked off at the electrodes.

$$U_1 - U_2\ =\ 0$$
symmetrical, undisturbed flow profile

$$U_1 \neq U_2$$
unsymmetrical or disturbed flow profile

Possible causes:
- Meas. tube not completely filled
- Deposits on bottom of measuring tube
- Liner of sensor defective
- Improperly installed, gaskets project e.g. into measuring tube

4.8 Special measurements

The following Table shows functions and parameters that need to be set in order to obtain special measured values and indications.

Special measurements	Set the functions Number, unit or property		Effect on Measurement	Status messages
• **Conductivity** Measurement and indication	C 1.3.01 Empty Pipe Activate with one of the 3 functions for Measurement	• Conductivity • Cond.+ empty pipe [A] • Cond.+ empty pipe [U]	Indication of measured values possible via display or outputs	-
• **Coil temperature** above the allowable limit value	No special settings needed, coil temperature is always measured		Indication of measured values possible via display or outputs	[U] coil temperature
• **Change of product** e.g. stop external counting via pulse output of Medium A = product, Medium B not measured	C 1.3.01 Empty Pipe • Conductivity • Cond.+empty pipe [A] • Cond.+ empty pipe [U] (Activate cond. meas. with one of the 3 functions above)	2.x.01 limit switch • set to conductivity 2.x.02 limit value: Set for Medium A: • Cond. Medium **A > B** Approx. lowest conductivity of A • Cond. Medium **A < B** approx. highest conductivity of A	Counting stopped; change from Medium A to Medium B signalled via the limit switches	no message

4.9 Special measurement tasks and diagnostics

The following Table shows functions and parameters to be set in order to perform special tasks, diagnostics, and obtain reactions, information, etc. during measurement.

Meas. / task / info / reaction	Set the functions number, unit or property		Effect on measurement	Status messages
• **Empty pipe (1)** **Stop** flow indication, flow outputs and flow counting	C 1.3.01 Empty Pipe • Cond.+ empty pipe [A] 2.x.01 limit switch • set to Empty Pipe 2.x.02 limit val. • set to approx. $^1/_3$ of lowest occurring conductivity		Flow indic. = **zero**, flow outputs = **zero**, flow counting **stopped**, cond. indic. = **approx. zero**	[A] application error [A] empty pipe
• **Empty pipe (2)** Flow indication, flow outputs and flow counting **remain active**	C 1.3.01 Empty Pipe • Cond.+ empty pipe [U] 2.x.01 limit switch • set to Empty Pipe 2.x.02 limit val. • set to approx. $^1/_3$ of lowest occurring conductivity		**undefined** flow indic., flow outputs and flow counting cond. indic. = approx. **zero**	[U] uncertain meas. [U] empty pipe
• **Full pipe (1)** Filling level below crown of pipe	C 1.3.10 Flow profile • ON		flow meas. and flow counting continue, accuracy dependent on filling level	[U] uncertain meas. [U] flow profile
• **Full pipe (2)** Filling level just below crown of pipe (only with 4 electrodes, special sensor version)	C 1.3.04 Full Pipe • ON C 1.3.05 Limit Full Pipe • Set to approx. $^1/_3$ d of lowest occurring conductivity		flow meas. and flow counting continue, accuracy dependent on filling level	[U] uncertain meas. [U] pipe not full
• **Flow profile ok?** Installation inlet/outlet run	C 1.3.10 Flow profile • ON		flow meas. and counting, accuracy dependent on filling level	[U] flow profile
• **Liner ok?** Shows severe bulging, erosion by abrasive media	C 1.3.10 Flow profile • ON		flow meas. and counting, accuracy dependent on the geometry of the defect	[U] flow profile

