How to use these Instructions

Flowmeters are delivered ready for operation.

The flow sensor must be installed in the pipeline as described in the instructions for installation inside the packing of the flow sensor.

- Connection of power supply (Sect. 1.1-1.2) Pages 6-7
- Electrical connection between IFC 110 F and primary head (Sect. 1.3) Pages 8-15
- Electrical connection of outputs and inputs (Sect. 2) Pages 16-24
- Factory settings (Sect. 2.7) and start-up (Sect. 3) Pages 25-27

Power the flowmeter. THAT’S ALL. The system is operative.

Operator control of the IFC 110 F signal converter is described in Sect. 4 and 5.
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Signal converter versions

The operating data are factory-set to your ordered specifications.

**IFC 110 F / D**  
*(Standard)*  
**Standard version**, with local display and control elements

**IFC 110 F / D / MP**  
*(Option)*  
**Same as display version**, additional with magnetic sensors (MP)

**IFC 110 F / D / MP / EEEx**  
*(Option)*  
**Same as display version (D + MP)**, for operation with flow sensors installed in hazardous areas

**IFC 110 F / RS 485**  
**Same as standard version**, but additionally with different interfaces

Items included with supply

- **Signal converter** in the version as ordered, see above.
- **Signal cable** in the version and length as ordered (standard: signal cable A, length 10 m / 30 ft)
- **Condensed installation and operating manual** in the ordered language for installation, electrical connection, start-up and operator control of the signal converter.
- **Service Manual** in english language.

Please note!  
In the Installation and Operating Manual there are hints with Sect. Numbers which you can find in the Handbook / Service Manual only!

Instrument nameplates

**Signal converter** (example)

**Signal converter IFC 110F-EEEx** (example)

**Flow sensor** (example)
Electromagnetic flowmeters are precision instruments designed for linear flow measurement of liquid products.

The process liquids must be electrically conductive: \( \geq 5 \text{ } \mu \text{S/cm} \)
(for cold demineralized water \( \geq 20 \text{ } \mu \text{S/cm} \)).

The full-scale range \( Q_{100\%} \) can be set as a function of the meter size: flow velocity of 0.3 - 12 m/s or 1 - 40 ft/s (s. Section 10.4.).

---

### Product liability and warranty

The electromagnetic flowmeters are designed solely for measuring the volumetric flowrate of electrically conductive, liquid process products.

These flowmeters are available for use in hazardous areas. Special regulations apply in this case, which are given in the special EEx directions.

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 regrets that it cannot repair or check your flowmeter(s) unless accompanied by the completed form sheet.

---

### CE / EMC / Standards / Approvals


---

### Software history

<table>
<thead>
<tr>
<th>Display &amp; control unit</th>
<th>Amplifier (ADC)</th>
<th>Inputs and outputs (I/O)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Software</td>
<td>Status</td>
<td>Software</td>
</tr>
<tr>
<td>3.19937.02.00</td>
<td>current</td>
<td>8.13393.02.00</td>
</tr>
</tbody>
</table>

---

**IMPORTANT!**

In respect of EEx versions, pay regard to all directions marked with the \( \text{\ding{63}} \) symbol, and also the information given in Sect. 6.1 and 13. **Only the EEx flow sensor may be installed in the hazardous area. The EEx certified signal converter must be installed outside the hazardous area!**
1 Electrical connection: power supply

1.1 Location and important installation notes

PLEASE NOTE!

- Electrical connection in accordance with VDE 0100 "Regulations for the erection of power installations with nominal voltages up to 1000 V" or equivalent national regulations.

- Do not cross or loop cables inside the terminal compartment.

- Use separate wiring (PG screwed cable entries) for power supply, field current lines, signal lines, outputs and inputs.

- Hazardous areas are subject to special regulations, see Section 6.1 and special installation instructions for hazardous-duty versions.

- Do not expose signal converter and switchgear cabinets with built-in converters to direct sunlight. Install a sunshade if necessary.

- Signal converters installed in switchgear cabinets require adequate cooling (e.g. by fans or heat exchangers).

- Do not expose signal converters to intense vibration.

- Keep the distance between the flow sensor and signal converter as small as possible, for empty pipe detection (EPD) ≤ 20 m / ≤ 66 ft. Observe maximum lengths of signal and field current lines (see Section 1.3.4).

- Use KROHNE signal line A (type DS, standard) or signal line B (type BTS, bootstrap, optional), standard length 10 m (33 ft).

- Generally use bootstrap signal lines B (type BTS) for PROFIFLUX 5000 F and VARIFLUX 6000 F flow sensors sized at 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. During installation particular care should therefore be given to identical settings of flow sensor constant GK (see instrument nameplate of flow sensor). In case GK constants are not identical, the signal converter must be adjusted to the flow sensor GK (see Sections 4 and 8.5).

- Dimensions of signal converter see Section 10.3.

**IMPORTANT!**

For EEx versions, also pay regard to all directions included in Sect. 6.1 and 13. Only the EEx flow sensor may be installed in the hazardous area. The EEx certified signal converter must be installed outside the hazardous area!
1.2 Power supply - connection

PLEASE NOTE!

- **Type of enclosure** IP 65 to IEC 529 / EN 60529 equivalent to NEMA 4/4X.

- **Dimensioning:** the flowmeter housing protecting the electronic equipment against dust and moisture must always be kept closed. The selected clearances and creeping distances comply with VDE 0110 and/or IEC 664 regulations for contamination grade 2. Supply circuits and output circuits are designed to meet standards of overvoltage classes III and II, respectively.

- **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 and 1.3.6).

**100-230 V AC** (tolerance range 85-255 V AC)

- Observe information on the instrument nameplate, power supply voltage and frequency.

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

- **CAUTION:** do not remove the internal connection (line) inside the terminal compartment of the signal converter (yellow/green wire) between the U-clamp terminal and terminal 10 - protective conductor (protection class I instrument).

- Connection diagrams I - IV for the power supply and for the electrical connection between flow sensor and signal converter, see Sections 1.3.5 (Standard) and 1.3.6 (EEx).

**24 V AC / DC** (tolerance ranges: AC 20.4 - 26.4 V / DC 18 - 31.2 V)

- Observe information on the instrument nameplate, power supply voltage and frequency.

- For technical reasons concerning the measuring process, a **functional grounding conductor FE** has to be connected to the separate U-clamp terminal inside the terminal compartment of the signal converter.

- A facility providing a **reliable electrical separation (PELV)** has to be provided for connections to functional extra-low voltages (24 V AC / DC) - (VDE 0100 / VDE 0106 and/or IEC 364 / IEC 536 or equivalent national regulations).

- Connection diagrams I - IV for the power supply and for the electrical connection between flow sensor and signal converter, see Sections 1.3.5 (Standard) and 1.3.6 (EEx).

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

**Warning:** Instrument must be properly grounded to avoid personnel shock hazard.
1.3 Electrical connection of flow sensors

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 mm² or AWG 14
2. Insulation
3. Stranded wire 0.5 mm² or AWG 20 (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 mm² or AWG 20
8. Outer sheath

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

The bootstrap technology always controls the individual shields (3) of the signal converter exactly to the voltage which is supplied to the signal conductors (5). As this prevents voltage differences between the individual shields (3) and signal conductors (5), no current flows via the line capacitances between 3 and 5. The line capacitance seems to become “zero”.

This allows greater cable lengths in case the electric conductivity of the liquid to be measured is low.

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 mm² or AWG 20 (5.1 red/5.2 white)
6. Stranded drain wire, 1st shield, 0.5 mm² or AWG 20 (6.1/6.2)
7. Special foil, 2nd shield
8. Stranded drain wire, 2nd shield, 1.5 mm² or AWG 14
9. Insulation
10. Mu-metal foil, 3rd shield
11. Stranded drain wire, 3rd shield, 0.5 mm² or AWG 20
12. Outer sheath

**Field current line C1**

Line 2 x 0.75 mm² (18 AWG) Cu or 2 x (4 x) 1.5 mm² (14 AWG) Cu (Cu = copper cross section)
The cross section depends on the required cable length.
For max. permissible cable lengths please refer to Section 1.3.4

---

**IMPORTANT!**

For EEx versions, also pay regard to all directions included in Sect. 6.1 and 13. Only the EEx flow sensor may be installed in the hazardous area. The EEx certified 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.

<table>
<thead>
<tr>
<th>Flow sensor</th>
<th>Converter</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Length</strong></td>
<td><strong>flow sensor</strong></td>
</tr>
<tr>
<td></td>
<td>mm</td>
</tr>
<tr>
<td>a</td>
<td>90</td>
</tr>
<tr>
<td>b</td>
<td>8</td>
</tr>
<tr>
<td>c</td>
<td>25</td>
</tr>
<tr>
<td>d</td>
<td>8</td>
</tr>
<tr>
<td>e</td>
<td>70</td>
</tr>
</tbody>
</table>

**Signal cable A** (type DS), double shielding

- For flow sensor

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

- For flow sensor

**Customer-supplied materials**

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>W</td>
<td>Insulation tubing (PVC), Ø 2.0-2.5 mm (Ø 1”)</td>
</tr>
<tr>
<td>X</td>
<td>Heat-shrinkable tubing or cable sleeve</td>
</tr>
<tr>
<td>Y</td>
<td>Wire end sleeve to DIN 41 228: E 1.5-8</td>
</tr>
<tr>
<td>Z</td>
<td>Wire end sleeve to DIN 41 228: E 0.5-8</td>
</tr>
</tbody>
</table>
1.3.3 Grounding of flow sensor

- The flow sensor must be correctly connected to ground.
- The grounding cable may not transfer interference voltages.
- Do not use the grounding cable to connect more than one device to ground.
- In hazardous areas the grounding line is also used for potential equalizing purposes. Special grounding instructions are contained in the installation instructions for hazardous-duty instruments (only supplied together with such instruments).
- The flow sensor is connected to ground by means of a **functional grounding conductor FE**.
- Special grounding instructions for the connection of several flow sensors are contained in the separate **installation instructions of the flow sensors**.
- These instructions also contain detailed descriptions on how to use grounding rings and how to install flow sensors in metal or plastic pipes or in pipes which are coated on the inside.

**Warning:** Instrument must be properly grounded to avoid personnel shock hazard.

**IMPORTANT!**
For EEx versions, also pay regard to all directions included in Sect. 6.1 and 13. **Only the EEx flow sensor may be installed in the hazardous area. The EEx certified signal converter must be installed outside the hazardous area!**
1.3.4 Cable lengths (max. distance between signal converter and flow sensor)

Abbreviations and explanations
The abbreviations used in the following tables, diagrams and connection diagrams stand for:

- **A**: Signal line A (type DS) with double shielding, max. length see diagram
- **B**: Signal line B (type BTS) with triple shielding, max. length see diagram
- **C**: Field current line, minimum cross section \(A_F\) and max. length see table
- **D**: High-temperature silicone line, 3x1.5 mm² (14 AWG) Cu, with single shield, max. length 5 m (16 ft)
- **E**: High-temperature silicone line, 2 x 1.5 mm² (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 in m or ft
- **K**: Electrical conductivity of the process liquid
- **ZD**: Intermediate connection box required in connection with lines D and E for flow sensors ALTOFLUX 4000 F, PROFIFLUX 5000 F and VARIFLUX 6000 F for process temperatures exceeding 150°C (302°F).

Recommended length of signal line
for magnetic field frequencies \(\leq \frac{1}{6} \times \) power frequency

<table>
<thead>
<tr>
<th>Flow sensor</th>
<th>Meter size DN mm</th>
<th>Inch</th>
<th>Signal line</th>
</tr>
</thead>
<tbody>
<tr>
<td>VARIFLUX 6000 F</td>
<td>2.5 - 80</td>
<td>1/10 - 1/2</td>
<td>B1</td>
</tr>
<tr>
<td></td>
<td>25 - 150</td>
<td>1/10 - 1/2</td>
<td>A1 / B3</td>
</tr>
<tr>
<td>PROFIFLUX 5000 F</td>
<td>2.5 - 15</td>
<td>1/10 - 1/2</td>
<td>B1</td>
</tr>
<tr>
<td></td>
<td>4 - 150</td>
<td>1/6 - 1/2</td>
<td>B2</td>
</tr>
<tr>
<td></td>
<td>25 - 80</td>
<td>1 - 3</td>
<td>A1 / B3</td>
</tr>
<tr>
<td>ALTOFLUX 4000 F</td>
<td>10 - 150</td>
<td>3/8 - 6</td>
<td>A1 / B3</td>
</tr>
<tr>
<td></td>
<td>200 - 1200</td>
<td>8 - 48</td>
<td>A2 / B4</td>
</tr>
<tr>
<td>ALTOFLUX 2000 F</td>
<td>150 - 250</td>
<td>6 - 10</td>
<td>A2 / B4</td>
</tr>
<tr>
<td>ECOFLUX 1000 F</td>
<td>10 - 150</td>
<td>3/8 - 6</td>
<td>A1 / B3</td>
</tr>
<tr>
<td></td>
<td>100 - 300</td>
<td>6 - 12</td>
<td>A2 / B4</td>
</tr>
<tr>
<td>M900</td>
<td>10 - 100</td>
<td>15 - 6</td>
<td>A2 / B4</td>
</tr>
</tbody>
</table>

Max. length and minimum cross section of field current line

<table>
<thead>
<tr>
<th>Length L</th>
<th>Cross section (A_F) (Cu), minimum</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 150 m</td>
<td>5 to 500 ft, 2 x 0.75 mm² Cu, 2 x 18 AWG</td>
</tr>
<tr>
<td>150 to 300 m</td>
<td>500 to 1000 ft, 2 x 1.50 mm² Cu, 2 x 14 AWG</td>
</tr>
<tr>
<td>300 to 600 m</td>
<td>1000 to 1900 ft, 4 x 1.50 mm² Cu, 4 x 14 AWG</td>
</tr>
</tbody>
</table>
1.3.5 Connection diagrams for power supply and flow sensors

Important remarks for circuit diagrams

PLEASE NOTE!

• The figures in brackets indicate the stranded drain wires of the shields (see cross-sectional drawings of signal lines in Section 1.3.1).

• Electrical connection to VDE 0100 "Regulations for the erection of power installations with nominal voltages up to 1000 V"

• Power supply 24 V AC / DC: protective extra-low voltages (PELV) acc. to VDE 0100/ VDE 0106 and/or IEC 364/IEC 365, or corresponding national regulations.

• Systems to be used in hazardous areas are subject to special regulations applying to electrical connections (see Section 1.3.6) for hazardous-duty instruments.

• PE = protective conductor
  FE = functional ground conductor

IMPORTANT!

Electrical connection of EEx flow sensors and EEx signal converters to be carried out as described in Sect. 1.3.6.

* Do not remove the internal connection (cable) inside the terminal compartment of the signal converter (yellow/green wire) between the U-clamp terminal and terminal 10 (protective conductor for protection class I instruments).
Process temperature below 150°C (302°F)

<table>
<thead>
<tr>
<th></th>
<th>Signal cable A (type DS)</th>
<th>Signal cable B (type BTS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>IFC 110 F  V 2.0</td>
<td>IFC 110 F  V 2.0</td>
</tr>
<tr>
<td></td>
<td>Flow sensor</td>
<td>Flow sensor</td>
</tr>
</tbody>
</table>

Process temperature above 150°C (302°F)

<table>
<thead>
<tr>
<th></th>
<th>Signal cable A (type DS)</th>
<th>Signal cable B (type BTS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>III</td>
<td>IFC 110 F  V 2.0</td>
<td>IFC 110 F  V 2.0</td>
</tr>
<tr>
<td></td>
<td>Flow sensor</td>
<td>Flow sensor</td>
</tr>
</tbody>
</table>
1.3.6 EEx-Connection diagrams for power supply and flow sensors

PLEASE NOTE!

- The figures in brackets indicate the stranded drain wires for the shields (see cross-sectional drawing of signal cable in Section 1.3.1).
- The connections for the intrinsically safe electrode circuit including the shield terminals are safety-separated up to a peak value of 375 V from the terminals for the power supply, for the inputs/outputs and for the field circuit. They are galvanically isolated from the housing (PE/PA).
- For connection of the intrinsically safe electrode circuit including shield terminals to the primary head, please refer to Item 12 in EN 60079-14. The non-intrinsically safe field circuit to be connected to the primary head in keeping with the requirements of Item 9 in EN 60079-14.
- The non-intrinsically safe input and output circuits may only be routed into the hazardous area in compliance with appropriate measures as specified in EN 60079-14.
- **Supply power (terminals 11,12)**
  In conformity with current regulations for electrical installations, an isolating facility is required to be provided for the signal converter. The housing of the IFC 110 F – EEx signal converter must be incorporated in the equipotential bonding system (via external PA connection).

### Note!
A PE safety conductor is not connected if a functional extra-low voltage with safety separation (PELV) is used. Grounding is then carried out by way of the equipotential bonding conductor.

- **Electrode circuit (terminals 1, 20, 2, 3, 30 and shield terminal S)**
  In conformity with the requirements for separation of intrinsically safe circuits, Category ib to EN 50 020, the cable for the intrinsically safe electrode circuit must, up to the terminals, be separated from all non-intrinsically safe circuits. Terminals 20 and 30 are optionally provided for connecting cables with single shielding. The terminal for the outer shield (S) is capacitance grounded in the signal converter. The outer overall shield to be connected by the shortest possible wire to the shield terminal. Shields to be carefully insulated from ground and from each other.

- **Field circuit FSV (terminals 7, 8)**
The field circuit is all-pole protected on the FSV circuit board with an **internal fusible link 160mA / 250V**.

- **Input/output circuits**
The connection is made to functional extra-low voltage circuits with safety separation (PELV). The I/O functions and technical data are described in the Standard Installation and Operating Instructions.

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

* Do not remove the internal connection (cable) inside the terminal compartment of the signal converter (yellow/green wire) between the U-clamp terminal and terminal 10 (protective conductor for protection class I instruments).
Process temperature below 150°C (302°F)

I  Signal cable A (type DS)  II  Signal cable B (type BTS)

IFC 110 F  V 2.0  IFC 110 F  V 2.0

Flow sensor

Process temperature above 150°C (302°F)

III  Signal cable A (type DS)  IV  Signal cable B (type BTS)

IFC 110 F  V 2.0  IFC 110 F  V 2.0

Flow sensor
2 Electrical connection: outputs and inputs

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

2.1 Important information for outputs and inputs ………………… PLEASE NOTE!

- The signal converter has the following outputs and inputs:

<table>
<thead>
<tr>
<th>Output and input group</th>
<th>Symbol</th>
<th>Terminals</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power output</td>
<td>I</td>
<td>I&lt;sub&gt;3&lt;/sub&gt; / I</td>
<td>active / passive selectable</td>
</tr>
<tr>
<td>Current output</td>
<td>P</td>
<td>P / P</td>
<td>for electronic totalizers</td>
</tr>
<tr>
<td>Pulse output</td>
<td>A&lt;sup&gt;1&lt;/sup&gt;* (P2)</td>
<td>A&lt;sup&gt;1&lt;/sup&gt;* / A⊥</td>
<td>for electromechanical totalizers</td>
</tr>
<tr>
<td>Status outputs</td>
<td>A&lt;sup&gt;1&lt;/sup&gt;* and A2</td>
<td>A&lt;sup&gt;1&lt;/sup&gt;* / A⊥ / A2</td>
<td>A⊥ common centre grounding contact</td>
</tr>
<tr>
<td>Status outputs</td>
<td>D1 and D2</td>
<td>D1 / D⊥ / D2</td>
<td>D⊥ common centre grounding contact</td>
</tr>
<tr>
<td>Control inputs</td>
<td>C1 and C2</td>
<td>C1 / C⊥ / C2</td>
<td>C⊥ common centre grounding contact</td>
</tr>
<tr>
<td>Internal power supply</td>
<td>E</td>
<td>E+ / E-</td>
<td>for active mode of outputs and inputs</td>
</tr>
</tbody>
</table>

* Output A1 can be used as a 2nd pulse output P2 for electromechanical totalizers or as a 4th status output, see Section 4.4, Fct. 3.07 HARDWARE.

- The output and input groups are electrically isolated from each other and from all other input and output circuits.

- **Please note:** A⊥ common centre grounding contact for outputs A1 and A2  
  D⊥ common centre grounding contact for outputs D1 and D2  
  C⊥ common centre grounding contact for control inputs C1 and C2

- **Active mode:** the signal converter supplies the power for the operation (selection) of receiver instruments, observe max. operating data (terminals E+ and E-).

- **Passive mode:** the operation (selection) of receiver instruments requires an external power supply (U<sub>ext</sub>), observe max. operating data.

- **Connection diagrams** of outputs and inputs are shown in Section 2.6.

- For operating data of outputs and inputs please refer to Sections 2.6 and 10.1.
2.2 **Current output I**

- The current output is electrically isolated from all other circuits.

- **Setting data and functions can note down in the Table in Sect. 3.**
  Please also refer to Section 2.7 "Standard factory settings".

- **All operating data and functions are adjustable** (see Sections 4.4 and 5.6, Fct. 1.05).

- **Max. load**:  
  - active operation: 15-500 Ω  
  - passive operation: ≤ 800 Ω

- **Selfcheck**:  
  - interrupting the mA loop, and  
  - short-circuit of mA loop via test function, see Fct. 2.03  
  or when power supply is switched on in Fct. 3.07  
  Error message on display (see Fct. 1.04, Section 5.4) and/or  
  status output (see Fct. 1.07-1.10, Section 5.8).

- **Current value for error identification** is adjustable, see Fct. 1.05 and Section 5.6.

- **Range change-over**, automatically or externally by control input,  
  see Sections 4.4 and 5.19, Fct. 1.07-1.10 and 1.11-12.  
  Setting range from 5-80% of Q_{100%}  
  (corresponding low to high range ratio from 1:20 to 1:1.25).  
  Change-over from high to low range at approx. 85% of low range and vice versa at approx.  
  98% of low range.  
  The active range is signalled via one of the four status outputs.

- **Forward/reverse flow measurement** (F/R mode) is possible (see Section 5.15).

- **Connection diagrams see Section 2.6.**
2.3 Pulse outputs P and A1

2.3.1 Pulse output P for electronic totalizers (EC)

- Pulse output P is electrically isolated from all other circuits.

- Setting data and functions can note down in the Table in Sect. 3. Please also refer to Section 2.7 "Standard factory settings".

- All operating data and functions are adjustable, see Sections 4.4 and 5.7, Fct. 1.05.

- Active mode: uses the internal power supply, terminals E+/E-
- Passive mode: requires external power supply, $U_{ext} \leq 32\,V\,DC/24\,V\,AC$, $I \leq 30\,mA$

- Max. adjustable frequency 10 kHz

- Scaling in pulses per unit time (e.g. 1000 pulses/s at $Q_{100\%}$ flow) or in pulses per unit volume (e.g. 100 pulses/m$^3$ or US Gal).

- Pulse width symmetric, pulse duty factor 1:1, independent of output frequency, automatic, with optimum pulse width, pulse duty factor approx. 1:1 at $Q_{100\%}$, or pulse width range from 0.01 to 1 s adjustable as required for correspondingly lower output frequency.

- Forward/reverse flow measurement (F/R mode) is possible, see Section 5.15.

- Connection diagrams see Section 2.6

- Schematic wiring diagram for pulse output P for electronic totalizers EC
  Similar to a relay contact, this pulse output switches direct and alternating voltages.
2.3.2 Pulse output A1 for electromechanical totalizers (EMC)

PLEASE NOTE:

The output terminal A1 can be used as status output A1 or as a 2nd pulse output A1 for electromechanical totalizers. Setting is as described in Fct. 3.07 HARDWARE, see Sections 4.4 and 5.18.

- Pulse output A1 is electrically connected to status output A2 (common centre grounding contact A⊥) but electrically isolated from all other circuits.

- Setting data and functions can note down in the Table in Sect. 3. Please also refer to Section 2.7 "Standard factory settings".

- All operating data and functions are adjustable, see Sections 4.4 and 5.7, Fct. 1.07.

  - Active mode: uses the internal power supply, terminals E+/E-
  - Passive mode: requires external power supply, \( U_{\text{ext}} \leq 32\,\text{V DC}/24\,\text{V AC}, I \leq 100\,\text{mA} \) (\( I \leq 200\,\text{mA} \) for polarized DC operation, see Section 6.3)

- Max. adjustable frequency 50 kHz

- Scaling in pulses per unit of time (e.g. 10 pulses/s at \( Q_{100\%} \) flow) or in pulses per unit of volume (e.g. 10 pulses/m³ or US Gal).

- Pulse width symmetric, pulse duty factor 1:1, independent of output frequency, automatic, with optimum pulse width, pulse duty factor approx. 1:1 at \( Q_{100\%} \), or pulse width range from 0.01 to 1 s adjustable as required for correspondingly lower output frequency.

- Forward/reverse flow measurement (F/R mode) is possible, see Section 5.15.

- Connection diagrams see Section 2.6

- Schematic wiring diagram for pulse output A1 for electromechanical totalizers EMC. This pulse output has a MOSFET switch as output which switches direct and alternating voltages similar to a relay contact.

![Diagram of pulse output A1 for electromechanical totalizers](image-url)
2.4 Status outputs A1 / A2 / D1 / D2

PLEASE NOTE:
The output terminal A1 can be used as status output A1 or as a 2nd pulse output A1 for electromechanical totalizers.
Setting is as described in Fct. 3.07 HARDWARE, see Sections 4.4 and 5.18.

- Status outputs A1/A2 and D1/D2 with the common centre grounding contacts A⊥ and B⊥ are electrically isolated from each other and from all other circuits.

- Setting data and functions can note down in the Table in Sect. 3.
Please also refer to Section 2.7 "Standard factory settings".

- All operating data and functions are adjustable, see Sections 4.4 and 5.8, Fct. 1.07-1.10.

- Active mode: uses the internal power supply, terminals E+/E-
Passive mode: requires external power supply, \( U_{\text{ext}} \leq 32\text{V DC}/24\text{V AC}, I \leq 100\text{mA} \)
  (I \( \leq 200\text{mA} \) for A1 in case of polarized DC operation, see Section 6.3)

- The following operating conditions can be signalled using the status outputs:
  - flow direction (F/R mode)
  - limits
  - error messages
  - active range in case of range change-over
  - inverse operation of A1 and A2 or D1 and D2,
    i.e. used as change-over switch with common centre grounding contact A⊥ or D⊥.

- Connection diagrams see Section 2.6

- Schematic wiring diagram for status outputs A1/A2 and D1/D2.
This status outputs have MOSFET switches as outputs which switch direct and alternating voltages similar to relay contacts.

2.5 Control inputs C1 and C2

- Control inputs C1 and C2 are electrically connected (common centre grounding contact C⊥) but electrically isolated from all other circuits.

- Setting data and functions can note down in the Table in Sect. 3.
Please also refer to Section 2.7 "Standard factory settings".

- All operating data and functions are adjustable, see Sections 4.4 and 5.9, Fct. 1.11-1.12.

- Active mode: uses the internal power supply, terminals E+/E-
Passive mode: requires external power supply, \( U_{\text{ext}} \leq 32\text{V DC}/24\text{V AC}, I \leq 10\text{mA} \)

- The following operating conditions can be initiated using the control inputs:
  - external range change
  - holding of output values
  - zeroing the outputs
  - resetting the internal totalizer
  - resetting (deleting) the error messages

- Connection diagrams see Section 2.6
### 2.6 Connection diagrams of outputs and inputs

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

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Current output (included HART®)</td>
</tr>
<tr>
<td>P, A1*</td>
<td>Pulse output</td>
</tr>
<tr>
<td>A1*, A2, D1, D2</td>
<td>Status outputs</td>
</tr>
<tr>
<td>C1, C2</td>
<td>Control inputs</td>
</tr>
</tbody>
</table>

**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 or terminals may not have any conductive connection with other electrically conducting parts.

**Interface operation with HART® or RS 485 (Option)**
see Sect. 6.4.

* * selectable as status output A1 or pulse output A1

**Active mode:** the IFC 110 F supplies the power required for operating (driving) the receiver instruments. Observe the max. operating data (terminals $E^+$ and $E^-$).

**Passive mode:** an external power supply source ($U_{ext}$) is required for operating (driving) the receiver instruments.

Groups A / C / D / E / I / P are electrically isolated from each other and from all other input and output circuits.

**Please note:**
- common reference potential
  - $A⊥$ for A1 and A2
  - $C⊥$ for C1 and C2
  - $D⊥$ for D1 and D2
**Current output $I_{\text{active}}$**

Ri 15 - 500 Ω

**Current output $I_{\text{active}}$ with automatic range change BA**
without external change-over relay

low range

high range

Ri 15 - 500 Ω

**Current output $I_{\text{passive}}$**
(see Sect. 6.8 passive/active operation)

selectable with internal power supply E or external power supply $U_{\text{ext}}$.

<table>
<thead>
<tr>
<th>$U_{\text{ext}}$</th>
<th>15 - 22 V DC</th>
<th>22 - 32 V DC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ri</td>
<td>0 - 500 Ω</td>
<td>0 - 800 Ω</td>
</tr>
</tbody>
</table>

**Forward/reverse flow measurement (F/R mode)**
for pulse and current outputs (P and $I_{\text{active}}$)
without external change-over relay

Electronic totalizers must be connected as shown in the connection diagrams for pulse output P on the following page.

**Pulse output A1 active**
for electromechanical totalizers (EMC)

Ri $\geq$ 160 Ω

$I \leq$ 100 mA

**Pulse output A1 passive**
for electromechanical totalizers (EMC)

$U_{\text{ext}} \leq$ 32 V DC / $\leq$ 24 V AC

$I \leq$ 10 mA

oder umschaltbar auf

$U_{\text{ext,2}} \leq$ 32 V DC

$I \leq$ 200 mA
7. **Pulse output \( P_{\text{active}} \)**
   - for electronic totalizers (EC)
   - for frequencies \( \leq 1 \text{ kHz} \)

\[ R_1 = 1 \text{k}\Omega / 0.5 \text{W} \quad I \leq 20 \text{mA} \quad R_{\text{EC}} > 100 \text{k}\Omega \]

<table>
<thead>
<tr>
<th>( R_2 ) / 0.2 W</th>
<th>10 k\Omega</th>
<th>1 k\Omega</th>
<th>270 \Omega</th>
</tr>
</thead>
<tbody>
<tr>
<td>( U_{\text{EC max}} )</td>
<td>22 V</td>
<td>12 V</td>
<td>5 V</td>
</tr>
</tbody>
</table>

8. **Pulse output \( P_{\text{active}} \)**
   - for electronic totalizers (EC)
   - for frequencies \( > 1 \text{ kHz} \)

\[ R = 1 \text{k}\Omega / 0.35 \text{W} \quad I \leq 30 \text{mA} \]

9. **Pulse output \( P_{\text{passive}} \)**
   - for electronic totalizers (EC)

   **for frequencies \( \leq 1 \text{ kHz} \)**
   - \( U_{\text{ext}} \leq 32 \text{V DC} / \leq 24 \text{V AC} \)
   - \( I \leq 30 \text{mA} \)
   - \( R = 1 - 10 \text{k}\Omega \)
   - \( P_R \geq \frac{U_{\text{ext}}^2}{R} \)

   **for frequencies \( > 1 \text{ kHz} \)**
   - \( U_{\text{ext}} = \leq 24 \text{V DC} / \text{AC} \)
   - \( R_{\text{EC}} \geq 100 \text{k}\Omega \)

<table>
<thead>
<tr>
<th>( I )</th>
<th>( \leq 30 \text{mA} )</th>
<th>( \sim 18 \text{mA} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( R )</td>
<td>560 \Omega</td>
<td>1 k\Omega</td>
</tr>
<tr>
<td>( P_R )</td>
<td>0.5 W</td>
<td>0.35 W</td>
</tr>
<tr>
<td>( U_{\text{EC}} )</td>
<td>16 V</td>
<td>18 V</td>
</tr>
</tbody>
</table>

*Shielded cables*

must be used to prevent radio interference at pulse output frequencies \( > 100 \text{ Hz} \)
Status outputs D1 / D2 / A1 / A2 active

\[ I \leq 100 \text{ mA} \]

\( \square \) e.g. message display

Status outputs D1 / D2 / A1 / A2 passive

\[ U_{\text{ext}} \leq 32 \text{ V DC} \leq 24 \text{ V AC} \]
\[ I \leq 100 \text{ mA} \]

\( \square \) e.g. message display

Control inputs C1 / C2 active

Contacts 24 V, 10 mA
\[ I \leq 7 \text{ mA} \]

Control inputs C1 / C2 passive

\[ U_{\text{ext}} \leq 32 \text{ V DC} \leq 24 \text{ V AC} \]
\[ I \leq 10 \text{ mA} \]
2.7 Standard factory settings

- All operating data are set at the factory in accordance with the specifications contained in the order.

- If no specifications are made in the order, instruments will be delivered with the standard parameters and functions indicated in the table below.

- To facilitate the start-up of the instrument, current and pulse outputs are set to handle measurements in "two flow directions" so that the current flow rates and volumes are displayed and/or counted independent of the direction of flow. The figures displayed may have a preceding sign.

- Such factory setting of current and pulse outputs may lead to measuring errors, particularly when volumes are metered and totalized.

- If e.g. pumps are switched off and "backflows" occur which are not within the low-flow cutoff (SMU) range, or if separate displays and counts are required for both flow directions.

- To avoid faulty measurements, it may therefore be necessary to change the setting of the following functions:

  - SMU low-flow cutoff Fct. 1.03, Section 5.3
  - display Fct. 1.04, Section 5.5
  - current output I Fct. 1.05, Section 5.6
  - pulse output P Fct. 1.06, Section 5.7

- For special applications, such as pulsating flows, see Sections 6.5 to 6.10

### Standard factory settings

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.01</td>
<td>Full-scale range</td>
<td>See instr. nameplate</td>
<td>1.08</td>
<td>Status output A2</td>
<td>ON</td>
</tr>
<tr>
<td>1.02</td>
<td>Time constant</td>
<td>3 Sec. for display, pulse, current and status outputs</td>
<td>1.09</td>
<td>Status output D1</td>
<td>All error</td>
</tr>
<tr>
<td>1.03</td>
<td>Low-flow cutoff</td>
<td>ON: 1%</td>
<td>1.10</td>
<td>Status output D2</td>
<td>Indication F/R</td>
</tr>
<tr>
<td>1.04</td>
<td>Display flow rate</td>
<td>m³/h</td>
<td>1.11</td>
<td>Control input C1</td>
<td>Totalizer reset</td>
</tr>
<tr>
<td></td>
<td>totalizer</td>
<td>m³</td>
<td>1.12</td>
<td>Control input C2</td>
<td>OFF</td>
</tr>
<tr>
<td>1.05</td>
<td>Current output function</td>
<td>I_{\text{active}}</td>
<td>3.01</td>
<td>Language</td>
<td>German</td>
</tr>
<tr>
<td></td>
<td>range error detection</td>
<td>2 directions</td>
<td>3.02</td>
<td>Flow sensor</td>
<td>See instr. nameplate + direction, see arrow on flow sensor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4-20 mA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>22 mA</td>
<td>3.04</td>
<td>Entry code</td>
<td>NO</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3.05</td>
<td>User unit</td>
<td>Liter/h</td>
</tr>
<tr>
<td>1.06</td>
<td>Pulse output P</td>
<td>2 directions</td>
<td>3.06</td>
<td>Application</td>
<td>steady flow</td>
</tr>
<tr>
<td></td>
<td>function</td>
<td>1000 pulses/Sec.</td>
<td></td>
<td></td>
<td>empty pipe NO</td>
</tr>
<tr>
<td></td>
<td>pulse value</td>
<td>symmetric</td>
<td></td>
<td></td>
<td>ADC gain automatic</td>
</tr>
<tr>
<td></td>
<td>pulse width</td>
<td></td>
<td></td>
<td></td>
<td>special filter OFF</td>
</tr>
<tr>
<td>1.07</td>
<td>Pulse output 2, A1</td>
<td>2 directions</td>
<td>3.07</td>
<td>Hardware</td>
<td>pulse output A1</td>
</tr>
<tr>
<td></td>
<td>function</td>
<td>1 pulse/s</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>pulse value</td>
<td>50 ms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>pulse width</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Start-up

- Before connecting to power, check that the instrument is correctly installed as described in Sections 1 and 2.

- The flowmeter, flow sensor and signal converter are delivered ready for operation. All operating data are set at the factory in accordance with your specifications. Please also refer to Section 2.7 "Standard factory settings".

- Switch on the power supply. The flowmeter immediately begins to measure the flow.

- When the power supply is switched on, the display successively shows START UP and READY. Then the current flow rate and/or the current totalizer count are displayed. Displays are either steady or cyclic depending on the setting described for Fct. 1.04.

- 2 light-emitting diodes (LED) in the "diagnostics" field on the front panel of the signal converter indicate the status of measurement.

<table>
<thead>
<tr>
<th>LED displays</th>
<th>Status of measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green &quot;normal&quot; LED is flashing</td>
<td>Everything O.K.</td>
</tr>
<tr>
<td>Green &quot;normal&quot; LED and red &quot;error&quot; LED are flashing alternately</td>
<td>Momentary overload of outputs and/or A/D converter. Detailed error messages by setting Fct. 1.04 DISPLAY, subfunction &quot;MESSAGES&quot; to &quot;YES&quot;, see Sections 4.4 and 5.5.</td>
</tr>
<tr>
<td>Red &quot;error&quot; LED is flashing</td>
<td>Fatal Error, see Sections 7.3 and 7.4</td>
</tr>
</tbody>
</table>

IMPORTANT!
For EEx versions, also pay regard to all directions included in Sect. 6.1 and 13. Only the EEx flow sensor may be installed in the hazardous area. The EEx certified signal converter must be installed outside the hazardous area!
### Setting data:

Here you can note down the settings of the signal converter!

<table>
<thead>
<tr>
<th>Fct. No.</th>
<th>Function</th>
<th>Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.01</td>
<td>Full-scale range</td>
<td></td>
</tr>
<tr>
<td>1.02</td>
<td>Time constant</td>
<td></td>
</tr>
<tr>
<td>1.03</td>
<td>Low-flow cut-off</td>
<td>ON: OFF:</td>
</tr>
<tr>
<td>1.04</td>
<td>Display</td>
<td>Flow Totalizer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Messages Trend</td>
</tr>
<tr>
<td>1.05</td>
<td>Current output I</td>
<td>Function Reverse range Range I Error</td>
</tr>
<tr>
<td>1.06</td>
<td>Pulse output P</td>
<td>Function Pulswidth Pulse value</td>
</tr>
<tr>
<td>1.07</td>
<td>Pulse output A1 or Status output A1</td>
<td>(for setting see below, Fct. 3.07, terminal A1)</td>
</tr>
<tr>
<td>1.08</td>
<td>Status output A2</td>
<td></td>
</tr>
<tr>
<td>1.09</td>
<td>Status output A3</td>
<td></td>
</tr>
<tr>
<td>1.10</td>
<td>Status output A4</td>
<td></td>
</tr>
<tr>
<td>1.11</td>
<td>Control input C1</td>
<td></td>
</tr>
<tr>
<td>1.12</td>
<td>Control input C2</td>
<td></td>
</tr>
<tr>
<td>3.01</td>
<td>Language</td>
<td></td>
</tr>
<tr>
<td>3.02</td>
<td>Flow sensor</td>
<td>Meter size</td>
</tr>
<tr>
<td></td>
<td></td>
<td>GK value</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Field frequency</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Power frequency</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Flow direction</td>
</tr>
<tr>
<td>3.04</td>
<td>Entry code required ?</td>
<td>☐ no ☐ yes</td>
</tr>
<tr>
<td>3.05</td>
<td>User-defined unit</td>
<td>← ← ← ↑ ↑ ↑ ↑ ↑ ↑ ↑</td>
</tr>
<tr>
<td>3.06</td>
<td>Application</td>
<td>Flow is</td>
</tr>
<tr>
<td></td>
<td></td>
<td>☐ steady ☐ pulsating</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Empty Pipe</td>
</tr>
<tr>
<td></td>
<td></td>
<td>☐ no ☐ yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Detection (EPD)</td>
</tr>
<tr>
<td>3.07</td>
<td>Hardware-settings</td>
<td>Terminal A1 is</td>
</tr>
<tr>
<td></td>
<td></td>
<td>☐ Pulse output</td>
</tr>
<tr>
<td></td>
<td></td>
<td>☐ Status output</td>
</tr>
<tr>
<td>3.08</td>
<td>Measuring point</td>
<td></td>
</tr>
<tr>
<td>3.09</td>
<td>Communication</td>
<td>☐ of</td>
</tr>
<tr>
<td></td>
<td></td>
<td>☐ HART ☐ KROHNE RS 485</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Address:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Baud rate:</td>
</tr>
</tbody>
</table>
4 Operating of the signal converter

4.1 KROHNE operating concept
4.2 Operating and control elements

The instrument can be operated by means of ....

... the 15 keys ④ and ⑤ accessible after removal of the glass cover,

... the 3 magnetic sensors ⑧ and the bar magnet without opening the housing (optional).

1 Display, 1st line Displaying numerical data
2 Display, 2nd line Displaying units and texts
3 Display, 3rd line 6 arrows to mark the current display
   flow rate current flow rate
   totalizer + totalizer
   - totalizer
   Σ sum totalizer (+ and -)
   control in 1/2 control input 1 or 2 active
4 5 keys for operating the signal converter ← → ↵ ↑ ↓
5 10 keys for direct numerical setting of function values (not function numbers)
6 Compass field showing that a key is pressed
7 magnet active LED green/red, magnetic sensors active
   green = built-in magnetic sensors (optional), see ⑧
   red = operation of one of the 3 magnetic sensors
8 3 magnetic sensors (optional), operated by bar magnet without opening the housing, function of the sensors as described for the three keys → ↓ ↑, see ④.
9 diagnostics 2 LEDs signalling the status of measurement
   normal green LED = correct measurement, everything O.K.
   error red LED = error, parameter or hardware error
10 IMoCom IMoCom bus, multipoint connector for connecting external supplementary equipment, see Section 6.4, slide window to the left
4.3 Key functions

In the following, the cursor or flashing part of the display is shown against a grey background.

**To start operator control**

![Diagram showing the transition from measuring mode to operator control mode](image)

PLEASE NOTE: if "YES" is selected in Fct. 3.04 ENTRY CODE, "CodE 1 - - - - - - - - -" appears in the display after pressing the → key.

Enter the password for the entry code which is a sequence of 9 keys: → → → ↓ ↓ ↓ ↑ ↑ ↑ (each keystroke confirmed by "* * ").

**To terminate operator control**

Press key ↓ any number of times until one of the following menus Fct. 1.0 OPERATION, Fct. 2.0 TEST or Fct. 3.0 INSTALL is displayed.

![Diagram showing the transition to the installation menu](image)

Store new parameters: acknowledge by pressing key ↓. Measuring mode is continued with new parameters.

New parameters not to be stored: press key ↑ to display "STORE NO". Measuring mode is continued with the "old" parameters after pressing key ↓.

**Keyboard with 10 keys**

The keyboard with the 10 keys (0-9) is used for setting all flashing numbers (cursor).

Exception: the digits of the function numbers, such as Fct. 1.03, can only be changed with keys ↑ or ↓.
To change numbers

increase number

3 9 7. 3 5
m 3 / h

↓

3 9 7. 4 5
m 3 / h

decrease number

To shift cursor (flashing position)

shift to right

3 9 7. 3 5
m 3 / h

←

3 9 7. 3 5
m 3 / h

shift to left

To alter texts (units)

In case of units, the numerical value is converted automatically.

select next text

3. 7 6 9 9
L i t e r / S e c

↑

9 3. 3 6 5
U S. G a l / m i n

select preceding text

To change from text (unit) to numerical setting

change to numerical setting

1 3. 5 7 1
m 3 / h

→

1 3. 5 7 1
m 3 / h

return to text setting

To change to subfunction

Subfunctions have no "Fct. No." and are identified by a "→"

To revert to function display

10. 3
S e c

→

F c t. 1. 0 2
T I M E C O N S T.
4.4 Table of settable functions

Abbreviations used:

A1, A2  Status outputs
  (A1 can also be 2nd pulse output A1)
C1, C2  Control inputs
D1, D2  Status outputs
DN  Meter size, nominal size
Fmax  = \( \frac{1}{2} \) x pulse width (s) for \( \leq 50 \) Hz
\( \leq 10 \) kHz if "AUTO" or "SYM." are selected in subfunction "PULSWIDTH"
Fmin  = 10 pulses/h
Fid  Conversion factor volume for any unit,
  see Fct. 3.05 "FACT. VOL."
Fr  Conversion factor time for any unit,
  see Fct. 3.05 "FACT. TIME"
GK  Flow sensor constant
I  Current output
I0%  Current at 0% flow rate
I100%  Current at 100% flow rate
P (P2)  Pulse output (2nd pulse output A1)
\( P_{\text{max}} \) = \( \frac{F_{\text{max}}}{Q_{100\%}} \)
\( P_{\text{min}} \) = \( \frac{F_{\text{min}}}{Q_{100\%}} \)
Q  Current flow rate
\( Q_{100\%} \)  100% flow rate = full-scale range
\( Q_{\text{max}} \)  = \( \frac{\pi}{4} \) DN² x \( v_{\text{max}} \) (= max. full-scale range
\( Q_{100\%} \) at \( v_{\text{max}} \) = 12 m/s or 40 ft/s)
\( Q_{\text{min}} \)  = \( \frac{\pi}{4} \) DN² x \( v_{\text{min}} \) (= min. full-scale range
\( Q_{100\%} \) at \( v_{\text{min}} \) = 0.3 m/s or 1 ft/s)
SMU  Low-flow cutoff for I and P
v  Flow velocity
\( v_{\text{max}} \)  Maximum flow velocity (12 m/s or 40 ft/s) at \( Q_{100\%} \)
\( v_{\text{min}} \)  Minimum flow velocity (0.3 m/s or 1 ft/s) at \( Q_{100\%} \)
F/R  Forward/reverse flow in F/R measuring mode

Fct. | Text | Description and setting |
--- | --- | --- |
1.0 | OPERATION | Operating menu |
| **FULL SCALE** | Full-scale range for flow rate \( Q_{100\%} \) |
| Selection of unit |
| • \( \text{m}^3/\text{h} \) |
| • \( \text{Liter}/\text{Sec} \) |
| • \( \text{US.Gal}/\text{min} \) |
| • user unit, factory setting "\( \text{Liter}/\text{h} \)" or "\( \text{US MGal}/\text{day} \)" (see Fct. 3.05) |
| Press \( \rightarrow \) key to change to numerical setting |
| **Setting ranges** |
| The range depends on the nominal width (DN) and the flow velocity (v):
| \( Q_{\text{min}} = \frac{\pi}{4} \) DN² x \( v_{\text{min}} \) |
| \( Q_{\text{max}} = \frac{\pi}{4} \) DN² x \( v_{\text{max}} \) |
| Nominal width/meter size
| DN 2.5–1200 / 1"–48": 0.0053 – 48 860 \( \text{m}^3/\text{h} \)
| 0.0237 – 218 560 \( \text{US.Gal}/\text{min} \)
| DN 1300–3000 / 52"–120": 1435 – 305 360 \( \text{m}^3/\text{h} \)
| (see Section 8.6) 6415 – 1 366 000 \( \text{US.Gal}/\text{min} \)
| Press \( \downarrow \) key to return to Fct. 1.01 FULL SCALE |
| \( \rightarrow \) VALUE P and/or \( \rightarrow \) VALUE P2 |
| Pulse value for pulse output P (Fct. 1.06 "VALUE P") and/or for the 2nd pulse output A1 (Fct. 1.07 "VALUE P2") has been changed. |
| With the "old" pulse values the output frequency (F) would have been exceeded or would not have been reached. |
| \( P_{\text{min}} = \frac{F_{\text{min}}}{Q_{100\%}} \) \( P_{\text{max}} = \frac{F_{\text{max}}}{Q_{100\%}} \) Check new values! |
1.02 | TIMECONST. | Time constant |
| Selection: |
| • ALL (applies to display and all outputs) |
| • ONLY I (only display, current and status outputs) |
| Press \( \downarrow \) key to change to numerical setting. |
| Range: |
| • 0.2 – 99.9 Sec |
| Press \( \downarrow \) key to return to Fct. 1.02 TIMECONST. |
1.03 | L.F. CUTOFF | Low-flow cutoff (L.F. CUTOFF) |
| Selection |
| • OFF (fixed tripping points: \( \text{ON} = 0.1\% / \text{OFF} = 0.2\% \)) |
| • PERCENT (variable tripping points) \( \text{ON} \) – 1 – 19\% \( \text{OFF} \) – 2 – 20\% |
| Press \( \rightarrow \) key to change to numerical setting. |
| Note: the cutoff "OFF" value must be greater than the cutoff "ON" value. |
| Press \( \downarrow \) key to return to Fct. 1.03 L.F. CUTOFF. |
### Description and Setting

#### 1.04 DISPLAY

**DISP.FLOW**

Selection of flow display
- NO DISP.
- User unit, factory setting "Liter/h" or "US MGal/day" (s. Sect. 3.05)
- m³/h
- PERCENT
- Liter/Sec
- BARGRAPH (value and bar graph display in %)
- US.Gal/min

Press \( \downarrow \) key to change to subfunction "DISP. TOTAL."

**DISP.TOTAL.**

Selection of totalizer display
- NO DISP. (totalizer is ON but no display)
- OFF (totalizer is OFF)
- + TOTAL.
- - TOTAL.
- +/- TOTAL.
- SUM (Σ)
- ALL (display single counts or all)

Press \( \downarrow \) key to change to setting of display unit.

**Format setting**
- Auto (exponent notation)
- # . #######
- ### . ######
- #### . ####
- ######

Press \( \downarrow \) key to change to subfunction "DISP. MSG."

**DISP.MSG.**

Additional messages desired during measuring mode?
- NO
- YES (cyclic change with display of measured values)

Press \( \downarrow \) key to return to Fct. 1.04 DISPLAY.

#### 1.05 CURRENT I

**CURRENT I**

Current output 1

**FUNCT. I**

Selecting the current output 1 function
- OFF (switched off)
- + DIR.
- - DIR. (measurement in one flow direction only)
- 2 DIR. (forward/reverse flow, F/R mode)

Press \( \downarrow \) key to change to subfunction "RANGE I"; if "2 DIR." is selected press this key to change to subfunction "REV. RANGE".

**REV. RANGE**

Setting the full-scale range for reverse flow of \( Q_{100\%} \)

Selecting the measuring range
- 0 - 20 mA
- 4 - 20 mA (fixed ranges)
- mA (user-defined range) \( I_{0\%} \) - \( I_{100\%} \)

(Press \( \downarrow \) key to change to numerical setting!)

**I ERROR**

Selecting the error value
- 22 mA
- 0.0 to \( I_{0\%} \) mA (variable when \( I_{0\%} \) ≥ 1 mA, see above)

Press \( \downarrow \) key to change to numerical setting.

### 1.06 PULS P

**Pulse output P**

Description of function of pulse output P on the next page.

### 1.07 STATUS A1 or PULS2 A1

**Status output A1**

Connected as status or pulse output (P2)

Description of function of status output A1 or 2nd pulse output A1 on the next page.
### Fct. 1.06 PULS P
**Pulse output P** for electronic totalizers up to 10,000 pulses/s.

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<tr>
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<th>Description and setting</th>
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<tr>
<td>1.06</td>
<td><strong>PULS P</strong></td>
<td>2nd pulse output A1 for electromechanical totalizers up to max. 50 Hz. Connection of terminal A1 as a 2nd pulse output A1 or as status output A1, see Fct. 3.07 HARDWARE, &quot;Terminal A1&quot;.</td>
</tr>
</tbody>
</table>

#### Fct. 1.07 PULS2 A1
**Pulse output A1** for electromechanical totalizers up to max. 50 Hz. Connection of terminal A1 as a 2nd pulse output A1 or as status output A1, see Fct. 3.07 HARDWARE, "Terminal A1".

### Fct. 1.08 \( \text{STATUS A2} \)
Status outputs A2, D1 and D2

### Fct. 1.09 \( \text{STATUS D1} \)
Description of function of status outputs A2, D1 and D2

### Fct. 1.10 \( \text{STATUS D2} \)
Description of function of status outputs A2, D1 and D2

### Fct. 1.11 \( \text{CONTROL C1} \)
Control inputs C1 and C2

### Fct. 1.12 \( \text{CONTROL C2} \)
Description of function of control inputs on the next page but one.

---

**Selecting the function for pulse outputs P and P2**

- **OFF**
- **+ DIR.**
- **- DIR.** (measuring in one flow direction only)
- **2 DIR.** (forward/reverse flow, F/R mode)

Press \( \downarrow \) key to change to subfunction "SELECT P or P2".

**Selecting the type of pulse**

- **PULSE/VOL.** (pulses per unit volume, flow rate)
- **PULSE/TIME** (pulses per unit time for 100% flow rate)

Press \( \downarrow \) key to change to subfunction "PULSWIDTH".

**Selecting the pulse width**

- 0.01 - 1.00 s (only for \( F_{\text{max}} < 50 \) pulses/s)
- **AUTO** (automatic = 50% of cycle duration of 100% output frequency)
- **SYM** (symmetric = pulse duty factor approx. 1:1 across the entire range)

Press \( \downarrow \) key to change to subfunction "VALUE P or P2".

**Setting the pulse value per unit volume** (only displayed when **PULSE/VOL.** is selected in "SELECT P or P2" above).

- \( \text{xxxx PulS/m}^3 \)
- \( \text{xxxx PulS/Liter} \)
- \( \text{xxxx PulS/US.Gal} \)

**Setting the pulse value per unit time** (only displayed when **PULSE/TIME** is selected in "SELECT P or P2" above).

- \( \text{xxxx PulS/Sec (=Hz)} \)
- \( \text{xxxx PulS/min} \)
- \( \text{xxxx PulS/h} \)

**Setting range** "xxxx" depends on pulse width and full-scale range:

\[
P_{\text{min}} = F_{\text{min}} / Q_{100\%}, \quad P_{\text{max}} = F_{\text{max}} / Q_{100\%}
\]

Press \( \downarrow \) key to return to Fct. 1.06 PULS P or Fct. 1.07 PULS2 A1.

---

Fct. 1.06 and 1.07 have identical menus and are configured in accordance with the same setting mode.
### Fct. 1.07 STATUS A1

**Status output A1** (terminal A1 connected as status output A1 or as a 2nd pulse output A1, see Fct. 3.07 HARDWARE, “terminal A1”)

- OFF
- ON
- ALL ERROR
- FATAL.ERROR
- INVERS D1 (inverse mode of D1 and D2)
- INVERS A1 (inverse mode of A1 and A2 possible only if A1 is operated as status output, see Fct. 3.07 HARDWARE, “terminal A1”)
- SIGN I, P or P2 (F/R mode)
- OVERFL. I, P or P2 (overloading the outputs)
- EMPTY PIPE (‘tube empty’ signal only with built-in option)
- TRIP. POINT

**Dynamic behaviour**

- TIMECONST.: I = ONLY I
- P or P2 = ALL

Press → key to change to character.
Selection: + DIR. - DIR. 2 DIR.

Press ↓ key to change to numerical setting.

Setting range: 000 - 150 PERCENT

Press ↓ key to return to Fct. 1.06, 1.07, 1.08 or 1.09.

### Fct. 1.08 STATUS A2

**Status output A2**

### Fct. 1.09 STATUS D1

**Status output D1**

### Fct. 1.10 STATUS D2

**Status output D2**

### Fct. 1.07 to 1.10

- All functions set for one of the status outputs are no longer available for the other status outputs.

### Fct. 1.11 CONTROL C1

**Control input C1 and C2**

- OFF
- EXT. RNG. (external range change)

Setting range: 05-80 PERCENT (= lower to upper range ratio 1:20 to 1:1.25, value must be higher than that of Fct. 1.03 L.F. CUTOFF)

Press ↓ key to return to Fct. 1.06 or 1.11 CONTROL C1 or C2

### Fct. 1.12 CONTROL C2

- OUTP. HOLD (hold output values)
- OUTP. ZERO (set outputs to ”min. values”)
- TOTAL.RESET (reset the totalizer)
- ERROR.RESET (delete error messages)

Press ↓ key to return to Fct. 2.01 "TEST Q".

### Fct. 2.0 TEST

**Test menu**

### Fct. 2.01 TEST Q

**Test measuring range Q**

Precautionary query

- SURE NO
- SURE YES

Press ↓ key to return to Fct. 2.01 "TEST Q".

Press ↑ key to select value:

-110 / -100 / -50 / -10 / 0 / +10 / +50 / +100 / +110 PCT.

of set full-scale range Q 100%.

Displayed value is available at outputs I and P.

Press ↓ key to return to Fct. 2.01 “TEST Q”.

### Fct. 2.02 HARDW. INFO

**Hardware information and error status**

Before consulting factory, please note down all 6 codes.

- SURE NO
- SURE YES

Press ↓ key to return to Fct. 2.03 "HARDW. TEST".

If errors are found, the first one is displayed. Press ↓ key to display next error. List of errors see Section 4.5.

Press ↓ key to return to Fct. 2.03 "HARDW. TEST".

### Fct. 2.03 HARDW. TEST

**Hardware test** (Precautionary query)

- SURE NO
- SURE YES

Press ↓ key to start test, duration approx. 60 s

Press ↓ key to return to Fct. 2.03 "HARDW. TEST".
### Sect. 4.4  IFC 110 F Signal converter

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<td>INSTALL.</td>
<td>Installation menu</td>
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</table>
| 3.01 | LANGUAGE | Select language for display texts  
|      |       | - GB / USA (English)  
|      |       | - S (Swedish)  
|      |       | - D (German)  
|      |       | - F (French)  
|      |       | Press ↓ key to return to Fct. 3.01 “LANGUAGE”. |
| 3.02 | FLOWMETER | Set data for flow sensor  
|      |       | → DIAMETER | Select size from meter size table  
|      |       | - DN 2.5 - 1200 mm equivalent to 1/10 - 48 inch  
|      |       | - DN 1300 - 3000 mm equivalent to 52 - 120 inch (see Sect. 8.6)  
|      |       | Select with ↑ key.  
|      |       | Press ↓ key to change to subroutine “FULL SCALE”. |
|      |       | → FULL SCALE | Full-scale range for flow Q_{100\%}  
|      |       | To set, refer to Fct. 1.01 “FULL SCALE”.  
|      |       | Press ↓ key to change to subroutine “GK VALUE”. |
|      |       | → VALUE P and/or VALUE P | Pulse value for pulse output P (Fct. 1.06 "VALUE P") and/or for the 2nd pulse output A1 (Fct. 1.07 "VALUE P2") has been changed.  
|      |       | With the “old” pulse values the output frequency (F) would have been exceeded or would not have been reached.  
|      |       | P_{\text{min}} = F_{\text{min}} / Q_{100\%}  
|      |       | P_{\text{max}} = F_{\text{max}} / Q_{100\%}  
|      |       | Check new value. |
|      |       | → GK VALUE | Set primary constant GK  
|      |       | See instrument nameplate of flow sensor.  
|      |       | Range:  
|      |       | - 1.0000 - 15.000  
|      |       | Press ↓ key to change to subroutine “FIELD. FREQ.”. |
|      |       | → FIELD FREQ. | Magnetic field frequency  
|      |       | Values: 1/2, 1/6, 1/18 and 1/36 of power frequency, see instr. nameplate.  
|      |       | Press ↓ key to change to subroutine “FLOW DIR.”;  
|      |       | on DC instruments change to subroutine “LINE FREQ.”. |
|      |       | → LINE FREQ. | Power frequency customary in the country where the instrument is used  
|      |       | Please note: this function is limited to instruments with DC supply unit (24 V DC) to suppress line frequency interferences.  
|      |       | Values: 50 Hz and 60 Hz  
|      |       | Press ↓ key to change to subroutine “FLOW DIR.”. |
|      |       | → FLOW DIR. | Define flow direction (in F/R mode: forward flow).  
|      |       | Set according to direction of arrow on flow sensor:  
|      |       | + DIR.  
|      |       | - DIR.  
|      |       | Select using ↑ key.  
|      |       | Press ↓ key to return to Fct. 3.02 “FLOWMETER”. |
| 3.03 | ZERO SET | Zero calibration  
|      |       | Note: carry out only at “0” flow and with completely filled measuring tube!  
|      |       | Precautionary query  
|      |       | • CALIB. NO  
|      |       | Press ↓ key to return to Fct. 3.3 “ZERO SET”.  
|      |       | • CALIB. YES  
|      |       | Press ↓ key to start calibration.  
|      |       | Duration approx. 15-90 s (depending on magnetic field frequency), current flow rate displayed in the selected unit (s. Fct. 1.04 “DISP. FLOW”).  
|      |       | A “WARNING” sign appears when flow rate “>0”;  
|      |       | acknowledge by pressing ↓ key.  
|      |       | • STORE NO  
|      |       | (do not store new zero value)  
|      |       | • STORE YES  
|      |       | (store new zero value)  
|      |       | Press ↓ key to return to Fct. 3.03 “ZERO SET”. |
| 3.04 | ENTRY CODE | Entry code required to enter setting mode?  
|      |       | • NO  
|      |       | (= entry with → only)  
|      |       | • YES  
|      |       | (= entry with → and Code 1: → → → ↓ ↓ ↓ ↑ ↑ ↑ )  
<p>|      |       | Press ↓ to return to Fct. 3.04 “ENTRY CODE”. |</p>
<table>
<thead>
<tr>
<th>Fct.</th>
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</table>
| 3.05 | USER UNIT | Set any required unit for flowrate and counting  
  → TEXT VOL. | Set text for required flowrate unit (max. 5 characters)  
  Factory setting = Liter or US MGal  
  Characters which can be assigned to each place:  
  ● A–Z, a–z, 0–9, or ‘-’ (= blank character).  
  Press ↓ key to transfer to subfunction “FACT. VOL.”  
  → FACT. VOL. | Set conversion factor ($F_M$) for volume  
  Factory setting “1.00000 E+3” for “Liter” or “2.64172E-4” for “US MGal”  
  (exponent notation, here $10^3$ or $2.64172 \times 10^{-4}$)  
  Factor $F_M$ = volume per 1m³.  
  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 any time (max. 3 characters)  
  Factory setting = “h” (hours)  
  Characters which can be assigned to each space:  
  ● A–Z, a–z, 0–9, or ‘-’ (= blank character).  
  Press ↓ key to transfer to subfunction “FACT. TIME”  
  → FACT. TIME | Set conversion factor ($F_T$) for time  
  Factory setting “3.60000 E+3” for “h” (exponent notation, here $3.3 \times 10^3$).  
  Set factor $F_T$ 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 UNIT.”  
  3.06 | APPLICAT. | Set modulation range of A/D converter  
  → FLOW | ● STEADY (150% of $Q_{100\%}$)  
  ● PULSATING (1000% of $Q_{100\%}$)  
  Press ↓ key to change to subfunction “EMPTY PIPE”.  
  EMPTY PIPE | Empty pipe detection EPD (see Sect. 6.9)  
  ● NO (Press ↓ key to change to subfunction “ADC Gain”)  
  ● YES (Press ↓ key to change to “VAL. FULL”)  
  ● VAL. FULL (Press ↓ key, precautionary query)  
  ● CALIB. NO (Press ↓ key to change to “VAL. EMPTY”)  
  ● CALIB. YES (Press ↓ key, calibration will start with flashing display “WAIT”, duration approx. 20 seconds)  
  Make sure that measuring tube is completely filled!  
  ● STORE NO (Press ↓ key to change to “VAL. EMPTY”)  
  ● STORE YES (Press ↓ key to change to “VAL. EMPTY”)  
  ● VAL. EMPTY (Press ↓ key, precautionary query)  
  ● CALIB. NO (Press ↓ key to change to “VAL. EMPTY”)  
  ● CALIB. YES (Press ↓ key, calibration will start with flashing display “WAIT”, duration approx. 20 seconds)  
  Make sure that measuring tube is completely empty!  
  ● STORE NO (Press ↓ key to change to subfunction “ADC GAIN”)  
  ● STORE YES (Press ↓ key to change to subfunction “ADC GAIN”)  
  Please Note: The values of the measured impedances must be in range 0 - 150. The difference of the value VAL. EMPTY must be 10 greater than the value of VAL. FULL!  
  → ADC GAIN | Set gain of A/D converter  
  ● AUTO  
  ● 10  
  ● 30  
  ● 100  
  Select with key ↑ or ↓  
  Press ↓ key to change to subfunction “SPEC. FILT.”.  
  → SPEC. FILT. | Activate special filter for noise/interference suppression?  
  PLEASE NOTE information and examples given in Sect. 6.6.  
  ● NO (Press ↓ key to change to Fct. 3.06 “APPLICAT.”)  
  ● YES (Press ↓ key to change to subfunction “LIMIT VAL.”).
### Sect. 4.5

#### Text Description and setting

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</table>
| → LIMIT VAL. | Set limit value for noise/interference suppression | (appears only when "YES" is selected under "SPEC. FILT.", see above) Setting range: 01-90 PERCENT of full-scale range Q₁₀₀%
see Fct. 3.02, subfunction "FULL SCALE"
Press ↓ key to change to subfunction "LIMIT CNT.". |
| → LIMIT CNT. | Totalizer active when exceeding limit value | (appears only when "YES" is selected under "SPEC. FILT.") Setting range: 001-250
Press ↓ key to return to Fct. 3.06 "APPLICAT.". |

### 3.07 HARDWARE

Determine HARDWARE functions

| → TERM.A1 | Terminal A1 | PULSOUTP. • STATUSOUTP. | Press key ↑ to transfer to subfunction "SELFCHECK". |
| → SELFCHECK | Carry out self check? | See Section 5.18. 
● YES 
● NO | (testing different parameters) Press key ↓ to transfer to subfunction "FIELD CURRENT". |
| → FIELDCUR. | Determine field current | ● INTERNAL 
● EXTERNAL | (only with power driver, see Sect. 8.6) Press ↓ key to return to Fct. 3.07 "HARDWARE". |

### 4.5 Error messages in measuring mode

The following list contains all errors which may occur during flow measurement. Errors are displayed when "YES" is selected in Fct. 1.04 DISPLAY, subfunction "DISP. MSG.".

<table>
<thead>
<tr>
<th>Error message</th>
<th>Description of error</th>
<th>Elimination of error</th>
</tr>
</thead>
</table>
| LINE INT.     | Power failure Note: no counting during power failure | Cancel error in RESET/QUIT menu 
Reset totalizer if necessary. |
| OVERFLOW I or OVERFL. I2 | Current output overranged. (flow rate > measuring range) | Check instrument parameters and correct if necessary. After elimination of the cause, the error message is cancelled automatically. See Sections 6.4 and 6.7. |
| OVERFLOW P or OVERFL. P2 | Pulse output P or Pulse output range P2 exceeded (flow rate > modulation range) | Check instrument parameters and correct if necessary. After elimination of the cause, the error message is cancelled automatically. See Sections 6.4 and 6.7. |
| I SHORT or I2 SHORT | Current output I or I2 externally shorted or load < 15 Ω | Check mA loop and increase load using additional resistor if necessary. |
| I OPEN or I2 OPEN | mA loop interrupted by current output I or I2 or load > 500 Ω | Check mA loop and reduce load to 500 Ω if necessary. |
| TOTALIZER | Overflow of internal totalizer | Delete error message in RESET/QUIT menu, see Sect. 4.6 |
| ADC | Analog/digital converter range exceeded | Set Fct. 3.06, subfunction ADC GAIN to “10”. See Sections 6.4 and 6.7. If error message does not disappear, consult factory. |
| ADC-PARAM. | Check sum error | Replace ADC printed circuit board |
| ADC-HARDW. | Hardware error A/D converter | Replace ADC printed circuit board |
| ADC GAIN | Hardware error A/D converter | Replace ADC printed circuit board |
| FC-HARDW. | Hardware error on field current PCB | Replace field current PCB |
| FATAL.ERROR | Fatal error, measurement interrupted | Replace electronic unit or consult factory. |
| EP PARAM. | Parameters of “Empty Pipe” are wrong | Error shut off automatically EPD function. Please check calibration values! Value Empty Pipe – Value Full pipe ≥ 10 Values must be in range of 0 – 150. |

* only for active operation
4.6 Resetting the totalizer and deleting error messages, RESET/QUIT menu

Delete error messages in RESET/QUIT menu

<table>
<thead>
<tr>
<th>Key</th>
<th>Display</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>↓</td>
<td>CodE 2</td>
<td>Key-in entry code 2 for RESET/QUIT menu: ↑ →</td>
</tr>
<tr>
<td>↑ →</td>
<td>ERROR QUIT.</td>
<td>Menu for error acknowledgement</td>
</tr>
<tr>
<td>→</td>
<td>QUIT. NO</td>
<td>Do not delete error messages, press ↓ twice to return to measuring mode.</td>
</tr>
<tr>
<td>↑</td>
<td>QUIT. YES</td>
<td>Delete error messages</td>
</tr>
<tr>
<td>↓</td>
<td>ERROR QUIT.</td>
<td>Error messages deleted</td>
</tr>
<tr>
<td>↓</td>
<td>- - - - - -</td>
<td>Return to measuring mode</td>
</tr>
</tbody>
</table>

Reset totalizer in RESET/QUIT menu

<table>
<thead>
<tr>
<th>Key</th>
<th>Display</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>↓</td>
<td>CodE 2</td>
<td>Key-in entry code 2 for RESET/QUIT menu: ↑ →</td>
</tr>
<tr>
<td>↑ →</td>
<td>ERROR QUIT.</td>
<td>Menu for error acknowledgement</td>
</tr>
<tr>
<td>↑</td>
<td>TOTAL.RESET</td>
<td>Menu for resetting totalizer</td>
</tr>
<tr>
<td>→</td>
<td>RESET NO</td>
<td>Do not reset totalizer, press ↓ twice to return to measuring mode.</td>
</tr>
<tr>
<td>↑</td>
<td>RESET YES</td>
<td>Reset totalizer</td>
</tr>
<tr>
<td>↓</td>
<td>TOTAL.RESET</td>
<td>Totalizer is reset</td>
</tr>
<tr>
<td>↓</td>
<td>- - - - - -</td>
<td>Return to measuring mode</td>
</tr>
</tbody>
</table>

4.7 Examples of signal converter settings

In the following example the cursor or flashing part of the display is shown in **bold** characters.

- **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

<table>
<thead>
<tr>
<th>Key</th>
<th>Display</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>→</td>
<td>Fct. 1.00</td>
<td>OPERATION FULL SCALE CURRENT I</td>
</tr>
<tr>
<td>→</td>
<td>Fct. 1.01</td>
<td>FUNCT. I</td>
</tr>
<tr>
<td>→</td>
<td>Fct. 1.05</td>
<td>RANGE I</td>
</tr>
<tr>
<td>4x ↑</td>
<td>04-20</td>
<td>mA old current range</td>
</tr>
<tr>
<td>2x ↑</td>
<td>00-20</td>
<td>mA new current range</td>
</tr>
<tr>
<td>↓</td>
<td>0</td>
<td>mA old value for error messages</td>
</tr>
<tr>
<td>↑</td>
<td>22</td>
<td>mA new value for error messages</td>
</tr>
<tr>
<td>↓</td>
<td>Fct. 1.05</td>
<td>OPERATION CURRENT I</td>
</tr>
<tr>
<td>↓</td>
<td>Fct. 1.00</td>
<td>STORE YES</td>
</tr>
<tr>
<td>↓</td>
<td>- - - - - -</td>
<td>Measuring mode with new current output data</td>
</tr>
</tbody>
</table>
5 Description of functions

5.1 Full-scale range \( Q_{100\%} \)

**Fct. 1.01 FULL SCALE**

Press → key

Select unit for full-scale range \( Q_{100\%} \)

- \( m^3/h \) (cubic metres per hour)
- \( \text{Liter/Sec} \) (litres per second)
- \( \text{US.Gal/min} \) (US gallons per minute)
- User-defined unit, factory setting = "Liter/h" (litres per hour) or "US MGal/day", see Section 5.14

Select with ↑ and ↓ keys.

Use → key to change to numerical setting, 1st number (cursor) flashes.

Set full-scale range \( Q_{100\%} \)

The setting range depends on the meter size (DN) and the flow velocity (v):

\[
Q_{\text{min}} = \frac{\pi}{4} \times \text{DN}^2 \times v_{\text{min}} \quad Q_{\text{max}} = \frac{\pi}{4} \times \text{DN}^2 \times v_{\text{max}}
\]

Nom. diameter/meter size

- DN 2.5 – 1200 / 1/10” – 48": 0.0053 – 48 860 m³/h
- DN 1300 – 3000 / 52” – 120": 1435 – 305 360 m³/h

Change flashing number (cursor) with ↑ and ↓ keys.

Use → and ← keys to shift cursor 1 place to right or left.

Flashing numbers (cursor) can also be directly set with the 10-key keyboard.

Press ↓ key to return to Fct. 1.1 FULL SCALE

Please note that if "VALUE P" or "VALUE P2" is displayed after pressing ↓ key:
PULSE/VOL. is set in Fct. 1.06 PULS P and/or in Fct. 1.07 PULS 2 A1, subfunction "SELECT P" and/or "SELECT P2". Due to the changed full-scale range \( Q_{100\%} \), the output frequency (F) of the pulse outputs is either exceeded or not reached:

\[
P_{\text{min}} = \frac{F_{\text{min}}}{Q_{100\%}} \quad P_{\text{max}} = \frac{F_{\text{max}}}{Q_{100\%}}
\]

Change pulse value accordingly, see Section 5.07 Pulse output P, Fct. 1.06 and/or 2nd pulse output A1, Fct. 1.07.

5.2 Time constant

**Fct. 1.02 TIMECONST.**

Press → key

Select

- ALL (applies to display and all outputs)
- ONLY I (applies only to display, current and status outputs)

Select with keys ↑ and ↓.

Press ↓ key to change to numerical setting, 1st number (cursor) flashes.

Set numerical value

- 0.2 - 99.9 s (seconds)

Change flashing number (cursor) with keys ↑ and ↓.

Use → and ← keys to shift cursor 1 place to right or left.

Flashing numbers (cursor) can also be directly set with the 10-key keyboard.

Press ↓ key to return to Fct. 1.02 TIMECONST.
5.3 Low-flow cutoff SMU

Fct. 1.03 L.F. CUTOFF
Press → key

Select
• OFF  (fixed tripping points:  ON = 0.1 %  /  OFF = 0.2 %)
• PERCENT  (variable tripping points:  ON = 1 - 19 %  /  OFF = 2 - 20 %)

Select with keys ↑ and ↓ (only if PERCENT is selected).
1st number (cursor) flashes.

Setting the numerical value when "PERCENT" is selected
• 01 to 19  (cutoff "ON" value, left of hyphen)
• 02 to 20  (cutoff "OFF" value, right of hyphen)

Change flashing number (cursor) with keys ↑ and ↓.
Use → and ← keys to shift cursor 1 place to right or left.
Flashing numbers (cursor) can also be directly set with the 10-key keyboard.
Press ↵ key to return to Fct. 1.03 L.F. CUTOFF.

Note: the cutoff "OFF" value must be greater than the cutoff "ON" value.

5.4 Display

Fct. 1.04 DISPLAY
Press → key

→ DISP. FLOW = select unit for display of flow rate, press → key
• NO DISP.  (no display)
• m³/h  (cubic metres per hour)
• Liter/Sec  (litres per second)
• US.Gal/min  (US gallons per minute)
• User-defined unit, factory setting = "Liter/h" (litres per hour) or "US MGal/day", see Section 5.14
• PERCENT  (percentage display)
• BARGRAPH  (numerical value and bar graph display in %)

Select with ↑ and ↓ keys.
Press ↓ key to change to subfunction "DISP. TOTAL."

→ DISP. TOTAL. = select unit for totalizer display, press → key
• NO DISP.  (no display)
• OFF  (internal totalizer switched off)
• + TOTAL.  • − TOTAL.  • +/- TOTAL.  • SUM. (Σ)  • ALL (sequential)

Select with ↑ and ↓ keys.
Press ↓ key to change to display unit setting.

• m³  (cubic metres)
• Liter  (litres)
• US.Gal  (US gallons)
• User-defined unit, factory setting = "Liter" (litres) or "US MGal/day", see Section 5.14

Select with ↑ and ↓ keys.
Use → key to change to totalizer format setting.
**Setting of totalizer format**

- Auto (exponent notation)
- #.############
- ##.############
- ###.############
- ####.############
- #####.############

Select with ↑ and ↓ keys.

Press ↓ key to change to subfunction "DISP. MSG."

→ DISP. MSG. = additional messages desired in measuring mode, press → key

- NO (no additional messages)
- YES (display additional messages, e.g. errors, in sequence with measured values)

Select with ↑ and ↓ keys.

Press ↓ key to return to Fct. 1.04 DISPLAY

**Note:** "BUSY" is displayed in measuring mode when all displays are set to "NO DISP." or "NO".
Sequencing of displays is automatic. In measuring mode, however, keys - and — can be used for manual sequencing. Return to automatic sequencing after approx. 3 minutes.

Please refer to Section 2.7 "Factory settings"

### 5.5 Internal electronic totalizer

The internal electronic totalizer counts in m³ regardless of the unit set in Fct. 1.04, subfunction "DISP. FLOW".

The counting range depends on the meter size and has been selected such that the totalizer will count for at least 1 year without overflow.

<table>
<thead>
<tr>
<th>Meter size</th>
<th>Counting range</th>
<th>US Gal equivalent</th>
</tr>
</thead>
<tbody>
<tr>
<td>DN (mm)</td>
<td>Counting range</td>
<td></td>
</tr>
<tr>
<td>2.5 - 50</td>
<td>999 999.99999999</td>
<td>0 - 264 172 052.35800</td>
</tr>
<tr>
<td>65 - 200</td>
<td>9 999 999.9999999</td>
<td>0 - 2 641 720 523.5800</td>
</tr>
<tr>
<td>250 - 600</td>
<td>99 999 999.9999999</td>
<td>0 - 26 417 205 235.800</td>
</tr>
<tr>
<td>700 -1000</td>
<td>999 999 999.9999999</td>
<td>0 - 264 172 052 358.00</td>
</tr>
</tbody>
</table>

Only part of the totalizer count is shown in the display as it is not possible to display a 14-digit number. Unit and format of the display are freely selectable. Refer to Fct. 1.04, subfunction "DISP. TOTAL." and Section 5.4 to determine which part of the count is to be displayed. Display overflow and totalizer overflow are independent of one another.

**Example**

Internal count 0000123.7654321 m³
Format, display unit XXXX.XXXX liter
Internal count in unit 0123765.4321000 liter
Displayed 3765.4321 liter
5.6 Internal power supply (E+/E-) for connected loads

Passive loads connected to the outputs and inputs can be fed by means of the internal power supply (terminals E+/E-).

\[ U = 24 \text{ V DC (observe polarity)} \]
\[ R_i = \text{approx. } 15 \Omega \]
\[ I \leq 100 \text{ mA} \]

Connection diagrams, see Section 2.6.

5.7 Current output I

Fct. 1.05 CUR. OUTP. I

Press → key

→ FUNCT. I = select function for current output, press → key

- OFF (switched off, no function)
- + DIR. { Fct. 3.02 FLOW METER, subfunction “FLOW DIR.”)
- – DIR. } (measurement in one direction, refer to selection of main flow direction in
- 2 DIR. } (2 flow directions, F/R mode, forward/reverse)

Select with ↑ and ↓ keys.
Press ↓ key to change to subfunction “RANGE I”.

Exception: when “OFF” is selected, return to Fct. 1.05 CUR. OUTP. I.
When “2 DIR.” is selected, change to subfunction “REV. RANGE”.

→ REV. RANGE = select full-scale range for reverse flow

(only displayed when “2 DIR.” is selected in “FUNCT. I” above)

Press → key

- 100 PCT. (same full-scale range \(Q_{100}\%\) as forward flow, see Fct. 1.01)
- PERCENT (adjustable range) Setting range 005 - 150 \% of \(Q_{100}\%\) (see Fct. 1.01)

Select with ↑ and ↓ keys.
Press → key to change to numerical setting.
Change flashing number (cursor) with keys ↑ and ↓. Use → and ← keys to shift cursor 1 place to right or left.
Flashing numbers (cursor) can also be directly set with the 10-key keyboard.
Press ↓ key to change to subfunction “RANGE I”.

→ RANGE I = select the measuring range, press → key

- 0 - 20 mA } fixed ranges
- 4 - 20 mA
- mA (any value) \(I_0% – I_{100%}\) \n\(\text{value } I_0% < I_{100%!}\) \n\(\begin{array}{c|c|c}
0-16 \text{ mA} & 4-20 \text{ mA}
\end{array}\)

Press → key to change to numerical setting.
Select with ↑ and ↓ keys.
Change flashing number (cursor) with keys ↑ and ↓. Use → and ← keys to shift cursor 1 place to right or left.
Flashing numbers (cursor) can also be directly set with the 10-key keyboard.
Press ↓ key to change to subfunction “I ERROR”
→ \textbf{1 ERROR} = set the error value, press \textit{→} key
- \(22 \text{ mA}\) (fixed value)
- \(0.0 - I_{0\%} \text{ mA}\) (variable value, only variable when \(I_{0\%} \geq 1 \text{ mA}\), see "RANGE I" above)

Select with \(↑\) and \(↓\) keys.
Change flashing number (cursor) with keys \(↑\) and \(↓\). Use \(→\) and \(←\) keys to shift cursor 1 place to right or left.
Flashing numbers (cursor) can also be directly set with the 10-key keyboard.
Press \(↓\) key to return to Fct. 1.05 CUR. OUTP. I

\begin{center}
\textbf{Please refer to Section 2.7 "Factory settings"} \end{center}

Refer to Section 2.6 for connection diagrams and to Section 5.16 for characteristics.

### 5.8 Pulse outputs P and A1

<table>
<thead>
<tr>
<th>Pulses output P</th>
<th>2nd pulse output A1</th>
</tr>
</thead>
<tbody>
<tr>
<td>for ...</td>
<td>electronic totalizer</td>
</tr>
<tr>
<td>Terminals P and P</td>
<td>A1 and A ⊥</td>
</tr>
<tr>
<td>(F_{\text{max}}) at full-scale range (Q_{100%})</td>
<td>10,000 pulses/s</td>
</tr>
<tr>
<td>(F_{\text{min}}) at full-scale range (Q_{100%})</td>
<td>10 pulses/h</td>
</tr>
<tr>
<td>Max. switching current</td>
<td>30 mA / AC or DC</td>
</tr>
<tr>
<td>Remark</td>
<td>--</td>
</tr>
</tbody>
</table>

**PLEASE NOTE:** check that output terminal "A1" is defined as pulse output in Fct. 3.07 “HARDWARE”, see Sections 2.2 and 5.17.

**Fct. 1.06 PULS P** and / or **Fct. 1.07 PULS2 A1**

Press \(→\) key

→ \textbf{FUNCT. P} = select function for pulse output, press \(→\) key
- \textbf{OFF} (switched off, no function)
- \textbf{+ DIR.} (measurement in one direction, refer to selection of main flow direction in Fct. 3.02 FLOW METER, subfunction "FLOW DIR.")
- \textbf{– DIR.} (2 flow directions, F/R mode, forward/reverse)

Select with \(↑\) and \(↓\) keys.
Press \(↓\) key to change to subfunction "SELECT P".
**Exception:** when "OFF" is selected, return to Fct. 1.06 PULS P or Fct. 1.07 PULS2 A1.

→ \textbf{SELECT P} = select pulse type, press \(→\) key
- \textbf{PULSE/VOL.} (pulses per unit volume, flow)
- \textbf{PULSE/TIME} (pulses per unit time for 100 \% flow)

Select with \(↑\) and \(↓\) keys.
Press \(↓\) key to change to subfunction "PULSWIDTH".
→ **PULSWIDTH** = select pulse width, press → key
- **AUTO** (automatic = 50 % of cycle duration of 100 % output frequency)
- **SYM.** (symmetric = pulse duty factor 1:1 across entire range)
- **SEC.** (variable) setting range 0.01 - 1.00 SEC

Select with ↑ and ↓ keys.
Press → key to change to numerical setting.
Change flashing number (cursor) with keys ↑ and ↓. Use → and ← keys to shift cursor 1 place to right or left.
Flashing numbers (cursor) can also be directly set with the 10-key keyboard.

Press ↓ key to change to subfunction "VALUE P" and/or "VALUE P2".

→ **VALUE P** = set pulse value per unit volume
only appears when "PULSE/VOL." is selected in "SELECT P", press → key
- XXXX PulS/m³
- XXXX PulS/litre
- XXXX PulS/US.Gal
- XXXX PulS/user-defined unit, factory setting = "Liter" or "US MGal/day", see Section 5.14

Select with ↑ and ↓ keys.
Press → key to change to numerical setting, 1st number (cursor) flashes.

Set numerical value
- XXXX (setting range depends on pulse width and full-scale range:
  \[ P_{min} = F_{min} / Q_{100\%} \quad P_{max} = F_{max} / Q_{100\%} \] )

Change flashing number (cursor) with keys ↑ and ↓. Use → and ← keys to shift cursor 1 place to right or left.
Flashing numbers (cursor) can also be directly set with the 10-key keyboard.
Press ↓ key to return to Fct. 1.06 PULS P or to Fct. 1.07 PULS2 A1.

or

→ **VALUE P** = set pulse value per unit time
only appears when "PULSE/TIME" is selected in "SELECT P", press → key
- XXXX PulSe/Sec
- XXXX PulSe/min
- XXXX PulSe/h
- XXXX PulSe/user-defined unit, factory setting = "h" or "day", see Section 5.14

Select with ↑ and ↓ keys.
Press → key to change to numerical setting, 1st number (cursor) flashes.

Set numerical value
- XXXX (setting range depends on pulse width)

Change flashing number (cursor) with keys ↑ and ↓. Use → and ← keys to shift cursor 1 place to right or left.
Flashing numbers (cursor) can also be directly set with the 10-key keyboard.
Press ↓ key to return to Fct. 1.06 PULS P or to Fct. 1.07 PULS2 A1.

---

Please refer to Section 2.7 "Factory settings".

Refer to Section 2.6 for connection diagrams and to Section 5.16 for characteristics.
5.9 Status outputs A1 / A2 and D1 / D2

PLEASE NOTE:
Connection diagrams see Section 2.6.

<table>
<thead>
<tr>
<th>Status outputs</th>
<th>A1</th>
<th>A2</th>
<th>D1</th>
<th>D2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Select Fct _ _ _ then press → key</td>
<td>1.07</td>
<td>1.08</td>
<td>1.09</td>
<td>1.10</td>
</tr>
<tr>
<td>Terminals</td>
<td>A1 / A⊥</td>
<td>A2 / A⊥</td>
<td>D1 / D⊥</td>
<td>D2 / D⊥</td>
</tr>
<tr>
<td>Max. switching current</td>
<td>100 mA/AC or DC</td>
<td>100 mA/AC</td>
<td>100 mA/AC</td>
<td></td>
</tr>
<tr>
<td>Remark</td>
<td>&quot;STATUSOUTP.&quot; must be selected in Fct. 3.07 HARDWARE, subfunction &quot;TERMINALS&quot;.</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

PLEASE NOTE:
Select function for status outputs, press → key

- ALL ERROR (indicate all errors)
- FATAL.ERROR (only indicate fatal errors)
- OFF (switched off, no function)
- ON (signals the operation of the flowmeter)
- SIGN I F/R mode of outputs see Fct. 1.02, Sect. 5.2 "Time constant"
- SIGN P/P2 exceeding I = ONLY I
- OVERFL. I output ranges P/P2 = ALL
- OVERFL. P/P2 (switches output A2 inverse to A1. A1 and A2 then operate as change-over elements with common centre grounding contact A⊥. Only available when status output is selected in Fct. 3.07 "TERM. A1").
- INVERS. A1 (switches output D2 inverse to D1. D1 and D2 then operate as change-over elements with common centre grounding contact D⊥).
- INVERS. D1
- EMPTY PIPE (signals that measuring tube is empty, only with option "empty tube detection")
- AUTO. RNG. (automatic range change) Setting range 5 - 80 PERCENT (= high to low range ratio, 1:20 to 1:1.25, value must be higher than that of Fct. 1.03 L.F. CUTOFF), see Section 5.20.
- FULL SCALE, see Section 5.19.
  - Select flow direction (characteristic) for full-scale range
    - + DIR.
    - – DIR.
    - 2 DIR.
  - Define full-scale range XXX – YYY
    - normally open contact: XXX > YYY
    - normally closed contact: XXX < YYY
    - hysteresis: difference between XXX and YYY.

Press ↓ key to change to numerical setting, 1st number (cursor) flashes.
Change flashing number (cursor) with keys ↑ and ↓. Use → and ← keys to shift cursor 1 place to right or left.
Flash numbers (cursor) can also be directly set with the 10-key keyboard.
Press ↓ key to return to Fct. 1.07, 1.08, 1.09 or 1.10 for status outputs A1, A2, D1 or D2.
### Characteristic of status outputs

<table>
<thead>
<tr>
<th>Characteristic of status outputs</th>
<th>Switch open</th>
<th>Switch closed</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF (switched off)</td>
<td></td>
<td>no function</td>
</tr>
<tr>
<td>ON (e.g. operation indicator)</td>
<td>power supply OFF</td>
<td>power supply ON</td>
</tr>
<tr>
<td>SIGN I (F/R mode)</td>
<td>forward flow</td>
<td>reverse flow</td>
</tr>
<tr>
<td>SIGN P/P2 (F/R mode)</td>
<td>forward flow</td>
<td>reverse flow</td>
</tr>
<tr>
<td>FULL SCALE (full-scale indicator)</td>
<td>inactive</td>
<td>active</td>
</tr>
<tr>
<td>AUTO. RNG. (autom. range change)</td>
<td>high range</td>
<td>low range</td>
</tr>
<tr>
<td>OVERFL. I (I range exceeded)</td>
<td>current output O.K.</td>
<td>cur. output range exceeded</td>
</tr>
<tr>
<td>OVERFL. P/P2 (P range exceeded)</td>
<td>pulse output O.K.</td>
<td>pulse output range exceeded</td>
</tr>
<tr>
<td>ALL ERROR (all errors)</td>
<td>error</td>
<td>no error</td>
</tr>
<tr>
<td>FATAL ERROR (only fatal errors)</td>
<td>error</td>
<td>no error</td>
</tr>
<tr>
<td>INVERS A1: status output A2 . . .</td>
<td>when A1 is closed</td>
<td>when A1 is open</td>
</tr>
<tr>
<td>INVERS D1: status output D2 . . .</td>
<td>when D1 is closed</td>
<td>when D1 is open</td>
</tr>
<tr>
<td>EMPTY PIPE (empty tube identification option)</td>
<td>when measuring tube is empty</td>
<td>when measuring tube is full</td>
</tr>
</tbody>
</table>

For factory settings please refer to Section 2.7.

### 5.10 Control inputs C1 and C2

**Fct. 1.11 CONTROL C1** and/or **Fct. 1.12 CONTROL C2**

Press → key

Select function for the control inputs, press ↑ or ↓ key

- **OFF** (switched off, no function)
- **OUTP. HOLD** (hold output values)
- **OUTP. ZERO** (set outputs to "min. values")
- **TOTAL. RESET** (reset totalizer)
- **ERROR. RESET** (acknowledge/delete error messages)
- **EXT. RNG.** (external range change for automatic range change, see Sect. 5.20. Setting range 5 - 80 PERCENT = low to high range ratio 1:20 to 1:1.25, value must be greater than that of Fct. 1.03 L.F. CUTOFF)

Press ↓ key to change to numerical setting, 1st number (cursor) flashes. Change flashing number (cursor) with keys ↑ and ↓. Use → and ← keys to shift cursor 1 place to right or left. Flashing numbers (cursor) can also be directly set with the 10-key keyboard.

Press ↓ key to return to Fct. 1.11 CONTROL C1 or to Fct. 1.12 CONTROL C2.

Please refer to Section 2.7 for factory settings.

Connection diagram see Section 2.6.
5.11 Language

**Fct. 3.01 LANGUAGE**

*Press → key*

**Select language for texts in display**
- D (German)
- S (Swedish)
- GB/USA (English)
- F (French)
- Other languages on request

*Select with ↑ and ↓ keys.*

*Press ↓ key to return to Fct. 3.01 LANGUAGE.*

5.12 Entry code

**Fct. 3.04 ENTRY CODE**

*Press → key*

**Select**
- NO (no code, enter setting mode by pressing → key)
- YES (enter setting mode by pressing → key and Code 1: → → ↓ ↓ ↑ ↑ ↑)

*Select with ↑ and ↓ keys.*

*Press ↓ key to return to Fct. 3.04 ENTRY CODE.*
5.13 Flow sensor

Fct. 3.02 FLOW METER

Press → key

→ DIAMETER = set meter size (see instrument nameplate), press → key

Select size from table of meter sizes:
- DN 2.5 – 1200 equivalent to $\frac{1}{10}$ - 48 inch
- DN 1300 – 3000 equivalent to 52 - 120 inch, see Section 8.6.

Select with ↑ and ↓ keys.

Press ↓ key to change to subfunction "FULL SCALE".

→ FULL SCALE = set full-scale range, press → key

Set as described in Section 5.1.

Press ↓ key to change to subfunction "GK VALUE".

Please note that if "VALUE P" or "VALUE P2" is displayed after pressing ↓ key:
PULSE/VOL. is set in Fct. 1.06 PULS P and/or in Fct. 1.07 PULS 2 A1, subfunction "SELECT P" and/or "SELECT P2". Due to the changed full-scale range $Q_{100\%}$, the output frequency (F) of the pulse outputs is either exceeded or not reached:

$$P_{\text{min}} = \frac{F_{\text{min}}}{Q_{100\%}}$$

$$P_{\text{max}} = \frac{F_{\text{max}}}{Q_{100\%}}$$

Change pulse value accordingly, see Section 5.08 Pulse output P, Fct. 1.06 and/or 2nd pulse output A1, Fct. 1.07.

→ GK VALUE = set flow sensor constant GK, press → key

- 1.0000 - 9.9999 (note information on instrument nameplate, do not change setting)

Change flashing number (cursor) with keys ↑ and ↓.

Use → and ← keys to shift cursor 1 place to right or left.

Flashing numbers (cursor) can also be directly set with the 10-key keyboard.

Press ↓ key to change to subfunction "FIELD FREQ."

→ FIELD FREQ. = set magnetic field frequency, press → key

- 1/2
- 1/6
- 1/18
- 1/36 (1/2, 1/6, 1/18 or 1/36 of power frequency, see instrument nameplate,
- 1/18
- 1/36 do not change setting, exceptions see Sections 6.4-6.10)

Select with ↑ and ↓ keys.

Press ↓ key to change to subfunction "FLOW DIR."

(for DC instruments change to subfunction "LINE FREQ.").

→ LINE FREQ. = set power frequency customary in country where instrument is used, press → key

(Please note: only applies to instruments with DC power unit)

- 50 Hz
- 60 Hz

Select with ↑ and ↓ keys.

Press ↓ key to change to subfunction "FLOW DIR."

→ FLOW DIR. = set flow direction, press → key

- + DIR. (for identification of flow direction see "+" arrow on flow sensor;
- - DIR. F/R mode: identification of "positive" flow direction)

Select with ↑ and ↓ keys.

Press ↓ key to return to Fct. 3.02 FLOW METER.

Zero check, see Fct. 3.03 and Section 7.1.

Please refer to Section 2.7 "Factory settings".
5.14 User-defined units

Fct. 3.05 USER UNIT

Press → key

→ TEXT VOL. = set text for user-defined flow unit, press → key

- Liter (max. 5 characters, factory setting = "Liter" or "US MGal")
  Characters which can be assigned to each place: A-Z, a-z, 0-9 or "-
  (= blank character).

Change flashing number (cursor) with keys ↑ and ↓.
Use → and ← keys to shift cursor 1 place to right or left.
Press ↓ key to change to subfunction "FACT. VOL.":

→ FACT. VOL. = set factor FM for volume, press → key

- 1.00000 E+3 (factory setting "1000" / Factor FM = volume per 1 m³)
  Setting range: 1.00000 E-9 to 9.99999 E+9 (= 10⁻⁹ bis 10⁹)

Change flashing number (cursor) with keys ↑ and ↓.
Use → and ← keys to shift cursor 1 place to right or left.
Press ↓ key to change to subfunction "TEXT TIME":

→ TEXT TIME = set text for required time, press → key

- h (max. 3 places, factory setting = "h"/hours or "day")
  Characters which can be assigned to each place: A-Z, a-z, 0-9 or "-
  (= blank character).

Change flashing number (cursor) with keys ↑ and ↓.
Use → and ← keys to shift cursor 1 place to right or left.
Press ↓ key to change to subfunction "FACT. TIME":

→ FACT. TIME = set factor FT for time, press → key

- 3.60000 E+3 (factory setting "3600" / set factor FT in seconds)
  Setting range: 1.00000 E-9 to 9.99999 E+9 (= 10⁻⁹ bis 10⁹)

Change flashing number (cursor) with keys ↑ and ↓.
Use → and ← keys to shift cursor 1 place to right or left.
Press ↓ key to return to Fct. 3.05 USER UNIT

Flashing numbers (cursor) can also be directly set with the 10-key keyboard.

Factors for volume FM (factor FM = volume per 1 m³)

<table>
<thead>
<tr>
<th>Volumetric unit</th>
<th>Text example</th>
<th>Factor FM</th>
<th>Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cubic metres</td>
<td>m³</td>
<td>1.0</td>
<td>1.00000 E+0</td>
</tr>
<tr>
<td>Liter</td>
<td>Liter</td>
<td>1 000</td>
<td>1.00000 E+3</td>
</tr>
<tr>
<td>Hectolitres</td>
<td>h Lit</td>
<td>10</td>
<td>1.00000 E+1</td>
</tr>
<tr>
<td>Decilitres</td>
<td>d Lit</td>
<td>10 000</td>
<td>1.00000 E+4</td>
</tr>
<tr>
<td>Centilitres</td>
<td>c Lit</td>
<td>100 000</td>
<td>1.00000 E+5</td>
</tr>
<tr>
<td>Millilitres</td>
<td>m Lit</td>
<td>1 000 000</td>
<td>1.00000 E+6</td>
</tr>
<tr>
<td>US gallons</td>
<td>USGal</td>
<td>264.172</td>
<td>2.64172 E+2</td>
</tr>
<tr>
<td>Millions US gallons</td>
<td>USMG</td>
<td>0.000264172</td>
<td>2.64172 E-4</td>
</tr>
<tr>
<td>Imperial gallons</td>
<td>GBGal</td>
<td>219.969</td>
<td>2.19969 E+2</td>
</tr>
<tr>
<td>Mega imperial gallons</td>
<td>GBMG</td>
<td>0.000219969</td>
<td>2.19969 E-4</td>
</tr>
<tr>
<td>Cubic feet</td>
<td>Feet³</td>
<td>35.3146</td>
<td>3.53146 E+1</td>
</tr>
<tr>
<td>Cubic inches</td>
<td>inch³</td>
<td>61 024.0</td>
<td>6.10240 E+4</td>
</tr>
<tr>
<td>US barrels liquid</td>
<td>US BaL</td>
<td>6.28982</td>
<td>6.28982 E+0</td>
</tr>
<tr>
<td>US barrels ounces</td>
<td>US BaO</td>
<td>33 813.5</td>
<td>3.38135 E+4</td>
</tr>
</tbody>
</table>

Factors for time FT (factor FT in seconds)

<table>
<thead>
<tr>
<th>Time unit</th>
<th>Text example</th>
<th>Factor FT (seconds)</th>
<th>Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seconds</td>
<td>sec</td>
<td>1</td>
<td>1.00000 E+0</td>
</tr>
<tr>
<td>Minutes</td>
<td>min</td>
<td>60</td>
<td>6.00000 E+1</td>
</tr>
<tr>
<td>Hours</td>
<td>h</td>
<td>3 600</td>
<td>3.60000 E+3</td>
</tr>
<tr>
<td>Day</td>
<td>DAY</td>
<td>86 400</td>
<td>8.64000 E+4</td>
</tr>
<tr>
<td>Year (=365 days)</td>
<td>YR</td>
<td>31 536 000</td>
<td>3.15360 E+7</td>
</tr>
</tbody>
</table>
5.15 F/R mode, forward/reverse flow measurement

- Refer to Section 2.6 for electrical connection of outputs.
- **Define direction of forward flow**, see Fct. 3.02, subfunction "FLOW DIR."
  in conjunction with F/R operation, this is where to set the direction of the forward flow.
  "+" means the same direction as shown by the arrow on the flow sensor.
  "-" means the opposite direction.
- Set one of the **status outputs** to "SIGN I", "SIGN P" or "SIGN P2", see Fct. 1.08-1.10 (1.07).
  Dynamic behaviour of outputs in case of "SIGN I, P or P2" see Section 5.8.
- **Current and/or pulse outputs** must be set to "2 DIR.", see Fct. 1.05, 1.06 and 1.07,
  subfunctions "FUNCT. I", "FUNCT. P" and "FUNCT. P2".

5.16 Output characteristics

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>( I )</td>
<td>current output</td>
</tr>
<tr>
<td>( I_{0%} )</td>
<td>0 or 4 mA</td>
</tr>
<tr>
<td>( I_{100%} )</td>
<td>20 mA</td>
</tr>
<tr>
<td>( P )</td>
<td>pulse outputs P and A1 (P2)</td>
</tr>
<tr>
<td>( P_{100%} )</td>
<td>pulses at ( Q_{100%} ), full-scale range</td>
</tr>
<tr>
<td>( Q_F )</td>
<td>1 flow direction, forward flow in F/R mode</td>
</tr>
<tr>
<td>( Q_R )</td>
<td>reverse flow in F/R mode</td>
</tr>
<tr>
<td>( Q_{100%} )</td>
<td>full-scale range</td>
</tr>
<tr>
<td>( S )</td>
<td>status outputs A1, A2, D1 and D2</td>
</tr>
</tbody>
</table>

1 flow direction | 2 flow directions
5.17 Applications

Fct. 3.06 APPLICAT.
Press → key twice

Set flow characteristics, select with ↑ or ↓ keys
- STEADY (steady flow)
- PULSATING (pulsating flow, e.g., caused by reciprocating pumps, refer to Sections 6.5 to 6.10 "Special applications")

Press ↓ key to change to subfunction "ADC GAIN".

Set ADC GAIN, select with ↑ or ↓ keys
- AUTO (for homogeneous process liquids, low pulsation)
- 10 (for high solids contents or extremely pulsating flows)
- 30 (for solids contents or pulsating flows)
- 100 (high resolution even at low flows)

Press ↓ key three times to return to Fct. APPLICAT.

Do not change the settings of subfunctions "SPEC. FILT.", "LIMIT VAL." and "LIMIT CNT." as these functions are needed to obtain steady signals for display and outputs for special applications, see Section 6.6.

5.18 Hardware settings

Fct. 3.07 HARDWARE
Press → key

Define function of terminal A1, press → key
- PULSOUTP. (= pulse output)
- STATUSOUTP. (= status output)

Select with ↑ or ↓ keys, press ↓ key to change to "Selfcheck"

Carry out selfcheck during measurement? Press → key
- NO • YES

Select with ↑ or ↓ keys, press ↓ key to change to "Field current".

What is checked? ADC gain and other parameters are continuously checked for their permissible values and deviations.

Errors are only displayed when "YES" is selected in Fct. 1.04 DISPLAY, subfunction "DISP. MSG.". After acknowledging/deleting the errors in the ERROR/QUIT menu (see Section 4.6), the tests described in a) and b) above are re-started. Test duration 4 to 20 minutes.

Select field current supply, press → key
- INTERNAL (DN 2.5–1600 / 1/10"–64")
- EXTERNAL (see Section 8.6)

Select with ↑ or ↓ keys,

Press ↓ key to return to Fct, 3.07 HARDWARE.
5.19 Limit switches

Fct. 1.07 - 1.10 Status outputs A1, A2, D1 or D2
(Define operating mode of output terminals A1, see Section 5.18)

Press → key
Press ↑ key as often as required to set one of the status outputs to “TRIP. POINT”

Press → key to change to “Characteristic” (flow direction).

Select: • + DIR.
• − DIR.
• 2 DIR.

Press ↓ key to change to numerical setting, 1st number (cursor) flashes.
Change flashing number (cursor) with keys ↑ and ↓. Use → and ← keys to shift cursor 1 place to right or left.

• Display: XXX – YYY

• Setting ranges: XXX value = 0 – 150% of Q100%
YYY value = 0 – 150% of Q100%
hysteresis ≥ 1% (= difference between XXX and YYY values)

• Switching behaviour (NO/NC contact) and hysteresis are adjustable.

NC contact XXX value > YYY value
Switch closes when flow exceeds XXX value

Example: XXX = 55%
YYY = 45%
hysteresis = 10%

NC contact XXX value < YYY value
Switch opens when flow exceeds YYY value

Example: XXX = 45%
YYY = 55%
hysteresis = 10%

Please note: if two status outputs (e.g. D1 and D2) are activated
it is possible to have e.g. min. and max. values signalled.
5.20 Range change

Automatic range change by status output

**Fct. 1.07 - 1.10 Status outputs A1, A2, D1 or D2**
(Define operating mode of output terminal A1, see Section 5.18)

Press → key

Press ↑ key as often as required to set one of the status outputs to automatic range change "AUTO. RNG."

Press ↓ key to change to numerical setting, 1st number (cursor) flashes.
Change flashing number (cursor) with keys ↑ and ↓. Use → and ← keys to shift cursor 1 place to right or left.
Flashing numbers (cursor) can also be directly set with the 10-key keyboard.

**Setting range:** 5 – 80 PERCENT of Q\(\text{100}\%\) (= low to high range ratio 1:20 to 1:1.25)

Press ↓ key to return to Fct. 1.07 - 1.10, status outputs A1, A2, D1 or D2.

External range change by control input

**Fct. 1.11 or 1.12 Control inputs C1 or C2**

Press → key

Press ↑ key as often as required to set one of the control inputs C1 or C2 to range change "EXT. RNG."

Press ↓ key to change to numerical setting, 1st number (cursor) flashes.
Change flashing number (cursor) with keys ↑ and ↓. Use → and ← keys to shift cursor 1 place to right or left.
Flashing numbers (cursor) can also be directly set with the 10-key keyboard.

**Setting range:** 5 – 80 PERCENT of Q\(\text{100}\%\) (= low to high range ratio 1:20 to 1:1.25)

Press ↓ key to return to Fct. 1.11 or 1.12, control inputs C1 or C2.
6 Special Applications, Functional Checks, Service and Order Numbers

6.1 Use in hazardous areas

6.1.1 General
Signal converters of type IFC 110 F - EEx are type tested as associated electrical apparatus in compliance with European Directive 94/9/EG (ATEX 100a) in conformity with European Standards EN 50 014 / EN 50 020.

The EC type examination certificate has been issued by the Physikalisch-Technische Bundesanstalt (PTB) under: PTB 02 ATEX 2163 X

Important, please note!
- Observe the directions, regulations and electrical data specified in the EC type examination certificate, see Section 13.
- In addition to the regulations for power installations (VDE 0100), pay particular attention to the regulations specified in EN 60079-14 “Electrical installations in hazardous areas”.
- Assembly, installation, commissioning and maintenance may only be carried out by "personnel trained in explosion protection"!

6.1.2 Main safety features
Both generation of the intrinsically safe electrode circuit and also protection of the non-intrinsically safe field circuit by fusible links form integral parts of the IFC 110 F - EEx signal converter.

- **Category / Zone**
  IFC 110 F - EEx signal converters are associated electrical apparatus required to be installed outside the hazardous area.
  The **intrinsically safe electrode circuit** is designed in **Category 2** for use in Zone 1.

- **Types of protection**
  The electrode circuit is designed in Intrinsic Safety **EEx ib IIC** type of protection.
  The **non-intrinsically safe field circuit** must be installed inside the hazardous area using a type of protection conforming to European Standard (e.g. Increased Safety "e").
  **Power supply** and **signal inputs / outputs** are non-intrinsically safe.

- **Field current fuse protection**
  The field circuit is fuse-protected in the signal converter IFC 110F – EEx by two fusible links on the FSV circuit board (TR5, 160 mA F).

- **Safety-relevant type code**
  The following code is used for type designation:

  **IFC 110 F / ... - E Ex**

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electromagnetic signal converter</td>
<td>Type series</td>
<td>Field housing for &quot;remote&quot; measuring systems</td>
<td>Marking – no effect on explosion protection</td>
<td>Special version for -40 °C</td>
<td>others as required</td>
</tr>
<tr>
<td>Approval to European standard</td>
<td>Explosion-protected equipment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
6.1.3 Installation and electrical connection
Type IFC 110 F - EEx signal converters are type tested as associated electrical apparatus. They are installed outside the hazardous area. The PE/PA connection (housing) must have protective bonding with the potential of the hazardous area (PA).

### Insulation ratings
The insulation of signal converters Type IFC 110 F - EEx is rated in conformity with VDE 0110-1, equivalent to IEC 664-1, and the following rated values have been taken into consideration:

- overvoltage category for the line circuit: III
- overvoltage category for the signal and measuring circuits: II
- insulation pollution degree: 2

**Important, please note without fail!**

- The buffer barrier for the intrinsically safe electrode circuit is an integral part of the IFC 110 F - EEx signal converter and is safety galvanically isolated.
- The cable entry for the interconnecting cable of the intrinsically safe electrode circuit is marked in light blue.
- The terminals of the intrinsically safe electrode circuit may only be connected to intrinsically safe circuits, even if the device is operated in the non-hazardous area.
- Electrical connection between front panel and potential to ground to be made by way of the fastening screws on the front panel. These must therefore always be properly tightened down (torque approx. 1.3 Nm).

### Start-up
Check the following points before starting up:

- that the line voltage (power supply) agrees with the details given on the nameplate.
- that the nominal value of the fuse for field current protection agrees with the maximum permissible nominal value specified for the flow sensor.

Evidence shall be furnished of the intrinsic safety for the electrode circuit together with the safety-relevant data of the interconnecting cable and of the flow sensor.

### Operation
Operator control of the signal converter is permitted during operation. For this purpose, remove the cover of the electronic compartment. Definitely avoid ingress of dirt and moisture when the housing cover is open.

### Preventive maintenance
The signal converter does not require any maintenance when used for the intended purpose. Within the scope of checks required to be carried out in hazardous areas to maintain systems in proper working order, visual inspection of the housing, cable entries and interconnecting cables for signs of damage should be carried out at regular intervals.

### Maintenance
Maintenance work of a safety-relevant nature within the meaning of explosion protection may only be carried out by the manufacturer, his authorized representative or under the supervision of authorized inspectors.

**Please note!**
Safety data see Sect. 10.1!
6.2 Magnetic sensors MP (optional)

- The MP magnetic sensors allow the signal converter to be operated with a bar magnet without opening the housing.

- This optional equipment can also be retrofitted (see Section 8.2). A green LED in the "magnet active" field on the front panel indicates that magnetic sensors are installed.

- The function of the three magnetic sensors is identical to the function of the corresponding keys.

- Take hold of the plastic cap of the bar magnet and touch the glass pane on top of the magnetic sensors with the blue end of the bar magnet (north pole).

- Sensor tripping is acknowledged by corresponding symbols appearing on the display and by a change of colour of the green LED referred to above.
6.3 Changing the load capacity of the output A1 for polarized DC operation

In case of polarized DC operation of output A1 (status or pulse output), the load capacity can be increased to \( I \leq 200 \text{ mA} \) (factory setting: \( I \leq 100 \text{ mA} \)).

Switch off the power supply before opening the housing!

1) Remove the cover from the terminal compartment (remove 2 screws).
2) Pull all plug-in terminals out of the sockets inside the terminal compartment.
3) Remove the glass cover from the control compartment (remove 4 screws).
4) Remove 4 screws from the front panel, take hold of the handle on the upper end of the front panel and carefully pull the complete electronic unit out of the signal converter housing.
5) Put down the electronic unit with the front panel facing down.
6) Unscrew the SLP screw from the I/O printed circuit board (inputs/outputs) and carefully pull the PCB out of the plug base (see illustration in Section 8.3).
7) Remove the two X4 jumpers from the I/O printed circuit board, turn them by 90° and plug them back into the PCB in "DC position" (see illustration of PCB I/O in Section 8.7).
8) Re-assemble in reverse order (items 6 to 1).

6.4 Interfaces

<table>
<thead>
<tr>
<th>Important, please note!</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Observe the directions and regulations and the electrical data specified in the EC type test certificate.</td>
</tr>
<tr>
<td>• In addition to the regulations for heavy-current installations (VDE 0100), pay particular attention to the requirements specified in EN 60079-14 “Electrical equipment in hazardous areas”.</td>
</tr>
<tr>
<td>• Assembly, installation, commissioning and maintenance work may only be carried out by “personnel trained in explosion protection”!</td>
</tr>
</tbody>
</table>

6.4.1 RS 232 adapter incl. IMoCom software (optional)

An RS 232 adapter including IMoCom software is available as an optional extra for operation of the signal converter with an MS-DOS PC. Detailed instructions are included in the package.

The RS 232 adapter connecting the signal converter to the PC or laptop is plugged into the IMoCom bus multipoint connector on the front panel of the signal converter (underneath the sliding window, see Section 4.2).

6.4.2 HART®-interface

The HART® interface is a smart interface, in other words a communication signal superimposed on the current output. All functions and parameters can be accessed via this interface.

The following HART® features are supported:
• point-to-point connection
• multidrop (up to 15 HART devices)

The burst mode is not normally used.
Further information about HART is available from the HART® Communication Foundation, of which KROHNE is a member.
Electrical connection

**HART\(^\circledR\) - active**
not with multidrop operation

**HART\(^\circledR\) - passive**
only with multidrop operation

| Bürde | ≥ 230 Ω |

Power supply unit (and section switch amplifier) must be set up accordingly if in use for HART\(^\circledR\) operation. For setting active/passive operation see Sect. 6.8.

### Settings and operation

<table>
<thead>
<tr>
<th>Fct.</th>
<th>Parameter</th>
<th>Point-to-point mode</th>
<th>Multidrop mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.05</td>
<td>Function</td>
<td>1 CORRECT. or 2 CORRECT.</td>
<td>OFF</td>
</tr>
<tr>
<td></td>
<td>Range I</td>
<td>4-20 mA or I(_{0%}) ≥ 4 mA</td>
<td>I(_{0%}) ≥ 4 mA</td>
</tr>
<tr>
<td>3.09</td>
<td>Communication</td>
<td>HART</td>
<td>HART</td>
</tr>
<tr>
<td></td>
<td>Address</td>
<td>0</td>
<td>01, 02, 03 ... 15 (use one address at one time only)</td>
</tr>
</tbody>
</table>

Operation

**Current output**
active or passive
passive only

For further information on setting the signal converter refer to chapters 4 and 5.

**HART\(^\circledR\) operating tools / Device Description (DD)**

The signal converter can be operated either via its local operator interface or by means of the HART\(^\circledR\) communicator, which is available from KROHNE.

Operator control by means of the HART\(^\circledR\) communicator requires a device description (DD) which we can load for you into the communicator. We can, of course, also load the DDs of all manufacturers who have filed their DDs with the HART\(^\circledR\) Communication Foundation.

If you wish to use the signal converter in your operating tool, for example, please ask for the description of the HART\(^\circledR\) command used so that you can address the complete signal converter functionality via HART\(^\circledR\).
6.4.3 KROHNE RS 485 Interface (Option)

Electrical connection

RS 485 Interface (Option, connection at plug-in terminal RS)

* The shields can be grounded as follows:
  1) directly at both ends
     or where there is risk of circulating currents,
  2) directly at one end (static shielding) or
  3) directly at one end and capacitive at the other end.

In the case of 2) and 3), a decrease in EMC is to be expected.

It is essential to blank off the final signal converter's electrical bus. To do this, solder up the semicircular circuits of solder points S3 and S4 on the RS485 - PCB. For further information refer to section 8.7.

The RS 485 protocol is available. Please contact your local KROHNE supplier / company.

Settings for use in interface operation

<table>
<thead>
<tr>
<th>Fct.</th>
<th>Parameter</th>
<th>KROHNE RS 485 Interface</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.09</td>
<td>Communication</td>
<td>KROHNE</td>
</tr>
<tr>
<td></td>
<td>Address</td>
<td>000-239</td>
</tr>
<tr>
<td></td>
<td>Baud rate</td>
<td>- 1200, 2400, 4800, 9600, 19200</td>
</tr>
</tbody>
</table>

For further information on setting the signal converter refer to chapters 4 and 5.
6.5 Pulsating flow

Application
Downstream of positive displacement pumps (reciprocating or diaphragm pumps) without pulsation damper.

Resetting the signal converter, see Sections 4 and 5.

Changing the settings

- **Fct. 3.02  FIELD FREQ.** (change the magnetic field frequency)
  - Stroke frequency less than 80 strokes/min. (at max. pump lift), do not change setting.
  - Stroke frequency 80-200 strokes/min. (at max. pump lift), change setting to 1/2, only recommended for PROFIFLUX 5000 F (DN 2.5-100 and 1/10"-4") and ALTOFLUX 4000 F (DN 10, 15, 50-100 and 1/10", 1/2", 2"-4"), for other types and sizes please consult factory.
  - Please note: at stroke frequencies near the limit of 80 strokes/min. additional measurement deviations of ± 0.5 % of the measuring value may occur occasionally.

- **Fct. 3.06  APPLICAT.** (adapt modulation limit of A/D converter to the application)
  Change setting of subfunction "FLOW" to "PULSATIN".

- **Fct. 1.04  DISP. FLOW** (change display of flow)
  Change setting to "BARGRAPH" in order to be able to evaluate the display ripple.

- **Fct. 1.02  TIMECONST.** (change time constant)
  - Change setting to "ALL" and set time (t) to seconds.
  - Recommendation: $t \text{ [s]} = \frac{1000}{\text{min. number of strokes/min.}}$
  - Example: min. number of strokes during operation = 50 strokes/min.
    $t \text{ [s]} = \frac{1000}{50/\text{min.}} = 20 \text{ s}$

  With this setting, the residual ripple of the display is approx. ± 2 % of the measuring value. Doubling the time constant reduces the residual ripple of the display by a factor of 2.
6.6 **Unstable display and outputs**

Unstable displays and outputs may occur:
- with high amounts of solids,
- with inhomogeneities,
- with badly blended mixtures,
- after constant chemical reactions in the process liquid or
- in ALTOFLUX 4000 F flow sensors when the wrong electrode material is selected for the process liquid, e.g. Hastelloy B2 for hydrochloric acid.

If the flow is pulsating because of the use of diaphragm or reciprocating pumps please refer to Section 6.5.

**Resetting the signal converter**, see Sections 4 and 5.

**When changing the signal converter settings**, the green LED (normal) and the red LED (error) on the front panel of the signal converter start to flash rapidly and frequently. This indicates that the A/D converter range is frequently exceeded and that not all measured values are evaluated.

**Change the following settings to allow the display ripple to be properly evaluated**:

Select "BARGRAPH" in Fct. 1.04 DISPLAY, subfunction "DISP. FLOW" and select "YES" in submenu "DISP. MSG."

Press key 4 times to return to measuring mode.

The following displays are possible in measuring mode:

- **ADC** = A/D converter range exceeded
- **OVERFL. I, P** and/or **P2** = one or several output ranges exceeded

### Change procedure A

**PLEASE NOTE:**
After each of the following changes check if the display and outputs are unsteady in measuring mode. Do not proceed to the next step unless the display and outputs continue to be unsteady.

- **Fct. 1.02 TIMECONST.** (change time constant)
  - Set to "ONLY I"; set to "ALL" when pulse output is also unsteady.
  - Set time constant to approx. "20 seconds", check if display remains unsteady and correct if necessary.

- **Fct. 3.06 APPLICAT.** (adapt modulation limit of A/D converter to the application)
  Change setting of subfunction "FLOW" to "PULSATING" on a trial basis.

  When the green LED and red LED continue to flash, change the setting of subfunction "ADC GAIN" to 30.

  Should the green LED and red LED continue to flash frequently, set value to 10.

- **Fct. 3.02 FIELD FREQ.** (change magnetic field frequency)
  Change the setting to 1/2 on a trial basis.

  If this has no significant effect, restore the last setting (usually 1/6).

  Only recommended for PROFIFLUX 5000 F (DN 2.5-100 and 1/10-4 inch) and ALTOFLUX 4000 F (DN 10, 15, 50-100 and 1/10, 1/2, 2-4 inch), for other types and sizes please consult factory.

If display and outputs continue to be unsteady or if the set time constant proves too high for your specific application (Fct. 1.02) please proceed as described in **change procedure B**.
Change procedure B

PLEASE NOTE:
Do not proceed according to change procedure B unless the steps of change procedure A proved unsuccessful.

Change procedure B must not be adopted for pulsating flows downstream of positive displacement pumps.

The following settings result in a modified dynamic behaviour of the system which is no longer defined by the setting of the time constant in Fct. 1.02.

- Fct. 1.02 TIMECONST.
  Change setting to 3 seconds.

- Fct. 3.06 APPLICAT.
  – Select "YES" in subfunction "SPEC. FILT." to activate a special noise filter.
  – Subfunction "LIMIT VAL." defines a window with a width (somewhere around the mean flow) equivalent to the value in PERCENT of the full-scale range Q\textsubscript{100\%} set here (Fct. 3.02, subfunction "FULL SCALE").

This value must always be a lot smaller than the amplitude of the display ripple (peak-to-peak).

**Example:**

\[
\begin{align*}
\frac{\Delta Q_{\text{max}}}{\Delta T} & \quad \left[ \frac{\%}{s} \right] = \frac{\text{LIMIT VAL.}}{\text{TIMECONST. (Fct. 1.02)}} \\
\text{Example:} & \quad \text{full-scale range } Q_{100\%} = 500 \text{ m}^3/\text{h} \\
\text{ripple mean value} & \quad = 25 \text{ m}^3/\text{h} = \pm 5\% \text{ of full-scale range } Q_{100\%} \\
\text{set amplitude to e.g.} & \quad \pm 2\%
\end{align*}
\]

Signals outside the ± LIMIT VALUE window are cut off (clipping). When e.g. interferences cause the measuring value to leave this window for a short time, the rate of change of the display and outputs is limited to...

\[
\frac{\Delta Q_{\text{max}}}{\Delta T} = \frac{\text{LIMIT VAL.}}{\text{TIMECONST. (Fct. 1.02)}}
\]

Formula applying to the above example:

\[
\frac{\Delta Q_{\text{max}}}{\Delta T} = \frac{2\%}{3 \text{ s}} = 0.66 \quad \frac{\%}{s}
\]

The delay required for passing on major changes of flow to the display and outputs is defined in subfunction "LIMIT CNT."

Set subfunction "LIMIT CNT." to 10 on a trial basis.

Should the measuring value leave the above window in one direction more than 10 times, this window is temporarily rendered inactive.

Display and outputs follow major changes of flow with the appropriate speed.

This setting provides an additional dead time for display and outputs:

**Dead time = LIMIT CNT. x duration of measuring cycle**

Duration of measuring cycle = **approx. 60 ms** (for magnetic field frequency = 1/6 line frequency, see Section 3.02, subfunction "FIELD FREQ.").

A "10" set in subfunction "LIMIT CNT." results in a dead time of approx. 600 milliseconds.

By changing the subfunctions "LIMIT VAL.", "LIMIT CNT." and "TIMECONST." (Fct. 1.02) on a trial basis, a setting can normally be found which ensures that the display and outputs are sufficiently stable.

**Each** of the steps described above must be followed by a check of the ripple of display and outputs in measuring mode.
6.7 Quickly changing flows

Application
For filling processes, high-speed control circuits, etc.

Resetting the signal converter, see Sections 4 and 5.

Changing the settings
- **Fct. 1.02 TIMECONST.** (change the time constant)
  - Change the setting to "ONLY I" and set time to 0.2 seconds.
- **Dynamic behaviour** for sizes DN 2.5-300 and \( \frac{1}{10} \) -12 inch
  - Dead time: approx. 0.06 at 50 Hz line frequency
  - approx. 0.05 at 60 Hz line frequency
  - Time constant: as set above, current output (mA) then is 0.1 seconds
- **Reduction of dead time by factor 3** (possible by changing the magnetic field frequency)
  - Change Fct. 3.02 FLOW METER, subfunction "FIELD FREQ." to "1/2",
  - only recommended for PROFIFLUX 5000 F (DN 2.5-100 and \( \frac{1}{10} \) -4 inch)
  - and ALTOFLUX 4000 F (DN 10, 15, 50-100 and \( \frac{1}{10}, \frac{1}{2}, 2-4 \) inch),
  - for other types and sizes please consult factory.

6.8 Changeover of current output, active / passive mode

Standard factory setting: active mode

The current output can be changed over to the passive mode. This requires a power source, either an external one or via the isolated internal one (24 V DC), power terminals E+ / E-.

See Sect. 2.6 for connection diagrams.

Proceed as follows to change over from active to passive mode, or vice versa.

**Changes on the I/O circuit board** (inputs/outputs), see diagram in Sect. 8.7

**Switch off power source before opening the housing!**

1) Remove glass cover from control compartment (detach 4 screws).
2) Remove cover from terminal compartment (detach 2 screws).
3) In terminal compartment, pull off all plug-in terminals.
4) Detach 4 screws from the front panel F and carefully pull complete electronic unit out of the converter housing using the grip at the top of the front panel.
5) Place electronic unit down on front panel F.
6) Detach the two fastening screws SLP from the I/O board (inputs/outputs) and carefully pull the board out of the pin base, see figures in Sect. 8.7.
7) On the printed side of the I/O board, transpose the two jumpers X3 and X6, in the same direction, to Position A (= active mode) or Position P (= passive mode).
8) Reassemble in reverse order, Points 6) - 1).
9) **Please note:**
   In the passive mode, load impedance monitoring under Fct. 1.04 DISPLAY and DISP. MESSAGES - yes is not possible.
6.9 Empty pipe detection EPD

The signal converter is equipped as standard with an EPD (Empty Pipe Detection) which only needs to be activated as and when required.

To ensure proper functioning, the following requirements need to be met:

<table>
<thead>
<tr>
<th>Type of signal cable</th>
<th>Electrical conductivity of process liquid</th>
<th>Nominal size of flow sensor</th>
<th>Max. length of signal cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>A = Type DS</td>
<td>&gt; 200 µS/cm</td>
<td>≥ DN 25 / ≥ 1“</td>
<td>&lt; 20 m / 65 ft</td>
</tr>
<tr>
<td>B = Type BTS</td>
<td>&gt; 50 µS/cm</td>
<td>≥ DN 25 / ≥ 1“</td>
<td>&lt; 20 m / 65 ft</td>
</tr>
</tbody>
</table>

Settings for empty pipe detection (EPD)
- Fct. 3.06 APPLICATION
- EMPTY PIPE
- YES (switched on)
- NO (switched off)

The calibration mode must be run through during initial start-up!
- If “YES” selected, the impedances for EMPTY and FULL PIPE need to be determined.
- Select subfunction VALUE FULL and CALIB. YES (determine impedance for “full pipe”)
  WAIT (approx. 20 s)
- Select subfunction VALUE EMPTY and CALIB. YES (determine impedance for “empty pipe”)
  WAIT (approx. 20 s)
- Store values after completion of calibration for “Full” and “Empty” values; quit operator control after the second calibration.

When the electrodes are not wetted (= empty pipe), typically a response time of approx. 20 seconds is required before “empty pipe” is indicated. In this time undefined display values and output signals are possible.

Functional description
A high-resistance AC voltage is applied to the electrodes. The process liquid in the measuring tube forms a voltage divider together with the internal resistance of the circuit. The voltage ratio is measured and weighted (see figure on right). Impedance and length of electrode cable will also affect the result.

The result is a numerical value proportional to the impedance at the input. The switching point of the Empty Pipe Detector is defined when the system is calibrated for “full pipe” and “empty pipe” (at approx. 2/3 of the range between the two calibration points). In order to function properly there must be a difference of at least “10” between the two calibration points. In operation, the display indicates in the range between 0 and 150 (non-dimensional). The value for “FULL PIPE” must be lower than that for “EMPTY PIPE”.

[Diagram of empty pipe detection system]

The calibration mode must be run through during initial start-up!
- If “YES” selected, the impedances for EMPTY and FULL PIPE need to be determined.
- Select subfunction VALUE FULL and CALIB. YES (determine impedance for “full pipe”)
  WAIT (approx. 20 s)
- Select subfunction VALUE EMPTY and CALIB. YES (determine impedance for “empty pipe”)
  WAIT (approx. 20 s)
- Store values after completion of calibration for “Full” and “Empty” values; quit operator control after the second calibration.

When the electrodes are not wetted (= empty pipe), typically a response time of approx. 20 seconds is required before “empty pipe” is indicated. In this time undefined display values and output signals are possible.

[Diagram of empty pipe detection system]
6.10 Stable signal outputs with empty measuring tube

**Important, please note!**
- Observe the directions and regulations and the electrical data specified in the EC type test certificate.
- In addition to the regulations for heavy-current installations (VDE 0100), pay particular attention to the requirements specified in EN 60079-14 “Electrical equipment in hazardous areas”.
- Assembly, installation, commissioning and maintenance work may only be carried out by “personnel trained in explosion protection”!

Output signals can be stabilized to values as for "zero" flow to prevent undefined output signals when the measuring tube is empty.

- **Display** 0
- **Current output** 0 or 4 mA, see setting in Fct. 1.05
- **Pulse output P** no pulses (= 0 Hz), see setting in Fct. 1.06
- **2nd pulse output A1** no pulses (= 0 Hz), see setting in Fct. 1.07

**Prerequisite:**
- electrical conductivity of process liquid $\geq 200 \text{ mS/cm}$, $\geq 500 \text{ mS/cm}$ for sizes DN 2.5 - 15 and 1/10" - 1/2".
- Signal cable length $\leq 20 / \leq 65$ ft and vibration free with signal converter.

<table>
<thead>
<tr>
<th>LA / S2 Empty Tube stabilization</th>
<th>LA / S4 electrode cleaning and Empty Tube stabilization</th>
</tr>
</thead>
<tbody>
<tr>
<td>steady display at &quot;0&quot; flow</td>
<td>LA / S4 prevents any deposits of high-resistance layers on the electrodes (e.g. fat from very creamy milk) and effects stabilization similar to the LA / S2. For this purpose, the electrodes are connected to $-12$ V via high-resistance resistors.</td>
</tr>
<tr>
<td>LA / S2 should be used when problems are encountered with EPD or the limits of the application are exceeded. At &quot;0&quot; flow, the electrodes are connected to 0 V (chassis) via high-resistance resistors.</td>
<td></td>
</tr>
</tbody>
</table>

To join the "semicircles" of the three soldering points S1, S2 and S4, see under "Point 8".

Possibly reset low-flow cutoff (SMU), see under Point 11

**Please note!**
Only use the two functions, if Empty Pipe Detection (EPD) is switched off, see Sect. 6.9 and in Fct. 3.06 Application → EMPTY PIPE.
Changes on A/D converter PCB, see illustration in Section 8.7

Switch off the power supply before opening the housing!

1) Remove the glass cover from the control compartment (remove 4 screws).
2) Remove the cover from the terminal compartment (remove 2 screws).
3) Pull all plug-in terminals out of the sockets inside the terminal compartment.
4) Remove 4 screws from the front panel, take hold of the handle on the upper end of the front panel and carefully pull the complete electronic unit out of the signal converter housing.
5) Put down the electronic unit with the front panel F facing down.
6) Unscrew the two S LP screws from the printed circuit boards FSV (field current supply) and ADC (analog/digital converter) and carefully pull both PCBs out of their plug bases (see illustration in Section 8.7).
7) Loosen the common plug-and-socket connection.
8) The circuit side of the ADC circuit board has 4 soldering points S1-S4 (two semicircles, each - see illustration in Section 8.7). Carefully scratch the protective lacquer off the soldering points which are used. Do not remove the protective lacquer from soldering point S3. Do not damage the conductive tracks.
9) Connect the semicircles of soldering points which are used with tin solder.
10) Re-assemble in reverse order (items 7 to 2).
11) For LA / S2 (empty tube stabilization) and LA / S4 (electrode cleaning and empty tube stabilization), check the setting of the low-flow cutoff SMU, Fct. 1.03, and reset if necessary:

<table>
<thead>
<tr>
<th>Full scale range Q_{100%}</th>
<th>Cutoff ...... values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>... OFF ...</td>
</tr>
<tr>
<td>&gt; 3 m/s</td>
<td>&gt; 10 ft/s</td>
</tr>
<tr>
<td>1 – 3 m/s</td>
<td>3 -10 ft/s</td>
</tr>
<tr>
<td>&lt; 1 m/s</td>
<td>&lt; 3 ft/s</td>
</tr>
</tbody>
</table>
7 Functional checks

7.1 Checking the zero with IFC 110 F signal converter, Fct. 3.03

- Set "zero" flow in the pipeline. Make sure that the measuring tube is completely filled with liquid.
- Switch on the system and wait 15 minutes.
- Press the following keys for zero measurement:

<table>
<thead>
<tr>
<th>Key</th>
<th>Display</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>→</td>
<td>Fct. 1.00</td>
<td>OPERATION</td>
</tr>
<tr>
<td>2x ↑</td>
<td>Fct. 3.00</td>
<td>INSTALL.</td>
</tr>
<tr>
<td>→</td>
<td>Fct. 3.01</td>
<td>LANGUAGE</td>
</tr>
<tr>
<td>2x ↑</td>
<td>Fct. 3.03</td>
<td>ZERO SET</td>
</tr>
<tr>
<td>→</td>
<td>CALIB. NO</td>
<td></td>
</tr>
<tr>
<td>↓</td>
<td>0.00</td>
<td>- - - - - / - - -</td>
</tr>
<tr>
<td>↑</td>
<td>STORE NO</td>
<td></td>
</tr>
<tr>
<td>↓</td>
<td>STORE YES</td>
<td></td>
</tr>
<tr>
<td>(2x) 3x ↓</td>
<td>Fct. 3.03</td>
<td>ZERO SET</td>
</tr>
</tbody>
</table>

Flow rate displayed in set unit, see Fct. 1.04 DISPLAY, subfunction "DISP. FLOW". 
Zero is measured, duration approx. 15-90 s. "WARNING" is displayed when flow is ">0", acknowledge by pressing ↓ key. 
If new value is not to be stored, press ↓ key (3 times) 4 times = return to measuring mode

STORE NO If new value is not to be stored, press ↓ key (3 times)

7.2 Checking the measuring range Q, Fct. 2.01

- For this test a measuring value can be simulated in the range of -110 to +110 percent of Q_{100%} (set full-scale range, see Fct. 1.01 FULL SCALE).
- Switch on the system.
- Press the following keys for checking the measuring range:

<table>
<thead>
<tr>
<th>Key</th>
<th>Display</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>→</td>
<td>Fct. 1.00</td>
<td>OPERATION</td>
</tr>
<tr>
<td>↑</td>
<td>Fct. 2.00</td>
<td>TEST</td>
</tr>
<tr>
<td>→</td>
<td>Fct. 2.01</td>
<td>TEST Q</td>
</tr>
<tr>
<td>↑</td>
<td>SURE NO</td>
<td></td>
</tr>
<tr>
<td>↓</td>
<td>SURE YES</td>
<td></td>
</tr>
<tr>
<td>↓</td>
<td>- - - - - / - - -</td>
<td></td>
</tr>
<tr>
<td>↑</td>
<td>- - - - - / - - -</td>
<td></td>
</tr>
<tr>
<td>(2x) 3x ↓</td>
<td>Fct. 2.01</td>
<td>TEST Q</td>
</tr>
</tbody>
</table>

End of test, actual measured values again available at outputs

Measuring mode with new zero
7.3 Hardware information and error status, Fct. 2.02

- Before consulting the factory about errors or flow measurement problems, please invoke Fct. 2.02 HARDW. INFO (hardware information).
- An 8-character and a 10-character status code are stored under this function in each of 3 "windows". These 6 status codes allow your compact flowmeter to be subjected to a simple and rapid diagnosis.
- Switch on the system.
- Press the following keys for a display of the status codes:

<table>
<thead>
<tr>
<th>Key</th>
<th>Display</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>→</td>
<td>Fct. 1.00</td>
<td>OPERATION</td>
</tr>
<tr>
<td>↑</td>
<td>Fct. 2.00</td>
<td>TEST</td>
</tr>
<tr>
<td>→</td>
<td>Fct. 2.01</td>
<td>TEST Q</td>
</tr>
<tr>
<td>↑</td>
<td>Fct. 2.02</td>
<td>HARDW. INFO</td>
</tr>
<tr>
<td>→</td>
<td>MODUL ADC</td>
<td>1st window</td>
</tr>
<tr>
<td>↑</td>
<td>MODUL I/O</td>
<td>2nd window</td>
</tr>
<tr>
<td>↑</td>
<td>MODUL DISP.</td>
<td>3rd window</td>
</tr>
</tbody>
</table>

**PLEASE NOTE DOWN ALL 6 STATUS CODES!**

<table>
<thead>
<tr>
<th>(2x) 3x ↓</th>
<th>Fct. 2.02</th>
<th>HARDW. INFO</th>
<th>Terminate hardware information</th>
</tr>
</thead>
</table>

7.4 Hardware test, Fct. 2.03

Please note:
Before beginning the test, deactivate any alarms and controllers as the current output will be tested with three values 4, 4.7 and 23 mA for a short period.

<table>
<thead>
<tr>
<th>Key</th>
<th>Display</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>→</td>
<td>Fct. 1.00</td>
<td>OPERATION</td>
</tr>
<tr>
<td>↑</td>
<td>Fct. 2.00</td>
<td>TEST</td>
</tr>
<tr>
<td>→</td>
<td>Fct. 2.01</td>
<td>TEST Q</td>
</tr>
<tr>
<td>2 x ↑</td>
<td>Fct. 2.03</td>
<td>HARDW. TEST</td>
</tr>
<tr>
<td>↑</td>
<td>↑</td>
<td>SURE NO</td>
</tr>
<tr>
<td>↑</td>
<td>↑</td>
<td>SURE YES</td>
</tr>
<tr>
<td>↓</td>
<td>WAIT</td>
<td>Hardware test in progress, duration approx. 60 seconds</td>
</tr>
<tr>
<td>↑</td>
<td>1st error</td>
<td>List of errors see Sect. 4.5. Errors are always displayed independent of setting in</td>
</tr>
<tr>
<td>↑</td>
<td>2nd error</td>
<td>3rd error</td>
</tr>
<tr>
<td>↑</td>
<td>3rd error</td>
<td>Fct. 1.04. If no error is detected, refer to next line.</td>
</tr>
<tr>
<td>↓</td>
<td>Fct. 2.03</td>
<td>HARDW. TEST</td>
</tr>
<tr>
<td>(2x) 3x ↓</td>
<td>- - - - -</td>
<td>- - - / - -</td>
</tr>
</tbody>
</table>

If you need to return your flowmeter to KROHNE, please refer to the last-but-one page of these instructions.
7.5 Faults and symptoms during start-up and flow measurement

- Most faults and symptoms occurring with the flowmeters can be eliminated by following the instructions indicated in the following tables.

- For greater clarity, faults and symptoms in the tables are divided into different groups.

- **LED** light-emitting diodes on the front panel (status messages)
  - D display
  - I current output I
  - P pulse outputs P and A1
  - S status outputs D1, D2, A1 and A2
  - C control inputs C1 and C2

Before contacting the KROHNE Service Department, please read the instructions in the table. THANK YOU.

<table>
<thead>
<tr>
<th>Group LED</th>
<th>Display</th>
<th>Cause</th>
<th>Remedial action</th>
</tr>
</thead>
<tbody>
<tr>
<td>LED 1</td>
<td>Both LEDs flash</td>
<td>A/D converter range exceeded</td>
<td>Reduce flow rate; if unsuccessful, test as described in Section 7.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Measuring tube drained, A/D conv. range exceeded</td>
<td>Fill measuring tube</td>
</tr>
<tr>
<td>LED 2</td>
<td>Red LED flashes</td>
<td>Fatal error, hardware and/or software fault</td>
<td>Replace signal converter, see Section 8.3</td>
</tr>
<tr>
<td>LED 3</td>
<td>Cyclic flashing of red LED, approx. 1 sec.</td>
<td>Hardware fault, watchdog trips</td>
<td>Replace signal converter, see Section 8.3</td>
</tr>
<tr>
<td>LED 4</td>
<td>Red LED on continuously</td>
<td>Hardware fault</td>
<td>Replace signal converter, see Section 8.3</td>
</tr>
<tr>
<td>Group D</td>
<td>Display</td>
<td>Cause</td>
<td>Remedial action</td>
</tr>
<tr>
<td>---------</td>
<td>---------</td>
<td>-------</td>
<td>----------------</td>
</tr>
</tbody>
</table>
| D 1     | LINE INT. | Power failure  
Note: no counting during power failure | Delete error message in RESET/QUIT. menu, reset totalizer if necessary. |
| D 2     | OVERFL. I | Current output range exceeded | Check instrument parameters and correct if necessary. Error message is deleted automatically after cause has been eliminated. |
| D 3     | OVERFL. P | Pulse output range exceeded  
Note: totalizer deviation is possible | Check instrument parameters and correct if necessary. Reset totalizer. Error message is deleted automatically after cause has been eliminated. |
| D 4     | ADW | A/D converter range exceeded | Error message is deleted automatically after cause has been eliminated. |
| D 5     | FATAL.ERROR | Fatal Error, all outputs are set to “min” values | Replace signal converter, see Sect. 8.3 or consult KROHNE Service, having first noted down hardware information and error status, see Sect. 7.3, Fct. 2.02. |
| D 6     | TOTALIZER | Counts lost  
(overflow, data error) | Delete error message in RESET/QUIT. menu. |
<p>| D 7     | I SHORT | Short circuit at current output | Check electrical connection acc. to Sect. 2.2 and correct if necessary. Load ≥ 15 Ω ! |
| D 8     | I OPEN | Open current output | Provide load ≤ 500 Ω ! |
| D 9     | ADC PARAM. | Fault detected on the ADC printed circuit | Check measuring accuracy. Replace ADC printed circuit board (see Sect. 8.4) or consult KROHNE Service, having first noted down hardware information and error status, see Sect. 7.3, Fct. 2.02 |
| D 10    | ADC HARDW. |  | |
| D 11    | ADC GAIN |  | |
| D 12    | STARTUP, cyclic flashing | Hardware fault, watchdog trips | Replace signal converter (see Sect. 8.3) or consult KROHNE Service, having first noted down hardware information and error status, see Sect. 7.3, Fct. 2.02. |
| D 13    | BUSY | Displays for flow, totalizers and messages disabled | Change setting in Fct. 1.4 |
| D 14    | Unsteady display | Low electrical conductivity, high solids content, pulsating flow | Increase time constant in Fct. 1.2, refer to Sect. 6.5 and 6.7. |
| D 15    | No display | Power supply OFF | Switch on power supply. Replace if blown, |</p>
<table>
<thead>
<tr>
<th>Group I</th>
<th>Faults / Symptoms</th>
<th>Cause</th>
<th>Remedial action</th>
</tr>
</thead>
</table>
| I 1     | Receiver instrument indicates "0"<br>Invoke test function 2.03 for analysis see Sect. 7.4.<br>(this check is only usefully, if current output is operating in active mode, see Sect. 6.8!) | Display shows...<br>  **I SHORT**<br>Current output shorted, Load is < 15 Ω<br>  **I OPEN**<br>Load resistance > 500 Ω<br>  **No information displayed after test** | Eliminate short circuit, Load must be ≥ 15 Ω!<br>Find interruption and eliminate. |}
| I 2     | Receiver instrument indicates "0". | Wrong connection/polarity | Connect properly, see Sect. 2.2 and 2.6. |
|         | **active mode**<br>Circuit and/or receiver instruments defective | Check circuit and receiver instrument at I₂ / I and replace if necessary. Check position of jumper X3 + X6 for active mode, see Sect. 6.8 and check fuse F9 on I/O PCB and replace if necessary, see Sect. 8.4 and 8.7. | |
|         | **passive mode**<br>Receiver instruments and/or external voltage source defective | Check connections, receiver instruments and external voltage source and replace if necessary. | |
|         | **internal mode**<br>Internal power supply (E+E-) is voltage source, shorted or defective current output | Check connections and cables, see Sect. 2.3 and 2.6. Voltage between E+ and E- approx. 24 V. If voltage is a lot smaller, switch off the instrument, eliminate the short circuit, check position of jumper X3 + X6 for passive mode, (see Sect. 6.8) and replace fuses F1 and F8 on the I/O PCB if necessary. Switch the instrument back on. If it still does not operate, current output is defective. Replace I/O PCB or complete electronic unit, see Sect. 8.3 and/or 8.4. | |
|         | Defective current output | Replace I/O PCB (see Sect. 8.4) or consult KROHNE Service, having first noted down hardware information and error status, see Sect. 7.3, Fct. 2.02. | |
|         | Wrong flow direction setting | Set properly in Fct. 3.1. | |
|         | Current output switched off | Switch on in Fct. 1.5. | |
### Group I

<table>
<thead>
<tr>
<th>Faults / Symptoms</th>
<th>Cause</th>
<th>Remedial action</th>
</tr>
</thead>
<tbody>
<tr>
<td>22 mA are available at current output (fault current)</td>
<td>Range of current output I is exceeded</td>
<td>Check instrument parameters and correct if necessary (see Sect. 2.2 and 5.7) or consult KROHNE Service, having first noted down hardware information and error status, see Sect. 7.3, Fct. 2.02.</td>
</tr>
<tr>
<td>22 mA are available at current output (fault current) and red LED flashes</td>
<td>Fatal Error</td>
<td>Replace signal converter or consult KROHNE Service, having first noted down hardware information and error status, see Sect. 7.3, Fct. 2.02.</td>
</tr>
<tr>
<td>Unsteady display</td>
<td>Electric conductivity of process liquid too low</td>
<td>Increase time constant (see Sect. 5.2, Fct. 1.2). Also refer to Sect. 6.7.</td>
</tr>
<tr>
<td>Receiver instruments indicate &quot;constant value&quot;</td>
<td>Control input C1 or C2 is set to &quot;Hold outputs&quot; and is activated</td>
<td>Change setting (see Sect. 5.10, Fct. 1.11 and 1.12), or deactivate control input.</td>
</tr>
<tr>
<td>Jumping current values</td>
<td>Current output is set to automatic range change</td>
<td>Change hysteresis or tripping ranges, see Sect. 5.20.</td>
</tr>
<tr>
<td>F/R-Mode: different displays for identical flow volumes in both directions</td>
<td>Different ranges set for &quot;forward flow&quot; and &quot;reverse flow&quot;</td>
<td>Change setting, see Sect. 5.15, Fct. 1.05 &quot;Rev. range&quot;.</td>
</tr>
<tr>
<td>Receiver instruments indicate &quot;min. values&quot;</td>
<td>Control input C1 or C2 is set to &quot;Zero outputs&quot; or &quot;Hold outputs&quot; and is activated</td>
<td>Change setting (see Sect. 5.10, Fct. 1.11 and 1.12) or deactivate control input.</td>
</tr>
<tr>
<td>Group P</td>
<td>Faults / Symptoms</td>
<td>Cause</td>
</tr>
<tr>
<td>---------</td>
<td>-------------------</td>
<td>-------</td>
</tr>
<tr>
<td>P 1</td>
<td>Totalizer connected but does not count pulses</td>
<td>Wrong connection/polarity</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Totalizer or external voltage source defective</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Internal power supply (E+E-) is voltage source, shorted or defective pulse output</td>
</tr>
<tr>
<td></td>
<td>Pulse output switched off or wrong flow direction setting</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fatal Error, red LED is on</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Control input C1 or C2 is set to “Zero outputs” and is activated</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Terminals A1 and A^ are not defined as a 2nd pulse output</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Resistance of totalizer too low for DC operation, I &gt; 100 mA</td>
<td></td>
</tr>
<tr>
<td>These causes only apply to the 2nd pulse output P2, terminal A1!</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P 2</td>
<td>Constant output of totalizer pulses</td>
<td>Control input C1 or C2 is set to &quot;Hold outputs&quot; and is activated</td>
</tr>
<tr>
<td>P 3</td>
<td>Unsteady pulse rate</td>
<td>Electrical conductivity of process liquid is too low</td>
</tr>
<tr>
<td>P 4</td>
<td>Pulse rate too high or too low</td>
<td>Incorrect pulse output settings</td>
</tr>
<tr>
<td>Group S</td>
<td>Faults / Symptoms</td>
<td>Cause</td>
</tr>
<tr>
<td>---------</td>
<td>-------------------</td>
<td>-------</td>
</tr>
<tr>
<td><strong>S 1</strong> (A1, A2, D1, D2)</td>
<td>No reaction from connected signalling instrument(s)</td>
<td>Defective signalling instrument(s) or external voltage source</td>
</tr>
<tr>
<td></td>
<td>Internal power supply (E+/E-) is voltage source: shorted, one or several pulse outputs defective</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Check connections and cables, change if necessary (see Sect. 2.6). Voltage between E+ and E- approx. 24 V. Check fuse F8 on the I/O PCB and replace if necessary (see Sect. 8.7). If instrument still does not operate, check fuses F.. on the I/O PCB for the status outputs and replace if necessary.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Control inputs C1 and C2 are set to &quot;Hold outputs&quot; or to &quot;0&quot;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>In addition to this, the red LED flashes = Fatal Error</td>
<td></td>
</tr>
<tr>
<td><strong>S 2</strong> (A1, A2, D1, D2)</td>
<td>Signalling instrument(s) is(are) constantly tripped</td>
<td>&quot;All Error&quot; or &quot;Fatal Error&quot; settings</td>
</tr>
<tr>
<td><strong>S 3</strong> (only for A1)</td>
<td>No reaction of connected signalling instrument</td>
<td>Terminal &quot;A1&quot; not defined as status output</td>
</tr>
<tr>
<td></td>
<td>Wrong connection/polarity</td>
<td></td>
</tr>
<tr>
<td><strong>S 4</strong> (only for A1)</td>
<td>Cyclic tripping of signalling instrument</td>
<td>Terminal &quot;A1&quot; not defined as status output</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group C</th>
<th>Faults / Symptoms</th>
<th>Cause</th>
<th>Remedial action</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>C 1</strong></td>
<td>No function of control inputs</td>
<td>Wrong connection</td>
<td>Connect properly, see Sect. 2.5 and 2.6.</td>
</tr>
<tr>
<td></td>
<td>Defective control input C or voltage source (internal or external)</td>
<td></td>
<td>Check connections and cables and change or replace if necessary. Check voltage source. Check fuses F6 and F7 on I/O PCB and replace if necessary.</td>
</tr>
<tr>
<td></td>
<td>Wrong setting of control inputs</td>
<td></td>
<td>Change, see Sect. 4.4 and 5.10.</td>
</tr>
</tbody>
</table>
7.6 Checking the flow sensor

Always switch off the power supply before opening the housing.

Required measuring instruments and tools

- Ohmmeter with at least 6 V measuring voltage range
- or AC voltage/resistance bridge

- **Note:** accurate measurements in the electrode area can only be obtained with an AC voltage/resistance bridge. The measured resistance also heavily depends on the electrical conductivity of the process liquid.

Preparations

- Switch off the power supply.
- Remove the cover from the terminal compartment (remove 2 screws).
- Pull out the two plug-in terminals SC (5-pin, signal line) and FP (4-pin, field current supply line), see illustration in Section 8.1.
- Fill the measuring tube of the flowmeter completely with process liquid.
- **Please note:** the following measurements must only be carried out for plug-in terminals which are occupied (used).

<table>
<thead>
<tr>
<th>Action</th>
<th>Typical result</th>
<th>Incorrect result for 1–3 = defective flow sensor, return to factory for repair, refer to last-but-one page!</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Measure resistance between wires 7 and 8</td>
<td>30 – 170 Ω</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Measure resistance between wires 1 and 7 or between wires 1 and 8</td>
<td>&gt; 20 MΩ</td>
</tr>
<tr>
<td>3</td>
<td>Measure resistance between wires 1 and 2 and between 1 and 3 (same measuring conductor always on wire 1!)</td>
<td>1 kΩ – 1 MΩ (see &quot;Note&quot; above) Both values should be approx. equal</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>When signal line B (type BTS/bootstrap) is used; measure resistance between the following lines: 1 and 20 / 1 and 30 / 20 and 30 2 and 20 / 3 and 30</td>
<td>&gt; 20 MΩ</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
7.7 Checking the signal converter using a GS 8 A simulator (optional)

GS 8 A operating elements and accessories

- **D** switch, flow direction
- **H** socket for plug H1 of cable Z
- **H1** plug of cable Z
- **L** power supply ON
- **P** potentiometer "zero"
- **Y** switch, measuring ranges
- **Z** cable between GS 8 A and signal converter
  ** active operation

Connection of GS 8 A to signal converter

**Switch off the power supply before starting work.**
1) Remove the cover from the terminal compartment of the signal converter.
2) Disconnect all flow sensor cables from terminals 1, 2, 3, 7, 8, 20 and 30, having first noted down which cable is connected to which terminal.
3) Connect the GS 8 A to the signal converter as shown above.
4) Slip plug H1 of cable Z into socket H on the front panel of the GS 8 A.
5) Connect the **mA meter** to terminals Is/I: accuracy class 0.1
   \[ \text{Ri = 15-500 W} \]
   \[ \text{range 0 / 4 - 20 mA} \]
6) Connect the **electronic totalizer** to terminals P / P: range 0 - 10 kHz
   \[ \text{time basis at least 1 s} \]
   For further details on the totalizer and its connection for active or passive modes of operation please refer to the connection diagrams in Section 2.6.
7) Test as described on the following two pages.
8) When the test is completed, disconnect the GS 8 A and re-connect the flow sensor and receiver instruments (items 4 to 1 above).

**PLEASE NOTE**
that an adapter is needed to connect the GS 8 simulator to the signal converter
(adapter Order No. 210764.00)
Checking the setpoint reading

1) Switch on the power supply and allow at least 15 minutes for "warming up".
2) Turn switch 𝐷 (GS 8 A front panel) to "0".
3) Adjust zero to 0 or 4 mA with the 10-turn potentiometer 𝑃 (GS 8 A front panel), depending on the setting in Fct. 1.05, deviation <± 10 µA.
4) Calculate the position of switch 𝑌 and displayed setpoints "𝑰" and "𝑓".

4.1) \[ X = \frac{Q_{100\%} \times K}{GK \times DN^2} \]

<table>
<thead>
<tr>
<th>𝑉</th>
<th>𝑇</th>
<th>𝑀𝑖𝑛</th>
<th>𝑎𝑓𝑡</th>
</tr>
</thead>
<tbody>
<tr>
<td>liters</td>
<td>25 464</td>
<td>424.4</td>
<td>7.074</td>
</tr>
<tr>
<td>m³</td>
<td>25 464 800</td>
<td>424 413</td>
<td>7 074</td>
</tr>
<tr>
<td>US Gallons</td>
<td>96 396</td>
<td>1 607</td>
<td>26.78</td>
</tr>
</tbody>
</table>

4.2) Determine position of switch 𝑌: use table (GS 8 A front panel) to determine value 𝑌 which comes closest to factor 𝑋 and meets condition 𝑌 ≤ 𝑋.

4.3) Calculate setpoint reading "𝑰" for current output:

\[ I = I_{0\%} + \frac{Y}{X} (I_{100\%} - I_{0\%}) \text{ in mA} \]

\[ I_{0\%} \text{ current (0/4mA) at 0% flow rate} \]
\[ I_{100\%} \text{ current (20mA) at 100% flow rate} \]

4.4) Calculate setpoint reading "𝑓" for pulse output:

\[ f = \frac{Y}{X} \times P_{100\%} \text{ in Hz} \]

\[ P_{100\%} \text{ pulses per second (Hz) at 100% flow rate} \]

5) Turn switch 𝐷 (GS 8 A front panel) to "+" or "-" (forward/reverse flow).
6) Set switch 𝑌 (GS 8 A front panel) to the value determined as described above.
7) Check setpoint readings 𝑈 and 𝑓, see items 4.3 and 4.4 above.
8) Deviation < 1.5 % of setpoint. If higher, replace signal converter, see Section 8.7.
9) Linearity test: set lower 𝑌 values, readings will drop in proportion to the calculated values for 𝑌.
10) **Switch off power supply** after completing the test.
11) Disconnect the GS 8 A.
12) Re-assemble in reverse order (items 2 to 1 "in connection of GS 8A").
    See also illustration in Section 8.1 and 8.7.
13) The system is ready for operation after the power supply is switched on again.

Example: see next page.
Example

Full-scale range
Meter size
Current at
Pulses at
Flow sensor constant

\[
\begin{align*}
Q_{100}\% &= 200 \text{ m}^3/\text{h (Fct. 1.01)} \\
DN &= 80 \text{ mm} = 3 \text{ inch (Fct. 3.02)} \\
Q_0\% &= 4 \text{ mA} \\
Q_{100}\% &= 20 \text{ mA} \\
Q_{100}\% &= 200 \text{ pulses/h (Fct. 1.06)} \\
DN &= 80 \text{ mm = } 3 \text{ inch} \\
I_0% &= 4 \text{ mA} \\
I_{100}% &= 20 \text{ mA} \\
P_{100}% &= 200 \text{ pulses/h} \\
GK &= 3.571 \text{ (see instrument nameplate)} \\
K &= 7074 \text{ (see table)}
\end{align*}
\]

Calculation of "X" and setting of "Y"

\[
X = \frac{Q_{100}\% \times K}{GK \times DN^2} = \frac{200 \times 7074}{3.571 \times 80 \times 80} = 61.905
\]

\(Y = 80\), setting of switch Y, see GS 8 A front panel (comes closest to the value of X and is smaller than X).

Calculation of setpoint readings I and f

\[
I = I_0\% + \frac{Y}{X} (I_{100}\% - I_0\%) = 4 \text{ mA} + \frac{40}{61.905} (20 \text{ mA} - 4 \text{ mA}) = 14.3 \text{ mA}
\]

Deviations are permissible between 14.1 and 14.6 mA (equivalent to ± 1.5 %).

\[
f = \frac{Y}{X} \times P_{100}\% = \frac{40}{61.905} \times \text{ pulses/h} = 180.9 \text{ pulses/h}
\]

Deviations are permissible between 178.2 and 183.6 pulses/h (equivalent to ± 1.5 %).

If you need to return your flowmeter to KROHNE, please refer to the last-but-one page of these instructions.
8.1 Replacing the power supply fuse

Switch off the power supply before opening the housing.
1) Remove the cover from the terminal compartment (remove 2 screws).
2) Unscrew the cap of the power supply fuse F.
3) Replace fuse F5 or F6, type 5 x 20 G (Order No. see Sect. 9).

<table>
<thead>
<tr>
<th>Fuse</th>
<th>Value</th>
<th>Breaking Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>F5</td>
<td>100-230 V AC</td>
<td>0.8 A T, 1500 A</td>
</tr>
<tr>
<td>F6</td>
<td>24 V AC / DC</td>
<td>1.6 A T, 150 A</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Terminals</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>F5/F6</td>
<td>Power supply fuses, values are indicated above</td>
</tr>
<tr>
<td>FP</td>
<td>Plug-in terminal for field current supply line, 4-pin</td>
</tr>
<tr>
<td>I/O</td>
<td>Plug-in terminal for outputs and inputs, 2x8-pin</td>
</tr>
<tr>
<td>PE/FE</td>
<td>U-clamp terminal for connecting protective conductor PE or functional grounding conductor FE</td>
</tr>
<tr>
<td>PS</td>
<td>Plug-in terminal for power supply line, 3-pin</td>
</tr>
<tr>
<td>RS</td>
<td>Plug-in terminal for interface(s)</td>
</tr>
<tr>
<td>S</td>
<td>U-clamp terminal for connecting the signal line shielding: signal line A: 2nd shield (7) signal line B: 3rd shield (11)</td>
</tr>
<tr>
<td>SC</td>
<td>Plug-in terminal for electrode signal line, 5-pin</td>
</tr>
<tr>
<td>S-EEEx</td>
<td>Same as “S”, only available for hazardous duty version</td>
</tr>
<tr>
<td>W</td>
<td>Internal connection, may not be removed.</td>
</tr>
</tbody>
</table>
8.2 Retrofitting of magnetic sensors MP (optional)

Switch off the power supply before opening the housing.

1) Remove the cover from the terminal compartment (remove 2 screws).
2) Pull all cables out of the plug-in terminals.
3) Remove the glass cover from the control compartment (remove 4 screws).
4) Remove 4 screws from the front panel F, take hold of the handle on the upper end of the front panel and carefully pull the complete electronic unit out of the signal converter housing.
5) Put down the electronic unit with the front panel F facing down (see illustration on the next but one page).
6) Position the 2 mm (0.08”) thick insulating strip (Order No. 3 15940.01) loosely on top of the MP printed circuit board (PCB). The magnetic sensors and chip capacitor slip into the 4 holes in the insulating strip. Slip the MP PCB and insulating strip from right to left between the front panel and BDE PCB, taking care that the MP PCB and insulating strip are slipped through the three retaining clips H at the back of front panel F. Slip the socket connector of the MP PCB onto the (5-pin) plug connector PLMP.
7) Fix the MP PCB with special steel tooth lock washer and nut SMP to establish contact between the back of the PCB and the back of the front panel. When correctly fitted, the MP PCB must be slightly bent between the final retaining clip H and the plug connector PLMP.
8) Re-assemble in reverse order (items 4 to 1 above).
9) Switch on the power supply. The "magnet active" LED on the front panel is green. The function of the corresponding keys is tripped by touching the glass pane above the 3 white fields “→, ↓ and ↑” with the bar magnet. The LED lights up red, see Section 4.2, items ⑦ and ⑧.
8.3 Replacing the complete electronic unit of the IFC 110 F signal converter

Switch off the power supply before opening the housing.

1) Remove the cover from the terminal compartment (remove 2 screws).
2) Pull all cables out of the plug-in terminals.
3) Remove the glass cover from the control compartment (remove 4 screws).
4) Remove 4 screws from the front panel F, take hold of the handle on the upper end of the front panel and carefully pull the complete electronic unit out of the signal converter housing.
5) Carefully remove the data EEPROM IC 14 (on ADC printed circuit board) from the old electronic unit and move it to the new electronic unit. Observe the direction of the IC when plugging the data EEPROM. After changing the EEPROM from the old to the new electronic unit, no further adjustments or settings are required. Refer to the drawing on the next page and to the illustrations of the printed circuit boards in Section 8.7.
6) Re-assemble in reverse order (items 4 - 1 above).
8.4 Replacing single printed circuit boards (PCBs)

Switch off the power supply before opening the housing.

1) Remove the cover from the terminal compartment (remove 2 screws).
2) Pull all cables out of the plug-in terminals.
3) Remove the glass cover from the control compartment (remove 4 screws).
4) Remove 4 screws from the front panel F, take hold of the handle on the upper end of the front panel and carefully pull the complete electronic unit out of the signal converter housing.
5) Put down the electronic unit with the front panel F facing down.
6) Remove screw(s) SLP from the PCB(s) to be replaced and carefully pull the PCB(s) out of the plug base(s). Fit new PCB(s), refer to the illustration in Sect. 8.3 (preceding page).
   • When replacing the PCBs FSV and/or ADC, always remove both PCBs together as they have a common plug-and-socket connector.
   • When replacing the ADC PCB, carefully move the data EEPROM IC 14 from the old to the new PCB and observe the direction of the IC during plugging. After changing the EEPROM from the old to the new electronic unit, no further adjustments or settings are required. Refer to the illustration in Section 8.7.
7) Re-assemble in reverse order (items 6 - 1 above).

8.5 Replacing the flow sensor

Switch off the power supply before beginning work.

1) Before removing the "old" flow sensor please note down which cable is connected to which terminal.
2) Install the new flow sensor as described in the installation instructions supplied with the instrument.
3) Electrically connect the flow sensor to the signal converter as described in these installation and operating instructions, see Sections 1.3.5 and 1.3.6.
4) During factory calibration, specific calibration data are determined for each flow sensor which are indicated on the instrument nameplate. These data include the primary constant GK and the magnetic field frequency which must be reset in Fct. 3.02 FLOW METER, subfunctions "GK VALUE" and "FIELD FREQ.", see Sections 4.4 and 5.13.
5) If the meter size of the flow sensor has changed, also reset the full-scale range Q100% and the meter size in Fct. 3.02 FLOW METER, subfunctions "DIAMETER" and "FULL SCALE", see Sections 4.4 and 5.13.
6) Perform zero test as described in Section 7.1 after the signal converter is reset.
7) Reset the internal electronic totalizer of the signal converter as described in Sect. 4.6 if necessary.

8.6 IFC 110 F replacements for old KROHNE signal converters

The IFC 110 F can replace all older KROHNE signal converter versions:

TIV 60 F / T 900 F / SC 100 A/F / SC 100 AS/F

This also applies to systems up to the size of DN 3000 / 120" that are operated with a power driver. Such replacements are delivered together with any new wiring diagrams and additional instructions for installation and setting of the IFC 110 F. You are kindly requested to comply with these instructions.
### 8.7 Illustration printed circuit boards (PCBs)

<table>
<thead>
<tr>
<th>110 - 230 AC</th>
<th>24 V DC / AC</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>X2</td>
<td>X1</td>
<td>Plug-in terminal inside terminal compartment</td>
</tr>
<tr>
<td>X1</td>
<td>X2</td>
<td>Internal connection to mother board</td>
</tr>
<tr>
<td>F5</td>
<td>F6</td>
<td>Power supply fuse (typ, value and order No. see Sect. 9)</td>
</tr>
</tbody>
</table>

- Small fuses TR5 (values and order No. see Sect. 9)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>5 V voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>F3</td>
<td>F5</td>
<td>5 V voltage</td>
</tr>
<tr>
<td>F4</td>
<td>F3</td>
<td>Field current supply</td>
</tr>
<tr>
<td>F7</td>
<td>F4</td>
<td>Current output and power for passive operation of outputs</td>
</tr>
<tr>
<td>F1</td>
<td>-</td>
<td>Coupling element</td>
</tr>
</tbody>
</table>

#### PCB 110 - 230 V AC

![PCB 110 - 230 V AC Diagram](image)

#### PCB 24 V DC / AC

![PCB 24 V DC / AC Diagram](image)
Analog/digital converter PCB, (ADC)

X1  internal connection to motherboard
X2  plug-in terminals in terminal compartment
X4  multipoint connector
IC 11 peripheral IC
    incl. control program

IC 12  microprocessor
IC 14  data EEPROM
D3  green LED on front panel
D4  red LED on front panel
EPD  empty pipe detection

Analog/digital converter PCB, rear side (detail)

S1  solder bridges for steady output signals
S2  when measuring tube is empty,
S4  see Sect. 6.8

S1  }
S2  
S4  }
Inputs/outputs PCB, I/O

**Jumper X3 + X6**
- **X3** + active operation
- **X6** + passive operation

**Jumper X4**
- DC operation ≤ 0.2 A
- AC operation ≤ 0.1 A (factory setting)

**X1** plug-in terminals inside terminal compartment
**X2** internal connection to motherboard
**X4** jumper, change-over of AC/DC operation of output A1, see Sect. 6.3
**X5** multipoint connector
**IC 11** control program EPROM
**IC 12** microprocessor
**X3/X6** jumper for active or passive operation of current output

Small fuses TR 5, values and Order No. see Section 9
- F1 P
- F2 A1
- F3 A2
- F4 D1
- F5 A2
- F6 C1
- F7 C2
- F8 E+
- F9 E−

**HART® / RS 485 PCB**

**X1** internal connection to mother board
**X2** plug-in terminal inside terminal compartment
F1, F2, F3 small fuses TR5
IC _ _ integrated circuit
S3, S4 solder bridges

S3, S4 solder bridges
### Order numbers

<table>
<thead>
<tr>
<th>Spare parts</th>
<th>Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electronic unit with display</td>
<td>2135520100</td>
</tr>
<tr>
<td>100-230 V AC without magnetic sensors</td>
<td></td>
</tr>
<tr>
<td>100-230 V AC with HART / RS 485</td>
<td>2135520300</td>
</tr>
<tr>
<td>24 V AC / DC without magnetic sensors</td>
<td>2135520700</td>
</tr>
<tr>
<td>Power supply fuses:</td>
<td>5080850000</td>
</tr>
<tr>
<td>(5 × 20 G fuse, breaking capacity 1500 A)</td>
<td>5119230100</td>
</tr>
<tr>
<td>(5 × 20 G fuse, breaking capacity 150 A)</td>
<td></td>
</tr>
<tr>
<td>Various small fuses TR5</td>
<td></td>
</tr>
<tr>
<td>• I/O PCB (inputs/outputs)</td>
<td>5075640000</td>
</tr>
<tr>
<td>F2, F8 T 250 mA</td>
<td>5075900000</td>
</tr>
<tr>
<td>F1, F3-F7, F9 T 160 mA</td>
<td></td>
</tr>
<tr>
<td>• NT PCB (power unit)</td>
<td>5080190000</td>
</tr>
<tr>
<td>100–230 V AC</td>
<td>5075860000</td>
</tr>
<tr>
<td>24 V AC/DC</td>
<td>5075780000</td>
</tr>
<tr>
<td>F3, F4</td>
<td></td>
</tr>
<tr>
<td>F7</td>
<td></td>
</tr>
<tr>
<td>F1</td>
<td></td>
</tr>
<tr>
<td>F3, F5</td>
<td></td>
</tr>
<tr>
<td>F4</td>
<td></td>
</tr>
<tr>
<td>F1</td>
<td></td>
</tr>
<tr>
<td>3-pin power supply</td>
<td>3161180100</td>
</tr>
<tr>
<td>plug-in terminals (printed and coded)</td>
<td>3160220100</td>
</tr>
<tr>
<td>8-pin outputs D and P, inputs C</td>
<td>3160230200</td>
</tr>
<tr>
<td>8-pin outputs A and I, internal power supply E</td>
<td>3160200100</td>
</tr>
<tr>
<td>4-pin field current supply</td>
<td>3160210100</td>
</tr>
<tr>
<td>5-pin signal line</td>
<td></td>
</tr>
<tr>
<td>RS 232 adapter incl. CONFIG operator software</td>
<td>V 035100131</td>
</tr>
<tr>
<td>(from version V 3.1 onwards)</td>
<td>V 035100132</td>
</tr>
<tr>
<td>Conversion kit MP for magnetic sensors (complete retrofitting kit)</td>
<td>V 150100004</td>
</tr>
<tr>
<td>Bar magnet for operating the magnetic sensors</td>
<td>2070530000</td>
</tr>
<tr>
<td>Flow sensor simulator GS 8 A</td>
<td>2070680200</td>
</tr>
<tr>
<td>Adapter to make older versions of GS 8 simulators suitable for use with IFC 110 F</td>
<td>2107640000</td>
</tr>
<tr>
<td>Glass cover for housing</td>
<td>2106730000</td>
</tr>
<tr>
<td>Sealing material for housing cover, by the metre</td>
<td>3137030000</td>
</tr>
<tr>
<td>ADC PCB (A/D converter)</td>
<td>VX 2134250100</td>
</tr>
<tr>
<td>I/O PCB (inputs/outputs)</td>
<td>VX 2115140100</td>
</tr>
<tr>
<td>FSV PCB (field current supply)</td>
<td>VX 2135520200</td>
</tr>
<tr>
<td>NT PCB (power unit) 100-230 V AC</td>
<td>2127970100</td>
</tr>
<tr>
<td>NT PCB (power unit) 24 V AC / DC</td>
<td>2133330100</td>
</tr>
<tr>
<td>HART / RS 485 PCB</td>
<td>2134310100</td>
</tr>
</tbody>
</table>
# Technical data

## 10.1 Signal converter

### Mode of operation and system structure

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement principle</td>
<td>Faraday's law of induction</td>
</tr>
<tr>
<td>Modularity</td>
<td>Measuring system consisting of signal converter and flow sensor</td>
</tr>
<tr>
<td>Measured variable</td>
<td>Volumetric flowrate (electrode voltage from flow sensor)</td>
</tr>
<tr>
<td>Electrical conductivity of product</td>
<td>( \geq 5 \mu S/cm ) ( \geq 20 \mu S/cm ) for demineralized cold water</td>
</tr>
</tbody>
</table>

### Versions

- **IFC 110 F / D (standard)**: Display version, with local display / control elements (15 keys)
- **IFC 110 F / D / MP (option)**: same as display version, additionally with magnetic sensors (MP) to control the signal converter using bar magnet without opening the housing
- **IFC 110 F / D / MP / _ EEx (option)**: ATEX-EEx version for hazardous areas, PTB 02 ATEX 2163 X

### Interfaces

- HART®
- RS 485 / PROFIBUS (add-on module)
- CONFIG software and adapter for operator control via MS-DOS-PC, connection to internal IMoCom interface (equipment bus)

### Full-scale range

- **Flowrate for Q = 100%**: 6 Liter/h to 86 860 m³/h or 0.03 to 401 080 US Gal/min, corresponding to flow velocity \( v = 0.3 \sim 12 \text{ m/s} \) or \( v = 1 \sim 40 \text{ ft/s} \)
- **Units**: m³/h, liter/s, US Gal/min or user-defined unit, e.g., liter/day or US Gal/day

### Input / output circuits

<table>
<thead>
<tr>
<th>Nominal voltages</th>
<th>( \leq 25 \text{ V AC} ) / ( \leq 50 \text{ V DC} ) (safety value ( U_m = 253 \text{ V} ))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active / passive</td>
<td>connection to protective extra-low voltage (PELV)</td>
</tr>
</tbody>
</table>

### Current output

#### Function

- all operating data configurable
- galvanically isolated from all input and output circuits

#### Current:

<table>
<thead>
<tr>
<th>Range</th>
<th>Fixed ranges</th>
<th>Variable ranges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed ranges</td>
<td>0 \sim 20 \text{ mA} and 4 \sim 20 \text{ mA}</td>
<td></td>
</tr>
<tr>
<td>Variable ranges</td>
<td>for Q = 0% ( I_{0%} = 0 \sim 16 \text{ mA} )</td>
<td></td>
</tr>
<tr>
<td></td>
<td>for Q = 100% ( I_{100%} = 4 \sim 20 \text{ mA} )</td>
<td></td>
</tr>
<tr>
<td>Load</td>
<td>min. 15 \text{ Ω}</td>
<td></td>
</tr>
<tr>
<td>Active operation</td>
<td>22 \text{ V DC} \leq U \leq 32 \text{ V DC}: ( R_L \leq 800 \text{ Ω} )</td>
<td></td>
</tr>
<tr>
<td>Passive operation</td>
<td>15 \text{ V DC} \leq U \leq 22 \text{ V DC}: ( R_L \leq 500 \text{ Ω} )</td>
<td></td>
</tr>
</tbody>
</table>

### Error identification

- 0 / 22 \text{ mA} and variable

### Pulse outputs (passive)

#### Function

- for electronic totalizers
- all operating data settable
- galvanically isolated

#### Terminals

- P / P

#### Pulse rate

- 0 \sim 10 000 pulses per s \( = \) Hz, min, h, m³, liter, etc., any scaling
- 0 \sim 50 pulses per s \( = \) Hz, min, h, m³, liter, etc., any scaling

#### Electrical data

- galvanically isolated
- galvanically isolated, but not from A2

#### U \leq 32 \text{ V DC} / \leq 24 \text{ V AC}

<table>
<thead>
<tr>
<th>Load</th>
<th>( I \leq 30 \text{ mA}, \text{ any polarity} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>U \leq 32 \text{ V DC} / \leq 24 \text{ V AC}</td>
<td>( I \leq 100 \text{ mA}, \text{ any polarity} )</td>
</tr>
<tr>
<td>( U \leq 32 \text{ V DC}, I \leq 200 \text{ mA} )</td>
<td>note polarity</td>
</tr>
</tbody>
</table>

### Pulse width

- automatic: pulse duty cycle 1:1, max. 10 000 pulses/s = 10 kHz

#### Variable

- 10 ms \sim 1 \text{ s}

#### Digital pulse division

- interpulse period non-uniform, therefore if frequency and cycle meters connected allow for minimum counting interval:

#### Forward/reverse flow measurement

- direction identified via status output
**Status outputs (passive)**

<table>
<thead>
<tr>
<th>Function, set for</th>
<th>D1 / D2 / A2</th>
<th>A1 (can also be operated as pulse output)</th>
</tr>
</thead>
<tbody>
<tr>
<td>trip point</td>
<td>trip point</td>
<td></td>
</tr>
<tr>
<td>flow direction</td>
<td>flow direction</td>
<td></td>
</tr>
<tr>
<td>automatic range change</td>
<td>automatic range change</td>
<td></td>
</tr>
<tr>
<td>error identification</td>
<td>error identification</td>
<td></td>
</tr>
<tr>
<td>overdriving</td>
<td>overdriving</td>
<td></td>
</tr>
<tr>
<td>empty pipeline</td>
<td>empty pipeline</td>
<td></td>
</tr>
</tbody>
</table>

**Terminals**

D1 / D2 / D ⊥ / A2 / A ⊥ / A1 / A ⊥

**Electrical data**

- galvanically isolated, but not from A2
- \( U \leq 32 \text{ V DC} / \leq 24 \text{ V AC} \)
- \( I \leq 100 \text{ mA, any polarity} \)

**Control inputs C1 and C2 (passive)**

- automatic range change, totalizer reset, error reset, start self-test, set outputs to min. values or hold last measured values of outputs
- \( U = 8 – 32 \text{ V DC, } I \leq 10 \text{ mA, any polarity} \)

**Internal power supply**

- for passive outputs and inputs and external receiver instruments
- \( U = 24 \text{ V DC; } R = \text{ approx. } 15 \text{ Ohm; } I \leq 100 \text{ mA} \)

**Time constant**

- \( 0.2 – 99.9 \text{ s, adjustable in increments of 0.1 second} \)

**Low-flow cutoff**

- cutoff "on" value: \( 1 – 19 \% \)
- cutoff "off" value: \( 2 – 20 \% \)

**Local display and operation**

- 3-line back-lit LCD
- actual flowrate, forward, reverse, sum totalizers (7 digits)
- or 25-character bar graph with percent display and status messages
- \( m^3/h, \text{ liter/s, US gallons/min or user-defined unit, e.g. hecto liter/h} \)

**Language of plain texts**

- English, German, French, Swedish, others on request

**Operation elements**

- 15 keys or as option with 3 additionally magnetic sensors for operation without opening the housing

**Electrode circuit**

- Type of protection: intrinsic safety [EEx ib IIC]
- \( U_0 = 18 \text{ V; } I_0 = 40 \text{ mA; } P_0 = 80 \text{ mW} \)

**Field power supply**

- pulsed bipolar DC field for all KROHNE primary heads, galvanically isolated from all input and output circuits
- \( U = 24 \text{ V AC; } R = \text{ approx. } 15 \text{ Ohm} \)

**Internal fuse protection**

- \( I \leq 160 \text{ mA} \)

**Power supply**

- \( U = 24 \text{ V AC; } I = 250 \text{ mA} \)

**Approvals and housing**

- Material of field housing: die-cast aluminium with polyurethane finish
- Ambient temperature: -25 to +60 °C / -13 to +140 °F
- EEEx, special "S": -40 to +55 °C / -40 to +131 °F

**Protection category (IEC 529 / EN 60 529)**

- EU / EMC Directives:
  - to EN 61326-1 (1977) and A1 (1998) directives and NAMUR Standard NE 21 II (2) G [EEEx ib] IIC
  - PTB 02 ATEX 2136 X

**Temporal Data, Measuring Principle and Block Diagram**

Sect. 10.1

05/2003

IFC 110 F

89
10.2 Error limits

Display, digital values, pulse output

F maximum error in % of measured value (MV), not typical values

v Flow velocity in m/s and ft/s

Reference conditions similar to EN 29 104

Product water at 10 – 30°C/ 50 – 86°F
Electrical conductivity > 300 µS/cm
Power supply (rated voltage) $U_N$ (± 2%)
Ambient temperature 20 – 22°C / 68-71.6 °F
Warm-up time 60 min
Max. calibration equipment error $10 \times$ smaller than F
Inlet / outlet runs $10 \times \text{DN} / 2 \times \text{DN}$ (DN = meter size)
Flow sensor properly grounded and centered

Calibrated on EN 17025 accredit to calibration equipment in direct volumetric comparsion.

### Flow sensor details

<table>
<thead>
<tr>
<th>Flow sensor</th>
<th>Meter size</th>
<th>Standard details</th>
<th>Option (extra charge)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DN mm</td>
<td>inch</td>
<td></td>
</tr>
<tr>
<td>VARIFLUX</td>
<td>2.5-6</td>
<td>$\frac{1}{10}$ - $\frac{1}{4}$</td>
<td>C</td>
</tr>
<tr>
<td>6000 F</td>
<td>10-80</td>
<td>$\frac{1}{6}$ - $\frac{1}{3}$</td>
<td>B</td>
</tr>
<tr>
<td>PROFIFLUX</td>
<td>2.5-6</td>
<td>$\frac{1}{10}$ - $\frac{1}{4}$</td>
<td>C</td>
</tr>
<tr>
<td>5000 F</td>
<td>10-100</td>
<td>$\frac{1}{6}$ - $\frac{1}{4}$</td>
<td>B</td>
</tr>
<tr>
<td>ALTOFLUX</td>
<td>10. - 25</td>
<td>$\frac{1}{8}$ - $\frac{1}{4}$</td>
<td>B</td>
</tr>
<tr>
<td>4000 F</td>
<td>32 - 1600</td>
<td>$\frac{1}{16}$ - 64</td>
<td>A</td>
</tr>
<tr>
<td>ALTOFLUX</td>
<td>150 - 250</td>
<td>6 - 10</td>
<td>B</td>
</tr>
<tr>
<td>2000 F</td>
<td>10 - 150</td>
<td>$\frac{1}{8}$ - $\frac{1}{6}$</td>
<td>B</td>
</tr>
<tr>
<td>ECOPFLUX</td>
<td>10 - 25</td>
<td>$\frac{1}{8}$ - $\frac{1}{6}$</td>
<td>B</td>
</tr>
<tr>
<td>1000 F</td>
<td>32 - 300</td>
<td>$\frac{1}{16}$ - 12</td>
<td>B</td>
</tr>
<tr>
<td>M 900</td>
<td>10. - 25</td>
<td>$\frac{1}{8}$ - $\frac{1}{6}$</td>
<td>B</td>
</tr>
<tr>
<td></td>
<td>32 - 300</td>
<td>$\frac{1}{16}$ - 12</td>
<td>B</td>
</tr>
</tbody>
</table>

Current output same error limits as above, additionally ± 10 µA

Reproducibility and repeatability 0.1% of MV, minimum 1 mm/s / 0.04 inch/s at constant flow

External influences typical values maximum values

<table>
<thead>
<tr>
<th>Ambient temperature</th>
<th>Pulse output</th>
<th>Current output</th>
<th>Power supply</th>
<th>Load</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.003% of MV (1)</td>
<td>0.01 % of MV (1)</td>
<td>&lt; 0.02 % of MV</td>
<td>&lt; 0.01 % of MV</td>
</tr>
<tr>
<td></td>
<td>0.01 % of MV (1)</td>
<td>0.025% of MV (1)</td>
<td>0.05 % of MV</td>
<td>0.02 % of MV</td>
</tr>
<tr>
<td></td>
<td>per 1 K / 1.8° F</td>
<td>temperature variation</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(1) All KROHNE signal converters undergo burn-in tests, duration minimum 20 hours at varying ambient temperatures – 20 to + 60°C/– 4 to + 140°F. The tests are controlled by computers.
## 10.3 Dimensions and weights IFC 110 F / IFC 110 F-EEEx and ZD / ZD-EEEx

**Dimensions in mm and inch**

### IFC 110 F Signal converters

- Weight approx. 4.1 kg / 9.0 lbs

### ZD Intermediate connection box

- Weight approx. 0.5 kg / 1.1 lbs

## 10.4 Flow table

$v = \text{flow velocity in m/s and ft/s}$

<table>
<thead>
<tr>
<th>Meter size</th>
<th>Full-scale range $Q_{100%}$ in m³/h</th>
</tr>
</thead>
<tbody>
<tr>
<td>DN (mm)</td>
<td>$v = 0.3 \text{ m/s}$</td>
</tr>
<tr>
<td></td>
<td>(minimum)</td>
</tr>
<tr>
<td>2.5 1/10</td>
<td>0.0053</td>
</tr>
<tr>
<td>4 1/8</td>
<td>0.0136</td>
</tr>
<tr>
<td>6 1/4</td>
<td>0.0306</td>
</tr>
<tr>
<td>10 3/8</td>
<td>0.0849</td>
</tr>
<tr>
<td>15 1/2</td>
<td>0.1909</td>
</tr>
<tr>
<td>20 3/4</td>
<td>0.3393</td>
</tr>
<tr>
<td>25 1</td>
<td>0.5302</td>
</tr>
<tr>
<td>32 -</td>
<td>0.8686</td>
</tr>
<tr>
<td>40 1/2</td>
<td>1.358</td>
</tr>
<tr>
<td>50 2</td>
<td>2.121</td>
</tr>
<tr>
<td>65 -</td>
<td>3.584</td>
</tr>
<tr>
<td>80 3</td>
<td>5.429</td>
</tr>
<tr>
<td>100 4</td>
<td>8.483</td>
</tr>
<tr>
<td>125 -</td>
<td>13.26</td>
</tr>
<tr>
<td>150 6</td>
<td>19.09</td>
</tr>
<tr>
<td>200 8</td>
<td>33.93</td>
</tr>
<tr>
<td>250 10</td>
<td>53.02</td>
</tr>
<tr>
<td>300 12</td>
<td>76.35</td>
</tr>
<tr>
<td>400 16</td>
<td>135.8</td>
</tr>
<tr>
<td>500 20</td>
<td>212.1</td>
</tr>
<tr>
<td>600 24</td>
<td>305.4</td>
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<td>(minimum)</td>
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<td>2.5</td>
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<td>1400</td>
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11 Measuring principle

The flowmeter is designed for electrically conductive fluids.

Measurement is based on Faraday’s law of induction, according to which a voltage is induced in an electrically conductive body which passes through a magnetic field. The following expression is applicable to the voltage:

\[ U = K \times B \times \bar{v} \times D \]

- \( K \) an instrument constant
- \( B \) magnetic field strength
- \( \bar{v} \) mean velocity
- \( D \) pipe diameter

Inside the electromagnetic flowmeter, the fluid passes through a magnetic field applied perpendicular to the direction of flow. An electric voltage is induced by the movement of the fluid (which must have a minimum electrical conductivity). This is proportional to the mean flow velocity and thus to the volume of flow. The induced voltage signal is picked up by two electrodes which are in conductive contact with the fluid and is transmitted to a signal converter for a standardized output signal.

This method of measurement offers the following advantages:

1) No pressure loss through pipe constriction or protruding parts.
2) Since the magnetic field passes through the entire flow area, the signal represents a mean value over the pipe cross-section; therefore, only relatively short straight inlet pipes 5 x DN from the electrode axis are required upstream of the flow sensor.
3) Only the pipe liner and the electrodes are in contact with the fluid.
4) Already the original signal produced is an electrical voltage which is an exact linear function of the mean flow velocity.
5) Measurement is independent of the flow profile and other properties of the fluid.

The magnetic field of the flow sensor is generated by a square wave current fed from signal converter to the field coils. This field current alternates between positive and negative values. Alternate positive and negative flowrate-proportional signal voltages are generated at the same frequency by the effect of the magnetic field, which is proportional to the current. The positive and negative voltages at the flow sensor electrodes are subtracted from one another in the signal converter. Subtraction always takes place when the field current has reached its stationary value, so that constant interference voltages or external or fault voltages changing slowly in relation to the measuring cycle are suppressed. Power line interference voltages coupled in the flow sensor or in the connecting cables are similarly suppressed.
12 Block diagram

2 FSV printed circuit board, field current supply (terminals 7 and 8)
- Large signal-to-noise ratio owing to low-loss field current supply with high frequencies and high currents.
- Pulsed direct current which is precisely controlled electronically, for the magnetic coils of the flow sensor.
- Operating and calibrating data are stored in an EEPROM so that the PCB can be easily replaced without the need for re-calibration.

3 BDE printed circuit board, motherboard
- Large illuminated LC display.
- 15 keys for operator control of signal converter
- Can be retrofitted with optional operator control by bar magnet.
- Distribution of general signals such as IMoCom bus, power supply.

4 I/O printed circuit board, inputs and outputs
- Groups, inputs and outputs are galvanically isolated from each other and from all other circuits.
- Power supply source for the inactive inputs and outputs.
- Specific KROHNE circuit KSA 04 for fine quantization of output pulses across a wide dynamic range.
- Active current output I (e.g. 0/4-20 mA) with load control.
- Pulse output P for electronic totalizers, max. 10 Hz.
- Pulse output A1 for electromechanical totalizers, max. 50 Hz, can also be used as status output A1.
- Several status outputs A1, A2, D1, D2.
- Control inputs C1 and C2.

5 IMoCom bus plug
Connecting external operating and testing devices, e.g. RS 232 adapter and CONFIG software for operator control of signal converter by MS-DOS PC or laptop.

6 Slots for plug-in modules, for upgrading or converting the signal converter
- HART / RS 485 ancillary board
- GTEX ancillary board for Ex-i operation of the signal converter outside hazardous areas.
- Other modules and ancillary boards in preparation.

1 ADC printed circuit board, analog / digital converter (terminals 1, 2, 3, 20 and 30)
- Signal processor protected against overload, for quick and precise processing of flow peaks up to and exceeding 20 m/s or 60 ft/s.
- Digital signal processor, sequential control and test routines.
- Patented high-resolution analog/digital converter, digitally controlled and monitored.
- Input amplifier allowing control of potential of signal line shielding (bootstrap).
- User parameter and internal calibration values are stored in separate EEPROMs (easily replaceable).
13 Approvals

13.1 EC-type examination certificate

EC-TYPE-EXAMINATION CERTIFICATE
(Translation)

Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres - Directive 94/9/EC

EC-type-examination Certificate Number:

PTB 02 ATEX 2163 X

Equipment: Measuring transducer, type IFC 110 F/...-EEx
Manufacturer: Krohne Messtechnik GmbH & Co. KG
Address: Ludwig Krohne Straße 5, 47058 Duisburg, Germany

This equipment and any acceptable variation thereto are specified in the schedule to this certificate and the documents therein referred to.

The Physikalisch-Technische Bundesanstalt, notified body No. 0102 in accordance with Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres, given in Annex II to the Directive.

The examination and test results are recorded in the confidential report PTB Ex 02-22121.

Compliance with the Essential Health and Safety Requirements has been assured by compliance with:

EN 50 014:1997 +A1+A2
EN 50 020:1994

If the sign "X" is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the schedule to this certificate.

This EC-type-examination Certificate relates only to the design, examination and tests of the specified equipment in accordance to the Directive 94/9/EC. Further requirements of the Directive apply to the manufacturing process and supply of this equipment. These are not covered by this certificate.

The marking of the equipment shall include the following:

II (2) G [EEx ib] IIC

Zertifizierungsstelle Explosionsschutz

Braunschweig, November 08, 2002

By order:

Dr.-Ing. U. Johannsmeyer
Regierungsdirektor

EC-type-examination Certificates without signature and official stamp shall not be valid. The certificates may be circulated only without alteration. Extracts or alterations are subject to approval by the Physikalisch-Technische Bundesanstalt. In case of dispute, the German text shall prevail.

Physikalisch-Technische Bundesanstalt • Bundesallee 100 • D-38116 Braunschweig
Physikalisch-Technische Bundesanstalt

SCHEDULE

EC-TYPE-EXAMINATION CERTIFICATE PTB 02 ATEX 2163 X

(15) Description of equipment
The measuring transducer, type IFC 110 F...-EEEx is used for flow rate measurement of electroconductive liquids. The apparatus is installed outside the hazardous area.

The permissible range of the ambient temperature is: -20 °C bis 55 °C (standard version) resp. -40 °C bis 55 °C (special version).

Electrical data

<table>
<thead>
<tr>
<th>Auxiliary power</th>
<th>24/100 ... 230 V AC +10% -15%, 25 VA</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>U_m = 253 V</td>
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<tr>
<td></td>
<td>24 V DC +30% -25%, 15 W</td>
</tr>
<tr>
<td></td>
<td>U_m = 253 V</td>
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</tbody>
</table>

Input/output circuits

- for connection to functional extra low voltage with safe electrical isolation (PELV)
- U_N ≤ 25 V AC
- U_N ≤ 50 V DC
- U_m = 253 V

Field circuit

<table>
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<tr>
<th>(terminals 7, 8)</th>
<th>U_N ≤ ±40 V (switched-mode direct voltage)</th>
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<td>I_N ≤ 160 mA (internal fuse)</td>
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</table>

Electrode circuit

- type of protection Intrinsic Safety EEEx ib IIC
- Maximum values:
  - U_o = 18 V (±9 V against ground)
  - I_o = 40 mA
  - P_o = 80 mW
  - kinked characteristic
  - L_o = 5 mH
  - C_o = 225 nF (C_i considered)

The electrode circuit is safely electrically isolated from all other circuits up to a peak value of the nominal voltage of 375 V.

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Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin
SCHEDULE TO EC-TYPE-EXAMINATION CERTIFICATE PTB 02 ATEX 2163 X

(16) Test report PTB Ex 02-22121

(17) Special conditions for safe use

1. Equipotential bonding has to be installed along the entire cable run of the intrinsically safe circuit.

2. The terminal for the equipotential bonding conductor has to be connected to equipotential bonding conductor of the hazardous area.

(18) Essential health and safety requirements
met by compliance with the standards mentioned above

Zertifizierungsstelle Explosionsschutz
By order:

Dr.-Ing. U. Johannes
Regierungsdirektor

Braunschweig, November 08, 2002

sheet 3/3

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13.2 EC-type examination certificate

Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

EG-Baumusterprüfbescheinigung

(1) Geräte und Schutzsysteme zur bestimmungsgemäßen Verwendung in explosionsgefährdeten Bereichen - Richtlinie 94/9/EG

(2) EG-Baumusterprüfbescheinigungsnummer

PTB 02 ATEX 2163 X

(3) Gerät: Messumformer Typ IFC 110 F/..-Ex

(5) Hersteller: Krohne Messtechnik GmbH & Co. KG

(6) Anschrift: Ludwig Krohne Straße 5, 47058 Duisburg, Deutschland

(7) Die Bauart dieses Gerätes sowie die verschiedenen zulässigen Ausführungen sind in der Anlage und den darin aufgeführten Unterlagen zu dieser Baustellerprüfbescheinigung festgelegt.


Die Ergebnisse der Prüfung sind in dem vertraulichen Prüfbericht PTB Ex 02-22121 festgehalten.

(9) Die grundlegenden Sicherheits- und Gesundheitsanforderungen werden erfüllt durch Übereinstimmung mit

EN 50 014:1997 +A1 +A2
EN 50 020:1994

(10) Falls das Zeichen „X“ hinter der Bescheinigungsnummer steht, wird auf besondere Bedingungen für die sichere Anwendung des Gerätes in der Anlage zu dieser Bescheinigung hingewiesen.


(12) Die Kennzeichnung des Gerätes muß die folgenden Angaben enthalten:

\[ \text{II (2) G [EEx ib] IIC} \]

Zertifizierungsstelle Explosionsschutz
Braunschweig, 08. November 2002

Dr.-Ing. U. Johannsmeyer
Regierungsdirektor
Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

Anlage
EG-Baumusterprüfbescheinigung PTB 02 ATEX 2163 X

(15) Beschreibung des Gerätes
Der Messumformer Typ IFC 110 F,...-EE-Ex dient zur Volumendurchflussmessung von elektrisch leitfähigen Flüssigkeiten. Das Gerät wird außerhalb des explosionsgefährdeten Bereiches errichtet. Der zulässige Bereich der Umgebungstemperatur beträgt: -20 °C bis 55 °C (Standardsausführung) bzw. -40 °C bis 55 °C (Sonderausführung).

Elektrische Daten:
Hilfsenergie je nach Ausführung (Klemmen 11 und 12)
24/100 ... 230 V AC +10% -15%, 25 VA
U_m = 253 V
24 V DC +30% -25%, 15 W
U_m = 253 V

Ein-/Ausgangsstromkreise zum Anschluss an Funktionskleinspannung mit sicherer Trennung (PELV)
(aktiv / passiv)
U_N ≤ 25 V AC
U_N ≤ 50 V DC
U_m = 253 V

Feldstromkreis (Klemmen 7, 8)
U_N ≤ ±40 V (getaktete Gleichspannung)
I_N ≤ 150 mA (interne Absicherung)

Elektrodenstromkreis (Klemmen 1, 2, 3, 20, 30) in Zündschutzart Eigensicherheit EE Ex ib IIIC
Höchstwerte:
U_b = 18 V (± 9 V gegen Erde)
I_b = 40 mA
P_o = 80 mW
geknickte Kennlinie
L_o = 5 mH
C_o = 225 nF (C berücksichtigt)

Der Elektrodenstromkreis ist von allen anderen Stromkreisen bis zu einem Schaltverbind der Nennspannung von 375 V sicher galvanisch getrennt.

EG-Baumusterprüfbescheinigungen ohne Unterschrift und ohne Siegel haben keine Gültigkeit.
Diese EG-Baumusterprüfbescheinigung darf nur unverändert weiterverbreitet werden.
Auszüge oder Änderungen bedürfen der Genehmigung der Physikalisch-Technischen Bundesanstalt.
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Braunschweig und Berlin
Anlage zur EG-Baumusterprüfbescheinigung PTB 02 ATEX 2163 X

(16) Prübericht: PTB Ex 02-22121

(17) Besondere Bedingungen:

1. Im gesamten Verlauf des eigensicheren Stromkreises ist Potenzialausgleich zu errichten.

2. Der Anschluss für den Potenzialausgleichssleiter ist mit dem Potenzialausgleich des explosionsgefährdeten Bereiches zu verbinden.

(18) Grundlegende Sicherheits- und Gesundheitsanforderungen:

erfüllt durch Übereinstimmung mit den vorgenannten Normen

Zertifizierungsstelle Explosionsschutz
Im Auftrag

Dr.-Ing. U. Johannesmeier
Regierungsdirektor

Braunschweig, 08. November 2002

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Notice
If you need to return flowmeters for testing or repair to KROHNE

Your electromagnetic flowmeter
• has been carefully manufactured and tested by a company with ISO 9001 certification
• and volumetrically calibrated in one of the world’s most accurate test rigs.

If installed and operated in accordance with these operating instructions, your flowmeter will rarely present any problems.

Should you nevertheless need to return a flowmeter for checkout or repair, please pay strict attention to the following points:

Due to statutory regulations concerning protection of the environment and the health and safety of our personnel, Krohne may only handle, test and repair returned flowmeters that have been in contact with liquids if it is possible to do so without risk to personnel and environment. This means that Krohne can only service your flowmeter if it is accompanied by a certificate in line with the following model confirming that the flowmeter is safe to handle.

If the flowmeter has been operated with toxic, caustic, flammable or water-endangering liquids, you are kindly requested
• to check and ensure, if necessary by rinsing or neutralizing, that all cavities in the flowmeter are free from such dangerous substances.
  (Directions on how you can find out whether the flow sensor has to be opened and then flushed out or neutralized are obtainable from Krohne on request.)
• to enclose a certificate with the flowmeter confirming that the flowmeter is safe to handle and stating the liquid used.

KROHNE regret that they cannot service your flowmeter unless accompanied by such a certificate.

<table>
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<th>SPECIMEN certificate</th>
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<td>Company: .........................</td>
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The enclosed electromagnetic flowmeter

Type: ........................................ KROHNE Order No. or Series No ..........................

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

Because this liquid is
  water-endangering * / toxic * / caustic * / flammable *
we have
  – checked that all cavities in the flowmeter are free from such substances *
  – flushed out and neutralized all cavities in the flowmeter *
(* delete if not applicable)
We confirm that there is no risk to man or environment through any residual liquid contained in this flowmeter.

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

Company stamp: