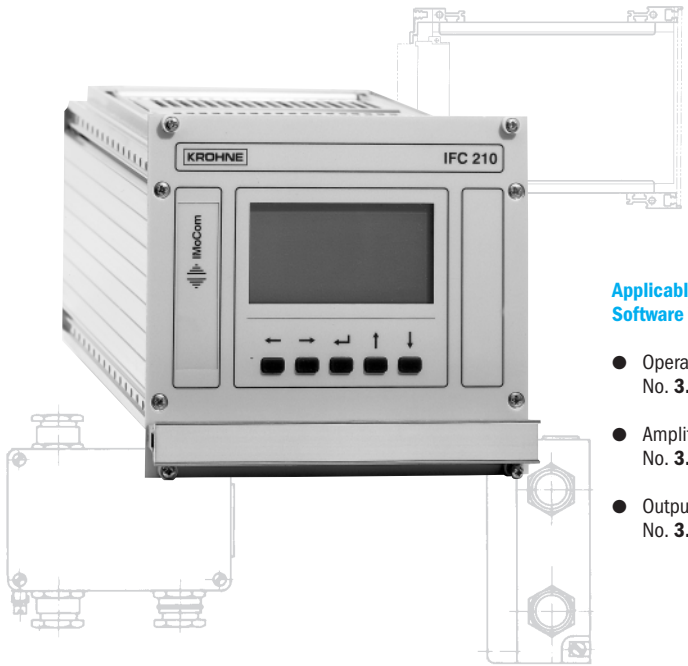
KROHNE

Condensed Instructions

IFC 210 E
IFC 210 E-EEx

Signal converters for electromagnetic flowmeters



Applicable to Software Versions

- Operating and check elements No. **3.18393.01**
- Amplifier (ADC) No. **3.17116.01**
- Outputs/inputs (I/O) No. **3.19005.01**

Contents

PLEASE NOTE

These concise instructions do not include the following: device description, technical data, standards, approvals, etc., nor conditions pertaining to product liability and warranty.

The operator is, however, obligated to take note of these sections in the detailed Installation and Operating Instructions.

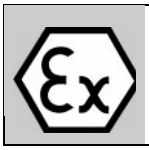
References to chapters

All references to chapters in these Condensed Instructions refer to those of the detailed “Installation and Operating Instructions”. It is important that the detailed Instructions be referred to for all chapters omitted from these Condensed Instructions. This particularly concerns installation and operation in hazardous areas!

1 Electrical connection: power supply

1.1 Location and important installation notes

- **Electrical connection in accordance with VDE 0100** "Regulations governing heavy-current installations with line voltages up to 1000 V" or **equivalent others national regulations**.
- Do not cross or loop **cables**.
- Use **separate cable** entries (see below) for power supply, field current cables, signal lines, outputs and inputs.
- Protect flowmeters or switchgear cabinets with built-in devices from direct **sunlight**. Fit a sunshade if necessary.
- When **installed in switchgear cabinets**, signal converters must be adequately cooled, e.g. use fans or heat exchangers. (dust-free air and no aggressive gases)
- Do not expose signal converters to intense **vibration**.
- Keep **distance between primary head and signal converter** as short as possible. Refer to Sect. 1.3.4 for maximum permissible length of signal and field current cables.
- Use the supplied KROHNE **signal cable A** (Type DS), standard length 10 m (33 ft), or optional **signal cable B** (Type BTS).
- Always **calibrate** primary head and signal converter **together**. Therefore, when installing, ensure **primary constant GK is identical**; refer to instrument nameplate for the primary head.
  If the GK is not identical, set the signal converter to the GK of the primary head.
  Refer also to Section 4.
- **Dimensions of signal converter,** refer to Section 10.4.



IMPORTANT!
For EEx versions, also pay regard to all special directions included in Sect. 6.1 and 13.
Only the EEx primary head may be installed in the hazardous area.
The signal converter must be installed outside the hazardous area!

1.2 Power supply - Electrical connection

PLEASE NOTE !

- Rated values: The flowmeter housings meets the requirements of IP 20 in conformity with EN 60529.
  No protection against water and moisture. If necessary, take appropriate protective measures.
  The selected creepage distances and clearances have been dimensioned in conformity with VDE 0110 and IEC 664 for contamination category 2. Supply circuits and output circuits are designed to meet the standards of overvoltage class II.

- Fuse protection, disconnecting device: fuse protection for the feeding power circuit, and also a disconnecting device (switch, circuit breaker) for isolating the signal converters must be provided (see also Sect. 1.3.5).

Power supply 100-230 V AC (Tolerance zone: 85-255 V AC)

- **Note information on instrument nameplate**: supply voltage and frequency

- **Connection diagrams** for electrical connection between primary head and signal converter: refer to Section 1.3.5.

Power supply 24 Volt AC / DC (Tolerance zone: **AC** 20.4 - 26.4 V / **DC** 18 - 31.2 V)

- **Note information on instrument nameplate**: supply voltage and frequency

- For measurement reasons, connect an **FE functional ground conductor**.

- If connected to a functional extra-low voltage source (24 V AC / DC, 48 V AC), provide for **protective separation (PELV)** in conformity with e.g. VDE 0100 / VDE 0106 or IEC 364 / IEC 536, or equivalent national regulations.

- **Connection diagrams** for power supply and electrical connection between primary head and signal converter: refer to Section 1.3.5.

IMPORTANT!
For EEx versions, also pay regard to all special directions included in Sect. 6.1 and 13.
Only the EEx primary head may be installed in the hazardous area.
The signal converter must be installed outside the hazardous area!

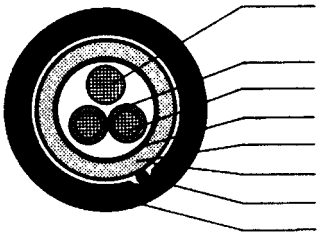
1.3 Electrical connection of separate primary heads

1.3.1 General remarks on signal lines A and B and field current line C

Proper operation of the equipment is ensured when KROHNE signal lines A and B are used with foil screen and magnetic shield.

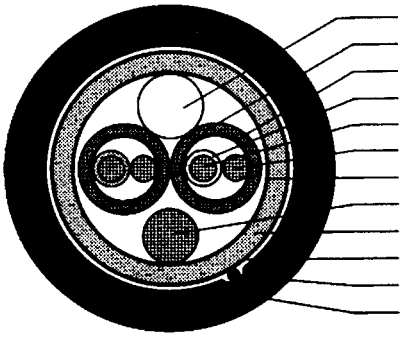
- Signal lines must be firmly installed.
- Shields are connected via stranded drain wires.
- Underwater or underground routing is possible.
- Insulating material flame-retardant to IEC 332.1 / VDE 0742.
- Low-halogen, unplasticized signal lines which remain flexible at low temperatures.

Signal line A (type DS) with double shielding



1 Stranded drain wire, 1st shield, 1.5 mm^2
2 Insulation
3 Stranded wire 0.5 mm^2 (3.1 red/3.2 white)
4 Special foil, 1st shield
5 Insulation
6 Mu-metal foil, 2nd shield
7 Stranded drain wire, 2nd shield, 0.5 mm^2
8 Outer sheath

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



1 Dummy glider wire
2 Insulation (2.1 red/2.2 white)
3 Special foil, 1st shield (3.1/3.2)
4 Insulation (4.1/4.2)
5 Stranded wire 0.5 mm^2 (5.1 red/5.2 white)
6 Stranded drain wire, 1st shield, 0.5 mm^2 (6.1 / 6.2)
7 Special foil, 2nd shield
8 Stranded drain wire, 2nd shield, 1,5 mm^2
9 Insulation
10 Mu-metal foil, 3rd shield
11 Stranded drain wire, 3rd shield,, 0,5 mm^2
12 Outer sheath

Field current line C
Line 2 × 0,75 mm^2, 2 × 1,5 mm^2 or 4 × 1,5 mm^2Cu, single shielding
(Cu = copper cross section)
The cross section depends on the required cable length, see table in Section 1.3.4.

IMPORTANT!
For EEx versions, also pay regard to all special directions included in Sect. 6.1 and 13.
Only the EEx primary head may be installed in the hazardous area.
The signal converter must be installed outside the hazardous area!

1.3.2 Stripping (preparation) of signal cables

Please note: The numbers in the drawings designate the stranded drain wires of signalling cables A and B, see sectional drawings in Sect. 1.3.1.

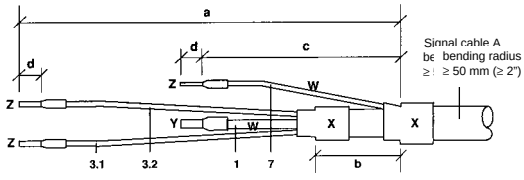
primary head

Length	primary head	
	mm	inch
a	90	3.60
b	8	0.30
c	25	1.00
d	8	0.30
e	70	2.80

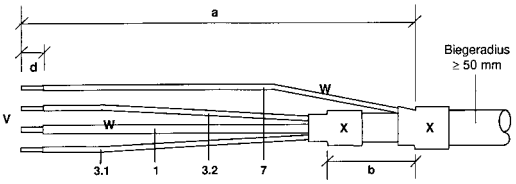
Converter

Length	Converter	
	mm	inch
a	40	2.80
b	10	0.30
d	5	0.30
e	20	2.00

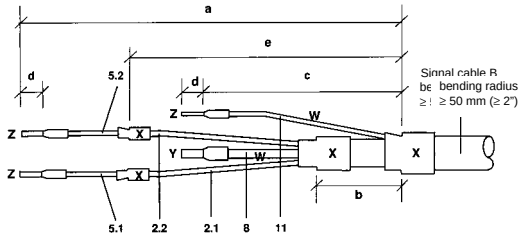
Signal cable A (type DS),
double shielding
for primary head



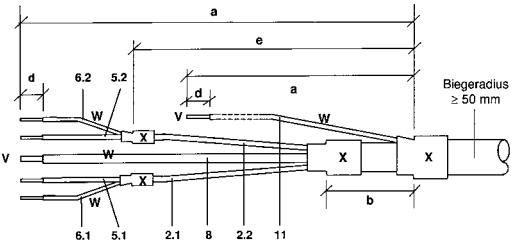
Signal cable A (type DS),
double shielding
for IFC 210 E Converter



Signal line B (type BTS),
with triple shielding (bootstrap)
for primary head



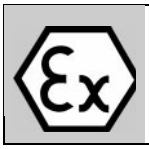
Signal line B (type BTS),
with triple shielding (bootstrap)
for IFC 210 E Converter



Customer-supplied materials	
V	Tin-coat all stranded drain wire ends!
W	Insulation tubing (PVC), Ø 2.0-2.5 mm (Ø 1")
X	Heat-shrinkable tubing or cable sleeve
Y	Wire end sleeve to DIN 41 228: E 1.5-8
Z	Wire end sleeve to DIN 41 228: E 0.5-8

1.3.3 Grounding of primary head

- All flowmeters must be grounded.
- The grounding conductor should not transmit any interference voltages.
- Do not ground any other electrical device together with this conductor.
- The primary head is connected to ground by means of an **FE functional ground conductor**.
- Special information on grounding various primary heads is contained in the separate **installation instructions for primary heads**.
- These instructions also contain detailed descriptions on how to use grounding rings and how to install primary heads in metal or plastic pipes or internally coated pipelines.



IMPORTANT!
For EEx versions, also pay regard to all special directions included in Sect. 6.1 and 13.
Only the EEx primary head may be installed in the hazardous area.
The signal converter must be installed outside the hazardous area!

1.3.4 Cable lengths (max. distance between signal converter and primary head)

Abbreviations and explanatory notes
used in the following tables, diagrams and connection diagrams

A Signal cable A (type DS), with double shielding, see diagram A for max. length

B Signal line B (type BTS) with triple shielding, max. length see diagram B

C Field current cable min. cross-section (AF) and max. length, see Table

D High-temperature silicone cable, 3 × 1.5 mm^2 (14 AWG) Cu, (with single shielding, max. length 5 m (16 ft)

E High-temperature silicone cable, 2 × 1.5 mm^2 (14 AWG) Cu, max. length 5 m (16 ft)

A_F Cross section of field current line C in Cu, see table

L Cable length

κ Electrical conductivity of the process liquid

ZD Intermediate connection box required in connection with cables D and E for primary heads ALTOFLUX IFS 4000 F, PROFIFLUX IFS 5000 F and VARIFLUX IFS 6000 F in cases where process temperatures exceed 150 °C (302 °F)

Recommended length of signal cable A (Type DS) **and B** (Type BTS)

Primary head	Meter size						Signal cable	
	DN mm			inch			A	B
AQUAFLUX F	10	-	1600	3/8	-	64	A1	B1
ECOFLUX IFS 1000 F	10	-	15	3/8	-	½	A4	B3
	25	-	150	1	-	6	A3	B2
ALTOFLUX IFS 2000 F	150	-	250	6	-	10	A1	B1
ALTOFLUX IFS 4000 F	10	-	150	3/8	-	6	A2	B2
	200	-	1600	8	-	64	A1	B1
PROFIFLUX IFS 5000 F	2.5	-	15	1/10	-	½	A4	B3
	25	-	100	1	-	4	A2	B2
VARIFLUX IFS 6000 F	2.5	-	15	1/10	-	½	A4	B3
	25	-	80	1	-	3	A2	B2
ALTOFLUX M 900	10	-	300	3/8	-	12	A1	B1

Diagram A

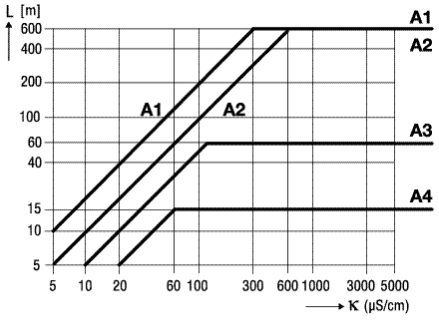
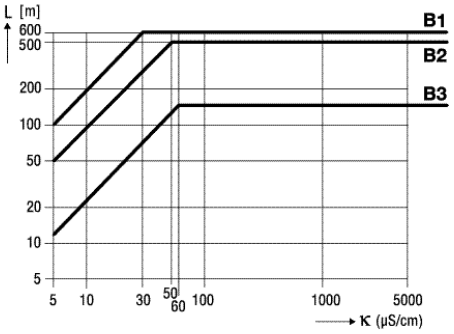


Diagram B



Field current cable C

Length L		Cross section A_F (Cu), minimum	
0 – 150 m	5 – 500 ft	2 x 0.75 mm²	/ 2 × 18 AWG
150 – 300 m	500 – 1000 ft	2 x 1.50 mm²	/ 2 × 14 AWG
300 – 600 m	1000 – 1900 ft	4 x 1.50 mm²	/ 2 × 12 AWG

1.3.5 Connection diagrams for power supply and primary head

PLEASE NOTE: Undocumented contacts/terminals to remain unwired.

The figures in brackets indicate the stranded drain wires for the shields
(see cross-sectional drawing of signal cable in Section 1.3.1).

- Electrical connection to VDE 0100 "Regulations governing heavy-current installations with line voltages up to 1000 V" or equivalent national regulations.

- 24 V AC / DC power supply: Functional extra-low voltage with protective separation in conformity with VDE 0100, Part 410 or equivalent national regulations (IFC 020 E: 24 V DC in preparation).

- Fuse protection of the feed line circuit with $I_{RAT} \leq 16$ A is required. Also, a disconnecting device (switch/circuit breaker) must be provided in the vicinity of the solidly connected signal converters or device groups, refer to EN 61 010. This disconnecting device must be easy to reach and also identifiable as such.

***** Contacts **2d, 2z, 4d, 4z** of **XA** must be electrically connected.

****** Connection to **8d** and/or **8z** of **XA.**

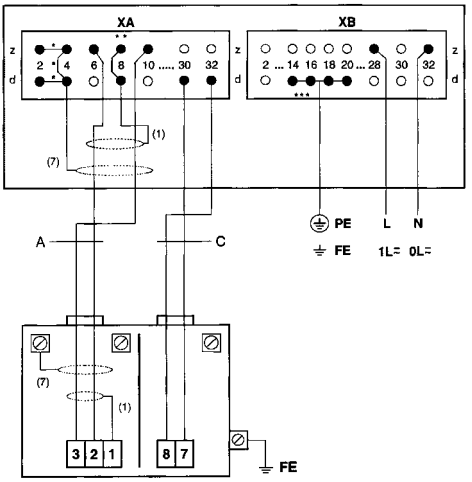
******* Contacts **d2 to d32** of **XB** are of leading type, for connection of **PE** (safety conductor) or **FE** (functional ground).
At least 4 contacts with adequate cross-section to be electrically connected.

Important:
Electrical connection of EEx primary heads and EEx signal converters
To be carried out as described in Sect. 1.3.6.

Process temperature < 150°C (302°F)

I Signal cable A (type DS)

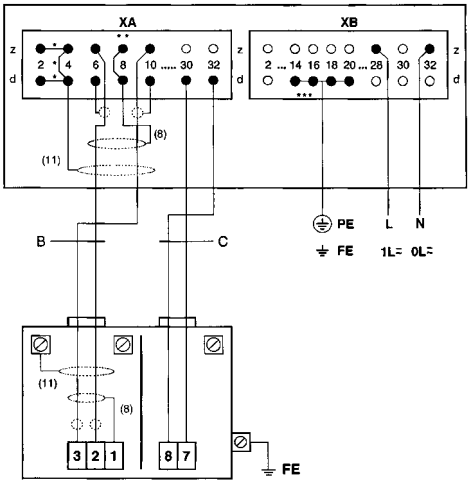
IFC 210 E



Primary head

II Signal cable B (type BTS)

IFC 210 E

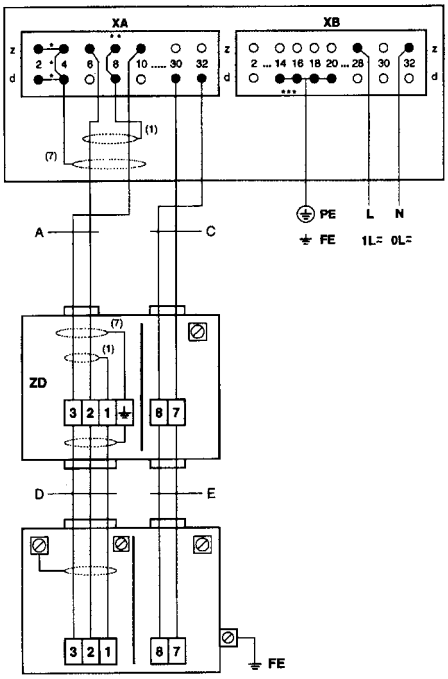


Primary head

Process temperature > 150°C (302°F)

III Signal cable A (type DS)

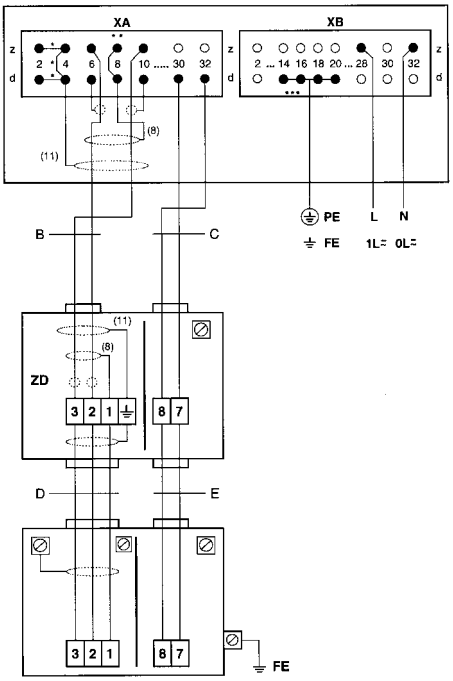
IFC 210 E



Primary head

IV Signal cable B (type BTS)

IFC 210 E



Primary head

1.3.6 EEx-Connection diagrams for power supply and primary head

Connection diagrams

PLEASE NOTE: Undocumented contacts/terminals to remain unwired.

The figures in brackets indicate the stranded drain wires for the shields (see cross-sectional drawing of signal cable in Section 1.3.1).

- Electrical connection to VDE 0100 "Regulations governing heavy-current installations with line voltages up to 1000 V" or equivalent national regulations.
- 24 V AC / DC power supply: Functional extra-low voltage with protective separation in conformity with VDE 0100, Part 410 or equivalent national regulations (IFC 020 E: 24 V DC in preparation).
- Fuse protection of the feed line circuit with $I_{RAT} \leq 16$ A is required. Also, a disconnecting device (switch/circuit breaker) must be provided in the vicinity of the solidly connected signal converters or device groups, refer to EN 61 010. This disconnecting device must be easy to reach and also identifiable as such.

***** Contacts **2d, 2z, 4d, 4z** of **XA** must be electrically connected.

****** Connection to **8d** and/or **8z** of **XA.**

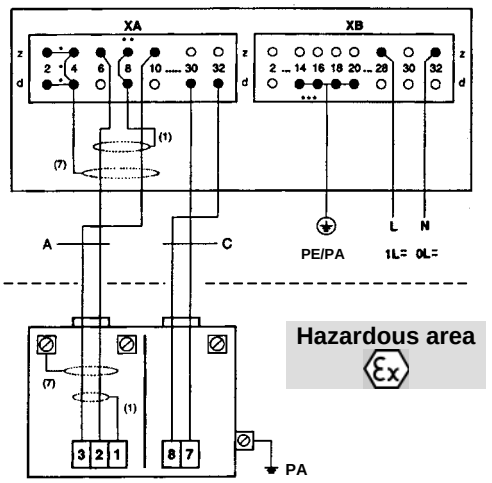
******* Contacts **d2 to d32** of **XB** are of leading type, for connection of **PE** (safety conductor) or **FE** (functional ground). **At least 4 contacts** with adequate cross-section to be electrically connected.

Important:
In respect of EEx versions, pay regard to all directions marked with the ⟨Ex⟩ symbol, and also the information given in Sect. 6.1 and 13.
Only the EEx primary head may be installed in the hazardous area.
The signal converter must be installed outside the hazardous area!

Process temperature < 150°C (302°F)

I Signal cable A (type DS)

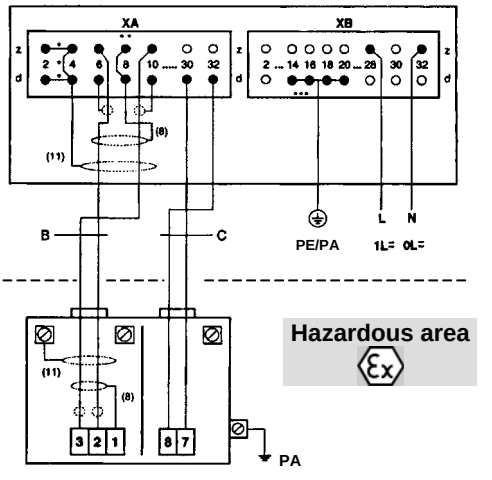
IFC 210 E-EEx



Primary head

II Signal cable B (type BTS)

IFC 210 E-EEx

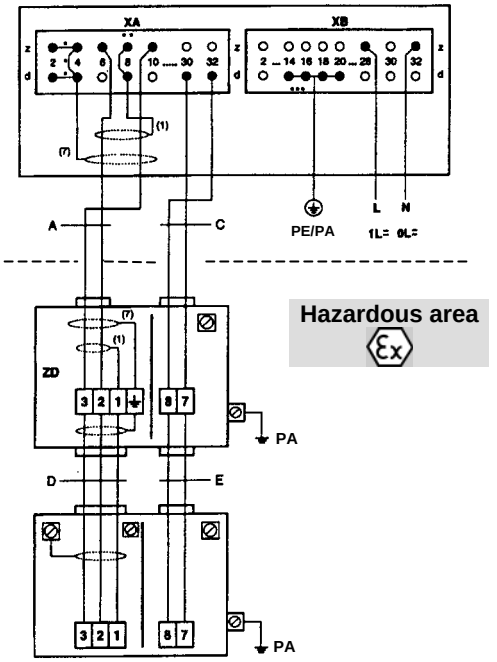


Primary head

Process temperature > 150°C (302°F)

III Signal cable A (type DS)

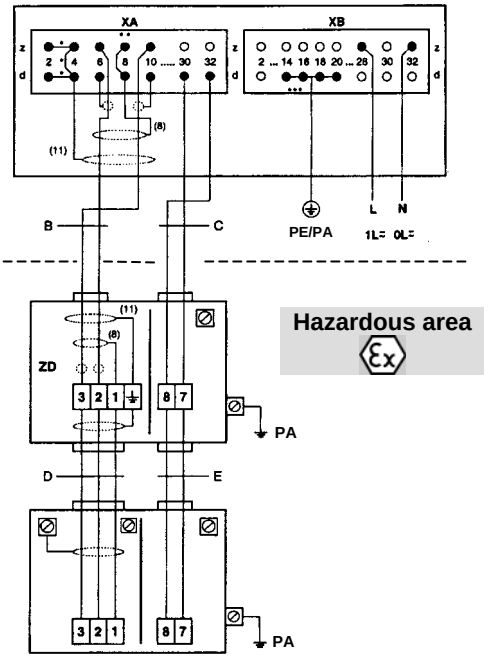
IFC 210 E-EEx



Primary head

IV Signal cable B (type BTS)

IFC 210 E-EEx



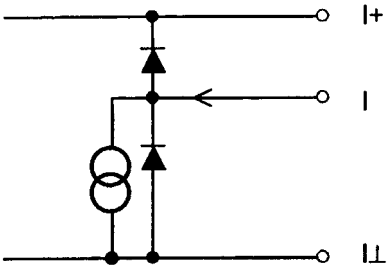
Primary head

2 Electrical connection of outputs and inputs

Important:
In respect of EEx versions, pay regard to all directions marked with the Ex symbol, and also the information given in Sect. 6.1 and 13.
Only the EEx primary head may be installed in the hazardous area.
The signal converter must be installed outside the hazardous area!

2.1 Current output I

- The current output is galvanically isolated from all input and output circuits.
- Setting data and functions can note down in Section 3.3.
  Please also refer to Sect. 3.2 Factory settings.
- Typical current output

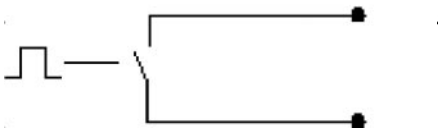


I+ approx. 22-25 V DC positive voltage of current output
I current sink
I⊥ chassis ground, current output

- All operating data and functions can be set, see Sect. 4 and 5.6, Fct. 1.05 for operator control
- The current output can also be used as an internal voltage source for the binary outputs and inputs.
- U_{int} = 22-25 V DC I = 23 mA when operated **without** receiver instruments at the current output
  I = 3 mA when operated **with** receiver instruments at the current output
- **Connection diagrams**, see Sect. 2.5: diagrams ① ② ③ ⑤ ⑦ ⑨ ⑩

2.2 Pulse output P

- The pulse output is galvanically isolated from the current output and all input circuits.
- Setting data and functions can note down in Section 3.3.
  Please also refer to Sect. 3.2 Factory settings.
- Typical pulse output P



P pulse output

P pulse output

- All operating data and functions can be set, see Sect. 4 and 5.7, Fct. 1.06 for operator control
- The pulse output can be operated in the active or passive mode.
- Active mode: The current output is the internal voltage source, connection of electronic totalizers (EC)
- Passive mode: External DC or AC voltage source required, connection of electronic (EC) or electromechanical (EMC) totalizers

Please note:
A fixed pulse width (0.01 – 1s) must be set for **operation with EMC totalizer**. Only then is an optocoupler active for higher output currents.

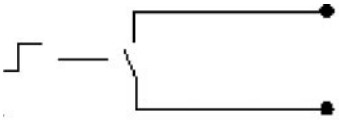
- Digital pulse division, interpulse period is non-uniform. Therefore, if frequency meters or
- cycle counters are connected, allow for minimum counting interval:

- gate time, counter $\leq \frac{1000}{P_{100\%}\ [Hz]}$

- **Connection diagrams,** see Sect. 2.5: diagrams ③ ④ ⑨ ⑩

2.3 Status outputs B1 and B2

- The status outputs are galvanically isolated from the current output and all input circuits.
- Setting data and functions can note down in Section 3.3.
  Please also refer to Sect. 3.2 Factory settings.
- Typical status outputs B1 and/or B2



B1/B2 status outputs B1/B2

B⊥ chassis ground, binary outputs and inputs

- All operating data and functions can be set,
  see Sect. 4 and 5.9, Fct 1.07 and/or 1.08 for operator control

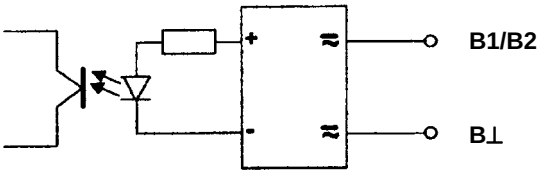
The status outputs can be operated in the active or passive mode.
Active mode: The current output is the internal voltage source.
Passive mode: External DC or AC voltage source required.

Characteristics of the status outputs	**Switch open**	**Switch closed**
OFF (switched off)	no function	
ON (e.g. operation indicator)	power OFF	Hilfsenergie EIN
SIGN I (F/R mode)	**F**orward flow	**R**everse flow
SIGN P (F/R mode)	**F**orward flow	**R**everse flow
TRIP POINT (limit switch)	inactive	active
AUTO RANGE (automatic range change)	high range	low range
OVERFLOW I (I overranged)	current output OK	current output overranged
OVERFLOW. P (P overranged)	pulse output OK	pulse output overranged
SMU I (low-flow cutoff active)	Inactive	active
SMU P (low-flow cutoff active)	Inactive	active
Inverse B1 (switches B2 inversely to B1)	B2 open, B1 closed	B2 closed, B1 open
ALL. ERROR (all errors)	errors	no error
FATAL.ERROR (fatal errors only)	errors	no error
EMPTY PIPE (option)	when measuring tube is empty	when measuring tube is full

- **Connection diagrams,** see Sect. 2.5: diagrams ⑤ ⑥ ⑨ ⑩

2.4 Control inputs B1 and B2

- The control inputs are galvanically isolated from the current output and all input circuits.
- Setting data and functions can note down in Section 3.3.
  Please also refer to Sect. 3.2 Factory settings.
- Typical current inputs B1 and B2



- All operating data and functions can be set,
  see Sect. 4 and 5.10, Fct 1.07 and/or 1.08 for operator control
- The control inputs must be operated in the passive mode.

Function of the control inputs	**inactive** no voltage	**active** voltage present
Off	No functions	
External range	High range	Low range
Hold measured values	Measured values follow the measurement	Hold measured values
Measured values at zero	Measured values follow the measurement	Measured values set to “zero“
Reset totalizer	inactive	Reset totalizer
Delete errors	inactive	Delete error messages

Connection diagram, see Sect. 2.5: diagram ⑦ ⑧

2.5 Connection diagrams for outputs and inputs

Important:
In respect of EEx versions, pay regard to all directions marked with the Ex symbol, and also the information given in Sect. 6.1 and 13.
Only the EEx primary head may be installed in the hazardous area.
The signal converter must be installed outside the hazardous area!

I Current output (included HART®)

P Pulse output

B1, B2 Status output (**S**) and / or Control input (**C**)

Totalizer
- electromechanical (EMC)
- electronic (EC)

milliammeter
0-20 mA or 4-20 mA and other

Key, N/O contact

External voltage source (U_{ext}),
DC or AC voltage,
connection polarity arbitrary

DC voltage,
external power source (U_{ext}),
note connection polarity

Please note ! Unwired contacts may not have any conductive connection with other electrically conducting parts.

Electrical connection to socket connector XC
Wiring diagrams ① to ⑩ of outputs and inputs.

Interface operation with HART® or RS 485 (Option) see Sect. 6.2.1 and 6.2.2.

Active mode

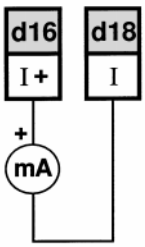
Power for operation (activation) of outputs and inputs supplied by the current output.

Passive mode

External power source required for operation (activation) of outputs and inputs.

① Current output I_{aktiv}

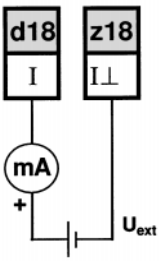
U = 0/4-20 mA
R_L < 800 Ω



② Current output I_{passiv}

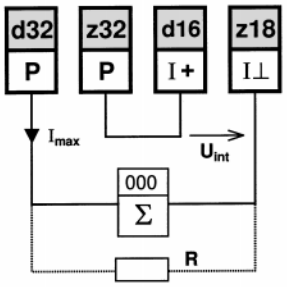
U_{ext}	15-22 V DC	22-32 V DC
R_L	0-500 Ω	0-800 Ω

I = 0/4-20 mA



③ Pulsoutput P_{activ}
for electronic totalizer (**EC**)

U_{int} = 22-25 V DC from current output
I_{max} ≤ 3 mA operation **with** current output **I**
I_{max} ≤ 23 mA operation **without** current output **I**



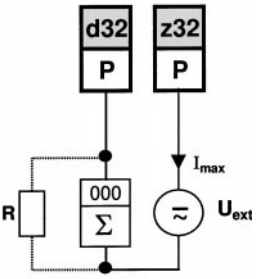
R = 10 kΩ, prevents incorrect counts when pulse output in open circuit

Where frequencies are > 100 Hz, use shielded cables (RFD)

④ Pulsoutput P_{passiv}
for electronic totalizer (**EC**) or electromechanical totalizer (**EMC**)

EMC: U_{ext} ≤ 32 V DC / ≤ 24 V AC
I_{max} ≤ 150 mA **f** ≤ 50 Hz
EC: U_{ext} ≤ 32 V DC I_{max} ≤ 20 mA

Pulses	≤ 1 kHz	< 10 kHz
R (load)	1-10 kΩ	1-3 kΩ

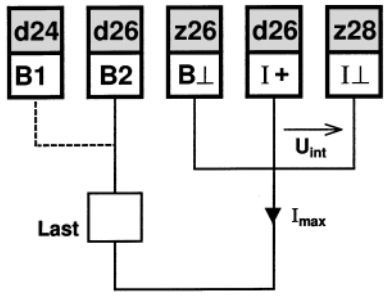


R = load impedance with EC totalizer operation; for value refer to table above

Where frequencies are > 100 Hz, use shielded cables (RFD)

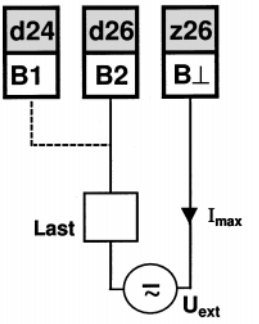
⑤ Statusoutput S_{activ}
(connection to B2 and/or B1)

U_{int} = 22-25 V DC from current output
I_{max} ≤ 3 mA operation **with** current output **I**
I_{max} ≤ 23 mA operation **without** current output **I**



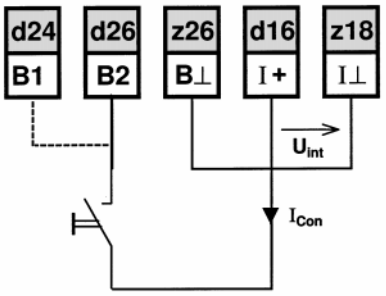
⑥ Statusoutput S_{passiv}
(connection to B2 and/or B1)

U_{ext} ≤ 32 V DC / ≤ 24 V DC
I_{max} ≤ 150 mA



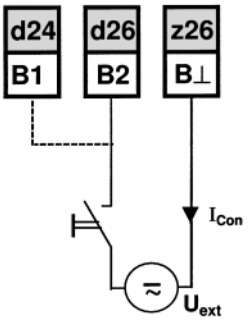
⑦ Control input C_{active}
(connection to B2 and/or B1)

U_{int} = 22-25 V DC from current output
$I_{con} \leq$ 4 mA (max. contact rating)



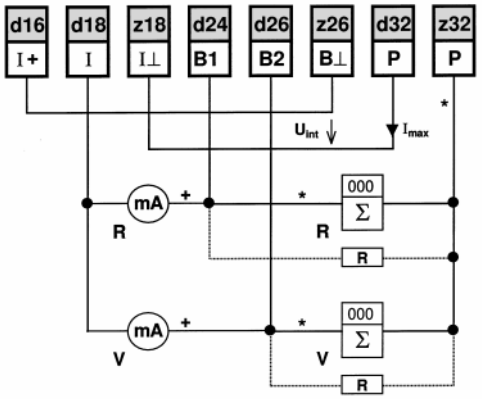
⑧ Control input $C_{passive}$
(connection to B2 and/or B1)

U_{ext} ≤ 32 V DC / ≤ 24 V AC
I_{con} ≤ 6 mA (max. contact rating)



⑨ F/R measurement (**F**=forward) (**R**=reverse)
Current output I_{active} **a**nd/or
pulse output P_{aktive} (for **EC**)
without external changeover relay

U_{int} = 22-25 V DC from current output
$I_{max} \leq$ 3 mA operation **with** current output **I**
$I_{max} \leq$ 23 mA operation **without** current output **I**



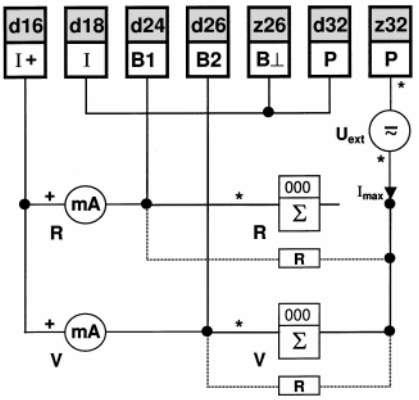
R = 10 kΩ, prevents incorrect counts when pulse output in open circuit

* Where frequencies are > 100 Hz, use shielded cables (RFD)

⑩ F/R measurement (**F**=forward) (**R**=reverse)
Current output $I_{passive}$ **a**nd/or
pulse output $P_{passive}$ (for **EC** or **EMC**)
without external changeover relay

EMC: U_{ext} ≤ 32 V DC / ≤ 24 V AC
I_{max} ≤ 150 mA **f** ≤ 50 Hz
EC: U_{ext} ≤ 32 V DC I_{max} ≤ 20 mA

Pulses	≤ 1 kHz	< 10 kHz
R (load)	1-10 kΩ	1-3 kΩ



R = load impedance with EC totalizer operation; for value refer to table above

* Where frequencies are > 100 Hz, use shielded cables (RFD)

3 Start-up

3.1 Power-on and measurement

- Before powering the system, please check that it has been correctly installed according to Sect. 1 and 2.
- The flowmeter is delivered ready for operational use. All operating data have been factory set in accordance with your specifications.
  Please refer to Sect. 3.2 "factory settings".
- Power the unit, and the flowmeter will immediately start process flow measurement.
- Refer to Sect. 4 and 5 for operator control.

3.2 Factory setting

All operating data are factory set according to your order specifications.

If you have not made any particular specifications at the time of ordering, the instruments will be delivered with the standard parameters and functions listed in the Table below.

To facilitate easy and rapid initial start-up, current output and pulse output are set to process flow measurement in "2 flow directions", so that the current flowrate is displayed and the volumetric flow counted independent of the flow direction. The measured values may possibly be shown with a " – " sign.

This factory setting for the current and pulse outputs may possibly lead to measuring errors, particularly in the case of volume flow counting:

For example, if pumps are switched off and a "backflow" occurs which is not within the range of the low-flow cutoff (SMU), or if separate displays and counts are required for both flow directions.

To avoid faulty measurements, therefore, it may be necessary to change the factory setting of some or all of the following functions:
– low-flow cutoff SMU, Fct. 1.03, Sect. 5.3
– display, Fct. 1.04, Sect. 5.4
– current output I, Fct. 1.05, Sect. 5.6
– pulse output P, Fct. 1.06, Sect. 5.7

Operation see **Section 4 and 5**.

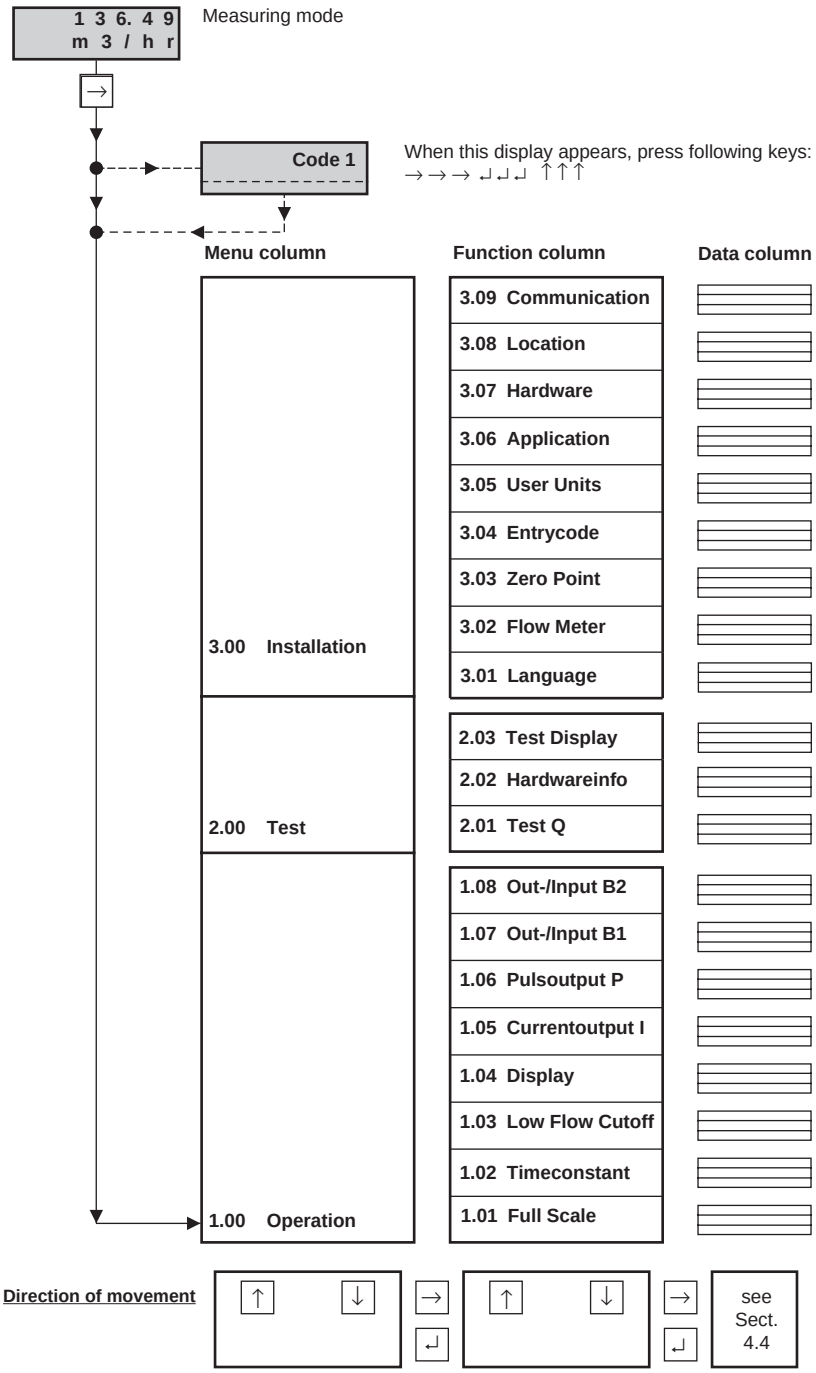
Standard factory settings

Function		Setting
1.01	Full-scale range $Q_{100\%}$	
1.02	Time constant	3 s, for I, B1, B2 and display
1.03	Low-flow cutoff SMU	ON: 1% OFF: 2%
1.04	Display flow rate totalizer(s) Messages Trend Updating Scaling	 m^3/hr or US Gal/min m^3 or US Gal no Mittelwert 1 sec. auto
1.05	Current output I function Range I I Max I Error	 2 directions 4-20 mA 22 mA 22 mA
1.06	Pulse output P function pulse width pulse value	 2 directions 50 ms 1 pulse/s

Function		Setting
1.07	Status output B1	flow directions
1.08	Control input B2	off
3.01	Language for display only	English
3.02	Flowmeter diameter flow direction (see arrow on primary head)	 see nameplate } + direction
3.04	Entry code	no
3.05	User unit	Liter/hr or USMGal/day
3.06	Application: Flow	steady
3.07	Hardware: Terminal B1 Terminal B2	Statusoutput Control input
3.08	Location	ALTOMETER
3.09	Communication	off

4 Operation of the signal converter

4.1 KROHNE operator control concept



4.2 Table of settable functions

Fct.	Display- Texts	Description and settings
1.00	**OPERATION**	**Operations menu**
1.01	**FULL SCALE**	**Full-scale range for flowrate $Q_{100\%}$** Select unit • m^3/hr • Liter/Sec • US.Gal/min • user unit, factory set is Liter/hr or US MGal/day (see Fct. 3.05) *Press → key to transfer to number setting.* Setting ranges: The ranges are dependent on the meter size (DN) and the flow velocity (v): $Q_{min} = \frac{\pi}{4} DN^2 \times v_{min}$ $Q_{max} = \frac{\pi}{4} DN^2 \times v_{max}$ Nom. dia. /meter size — v_{min} = 0,3 m/s (1 ft/s) — v_{max} = 12 m/s (40 ft/s) • DN 2.5–1600 / $^1/_{10}$ – 64: 0.0053 – 86 859 m^3/hr 0.0237 – 401 080 US Gal/min *Press ↵ key to return to Fct. 1.01 FULL SCALE.*
	VALUE P	**Pulse value has been changed.** With the old pulse values the output frequency (F) would have been exceeded or not reached. **P_{min}** = F_{min} / $Q_{100\%}$ **P_{max}** = F_{max} / $Q_{100\%}$ **Check new values!**
1.02	**TIMECONST.**	**Time constant** Select:: • ALL (applies to display and all outputs) • ONLY Current output (only display, current and status outputs) *Press ↵ key to transfer to number setting.* Range: • 0.2 – 99.9 Sec *Press ↵ key to return to Fct. 1.02 TIMECONST.*
1.03	**L.F.CUTOFF**	**Low-flow cutoff (SMU)** • OFF (fixed values: ON = 0.1% / OFF = 0.2%) PERCENT (variable values) ON 1 – 19% OFF 2 – 20% *Press → key to transfer to number setting.* Note: Cutoff off value must be greater than cutoff on value. *Press ↵ key to return to Fct. 1.03 L.F. CUTOFF.*
1.04	**DISPLAY**	**Display functions**
	Contrast	**Set display contrast** • range from **+ 15** (high contrast) to **- 15** (low contrast) *Press ↵ key to transfer to subfunction "Flow".*
	Flow	**Set format for flow rate display** • #### • ### . # • ## . ## • # . #### • Auto *Press key →* to move to unit selection. Selection unit: • m^3/hr • Liter/Sec • US Gal/min user unit, factory set is Liter/hr or US MGal/day (see Fct. 3.05) *Press ↵ key to transfer to subfunction "Totalizer".*
	Totalizer	**Set format for display of volume** Select decimal positions: • ####### • ###### . # • ##### . ## • #### . ### • ### . #### • ## . ##### • # . ###### • Auto *Press →* key to move to unit selection. • m^3 • Liter • US Gal user unit, factory set is Liter or US MGal (see Fct. 3.05) *Press ↵ key to transfer to subfunction "Messages".*

Fct.	Display- Texts	Description and settings
	Messages	**Additional displays wanted in measuring mode?** • no • yes (overlay additional messages) *Press ↵ key to transfer to subfunction "Trend".*
	Trend	**Set graphic display** Selection: • Average (show average values over time base) • Min. & Max. (min./max. values over time base) • Every Value (all values numbered consecutively) *Press ↵ key to transfer to subfunction "Updating".* *When* "every value" *selected, transfer to subfunction* "Scaling".
	Updating	**Update measured values in graphic display** (this not shown when "every value", see above, selected) Selection: • 0.1 Sec. • 0.2 Sec. • 0.5 Sec. • 1 Sec. • 2 Sec. • 5 Sek. • 1 Min. • 2 Min. • 5 Min. *Press ↵ key to transfer to subfunction "Scaling".*
	Scaling	**Set scaling of graphic display** Selection: • 0% ... 100% • - 25% ... 100% • 0% ... 50% • 50% ... 100% • -100% ... 0% • 25% ... -100% • - 50% ... 0% • -100% ... - 50% • Auto *Press ↵ key to return to Fct. 1.04 DISPLAY.*
1.05	**Current output I**	**Set Current output I**
	Function	**Set Function** • Off (switched off) • 1 Direction (1 flow direction) • 2 Directions (forward/reverse flow, F/R flow measurement) *Press ↵ key to transfer to subfunction "Range I".*
	Range I	**Set measuring range ($I_{0\%}$ ... $I_{100\%}$)** • 0 - 20 mA • 4 - 20 mA (fixed ranges)) • mA (user-defined range) • Range: $I_{0\%}$ - $I_{100\%}$ (Value $I_{0\%} < I_{100\%}$!) 0 - 16 mA 4 - 20 mA *Press → key to transfer to number setting.* *Press ↵ key to transfer to subfunction "I Max".*
	I Max	**Set I Max** Selection: • 20,5 mA • 22 mA *Press ↵ key to transfer to subfunction "I Error".*
	I Error	**Set current for error identification (I_{Error})** • 22 mA • 0.0 mA (... < $I_{0\%}$, variable only, see above if $I_{0\%}$ > 1 mA) *Press → key to transfer to number setting.* *Press ↵ key to transfer to subfunction "Range I".*
	Reverse Range	**Set full-scale range for reverse flow** (appears only when 2 Directions selected, see above) setting range: 005 - 150% of $Q_{100\%}$ (different value for reverse flow) *Press → key to transfer to number setting.* *Press ↵ key to return to Fct. 1.05 "Current output I".*

Fct.	Display- Texts	Description and settings
1.06	**Pulsoutput P**	**Set Pulsoutput P**
	Function	**Set Function** Selection: • Off (switched off) • 1 Direction (1 flow direction) • 2 Directions (forward/reverse flow, F/R flow measurement) *Press ↵ key to transfer to subfunction "Pulswidth".*
	Pulswidth	**Set pulse width** Selection: • 0.01 - 1.00 Sec (only for F_{max} < 50 pulse/s) • automatic (= 50% of the period duration) of the 100% output frequency)) • symmetrical (= pulse duty ratio 1:1 over total range) *Press ↵ key to transfer to subfunction "Pulsvalue".*
	Pulsvalue	**Set pulse value** pulse value per unit volume • $1/m^3$ • 1/Liter • 1/US Gal • PulS/ user-defined unit, factory-set is Liter or US M.Gal (see Fct. 3.05) pulse value per unit time • PulSe/Sec (=Hz) • PulSe/min • PulSe/hr • PulSe/user-defined unit, factory-set is hr (see Fct. 3.05) *Press ↵ key to return to Fct. 1.06 "Pulsoutput P".*
1.07	**Output/Input B1**	**Assignment of terminal B1** see Fct. 3.07 Hardware: Either **STATUS OUTPUT** or **CONTROL INPUT** For settings, refer to one of the following descriptions.
1.08	**Output/Input B2**	**Assignment of terminal B2** see Fct. 3.07 Hardware: Either **STATUS OUTPUT** or **CONTROL INPUT** For settings, refer to one of the following descriptions.
1.0_	**Status output** **B1** and/or **B2**	**Setting as status output** • Off (status output switched off) • On (status output switched on, e.g. as operation indicator) EMPTY PIPE (signals that pipe is empty , only if option installed) • SIGN.I or P (F/R flow measurement) • Overflow I or P (overranging of outputs) } I = I only P = ALL • SMU I or P (signals when low-flow cutoff is active) • Inverse B1 • Trip Point: (press key ↵ to transfer to Characteristics) Selection: • + direction • - direction • 2 directions (press ↵ key to transfer to number setting) Setting range 005 - 150% • automatic range change (press ↵ key to transfer to number setting) Setting range 05 - 80% (= ratio of lower to upper range) • All Errors • Fatal error only *Press ↵ key to return to Fct. 1.07* and/or 1.08 "*Statusoutput*"
1.0_	**Controlinput** **B1** and/or **B2**	**Set as Control input** • Off (switched off) • Ext.Range (external range change) Press ↵ key to transfer to number setting. Setting range: 05 - 80% (= ratio of lower to upper range from 1:20 to 1:1.25. Value must be greater than that of Fct. 1.03 L.F. CUTOFF). • Outp.Hold (hold value of outputs) • Outp.Zero (set outputs to min.values) • Total. Reset (reset totalizers) • Error. Reset (delete error messages) *Press ↵ key to return to Fct. 1.07* and/or 1.08 "*Statusoutput*"

Fct.	Display-Texts	Description and settings
2.00	**Test**	**Test menu**
2.01	**Test Q**	**Test measuring range Q** Precautionary query • SURE NO *Press ↵ key to return to Fct. 2.01 TEST Q .* • SURE YES *Press → key to transfer to number setting.* select value: -110 / -100 / -50 / -10 / 0 / +10 / +50 / +100 / +110 PCT.. of set full-scale range $Q_{100\%}$. Displayed value present at outputs I and P. *Press ↵ key to return to Fct. 2.01 "TEST Q" .*
2.02	**Hardwareinfo**	**Hardware information and error status** Before consulting factory, please note down all codes.
	Modul ADC	X . X X X X X . X X Y Y Y Y Y Y Y Y Y Y
	Modul IO	X . X X X X X . X X Y Y Y Y Y Y Y Y Y Y *Press ↵ key to transfer to next info.*
	Modul DISP..	X . X X X X X . X X Y Y Y Y Y Y Y Y Y Y
	Modul RS	X . X X X X X . X X (only provided if "computer interface" Y Y Y Y Y Y Y Y Y Y Option installed)
		Press ↵ key to return to Fct. 2.02 "Hardwareinfo".
2.03	**Test Display**	**Press → key to start test of display, duration approx. 5 sec.**

Fct.	Display-Texts	Description and settings
3.00	**Installation**	**Installation menu**
3.01	**Language**	**Select language for display texts** • GB / USA (English) • F (French) • D (German) • others on request *Press ↵ key to return to Fct. 3.01 "Language".*
3.02	**Flowmeter**	**Set data for primary head**
	Diameter	**Select size from meter size table** • DN 2.5 - 3000 mm equivalent to $^1/_{10}$ – 120 inch *Select with ↑ key.* *Press ↵ key to transfer to subfunction "Full Scale".*
	Full Scale	**Full-scale range for flow $Q_{100\%}$** Selection unit: • m^3/hr • Liter/Sec • US Gal/min user unit, factory set is Liter/hr or US MGal/day (see Fct. 3.05) *Press → key to transfer to number setting.* Setting ranges: The ranges are dependent on the meter size (DN) and the flow velocity (v): Q_{min} = DN^2 x v_{min} Q_{max} = DN^2 x v_{max} Nom. dia. /meter size V_{min} = 0,3 m/s (1 ft/s) V_{max} = 12 m/s (40 ft/s) • DN 2.5–1600 / $^1/_{10}$ – 64: 0.0053 – 86 859 m^3/hr 0.0237 – 401 080 US Gal/min *Press ↵ key to transfer to subfunction "Gk Value".*
	Value P	**Pulse value has been changed.** With the old pulse values the output frequency (F) would have been exceeded or not reached. **P_{min}** = F_{min} / $Q_{100\%}$ **P_{max}** = F_{max} / $Q_{100\%}$ **Check new values!**
	Gk Value	**Set primary constant GK** see primary head nameplate. Range: • 1.0000 - 9.9999 *Press ↵ key to transfer to subfunction "Field Frequenz".*

Fct.	Display-Texts	Description and settings
	Field Frequenz	**Set Magnetic field frequency** (f_{Netz} = power frequency) • $^1/_2 \times f_{Netz}$ • $^1/_6 \times f_{Netz}$ • $^1/_{18} \times f_{Netz}$ • $^1/_{36} \times f_{Netz}$ *Select with ↑ key.* *Press ↵ key to transfer to subfunction "Flow Direction".* for DC devices to subfunction „Line Frequenz"
	Line Frequenz	**Normal line frequency in your country** This function is only provided for units with DC power supply • 50 Hz • 60 Hz *Select with ↑ key.* *Press ↵ key to transfer to subfunction "Flow Direction".*
	Flow Direction	**Define flow direction** (in F/R mode: forward flow). • + Direction • - Direction *Select with ↑ key.* *Press ↵ key to return to Fct. 3.02 "Flowmeter".*
3.03	**Zero Point**	**Zero calibration**
		• return (quit function without making change) • calculate (calculate new zero value) Press ↵ key to start, duration approx. 15-90 seconds. Save new value, select with ↑ key: • save no (do **not** save zero value) • save yes (save new zero value) • change (change zero value manually) Press → key to transfer to unit selection: • m^3/h • Liter/s • US Gal/min • any unit, see Fct. 3.05 (factory setting: Liter/h) Press → key to transfer to number setting. Value may be max. 10% of $Q_{100\%}$ *Press ↵ key to return to Fct. 3.03 "Zero Point".*
3.04	**Entrycode**	**Entry code required to enter setting mode?** • NO (= entry with → only) • YES(= entry with → and Code 1:→ → → ↵ ↵ ↵ ↑ ↑ ↑) *Press ↵ key to return to Fct. 3.04 "Entrycode".*
3.05	**User Units**	**Set any required unit for flowrate and counting**
	Text Volumen	**Set text for required flowrate unit** (max. 5 characters) Factory-set: Liter or MGal . Characters assignable to each place: • A-Z, a-z, 0-9, or — (= blank character) *Press ↵ key to transfer to subfunction "Factor Volumen".*
	Factor Volumen	**Set conversion factor (FM) for volume** Factory set 1.00000 for Liter or 2.64172E-4 for US MGal (exponent notation, here: 1x 10^3 or 2.64172x10^{-4}). Factor FM = volume per $1m^3$. Setting range • 1.00000 E-9 to 9.99999 E+9 (= 10^{-9} to 10^{+9}) *Press ↵ key to transfer to subfunction "Text Time".*
	Text Time	**Set text for required time unit** (max. 5 characters) Factory-set: hr. Characters assignable to each place: • A-Z, a-z, 0-9, or — (= blank character) *Press ↵ key to transfer to subfunction "Factor Time".*
	Factor Time	**Set conversion factor (F_T) for time** Factory-set: 3.60000 E+3 for hour or 8.64000 E+4 for day (exponent notation, here: 3.6 x10^3 or 8.64 x10^{-4}). Set factor FT in seconds. Setting range • 1.00000 E-9 to 9.99999 E+9 (= 10^{-9} to 10^{+9}) *Press ↵ key to return to Fct. 3.05 "User Units".*
3.06	**Application**	**Set application conditions**
	Flow	**Set characterization for flow** • Steady (steady flow, max. 150% of $Q_{100\%}$) • Pulsating (pulsating flow, up to 1000% of $Q_{100\%}$ e.g. caused by reciprocating pumps, refer to Sect. 6.4) *Press ↵ key to transfer to subfunction "Empty Pipe".*
	Empty Pipe	**Signal when measuring tube is empty** (refer to Sect. 6.3) • no • yes (possible only with built-in option) *Press ↵ key to return to Fct. 3.06 "Application".*

Fct.	Display-Texts	Description and settings
3.07	**Hardware**	**Assign outputs and inputs to terminals B1 and B2**
	Terminal B1	**Define function of terminal B1** (valid for Fct. 1.07) • Statusoutput • Controlinput (*Select with ↑ key.*) *Press ↵ key to transfer to subfunction "Terminal B2".*
	Terminal B2	**Define function of terminal B2** (valid for Fct. 1.08) • Statusoutput • Controlinput (*Select with ↑ key.*) *Press ↵ key to transfer to subfunction "Fieldcurrent".*
	Fieldcurrent	**Define field current supply** • Intern • Extern (> DN 1600 / > 64" with power driver) *Press ↵ key to return to Fct. 3.07 "Hardware".*
3.08	**Location**	**Set measuring point tag** Factory setting: ALTOMETER Characters assignable to each place: • A-Z, a-z, 0-9 or „-" (=blank character).) *Press ↵ key to return to Fct. 3.08 "Location".*
3.09	**Communication**	**Set comminucation interface** • Off (switched off)) • HART (HART®-interface switched on)) • KROHNE (KROHNE RS 485-interface switched on), (only provided if daughter board installed (option).) • Address: „HART" 00-15 / „KROHNE" 000-239 • Baud rate: 1200, 2400, 4800, 9600 or 19200 (appears with selection "KROHNE" only)") *Press ↵ key to return to Fct. 3.09 "Communication".*

4.3 Error messages in measuring mode

The following list gives all errors that can occur during process flow measurement. Errors shown in display when "Yes" set in Fct. 1.04 Display, subfunction "Messages.".

Error messages	Description of error	Error clearance
Line Int.	Power failure Note: no counting during power failure	Cancel error in Reset-Quit menu, see Sect. 4.6. Reset totalizer if necessary.
Overflow I	Current output overranged (Flow > I Max)	Check and if necessary correct instrument parameters. After elimination of cause, error message deleted automatically.
Overflow P	Pulse output overranged. (Flow > I Max)	Check and if necessary correct instrument parameters. After elimination of cause, error message deleted automatically.
Totalizer	Totalizer has been reset.	Cancel error message in Reset/Quit. menu, see Sect. 4.6.
ADC	Analog / digital converter overranged	Error message deleted automatically after elimination of cause.
Fatal Error	Fatal error, all outputs set to "min. values"	Please consult factory.
Empty Pipe	Pipe has run dry. This message appears only when the **"empty pipe identifier" option is installed** and the function is switched on under Fct. 3.06 Application, submenue "Empty Pipe".	Fill pipe.

4.4 Reset totalizer and cancel error messages

Cancel error messages in RESET / QUIT menu

Key	Display		Description
	- - - - - - -	- - - - - / - - -	Measuring mode
↵	**Code 2**	- -	Key in entry code 2 for Reset / Quit menu: ↑ →
↑ →		**Error Quit ....**	Menu for error acknowledgement
		... No	Do **not** delete error messages, press ↵ twice = return to measuring mode.
↑		**... Yes**	Delete error messages
↵		**Reset totalizer …**	
↵	- - - - - - -	- - - - - / - - -	Return to measuring mode

Reset totalizer(s) in RESET / QUIT menu

Key	Display		Description
	- - - - - - -	- - - - - / - - -	Measuring mode
↵	**Code 2**	- -	Key in entry code 2 for Reset / Quit menu: ↑ →
↑ →		**Error Quit ....**	Menu for error acknowledgement
↵		**Reset totalizer …**	Menu for resetting totalizer
→		**... No**	Do **not** delete error messages, press ↵ twice = return to measuring mode.
↑		**... Yes**	Reset totalizer
↵	- - - - - - -	- - - - - / - - -	Return to measuring mode

4.5 Examples of setting the signal converter

As an example the **cursor**, flashing part of display, is shown below in **bold** type.

- **Change measuring range of current output and value for error messages** (Fct. 1.05):
- Change measuring range from 04-20 mA to **00-20 mA**
- Change value for error messages from 0 mA to **22 mA**

Key	Display		Description
→			If “Yes” set under Fct. 3.04 Entry Code, key in the 9-keystroke Code 1 now: → → → ↑ ↑ ↑ ↵ ↵ ↵
	Fct. 1.00	**Operation**	
→	Fct. 1.**01**	**Full Scale**	
4 × ↑	Fct. 1.**05**	**Currentoutput I**	
→		Function	
→ ↵		Range I	
→	**04-20**	mA	Old current range
2 × ↑	**00-20**	mA	New current range
2 × ↵		I Error	
→	**0**	mA	Old value for error messages
↑	**22**	mA	New value for error messages
↵	Fct. 1.**05**	**Currentoutput I**	
↵	Fct. 1.00	**Operation**	
↵		**Store Yes**	
↵	- - - - - - -	- - - - - / - - -	Measuring range with new data for the current output