Meas. / task info / reaction	Set the functions number, unit or property		Effect on measurement	Status Messages
• Deposits (1) Insulating, on the electrodes	C 1.3.01 Empty Pipe • Cond.+ empty pipe [A] • Cond.+ empty pipe [U]	2.x.01 limit switch • set to conductivity 2.x.02 limit val. • set to approx. $^{1}/_{3}$ of lowest occurring conductivity	same as above empty pipe 1 or 2	
• Deposits (2) of different thickness, on the electrodes	C 1.3.01 Empty Pipe • Cond.+ empty pipe [U]		**undefined** flow indication, flow outputs, flow counting and conductivity indication	[U] uncertain meas. [U] electrode symmetry
• Deposits (3) on bottom of tube	C 1.3.10 Flow Profile • ON		flow indication and flow counting, accuracy dependent on thickness of deposits and on conductivity	[U] uncertain meas. [U] flow profile
• Deposits (4) conductive, on tube inner wall, causing electrode short-circuit	C 1.3.01 Empty Pipe • Conductivity • Cond.+ empty pipe [A] • Cond.+ empty pipe [U]	2.x.01 limit switch • set to conductivity 2.x.02 limit val. • set to approx. twice the value of process conductivity	flow indication and flow counting, accuracy dependent on thickness of deposits and on conductivity	**-**
• Electrode coating (1) insulating, **stop** flow indic., flow outputs and flow counting	C 1.3.01 Empty Pipe • Cond.+ empty pipe [A]	2.x.01 limit switch • set to conductivity 2.x.02 Glimit value • set to approx. $^{1}/_{3}$ of lowest occurring conductivity	flow indication, flow outputs, flow counting **stopped,** Accuracy of conductivity indication dependent on resistance of coating	[A] applica- tion error [A] pipe empty
• Electrode coating (2) Flow indic., flow outputs and flow counting **remain active**	C 1.3.01 Empty Pipe • Cond.+ empty pipe [U]	2.x.01 limit switch • set to conductivity 2.x.02 limit value • set to approx. $^{1}/_{3}$ of the lowest occurring conductivity	Flow indication, flow outputs, flow counting and cond. indication **continue to be active,** accuracy dependent on resistance of coating	[U] uncertain meas. [U] pipe empty
• Solids in medium Noisy flow indication and flow outputs	C 1.3.13 Electrode noise • ON C 1.3.14 Limit Electr. Noise • set e.g. to approx. 0.1× the current flow velocity		If flow indications, flow outputs and counts very noisy, perhaps additionally activate pulse or noise filters, see Fct. C1.2.04 and 07, resp.	[U] electrode noise
• Gas bubbles in **medium** Noisy flow indication and flow outputs	C 1.3.13 Electrode noise • ON C 1.3.14 Limit Electr. Noise • Set e.g. to approx. 0.1× the current flow velocity		If flow indications, flow outputs and counts very noisy, perhaps additionally activate pulse or noise filters, see Fct. C1.2.04 and 07, resp.	[U] electrode noise
• Electrode corrosion Noisy flow indic and flow outputs, sensor failure	C 1.3.13 Electrode noise • ON C 1.3.14 Limit Electr. Noise • Set e.g. to approx. 0.01 m/s		If flow = zero and pipeline is flowing full, noise might be an indication of electrode corrosion	[U] electrode noise

4.10   Status messages and diagnostics information

• These messages are shown on page 3 of the display. mA- and status outputs can be set so that error messages are signalled, see Sect. 4.4, Fct. C 2.x.04 (current) and Fct. C 2.x.01 (status).

• **Please note:**   for settings with mA and/or status outputs:
  - uncertain measurement (U)   = all errors of Categories U, A and F
  - application error (A)   = all errors of Categories A and F
  - fault in device (F)   = all errors of Category   F

Display messages	Description	Possible causes, remedial action

status: **F _ _ _ _**
(_ _ _ _ see texts below)
	**= operational fault in device,
	  mA output ≥ 3.5 mA, Status outputs open,
	  pulse / frequency output: no pulses**
		Repair necessary !

fault in device	Operational fault in device. No measurement possible	Group message, when one of the following or some other severe error occurs
IO 1	Error, operational fault in IO 1. No measurement possible	Try the following: Load settings (Fct. C 4.6.3) (Backup 1 or Backup 2 or factory settings).
IO 2	Error, operational fault in IO 2, No measurement possible	
parameter	Error, operational fault in device, Parameters no longer useable No measurement possible	If status message still does not disappear, replace electronic unit.
Configuration (also when module changed)	Identified configuration differs from the one stored. No measurement possible	After change of module, confirm query for changed configuration. If device configuration unchanged: defective, replace electronic unit.
display (no longer available)	Error, operational fault in display	Defective, replace electronic unit
sensor electronics	Error, operational fault in sensor electronics, No measurement possible	Defective, replace electronic unit
sensor global	Data error in the global data of the sensor electronic equipment No measurement possible	Load settings (Fct. C 4.6.3) (Backup 1 or 2 or factory settings). If status message still does not disappear, replace electronic unit.
sensor local	Data error in the local data of the sensor electronics. No measurement possible	Defective, replace electronic unit
field current local	Data error in the local data of the field current supply. No measurement possible	Defective, replace electronic unit
current output A	Operational fault in current output at the pair of terminals indicated. Measured value at this pair of terminals no longer available	Defective, replace electronic unit or I/O module.
current output B		
current output C		
Operator software	Fault revealed by CRC check of operator software, device not operable.	Replace electronic unit
Hardware settings	The set hardware parameters do not match the identified hardware. A dialogue appears in the display.	Answer queries in dialogue mode, follow directions.
Hardware identification	Existing hardware cannot be identified. There are either defects or unknown modules.	Replace electronic unit
RAM/ROM error IO1	A RAM or ROM error is detected during the CRC check.	Defective, replace electronic unit or I/O module
RAM/ROM error IO2		

Display messages	Description	Possible causes, remedial action
Status: A _ _ _ _ (_ _ _ _ = see texts below	**= application-sensitive fault, device OK, measured values affected**	**Application test or operator action necessary !**
Application error	Application fault, device OK. Use measured values with caution	Group message, when errors as below or other application errors occur.
Empty pipe	1 or 2 measuring electrodes are not in contact with the medium: flow indication = 0. *Monitoring / message only if* *"cond.+empty pipe [A]"* *under Fct. C 1.3.01 Empty Pipe is activated*	Pipe not filled, function dependent on Fct. C 1.3.01. Check installation. Or electrodes completely insulated by e.g. oil film. Clean!
Flow rate too high (not when pipe empty)	Overrange, Filter setting limits the measured values	Limitation Fct. C 1.2.01: Increase values
Field frequency too high (not when coil has open circuit)	Field current has not settled, measured flow value inaccurate	If Fct. C 1.1.14 Settling Time is set to "Manual", increase value in Fct. C 1.1.15. If "Standard" is set, set field frequency in Fct. C 1.1.13 acc. to sensor nameplate.
DC Offset (not when pipe empty)	ADC overdriven by DC input level, flow measured value = 0	For IFC 300 F and W: check connection of signal cable
Open circuit A	Load of current output A too high	Current not correct, mA output cable has open circuit or load too high. Check cable, reduce load (should be < 1000 Ohm)!
Open circuit B	Load of current output B too high	
Open circuit C	Load of current output C too high	
Over range A	Measured value at terminals A limited by filter setting	Check with Fct. C 2.1 Hardware or sticker in terminal compartment, which output is connected to the terminal. If current output: Extend Fct. C 2.x.06 Measuring Range and Fct. C 2.x.08 Limitation If frequency output: extend values under Fct. C 2.x.05 and Fct. C 2.x.07.
Over range B	Measured value at terminals B limited by filter setting	
Over range C	Measured value at terminals C limited by filter setting	
Over range D	Measured value at terminals D limited by filter setting	
Active settings	Fault detected during CRC check of active settings	Upload Backup 1 or Backup 2 settings, check and adjust if necessary.
Factory settings	Fault detected during CRC check of factory settings	
Backup 1 / 2 settings	Fault detected during CRC check of Backup 1 / 2 settings	Store active settings in Backup 1 / 2.
Status: U _ _ _ _ (_ _ _ _ see texts below)	**= uncertain flow measurement, measurement continues, accuracy possibly less**	**Maintenance necessary!**
uncertain measurement	uncertain flow measurement, measurement continues with less accuracy	Group message, when faults as below or other influences occur.
Pipe not full (applies only to primary heads with 3 or 4 electrodes, Option)	Full-pipe electrode (Option) is not in contact with the medium. *Monitoring / message only plausible when the lowest appropriate electrical conductivity is set under Fct. C 1.3.03 Full Pipe = "on" and under Fct. C 1.3.04 Limit Full Pipe*	Measuring tube not completely filled, error dependent on fill level. If necessary, change wiring! Or: Electrodes completely insulated e.g. by oil film. Clean!

Display messages	Description	Possible causes, remedial action
Status: U _ _ _ _ **(**cont´d)	**= uncertain flow measurement,** **measurement continues, measured** **values uncertain**	**Maintenance necessary!**
Empty pipe	1 or 2 measuring electrodes are not in contact with the medium. Display can assume arbitrary values! *Monitoring / message only when "cond.+ empty pipe [U]"is activated under Fct. C 1.3.01 Empty Pipe*	Filling level of EMF less than 50% or electrodes completely insulated. If "0" to be indicated when pipe is empty, activate under Fct. C 1.3.01 "cond.+empty pipe **[A]**".
Linearity	Measured values at both field current levels are not equal. *Monitoring / message only after input of Fct. C 1.3.05 Linearity "on" and in Fct. C 1.1.03 GK values "GK+GKL" and the GK and GKL values on the nameplateof the primary head in Fct. C 1.1.04.*	Very strong external magnetic fields, or defect in sensor´s magnetic circuit or in signal processing
Flow profile	Disturbed flow profile , flow continues to be indicated. *Monitoring / message only when "on" is activated under Fct. C 1.3.08 Flow Profile*	Unimpeded inlet and outlet runs of sensor too short, Pipeline not fulll Measuring tube liner damaged.
Electrode noise (not when pipe empty)	Electrode noise too high, flow measurement continues, mA and display indication possibly noisy. *Monitoring / message only if Fct. C 1.3.09 Electrode Noise is activated, and Fct. C 1.3.10 Limit Noise has been set.*	a) Electrodes extremely soiled b) Conductivity too low c) Gas bubbles, solids or chem. reactions in medium d) Electrode corrosion (if message also appears when flow is zero) To b), c): activate noise or pulse filter Fct. C 1.2.04, C 1.2.07 , To b): EMF poss. unsuitable To d): use sensor with suitable electrode material
Gain error	Preamplif. not equal to calib. value. Measuring error possible. *Message only when Fct. C 1.3.01 Gain activated*	Defect: replace electronic unit!
Electrode symmetry	Impedance of measuring electrodes not equal, *Monitoring / message only if Fct C 1.3.01 Conductivity (also..[A] or.[U]) activated.*	Deposits in measuring tube or electrode short circuit to ground. Clean and check measuring tube!
Field coil broken	Coil resistance too high, indication poss. zero.	Check field current connections to electronic module (in separate versions: the field current cable) for break / short circuit
Field coil bridged	Coil resistance too low, indication poss. zero	
Field current deviation (not when coil broken)	Field current not equal to calib. value, *Monitoring / message only if Fct. C 1.3.07 Field Current activated*	Check field current connections; if OK: electronics defective, replace electronic unit.
Field frequency too high	Magnetic field does not settle properly.	If Fct. C 1.1.14 Settling Time set to "Manual", increase value in Fct. C 1.1.15. If "Standard" is set, set field frequency in Fct. C 1.1.13 acc. to sensor nameplate.
Electronic temperature	Temperature of electronic equipment too high. Impairs service life (reliability)!	Ambient temperature too high, direct solar radiation or, for C Version, process temp. too high.
Field coil temperature (not when coil broken)	Coil temperature too high	Process temperature and ambient temperature too high
Overflow, counter 1 / 2	Counter has overrun and started again at zero.	
Backplane invalid	The data record on the backplane is invalid. The CRC check has revealed a fault.	

Display messages	Description	Possible causes, remedial action
Status: C _ _ _ _ (_ _ _ _ see texts below)	**= Output values in part simulated or fixed**	
Checks in progress	Testing mode by invoking test or simulation functions, All or some outputs not available, Measured values may poss. be simulated	Message via HART or FDT, as the case may be. Indic. via the display when outputs held by control input or have been set to zero
Test XXXXX (_ _ _ _ see texts below)	Test of relevant unit activated	
Status: I _ _ _ _ (_ _ _ _ see texts below)	**= Information (current measurement OK)**	
Counter 1 stopped	Counter 1 has stopped counting	If counter to continue counting, activate "yes" in Fct. C 2.y.09 Start Counter
Counter 2 stopped	Counter 2 has stopped counting	
Line failure	Indicates that the device was out of service for an unknown period due to a power failure	Cause: temporary line failure, during which counters stopped counting.
Control input A active	Message appears when the control input at terminals A or terminals B is active.	This message is for information only
Control input B active		
Over range Display 1	1st line on page 1 and/or 2 of display limited by filter setting, indication not correct	Menu Display Fct. C 4.3 and/or C 4.4, select Meas. Page 1 or 2, and increase values in Functions C 4.z.03 Meas. Range and/or C 4.z.04 Limitation
Over range Display 2		
Backplane, sensor	The sensor data on the backplane are no use because they have been generated with an incompatible version.	
Backplane settings	The global settings on the backplane are no use because they have been generated with an incompatible version.	
Backplane difference	The data on the backplane differ from the data in the display. If the data can be used, a dialogue is indicated in the display.	
Optical interface	The optical interface is in use. The keys on the local display are inoperative.	Keys are ready to operate again 60s after end of data transfer / removal of the optocoupler

5   Technical data

5.1   IFC 300 signal converter

Versions

Standard	IFC 300 **C**	Compact version	all versions with HART®, Display and operator control elements
	IFC 300 **F**	Field housing version	
	IFC 300 **W**	Version for wall mounting	
	IFC 300 **R**	19" rack version	

Option	Interfaces (for all versions)		Fieldbus Foundation and PROFIBUS PA and DP
	IFC 300 _ / **BC**		for Batch Control applications
	EEx versions:	ATEX	EEx Zone 1 d + e + i and EEx Zone 2
		FM	Class I DIV 1 + 2
		CSA	GP / Class I DIV 1 + 2
		TIIS	Zone 1 + 2
		Aus	Ex Zone 1 + 2
	Approvals:	Volumetric meter for custody transfer	cold water: OIML R 49 and KIWA BKR 618/4
			excl. water: OIML R 117

Measurements / Measured variables	Units	in metric, British or in US units
	Volume flow rate	Full-scale range $Q_{100\%}$ settable as required from approx. 5 l/h - 400 000 m³/h,equivalent to 220 - 1 800 000 US gal/min (dependent on meter size) for electrical conductivities of the process product from ≥ 1 µS/cm (≥ 20 µS/cm for demineralized water)
	Flow velocity	settable as required from 0 - 15 m/s equivalent to 0 - 50 ft/s (both directions)
	Mass flow rate	derived from volume flow rate at known and constant density (settable from 100 - 5000 kg/m³ equivalent to 0.8340 - 41.73 lb/gal)
	Electrical conductivity	settable as required from approx. > 0 to ≤ 10000 µS/cm
	Temperature	in sensor, settable as required from -40 to +200°C / -40 to +392°F

Diagnostic functions	Standards	meets and exceeds VDI / NAMUR / WIB 2650
	Messages	Output of messages optionally via display, current and/or status output, and also HART® or bus interface
	Accuracy and function	Monitoring of µP and memory, field current, limit overshooting, temperature of electronic equipment, accuracy of signal processing, signal and field current cables, break or short circuit, and load and open circuit of current output
	Application	Monitoring of correct installation (flow profile, inlet and outlet runs), Monitoring for: empty measuring tube (partial filling), conductivity too low, electrode short circuit, electrode insulation or corrosion, gas bubbles (cavitation), solids, temperature of field coils, and damage to the liner

Display and operator control

Type	Graphic display (backlit – white) 128 × 64 pixels / 59 × 31 mm

Display functions — 3 pages (page through with $\uparrow$)
- pages 1 / 2:
  optionally with one to three lines.
  Each line can be used to show current volume /
  mass flow rate, other measured variables or
  counts
  In a 2-line setting, the measured variable in the
  1st line can be shown in the form of a bar
  graph in the 2nd line.
  Display ranges and number of places freely
  selectable.
- Page 3: List of diagnostic and status messages

Units — metric, British and US units, selectable from lists for volumetric and mass flow rates,
flow velocity, electrical conductivity, temperature, volume, mass and density

Counter places — Max. 8

Language of display texts — English, German, French, others on request

Operating elements — 4 optical keys ($\rightarrow$ ↵ $\downarrow$ $\uparrow$) for operator control of the signal converter without opening the housing

Infrared interface for reading and writing all parameters with KROHNE IR-Interface without opening the housing

Output / input assemblies — For number and possible combinations of the various outputs and inputs, refer to Sect. 2.2

Current output

Function
- Volume and mass flow rate, flow velocity, field coil temperature or
  electrical conductivity
- HART$^®$ interface is standard
  (but not for all option modules), see Sect. 2.2
- active or passive operation, dependent on the output / input assemblies, see Sect. 2.2

Op. values and load rating — active — $I \leq 22$ mA / $R_L \leq 1$ kΩ

passive — $I \leq 22$ mA / $U \leq 32$ V DC

Current — Measuring range I_{min} - I_{max} between 0 - 20 mA settable as required

Overrange — Setting: 0.00 mA $\leq$ value $\leq$ 21.5 mA

Error identification — 0 mA $\leq I_{Err} < I_{min}$ or $I_{max} < I_{Err} \leq 22$ mA

Forward / reverse measurement — Direction identified via status output, see below

Automatic range or external range — via status output or control input, see below

Time constant — 0 - 100.0 s, settable as required

Low-flow cutoff — Value: 00.0 - 20.0 %
Hysteresis: ± 00.0 - 20.0 %.] of $Q_{100\%}$, settable as required

Pulse / frequency output

Function		• When set as frequency output: volume, mass, flow velocity, coil temperature or electrical conductivity • When set as pulse output: volume, mass (e.g. 1 pulse / m^3 or / kg) • active or passive mode, dependent on the output / input assemblies, see Sect. 2.2
Op. values and load rating	active	$f \leq 10$ kHz: $I \leq 20$ mA / $f \leq 100$ Hz: $I \leq 100$ mA U_{nom} 24 V DC / U_0 1.5 V @ 10 mA
	passive	$f \leq 10$ kHz: $I \leq 20$ mA / $f \leq 100$ Hz: $I \leq 100$ mA $U \leq 32$ V DC / $U_0 \leq 1.5$ V @ 10 mA
	NAMUR	to EN 60947-5-6 (operating data as for "passive")
Pulse rate		0 - 10 kHz, scalable (overflow up to $f_{max} \leq 12$ kHz)
Pulse width		0.05 - 2000 ms (autom., symm. or settable)
Forward / reverse measurement		Direction identified via status output, see below
Time constant		0 - 100.0 s, settable as required
Low-flow cutoff		Value: 00.0 - 20.0 % ⎤ of $Q_{100\%}$, settable as Hysteresis: ± 00.0 - 19.9 %. ⎦ required

Status output

Function		• limit switch, empty pipe, polarity sign, overrange, automatic range, counter preset, failure, maintenance requirement, adjustable to inverse operation • active or passive operation, dependent on output / input assemblies, see Sect. 2.2
Op. values and load rating	active	$U \leq 24$ V DC/ $I \leq 100$ mA / $U_0 \leq 1.5$ V @ 10 mA
	passive	$U \leq 32$ V DC/ $I \leq 100$ mA / $U_0 \leq 1.5$ V @ 10 mA
	NAMUR	to EN 60947-5-6 (operating data as for "passive")
Time constant		0 - 100.0 s, settable as required

Control input

Function		• hold outputs, set outputs to zero, counter reset, error reset, range change, operating state: (off) • active or passive operation, dependent on output / input assemblies, see Sect. 2.2
Op. values and load rating	active	$I_{nom} = 16$ mA / $U_{nom} = 24$ V DC
	passive	$U \leq 32$ V DC / $U_{on} > 19$ V DC / $U_{off} < 2.5$ V DC
	NAMUR	to EN 60947-5-6 (operating data as for "passive")

Internal electronic counters

Number	2, settable independent of one another
Measured variable	Volume or mass flow rate
Function	Sum + or – counter and preset counter
Time constant	0 - 100.0 s, settable as required
Low-flow cutoff	Value: 00.0 - 20.0 % ⎤ of $Q_{100\%}$, settable Hysteresis: ± 00.0 - 19.9 %. ⎦ as required

Electrode circuit

<u>Terminals</u>	Term. 1, 2, 3, 4 and 20, 30, 40 (not provided in Compact Version C)

Field current supply

<u>Type</u>	bipolar pulsed DC field for all KROHNE sensors (primary heads), galvanically separated from all input and output circuits
<u>Terminals</u>	Term. 7, 8 and 9 (not provided in Compact Version C)
<u>Current / voltage</u>	±0.125 A (± 5 %) $U_N \leq 40$ V
<u>Clock frequency</u>	$^{1}/_{36}$ up to 2 x power frequency, settable acc. to the calibration data of the sensor

Power supply	**AC Version**	**DC Version**
<u>Voltage range</u> (without changeover)	100 - 230 V AC	12 - 24 V DC
<u>Tolerance band</u>	-15 % / +10 %	-25 % / +30 %
<u>Frequency</u>	48 - 63 Hz	-
<u>Power consumption</u> (incl. sensor)	$\leq$ 22 VA	$\leq$ 12 W

When connected to functional extra-low voltage (12 - 24 V DC), protective separation (PELV) must be ensured
(to VDE 0106 and IEC 364 / 536 or equivalent national regulations).

Housing

<u>Materials</u>	**• C**	Compact:	die-cast aluminium (optionally stainl. steel 1.4404)
	• F	Field housing	die-cast aluminium (optionally stainl. steel 1.4404)
	• W	Wall-mounted hsg	polyamide
	• R	19" rack	aluminium section, stainless steel and aluminium sheet, in part with polyester coating
<u>Ambient temperature</u>	• in operation		-40 … +65 °C / -40 … 149 °F
	• in storage		-50 … +70 °C / -58 to +158 °F
<u>Degree of protection</u>			
(IEC 529 / EN 60 529)	**• C**	Compact:	IP 67 / NEMA 6
	• F	Field housing	IP 67 / NEMA 6
	• W	Wall-mounted hsg	IP 65 / NEMA 4 and 4X
	• R	19" rack	IP 20 / NEMA 1
<u>Cable entry</u>	for Versions C, F and W		M 20 × 1.5, ½" NPT or PF ½"

Signal cables

• KROHNE DS 300 (standard)	double shield, signal cable A, standard length 5 m
• KROHNE BTS 300 (option)	triple shield, signal cable B

• other signal cables (note following operating data!)	- Low-voltage directives to EN 60 811 or
	  equivalent national standards
	- Capacitance of signal wire:
	  wire to wire and wire to shield
	  < 150 pF / m <u>or</u> 50 pF / ft
	- Isolation resisance
	  > 100 GΩ / km <u>or</u> > 240 GΩ / mile
	- U_{max} < 24 V - I_{max} < 100 mA
	- Voltage checks
	  signal wire / inner shield 500 V
	  signal wire / signal wire 1000 V
	  signal wire / outer shield 1000 V
	- Twisting / strapping of signal wires
	  minimum 10× / m <u>or</u> 3× / ft
	   important when screening magnetic fields

5.2   Selection table for KROHNE sensors (primary heads)

Sensor	Meter size			Special features	EEx-Version (various)	Custody transfer
	Connection	DN mm	inch			
OPTIFLUX 1000	Sa	DN 10 - 150	$^3/_8$" - 6"	Teflon® PFA liner	-	-
OPTIFLUX 2000	Fl	DN 25 - 3000	1" - 120"	specifically for water	-	-
OPTIFLUX 4000	Fl	DN 2.5 - 3000	$^1/_{10}$" - 120"	Teflon® PFA, ETFE, and others	yes	yes
OPTIFLUX 5000	Sa	DN 2.5 - 100	$^1/_{10}$" - 4"	ceramics, 99.7 % Al_2O_3	yes	yes
	Fl	DN 150 - 250	6" - 10"		-.	-
OPTIFLUX 6000	Food	DN 2.5 - 150	$^1/_{10}$" - 6"	Teflon® PFA liner hygienic use	yes	-

Sa   Sandwich design, flangeless

Fl   Flanged design

Food   hygienic screw, clamp and flange connections

Teflon® is a registered trademark of DuPont.

5.3   Flow tables
v = flow velocity in m/s   **v = flow velocity in ft/s**

Full scale range $Q_{100\%}$			Meter size in …		Full scale range $Q_{100\%}$		
v = 0.3 m/s	v = 1.0 m/s	v = 12 m/s	DN mm	inch	v = 1.0 ft/s	v = 10 ft/s	v = 40 ft/s
minimum		maximum			minimum		maximum
0.0053	0.0177	0.2121	**2.5**	$^1/_{10}$	0.0237	0.2372	0.9486
0.0136	0.0452	0.5429	**4**	$^1/_8$	0.0607	0.6071	2.428
0.0306	0.1018	1.222	**6**	$^1/_4$	0.1366	1.366	5.464
0.0849	0.2827	3.392	**10**	$^3/_8$	0.3794	3.794	15.18
0.1909	0.6362	7.634	**15**	$^1/_2$	0.8538	8.538	34.15
0.3393	1.131	13.57	**20**	$^3/_4$	1.518	15.18	60.71
0.5302	1.767	21.20	**25**	1	2.372	23.72	94.86
0.8686	2.895	34.74	**32**	-	3.886	38.86	155.4
1.358	4.524	54.28	**40**	$1^1/_2$	6.071	60.71	242.8
2.121	7.069	84.82	**50**	2	9.486	94.86	379.4
3.584	11.95	143.3	**65**	-	16.03	160.3	641.3
5.429	18.10	217.1	**80**	3	24.28	242.8	971.4
8.483	28.27	339.2	**100**	4	37.94	379.4	1 518
13.26	44.18	530.1	**125**	-	59.29	592.9	2 372
19.09	63.62	763.4	**150**	6	85.38	853.8	3 415
33.93	113.1	1 357	**200**	8	151.8	1 518	6 071
53.02	176.7	2 120	**250**	10	237.2	2 372	9 486
76.35	254.5	3 053	**300**	12	341.5	3 415	13 660
135.8	452.4	5 428	**400**	16	607.1	6 071	24 284
212.1	706.9	8 482	**500**	20	948.6	9 486	37 944
305.4	1 018	12 215	**600**	24	1 366	13 660	54 640
415.6	1 385	16 625	**700**	28	1 859	18 593	74 371
542.9	1 810	21 714	**800**	32	2 428	24 284	97 138
662.8	2 290	26 510	**900**	36	3 074	30 735	122 940
848.2	2 827	33 929	**1 000**	40	3 794	37 944	151 778
1 221	4 072	48 858	**1 200**	48	5 464	54 640	218 560
1 663	5 542	66 501	**1 400**	56	7 437	74 371	297 484
2 171	7 238	86 859	**1 600**	64	9 714	97 138	388 551
2 748	9 161	109 931	**1 800**	72	12 294	122 940	491 760
3 393	11 310	135 717	**2 000**	80	15 178	151 778	607 111
4 105	13 685	164 217	**2 200**	88	18 365	183 651	734 605
4 866	16 266	195 432	**2 400**	96	21 856	218 560	874 240
5 734	19 113	229 361	**2 600**	104	25 650	256 504	1 026 018
6 650	22 167	266 005	**2 800**	112	29 748	297 484	1 189 938
7 634	25 447	305 363	**3 000**	120	34 150	341 500	1 366 000

5.4 Measuring accuracy / error limits (under reference conditions, see below)

All KROHNE EMFs are calibrated by direct volumetric comparison on internationally traceable calibration rigs accredited in conformity with EN 17025.
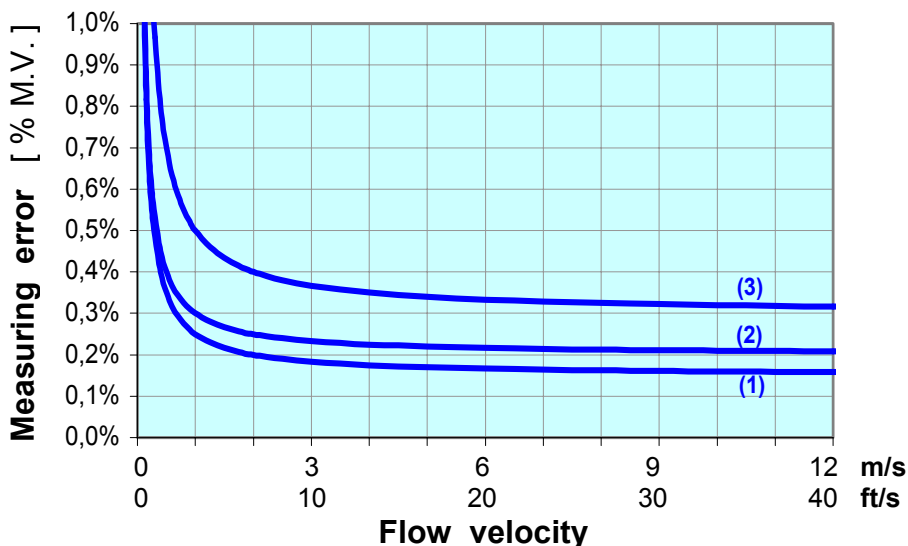
OPTIFLUX sensors	DN [mm]	[inch]	Measuring error	Curve
5300	10-100	$^3/_8$" - 4"	0.15% of M.V. + 1mm/s 0.04"/s	1
	150 - 250	6" - 10"	0.2% of M.V.+ 1mm/s 0.04"/s	2
2300 / 4300	10 - 1600	$^3/_8$" - 64"	0.2% of M.V.+ 1mm/s 0.04"/s	2
6300	10 - 150	$^3/_8$" - 6"		
1300	10 - 150	$^3/_8$" - 6"	0.3% of M.V.+ 2mm/s 0.08"/s	3
4300 / 5300 / 6300	2.5 - 6	$^1/_{10}$" - $^1/_4$"		
2300 / 4300	> 1600	> 64"		

Special calibrations on request

Reference conditions similar to those in EN 29 104

Process product	water at 10 – 30°C / 14 … 86°F
Electrical conductivity	> 300 µS/cm
Power supply	U_N ± 2% (U_N = rated voltage)
Ambient temperature	18 – 28°C / 65 -82°F
Warm-up time	approx. 10 min
Calibration equipment	max. uncertainty < 0.2 x F
Inlet / outlet runs	equiv. to 10 x DN / 2 x DN (DN = meter size)
Primary head	properly grounded and centered

Every single KROHNE signal converter undergoes a burn-in test for a minimum of 20 hours at varying ambient temperatures from –20 to +60°C / -40 to +149°F. Functioning and accuracy of each signal converter are monitored by computer.
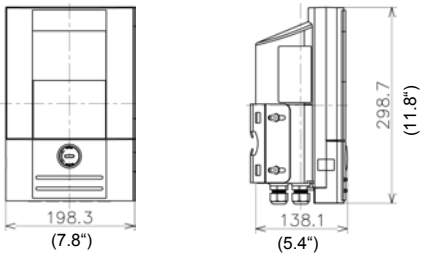
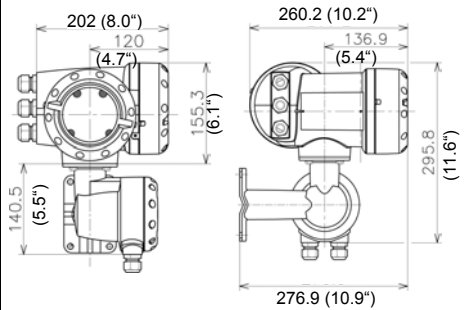## 5.5 Dimensions and weights IFC 300 signal converter

Dimensions in mm and (inch)
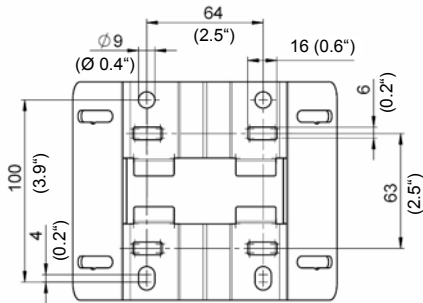
IFC 300 C Compact housing
Weight: approx. 4.2 kg / 9.3 lb
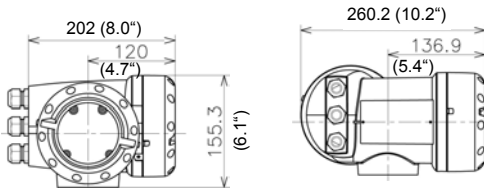
IFC 300 W Wall-mounted housing
Weight: approx. 2.4 kg / 5.3 lb

IFC 300 F Field housing
Weight: approx. 5.7 kg / 12.6 lb

Wall and pipe mounting plate IFC 300 W

Several IFC 300 W mounted side by side

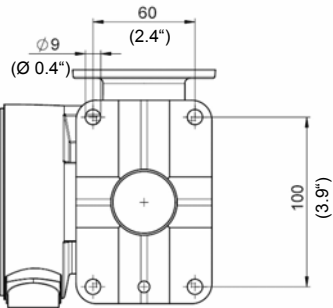Centre-to-centre distance of mounting plates ≥ 240 mm

For wall mounting:
Use holes sized:
width x height = 60 x 100 = 2.4" × 3.9"

For mounting on standpipe:
Use rectangular cutouts. Clips may not extend through mounting plate more than max. 10 mm. = 0.4"

Wall and pipe mount IFC 300 F

Several IFC 300 F mounted side by side

When all mounted on one level:
centre-to-centre distance of mounts:
≥ 600 mm / ≥ 23.6",
so as to allow easy access to terminal compartment for power and outputs.

Recommended for larger number of IFC 300 F meters: staggered arrangement laterally and vertically (e.g. vertical spacing of mounting plates ≥ 250 mm / ≥ 9.8")

Returning a device for testing or repair to KROHNE

This device 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 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, KROHNE may only handle, test and repair returned devices that have been in contact with products without risk to personnel and environment.

This means that KROHNE can only service this device if it is accompanied by the following certificate confirming that the device is safe to handle.

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 neutralizing, 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.

We cannot service this device unless accompanied by such a certificate.

S P E C I M E N   certificate

Company: Address:
……………………………………………..   ……………………………………………………

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

Tel. No.:   Fax No.:
……………………………………………..   …………………………………………………...

The enclosed device

Type:
………

KROHNE Order No. or Series No.:
…….

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

Because this liquid is   O water-hazardous   O toxic   O caustic   O flammable

we have   O checked that all cavities in the instrument are free from such substances
           O flushed out and neutralized all cavities in the device

We confirm that there is no risk to humans or environment through any residual liquid contained in this device.

Date: Signature:
…………………………………   ……………………………………………………………………

Company stamp: