Electromagnetic flowmeter
in partially filled pipes
for water and waste water
part A  System installation and start-up

1  Installation of the primary head
1.1  Selecting the installation location
1.2  Grounding rings
1.3  Torques
1.4  Grounding IFS 4000 PF
1.5  Electrical connections of primary head
   1.5.1  Connection to power
   1.5.2  Data interface between primary head and signal converter
   1.5.3  Electrode cable
   1.5.4  Field current cable
   1.5.5  Cable lengths: max. allowed distance between primary head and signal converter
   1.5.6  Connection diagram IFC 110 PF with IFS 4000 PF

2  Installation of the signal converter
   2.1  Please note the following information concerning installation and operation of the IFC 110 PF
   2.2  Choice of installation location
   2.3  Connection to power
   2.4  Connection between IFC 110 PF and IFS 4000 PF
   2.5  Outputs and inputs
   2.5.1  Important information for outputs and inputs
   2.5.2  Current output I
   2.5.3  Pulse outputs P and A1
   2.5.3.1  Pulse output P for electronic totalizers
   2.5.3.2  Pulse output A1 for electromechanical totalizers
   2.5.4  Status outputs A1 / A2 / D1 / D2
   2.5.5  Control inputs C1 and C2
   2.5.6  Connection diagrams of outputs and inputs
   2.5.7  Standard factory settings

3  Start-up

Part B  Signal converter IFC 110 PF

4  Operating the signal converter
   4.1  Krohne operating concept
   4.2  Operating and control elements
   4.3  Key functions
   4.4  Table of settable functions
   4.5  Error messages in measuring mode
   4.6  Resetting the totalizer and deleting error messages, RESET/QUIT menu

5  Description of functions
   5.1  Full-scale range $Q^{100\%}$
   5.2  Time constant
5.3 Low-flow cutoff SMU
5.4 Display
5.5 Internal electronic counter
5.6 Internal power supply (E+ / E-) for connected loads
5.7 Current output I
5.8 Pulse outputs P and A1
5.9 Status outputs A1 / A2 and D1 / D2
5.10 Control inputs C1 and C2
5.11 Language
5.12 Entry code
5.13 Primary head
5.14 User-defined units
5.15 F/R mode, forward/reverse flow measurement
5.16 Output characteristics
5.17 Applications
5.18 Hardware settings
5.19 Limit switches
5.20 Range change

Part C Special Applications, Functional Checks, Service and Order Numbers

6 Special applications
6.1 Use in hazardous areas
6.2 Magnetic sensors MP (optional)
6.3 Changing the load capacity of the output A1 for polarized DC operation
6.4 RS 232 adapter incl. CONFIG software (optional)
6.5 Pulsating flow
6.6 Unstable display and outputs
6.7 Stable signal outputs with empty measuring tube

7 Functional checks
7.1 Checking the zero with the IFC 110 PF signal converter, Fct. 3.03
7.2 Checking the measuring range Q, Fct. 2.01
7.3 Hardware information and error status , Fct. 2.02
7.4 Hardware test, Fct. 2.03
7.5 Faults and symptoms during start-up and flow measurement
7.6 Checking the primary head
7.6.1 Checking the level meter
7.6.2 Checking the velocity meter
7.7 Checking the signal converter using a GS 8 A simulator (optional)

8 Service
8.1 Replacing the power supply fuse
8.2 Retrofitting of magnetic sensors MP (optional)
8.3 Replacing the complete electronic unit of the IFC 110 PF signal converter
8.4 Replacing single printed circuit boards (PCBs)
8.5 Illustrations of printed circuit boards (PCBs)

9 Order numbers

Part D Technical Data, Measuring Principle and Block Diagram

10 Technical data
10.1 Primary head IFS 4000 PF
10.1.1 General information
10.1.2 Dimensions and weight IFS 4000 PF
10.2 Signal converter IFC 110 PF
10.2.1 General information
10.2.2 Dimensions and weight IFC 110 PF
10.3 Complete system IFM 4110 PF
10.3.1 Full-scale range Q₁₀₀%
10.3.2 Error limits under reference conditions

11 Block Diagram

12 Measuring principle

If you need to return flowmeters for testing or repairing to Krohne
How to use these Installation and Operating Instructions

• For easy reference these instructions are divided into 5 parts.
• Only Part A is needed for installation and initial start up.
• All electromagnetic flowmeters are factory-set to your order specifications. Therefore, no further adjustments are necessary prior to start-up.

Part A Install flowmeter in the pipeline, connect up, power the flowmeter, that’s all!
The system is operative.

Part B Operator control and action of the IFC 110 PF signal converter.
Part C Special applications, service, and functional checks.
Part D Technical data, dimensions, block diagram and measuring principle.
Part E Index

Product liability and warranty

These electromagnetic flowmeters are suitable solely for measuring the volumetric flowrate of electrically conductive liquids, slurries and pastes. Responsibility as to suitability and intended use of our instruments 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 TIDALFLUX flowmeters have to be returned to Krohne, please fill in the form on the penultimate page of this installation and operating instructions manual. A repair or checkout is only possible when this form is filled in completely and returned to Krohne together with the instrument.

System description

The IFM 4110 PF electromagnetic flowmeters are precision instruments designed for the linear flow measurement of electrically conductive liquids, pastes and slurries with a minimum conductivity of 50 μS/cm (μmho/cm). The combination of a magnetic inductive flowmeter and a capacitive height measuring system stands for precise flow measurement in both fully and partly filled pipe lines. The filling degree must be at least 10 percent of the inner diameter.

Example of type designation:

IFM 4110 PF

PF Partly filled flowmeter
110 IFC 110 PF signal converter, field housing.
4 Primary head type IFS 4000
IFM Electromagnetic flowmeter system
Available version

<table>
<thead>
<tr>
<th>System:</th>
<th>IFM 4110 PF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary head:</td>
<td>IFS 4000 PF</td>
</tr>
<tr>
<td>• type:</td>
<td>Irathane</td>
</tr>
<tr>
<td>• liner measuring section:</td>
<td>Irathane</td>
</tr>
<tr>
<td>• Meter size:</td>
<td>200 - 600 mm / 8 – 24 inches (others on request)</td>
</tr>
<tr>
<td>Rated pressure</td>
<td>PN 10 (others on request)</td>
</tr>
<tr>
<td>Max. operating pressure</td>
<td>10 bar (others on request)</td>
</tr>
<tr>
<td>Signal converter:</td>
<td>IFC 110 PF</td>
</tr>
</tbody>
</table>

Items included with supply

Items included:
- Flowmeter IFM 4110 PF as ordered
  - signal converter IFC 110 PF, field housing
  - primary head IFS 4000 PF
  - signal cable type DS (standard) or BTS, standard length 10 meter
  - data cable, standard length 10 meter
- Installation and operating instructions for operation of the IFM 4110 PF flowmeter.
- Report of factory settings of the signal converter IFC 110 PF.
- Calibration certificate for completely filled flowmeter.

Items not included:
- Installation materials (bolts, nuts, washers, gaskets etc.)
- Field current cable
- Power supply cables for primary head and converter

These items should be provided by the customer.

Note: for IP68 version, the power supply cable for the primary head and the field current cable are mounted already at delivery.

CE / EMC / Standards / Certification

- Electromagnetic flowmeters with IFC 110 PF signal converters meet EU-EMC Guidelines, the NAMUR Recommendations NE 5/93 and are provided with the CE mark.
- All fabrication shops and production sequences are ISO 9001 certified.
Part A  System installation and start-up

1  Installation of the primary head

1.1  Selecting the installation location

1. Location and position as required, but electrode axis must be approximately horizontal. Max. deviation ± 2°.
2. Slope of measuring section, primary head with in- and outlet sections, is allowed to have maximum deviation of ±1% compared to horizontal.
3. Flow direction +/-, arrow on primary head must point in direction of flow.
4. Bolts and nuts: to install, make sure there is sufficient room next to the pipe flanges.
5. Vibration: support the pipeline on both sides of the flowmeter.
6. Use adapter pipes to permit axial shifting of counter flanges to facilitate installation.
7. Straight inlet run minimum of 5 x DN and outlet run minimum of 3 x DN (DN = meter size), measured from the electrode axis. These are minimum values! Please take precautions to make sure that the flow profile inside the tube is axially symmetric. If this is not the case, the inlet and/or outlet sections have to be increased. Also, take precautions to minimize the amount of air bubbles in the fluid, i.e. caused by falling water in front of the primary head. Increase the inlet section if air can not be avoided.
8. Vortex or corkscrew flow: increase inlet and outlet sections or install flow straighteners.
9. Strong electromagnetic fields and large “iron masses”: avoid in vicinity of flowmeter.
10. Zero setting is automatic in flowmeters with pulsed DC field. Electrode contamination does therefore not cause any zero drift.
    For most applications it is convenient and customary to check the zero by shutting off the flow. Shutoff valves should therefore be provided upstream and/or downstream of the primary head unless the pipe configuration already rules out the possibility of the primary head being drained of fluid. For zero check see section 7.1.
12 Mixing different fluid products. Install flowmeter upstream of mixing point or at an adequate distance downstream, minimum 30 x DN (DN = meter size), otherwise output/display may be unsteady.
13 Ambient temperature < 60 °C / 140 °F
    Refer to sect. 10.1 for process temperature and pressure limits due to material used for measuring section/liner.
    When the primary head has to be installed in direct sunlight, please install a sunshade if necessary.
14 Long pipelines. Always install control and shutoff valves downstream of flowmeter (vacuum!).
15 Pumps. Never install flowmeter on pump suction side (vacuum!).
16 Service opening. It is strongly advised to construct some kind of service opening at the top of the connecting pipeline, just before or just after the Tidalflux. In this way it is possible to see the flow, which can be helpful if problems occur. Also, it can be helpful to clean the liner if this gets polluted.

1.2  Grounding rings

- Required in conjunction with electrically non-conductive pipes, i.e. synthetic, internally coated or concrete pipes. Especially for the level measurement system special grounding rings have to be used. These rings have a cylindrical part that must go into the connected pipelines. Therefore the inner diameter of the pipeline must be known so the grounding rings can be made in a way they just fit in the pipeline. This is very important to keep a good flow profile of the fluid with as less disturbances as possible.
- Grounding rings form a conductive connection with the fluid in order to get a low-impedance connection
- Material CrNi steel 1.4571 or SS 316 Ti-AISI, others on request.
- For grounding and connection of the grounding rings, refer to sect. 1.4.

1.3  Torques

Bolts: tighten uniformly in diagonally opposite sequence, see table for number and type

IFS 4000 PF with Irathane liner, > 12 mm / > 0.47”:

<table>
<thead>
<tr>
<th>Meter size DN mm</th>
<th>Pressure rating [PN]</th>
<th>Bolts</th>
<th>Max. torque Nm (ft lbf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>200</td>
<td>10</td>
<td>8x M20</td>
<td>68 (49.2)</td>
</tr>
<tr>
<td>250</td>
<td>10</td>
<td>12x M20</td>
<td>65 (47.0)</td>
</tr>
<tr>
<td>300</td>
<td>10</td>
<td>12x M20</td>
<td>76 (54.9)</td>
</tr>
<tr>
<td>Meter size</td>
<td>Body pressure rating</td>
<td>Bolts for ANSI class 150 flanges</td>
<td>Max. torque Nm (ft lbf)</td>
</tr>
<tr>
<td>------------</td>
<td>----------------------</td>
<td>----------------------------------</td>
<td>-------------------------</td>
</tr>
<tr>
<td>8</td>
<td>145</td>
<td>8 x ¾”</td>
<td>69 (49.9)</td>
</tr>
<tr>
<td>10</td>
<td>145</td>
<td>12 x 7/8”</td>
<td>79 (57.1)</td>
</tr>
<tr>
<td>12</td>
<td>145</td>
<td>12 x 7/8”</td>
<td>104 (75.2)</td>
</tr>
<tr>
<td>14</td>
<td>145</td>
<td>12 x 1”</td>
<td>93 (76.2)</td>
</tr>
<tr>
<td>16</td>
<td>145</td>
<td>16 x 1”</td>
<td>91 (65.8)</td>
</tr>
<tr>
<td>18</td>
<td>145</td>
<td>16 x 1 1/8”</td>
<td>143 (103.4)</td>
</tr>
<tr>
<td>20</td>
<td>145</td>
<td>20 x 1 1/8”</td>
<td>127 (91.8)</td>
</tr>
<tr>
<td>24</td>
<td>145</td>
<td>20 x 1 ¼”</td>
<td>180 (130.1)</td>
</tr>
</tbody>
</table>

**Note:** Process pressure must not exceed ANSI flange rating. Refer to ANSI Standard B 16.5.

Other meter sizes on request.

### 1.4 Grounding IFS 4000 PF

- The flowmeter (primary head) must be properly grounded.
- The ground conductor must not transmit any interference voltages. Therefore, do not connect any other electrical devices to this conductor.

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

**Metal pipeline, not internally coated**

Grounding without grounding rings

**Electrically non-conductive pipeline**

Grounding with grounding rings (option)

- **RF** Pipe
- **V1, V2** Connecting wires, bolted to the “neck” of the IFS 4000 PF. Threaded holes to be provided for M6 bolts for flange-side (RF) connection. Use factory-supplied mounting material for connection of grounding rings E.
1.5 Electrical connections of primary head

1.5.1 Connection to power

**Electrical connection in conformity with VDE 0100 / EN 61010-1**

“Regulations governing heavy-current installations with rated voltages up to 1000 V” or equivalent national standard.

The electronics unit on top of the primary head needs a power supply of 115/230 V 48-63 Hz (14 VA), other voltages are available as an option.

Please observe the information given on the nameplate of the primary head or in the terminal box about voltage and frequency.

Please see also connection diagram in sect. 1.5.6.

1.5.2 Data interface between primary head and signal converter

Data cable: 3 x 1,5 mm², shielded, for example Liycy, standard 10 meter included. For information about the connection, see the connection diagram in sect. 1.5.6. Special attention should be given to the PG9 cable gland, which is necessary to guarantee a faultless operation of data transfer between the signal converter and the primary head. The shielding of the data cable should therefore be connected to the housing by means of the two metal rings behind the rubber part in the gland. The shielding must be put between the two metal rings in a way that the shielding makes contact with the metal rings all around the cable. See also following figure:

![Data cable diagram](image)

1.5.3 Electrode cable

**General information to signal cables type DS and type BTS**

**General**

Krohne signal cables types DS and BTS with foil and magnetic shields will ensure faultless system operation.

- The signal cable must be a rigid installation. Cables must be secured so they do not move, or must be run in conduit.
- No separate installation of signal and field power supply cables required - can be run in same conduit along with other signal and field power cables. Do not run in same conduit with power cables for other devices.
- Shields are connected via stranded drain wires.
- Suitable for under water and underground installations.
- Insulating material flame-retardant to IEC 332.1/VDE 0472
- Low in halogen and unplasticized.
- Flexible at low temperatures.

**For connection of the cable, see the connection diagram in sect. 1.5.6.**

**Signal cable type DS**

with double shielding

1. Stranded drain wire, 1st shield, 1.5 mm² (14 AWG)
2. Insulation
3. Stranded wire 0.5 mm² (20 AWG)
4. Special foil, 1st shield
5. Insulation
6. Mu-metal foil, 2nd shield
7. Stranded drain wire, 2nd shield, 0.5 mm² (20 AWG)
8 Outer sheath

Bootstrap signal cable type BTS
The signal converter automatically controls the individual shields (3) to exactly the same voltage as that applied to the signal wires (5). Since the voltage difference between signal wires (5) and individual shields (3) is virtually zero, there is no flow of current via the line capacitance 3+5; thus, line capacitance is apparently zero. Much longer cable lengths are then permitted for fluids with low electrical conductivity levels.
1 Dummy glider wire
2 Insulation
3 Special foil, 1st shield
4 Insulation
5 Stranded wire 0.5 mm² (20 AWG)
6 Stranded drain wire, 1st shield, 0.5 mm² (20 AWG)
7 Special foil, 2nd shield
8 Stranded drain wire, 2nd shield, 1.5 mm² (14 AWG)
9 Insulation
10 Mu-metal foil, 3rd shield
11 Stranded drain wire, 3rd shield, 0.5 mm² (20 AWG)
12 Outer sheath

1.5.4 Field current cable
The cross-section of the field current cable (standard not included) is dependent on the length that is required:

<table>
<thead>
<tr>
<th>length</th>
<th>Cross-section</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 150 m (0 – 500 ft)</td>
<td>2 x 0.75 mm² Cu (2 x 18 AWG)</td>
</tr>
<tr>
<td>150-300 m (500 – 1000 ft)</td>
<td>2 x 1.5 mm² Cu (2 x 14 AWG)</td>
</tr>
<tr>
<td>300 – 600 m (1000 – 2000 ft)</td>
<td>4 x 1.5 mm² Cu (4 x 14 AWG)</td>
</tr>
</tbody>
</table>

1.5.5 Cable lengths: max. allowed distance between primary head and signal converter

- Determining the maximum permissible distance between primary head and signal converter
  1. The length of signal cable is dependent on the electric conductivity of the liquid product and of the type of cable used.
     For BTS cable (optional) the maximum length is 600 m, independent of the conductivity.
     For DS cable (standard) the maximum length is as follows:

     | electr. conductivity [µS/cm] | max. length [m] |
     |-----------------------------|-----------------|
     | 50                          | 120             |
     | 100                         | 200             |
     | 200                         | 400             |
     | 400                         | 600             |

  2. The length of field current cable is determined by the cable cross-section $A_F$, see sect. 1.5.4.
  3. The length of the data interface cable must not exceed 600 m.
  4. The shortest cable length obtained either according to Point 1, 2 or 3 is the maximum permissible distance between primary head and signal converter!

1.5.6 Connection diagram IFC 110 PF with IFS 4000 PF
In the following diagram you can see how to connect the two devices with each other. In this diagram the data interface cable is called “Q”, the field current cable is “C” and the electrode cable is “DS”.

![Connection diagram IFC 110 PF with IFS 4000 PF](image)
2. Installation of the signal converter

2.1 Please note the following information concerning installation and operation of the IFC 110 PF

- Electrical connection in conformity with VDE 0100 / EN 61010-1
  "Regulations governing heavy-current installations with rated voltages up to 1000 V" or equivalent national standard. Refer to connection diagram, sect. 1.5.6, for power connection to signal converter.

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

- Do not cross or loop the cables in the connection box. Use separate PG or NPT screwed conduit entries for each cable.
- On normal customer orders, the GK (primary constant) of the signal converter is factory-set to match that of the primary head with which it has been ordered. The GK is noted on the primary head nameplate and also shown on the converter nameplate. These instruments should be installed together.

2.2 Choice of installation location

- Do not expose signal converter to direct sunlight. Install a sunshade if necessary.
- Do not expose to intense vibration.
- Ensure adequate cooling of IFC 110 PF unit when installed in switchgear cubicle(s), e.g. use heat exchangers.
- Install signal converter as close as possible to the primary head.
- Use factory-supplied standard signal cable (type DS), standard length 10 m (30ft). For longer lengths and bootstrap signal cable (type BTS, optional), refer to sect. 1.5.3.
- Use factory-supplied data cables, standard length 10 m, for the RS485 interface between primary head and signal converter.

2.3 Connection to power

- Note information given in sect. 2.1!
- Note the information given on the instrument nameplates on the signal converter (voltage, frequency!).

2.4 Connection between IFC 110 PF and IFS 4000 PF

- Data interface cable; for general information and max. length see sect. 1.5.2 and 1.5.5; for connection see sect. 1.5.6.
- Signal cable type DS with double shielding or type BTS with triple shielding (optional); for general information and max. length see sect. 1.5.3 and 1.5.5; for connection see sect. 1.5.6.
- Field power supply cable; for minimum cross-section (A<sub>F</sub>) and length see sect. 1.5.4 and 1.5.5; for connection see sect. 1.5.6.

2.5 Outputs and inputs

2.5.1 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>Current output</td>
<td>I</td>
<td>I+/-</td>
<td>Always active</td>
</tr>
<tr>
<td>Pulse output</td>
<td>P</td>
<td>P / P</td>
<td>For electronic totalizers</td>
</tr>
<tr>
<td>Pulse output</td>
<td>A1¹ (P2)</td>
<td>A1¹ / A⊥</td>
<td>For electromechanical counters</td>
</tr>
<tr>
<td>Status outputs</td>
<td>A1² and A2</td>
<td>A1² / 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>

¹Output A1 can be used as a 2nd pulse output P2 for electromechanical totalizers or as a 4th status output, see sect. 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 (\(U_{\text{ext}}\)), observe max. operating data

• **Connection diagrams** of outputs and inputs are shown in sect. 2.5.6.

• For **operating data** of outputs and inputs please refer to sect. 10.2.1.

### 2.5.2 Current output I

- The continuously active **current output is electrically isolated** from all others circuits.
- All operating data and functions are adjustable.
- Allowed load: \(15-500\, \Omega\)
- 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 (Fct. 1.04) and/or status output (Fct. 1.07-1.10).
- **Current value for error identification** is adjustable, see Fct. 1.05.
- **Range change-over,** automatically or externally by control input, see 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 1:25).  
  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 signaled via one of the four status outputs.
- **Forward / reverse flow measurement** (F/R mode) is possible.
- **Connection diagrams** see sect. 2.5.6.

### 2.5.3 Pulse outputs P and A1

#### 2.5.3.1 Pulse output P for electronic totalizers

- **Pulse output P is electrically isolated** from all other circuits
- All operating data and functions are adjustable, see Fct. 1.05.
- **Active mode:** uses the internal power supply, terminals E+/E-
- **Passive mode:** requires external power supply, \(U_{\text{ext}}<32\, \text{V DC} / 24\, \text{V AC}, I \leq 30\, \text{mA}\)
- **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/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.
- **Connection diagrams** see sect. 2.5.6
- **Schematic wiring diagram for pulse output P** for electronic totalizers.  
  Similar to a relay contact, this pulse output switches direct and alternating voltages.

![Schematic diagram of pulse output P](image-url)
### 2.5.3.2 Pulse output A1 for electromechanical totalizers

**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.

- **Pulse output A1 is electrically connected** to status output A2 (common centre grounding contact A⊥) but **electrically isolated from all other circuits**.
- **All operating data and functions are adjustable**, see Fct.1.07.
- **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, $I \leq 100$ mA ($I \leq 200$ mA for polarized DC operation).
- **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/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 corresponding lower output frequency.
- **Forward/reverse flow measurement** (F/R mode) is possible,
- **Connection diagrams see sect. 2.5.6**
- **Schematic wiring diagram for pulse output A1** for electromechanical totalizers. This pulse output has a MOSFET switch as output which switches direct and alternating voltages similar to a relay contact.

![Schematic Wiring Diagram](#)

### 2.5.4 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.

- **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**.
- **All operating data and functions are adjustable**, see Fct. 1.07-1.10.
- **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, $I \leq 100$ mA ($I \leq 200$ mA for A1 in case of polarized DC operation).
- **The following operating conditions can be signaled** 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 sect. 2.5.6.
- Schematic wiring diagram for status outputs A1/A2 and D1/D2.
  These status outputs have MOSFET switches as outputs which switch direct and alternating voltages similar to relay contacts.

![Connection diagram](image)

**2.5.5 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.
- All operating data and functions are adjustable, see Fct. 1.11-1.12.
- **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, $I \leq 10$ 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 sect. 2.5.6

**2.5.6 Connection diagrams of outputs and inputs**
- **Active mode:** The IFC 110 PF supplies the power required for operating (driving) the receiver instruments. Observe the max. operating data (terminals E+/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

![Connection diagram](image)
Contacts 24 V, 10 mA
\[ I \leq 7 \text{ mA} \]

Current output I
\[ R_i = 15 \text{ – } 500 \Omega \]

Pulse output A1 active
for electromechanical totalizers
\[ R_i \geq 160 \Omega \quad I \leq 100 \text{ mA} \]
Forward / reverse flow measurement (F/R mode)
for pulse and current outputs (P and I)
without external change-over relay

Electronic totalizers must be connected as shown in the connection diagrams for pulse output P
on the following figures
**Pulse output** $P_{\text{active}}$ for electronic counters

*for frequencies $\leq 1 \text{ kHz}$*

\[
\begin{align*}
R_1 &= 1 \text{k}\Omega / 0.5 \text{ W} \\
I_{\text{max}} &\leq 20 \text{ mA} \\
R_{\text{EC}} &> 100 \text{k}\Omega \\
R_2 &= 0.2 \text{ W} \\
U_{\text{EC}} &= 10 \text{ V} \quad 1 \text{ k}\Omega \quad 270 \Omega \\
\end{align*}
\]

*for frequencies $> 1 \text{ kHz}$*

\[
R = 1 \text{k}\Omega / 0.35 \text{ W}
\]

**Pulse output** $P_{\text{passive}}$ for electronic totalizers

*for frequencies $\leq 1 \text{ kHz}$*

\[
\begin{align*}
U_{\text{ext}} &\leq 32 \text{ V DC} / \leq 24 \text{ V AC} \\
I &\leq 30 \text{ mA} \\
R & = 1 \text{ – } 10 \text{ k}\Omega \\
P_{\text{R}} &\geq U_{\text{ext}} / R \\
\end{align*}
\]

*for frequencies $> 1 \text{ kHz}$*

\[
\begin{align*}
U_{\text{ext}} &= 24 \text{ V DC} / \text{AC} \\
R_{\text{EC}} &\geq 100 \text{ k}\Omega \\
\end{align*}
\]

\[
\begin{align*}
I &\leq 50 \text{ mA} \quad 18 \text{ mA} \\
\end{align*}
\]

\[
\begin{align*}
R &= 560 \Omega \quad 1 \text{k}\Omega \\
P_{\text{R}} &= 0.5 \text{ W} \quad 0.35 \text{ W} \\
U_{\text{EC}} &= 16 \text{ V} \quad 18 \text{ V} \\
\end{align*}
\]

*Shielded cables* must be used to prevent radio interference at pulse output frequencies $> 100 \text{ Hz.}$
2.5.7 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 the flow. The figures displayed may have a preceding sign.

Such factory settings of current and pulse outputs may lead to measuring errors, particularly when volumes are metered and totaled, for example if 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.
- display Fct. 1.04.
- current output I Fct. 1.05.
- pulse output P Fct. 1.06.

### 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 of primary head</td>
<td>1.10</td>
<td>Status output D2</td>
<td>Indication F/R</td>
</tr>
<tr>
<td>1.02</td>
<td>Time constant</td>
<td>3 sec. for display, pulse, current and status outputs</td>
<td>1.11</td>
<td>Control input C1</td>
<td>Totalizer reset</td>
</tr>
<tr>
<td>1.03</td>
<td>Low-flow cutoff</td>
<td>OFF</td>
<td>1.12</td>
<td>Control input C2</td>
<td>OFF</td>
</tr>
<tr>
<td>1.04</td>
<td>Display Flow rate totalizer</td>
<td>m³/hr</td>
<td>3.02</td>
<td>Primary head meter size direction of flow</td>
<td>See instr. nameplate + direction, see arrow on primary head</td>
</tr>
<tr>
<td>1.05</td>
<td>Current output I function range</td>
<td>2 directions 4-20 mA 22 mA</td>
<td>3.04</td>
<td>Entry code</td>
<td>NO</td>
</tr>
<tr>
<td>1.06</td>
<td>Pulse output P Function pulse value pulse width</td>
<td>2 directions 1000 pulses/s symmetric</td>
<td>3.05</td>
<td>User unit</td>
<td>Liter/hr</td>
</tr>
<tr>
<td>1.07</td>
<td>Pulse output 2, A1 function pulse value pulse width</td>
<td>2 directions 1 pulse/s 50 ms</td>
<td>3.06</td>
<td>Application flow ADC gain special filter</td>
<td>pulsating automatic OFF</td>
</tr>
<tr>
<td>1.08</td>
<td>Status output A2</td>
<td>ON</td>
<td>3.07</td>
<td>Hardware terminal A1 self check</td>
<td>pulse output A1 NO</td>
</tr>
<tr>
<td>1.09</td>
<td>Status output D1</td>
<td>All error</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3 Start-up

- Before connecting to power, check that the instrument is correctly installed as described in Sections 1 and 2.
- The flowmeter (primary head and signal converter) is delivered ready for operation. All operating data are set at the factory in accordance with your specifications.
  **Please also refer to sect. 2.5.7 “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 settings described for Fct. 1.04.
- **PLEASE NOTE !** (If “YES” is entered in self check function 3.07)
  When powered, the signal converter checks the current output by performing a short test with three different currents. To prevent false alarm, controllers or alarm functions should not be activated before the instrument is switched on.
- **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 “normal” LED is flashing</td>
<td>Everything O.K.</td>
</tr>
<tr>
<td>Green “normal” LED and red “error” LED are flashing alternately</td>
<td>Momentary overload of outputs and/or AD converter. Detailed error messages by setting Fct. 1.04 DISPLAY. Subfunctions “MESSAGES” to “YES”, see sections 4.4 and 5.4.</td>
</tr>
<tr>
<td>Red “error” LED is flashing</td>
<td>Fatal Error, see sections 7.3 and 7.4.</td>
</tr>
</tbody>
</table>
### 4. Operating the signal converter

#### 4.1 Krohne operating concept

**Measuring mode**

When this is shown on the display, press the following keys: → → → → → → → →

<table>
<thead>
<tr>
<th>Menu level</th>
<th>Function level</th>
<th>Data level</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.0 INSTALL.</td>
<td>3.07 HARDWARE</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.06 APPLICAT.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.05 USER UNIT</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.04 ENTRY CODE</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.03 ZERO SET</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.02 FLOW METER</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.01 LANGUAGE</td>
<td></td>
</tr>
<tr>
<td>2.0 TEST</td>
<td>2.03 HARDW. TEST</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.02 HARDW. INFO</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.01 TEST Q</td>
<td></td>
</tr>
<tr>
<td>1.0 OPERATION</td>
<td>1.11-1.12 Control Inputs</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.07-1.10 Outputs A1 (P2), A2, D1, D2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.06 PULS P</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.05 CURRENT</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.04 DISPLAY</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.03 L.F. CUTOFF</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.02 TIMECONST.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.01 FULL SCALE</td>
<td></td>
</tr>
</tbody>
</table>

See Section 4.4
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).

Display, 1st line Displaying numerical data
Display, 2nd line Displaying units and texts
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

5 keys for operating the signal converter ← → ↓ ↑
10 keys for direct numerical setting of function values (not function numbers)
Compass field showing that a key is pressed
magnet active LED green/red, magnetic sensors active
green = built-in magnetic sensors (optional), see ⑥
diagnostic red = operation of one of the 3 magnetic sensors
3 magnetic sensors (optional), operated by bar magnet without opening the housing, function of the sensors as described for the three keys → ↓ ↑, see ④.

2 LED’s signaling the status of measurement
normal green LED = correct measurement, everything O.K.
error red LED = error, parameter or hardware error
IMoCOM ImoCom bus, multipoint connector for connecting external supplementary equipment, see sect. 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 **gray** background.

**To start operator control**

Measuring mode

```
1 3 . 5 7 1
m 3 / h r
```

operator control mode

```
F c t . 1 . 0
OPERATION
```

**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.

```
F c t . 3 . 0
INSTALL
```

Press key ↓

```
STORE YES
```

**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**

```
3 9 7 . 3 5
m 3 / h r
```

Increase number

```
3 9 7 . 4 5
m 3 / h r
```

Decrease number

**To shift cursor** (flashing position)

```
3 9 7 . 3 5
m 3 / h r
```

Shift to right

```
3 9 7 . 3 5
m 3 / h r
```
Shift to left

Select next text

To alter text (units)
In case of units, the numerical value is converted automatically.

13.571 m³/hr

Select preceding text

To change from text (unit) to numerical setting

Change to numerical setting

13.571 m³/hr

To change to subfunction
Subfunctions have no “Fct. No.” and are identified by a “→” in the upper left corner.

Press key ↓

Range I

To revert to function display

Press key ↓

Fct. 1.02

Time Const.

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 =½ x pulse width (s) ≤ 1 kHz if “AUTO” or “SYM.” are selected in subfunction “PULSWIDTH”
Fmin = 10 pulses/hr
FM Conversion factor volume for any unit, see Fct. 3.05 “FACT. VOL.”
Ft Conversion factor time for any unit, see Fct. 3.05 “FACT. TIME”
GK Primary head constant
I Current output
I0% Current at 0% flow rate
I100% Current at 100% flow rate

P (P2) Pulse output (2nd pulse output A1)
Pmax =Fmax/Q100%
Pmin =Fmin/Q100%
Q Current flow rate
Q100% 100% flow rate = full scale range
Qmax = = x DN² x vmax (= max. full-scale range)
      4
100% at vmax = 12 m/s or 40 ft/s
Qmin = = x DN² x vmin (= min. full-scale range)
      4
100% at vmin = 0.3 m/s or 40 ft/s
SMU Low-flow cutoff for I and P
v Flow velocity
vmax Maximum flow velocity (12 m/s or 40 ft/s) at Q100%
 vmin Minimum flow velocity (0.3 m/s or 1 ft/s) at Q100%
F/R Forward/reverse flow in F/R measuring mode
<table>
<thead>
<tr>
<th>Fct. No.</th>
<th>Text</th>
<th>Description and setting</th>
</tr>
</thead>
</table>
| 1.01 | **FULL SCALE** | Full-scale range for flow rate $Q_{100\%}$<br>Selection of unit<br>• m/hr, liter/Sec, US.Gal/min<br>• user unit, factory setting “Liter/hr” or “US Mgal/day” (see Fct. 3.05)<br><br>Press → key to change to numerical setting<br>Setting ranges<br>The range depends on the nominal width (DN) and the flow velocity ($v$):<br>$Q_{\text{min}} = \frac{\pi}{4} x DN^2 x v_{\text{min}}$

$Q_{\text{max}} = \frac{\pi}{4} x DN^2 x v_{\text{max}}$

$v_{\text{min}} = 0.3 \text{ m/s (1 ft/s)}$; $v_{\text{max}} = 12 \text{ m/s (40 ft/s)}$

→ VALUE P and/or→ 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.<br>With the “old” pulse values the output frequency ($F$) would have been exceeded or would not have been reached.<br>$P_{\text{min}} = F_{\text{min}} / Q_{\text{100\%}}$

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

Check new values! |
| 1.02 | **TIMECONST.** | Time constant<br>Selection:<br>- ALL (applies to display and all outputs)<br>- ONLY I (only display, current and status outputs)<br><br>Press → key to change to numerical setting.<br>Range: - 0.2 – 99.9 Sec<br>Press → key to return to Fct. 1.02 TIMECONST. |
| 1.03 | **L.F. CUTOFF** | Low-flow cutoff (L.F. Cutoff)<br>• OFF (fixed tripping points: ON = 0.1% / OFF = 0.2%)<br>• PERCENT (variable tripping points) ON 1% OFF 2-20%<br><br>Press → key to change to numerical setting<br>Note: the cutoff “OFF” value must be greater than the CUTOFF “ON” value.<br>Press → key to return to Fct. 1.03 L.F. CUTOFF. |
| 1.04 | **DISPLAY** | Display functions<br>→ DISP.FLOW | Selection of flow display<br>• NO DISP.<br>• User unit, factory setting “Liter/hr” or “US Mgal/day”<br>• m3/hr<br>• PERCENT<br>• Liter/Sec<br>• BARGRAPH (value and bargraph display in %)<br>• US.Gal/min<br>Press → key to change to subfunction “DISP. TOTAL” |
| → DISP.TOTAL. | Selection of totalizer display<br>• NO DISP. (totalizer is ON but no display)<br>• OFF (totalizer is OFF)<br>• TOTAL.<br>• -TOTAL.<br>• +/- TOTAL.<br>• SUM ($\Sigma$)<br>ALL (display single counts or all)<br><br>Press → key to change to setting of display unit.<br>-------------------------------------------------------------------<br>• m3<br>• Liter<br>• US.Gal<br>• User unit, factory setting “Liter”<br>Press → key to transfer to format setting.<br>-------------------------------------------------------------------<br>Format setting<br>• Auto (exponent notation)<br>##.#######<br>#####.###<br>##.####<br>######.##<br>###.####<br>#######<br>Press → key to change to subfunction “DISP.LEVEL” |
| → DISP.LEVEL | Display measured (relative) level of fluid<br>• NO<br>• YES (cyclic change with display of measured values)<br>Press → key to change to subfunction “DISP. MSG.” |
| → DISP.MSG. | Additional messages desired during measuring mode?<br>• NO<br>• YES (cyclic change with display of measured values)<br>Press → key to return to Fct. 1.04 DISPLAY. |
| 1.05 | **CURRENT I** | Current output I<br>→ FUNCT. I | Selecting the current output I function<br>• OFF (switched off)<br>• + DIR.<br>• -DIR. (measurement in one flow direction only)<br>• 2 DIR. (forward/reverse flow, F/R mode)<br>Press → 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 $Q_{100\%}$ (only displayed when “2 DIR.” is selected)<br>• 100 PCT. (same as forward flow $Q_{100\%}$, see Sect. 1.01)<br>• PERCENT setting range: 0.05 – 150% of $Q_{100\%}$ (different value for reverse flow)<br>Press → key to change to numerical setting! |
### 1.06 PULS P

Pulse output P for electronic counters up to 10.000 pulses/s

#### → FUNCT. P

Selecting the function for pulse output P
- **OFF**
- **+ DIR.** (measuring in one flow direction only)
- **2 DIR.** (forward/reverse flow, F/R mode)

Press ↓ key to change to subfunction “SELECT P”.

#### → SELECT P

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

Press ↓ key to change to subfunction “PULSWIDTH”.

#### → PULSWIDTH

Selecting the pulse width
- 0.01 – 1.00 s (only for F<sub>max</sub> < 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 ↓ key to change to subfunction “VALUE P”.

#### → VALUE P

Setting the pulse value per unit time (only displayed when “PULSE/TIME” is selected)
- **xxxx PulS/Liter**
- **xxxx PulS/Liter user unit, factory setting “Liter” or “US Mgal” (see Fct. 3.05)**

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 ↓ key to return to Fct. 1.06 PULS P.

#### → VALUE P

Setting the pulse value per unit time (only displayed when “PULSE/TIME” is selected)
- **xxxx PulS/min**
- **xxxx PulS/hr**

Setting range “xxxx” depends on pulse width (see above).

Press ↓ key to return to Fct. 1.06 PULS P.

### 1.07 STATUS A1 or PULS2 A1

2nd pulse output A1 for electromechanical totalizers up to max. 50 pulses/s.

Connection of terminal A1 as a 2nd pulse output A1 or as status output A1, see Fct. 3.07 HARDWARE, “Terminal A1”

#### → FUNCT. P

Selecting the function for pulse output P
- **OFF**
- **+ DIR.** (measuring in one flow direction only)
- **2 DIR.** (forward/reverse flow, F/R mode)

Press ↓ key to change to subfunction “SELECT P”.

#### → SELECT P

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

Press ↓ key to change to subfunction “PULSWIDTH”.

#### → PULSWIDTH

Selecting the pulse width
- 0.01 – 1.00 s (only for F<sub>max</sub> < 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 ↓ key to change to subfunction “VALUE P”.

#### → VALUE P

Setting the pulse value per unit time (only displayed when “PULSE/TIME” is selected)
- **xxxx PulS/min**
- **xxxx PulS/hr**

Setting range “xxxx” depends on pulse width (see above).

Press ↓ key to return to Fct. 1.07 PULS2 A1.

### 1.07 STATUS A1

Status output A1 (terminal A1 connected as status or pulse output (P2) see Fct. 3.07 HARDWARE, “Terminal A1”)

### 1.08 STATUS A2

Status output A2

### 1.09 STATUS D1

Status output D1

### 1.10 STATUS D2

Status output D2
### Fct. 1.11 CONTROL C1 | Fct. 1.12 CONTROL C2

- **OFF**
- **INVERS D1** (inverse mode of D1 and D2)
- **INVERS A1** (inverse mode of A1 or A2 possible only if A1 is operated as status output, see Fct. 3.07 HARDWARE, “terminal A1”)
- **SIGN I, P or P2**
- **OVERFL. I, P or P2** (overloading the outputs)
- **EMPTY PIPE**
- **TRIP. POINT**
  - Press \(\text{\textregistered}\) key to change to character selection:
    - + DIR.
    - - DIR.
    - 2 DIR.
- **AUTO.RNG.** 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).
- **OUTP. HOLD**
- **OUTP. ZERO** (set outputs to “min. values”)
- **TOTAL.RESET** (reset the totalizer)
- **ERROR.RESET** (delete error messages)

### Fct. 2.0 TEST

#### 2.01 TEST Q
- **Test measuring range Q**
  - Precautionary query
  - **SURE NO** Press \(\text{\textregistered}\) key to return to Fct. 2.01 “TEST Q”.
  - **SURE YES** Press \(\text{\textregistered}\) key, then use \(\text{-}\) key to select value:
    - -110 / -100 / -50 / -10 / 0 / +10 / +50 / +100 / +110 PCT.
  - Displayed value is available at outputs I and P.

#### 2.02 HARDW. INFO
- **Hardware information and error status**
  - Before consulting factory, please note down all 8 codes.
  - \(\rightarrow\) **MODUL ADC**
    - X...X.X.X.X.X.X X.Y.Y.Y.Y.Y.Y.Y
    - Press \(\text{\textregistered}\) key to transfer to “MODUL IO”.
  - **MODUL IO**
    - X...X.X.X.X.X.X X.Y.Y.Y.Y.Y.Y.Y
    - Press \(\text{\textregistered}\) key to transfer to “MODUL DISP.”.
  - **MODUL DISP.**
    - X...X.X.X.X.X.X Y.Y.Y.Y.Y.Y.Y.Y
    - Press \(\text{\textregistered}\) key to transfer to “MODUL RS”.
  - **MODUL RS**
    - X...X.X.X.X.X.X Y.Y.Y.Y.Y.Y.Y.Y
    - Press \(\text{\textregistered}\) key to return to Fct. 2.02 “HARDW. INFO”.

#### 2.03 HARDW. TEST
- **Hardware test**
  - Precautionary query
  - **SURE NO** Press \(\text{\textregistered}\) key to return to Fct. 2.03 “HARDW. INFO”.
  - **SURE YES** Press \(\text{\textregistered}\) key to start test, duration approx. 60 s.
  - If errors are found, the first one is displayed. Press \(\text{\textregistered}\) key to display next error.
  - List of errors see Section 4.5.
- Press \(\text{\textregistered}\) key to return to Fct. 2.03 “HARDW. TEST”.

---

27
### 3.0 INSTALL.

#### 3.01 LANGUAGE
Select language for display texts
- **GB / USA (English)**
- **F (French)**
- **D (German)**

**Press \( \text{key} \) to return to Fct. 3.01 “LANGUAGE”**.

#### 3.02 FLOWMETER
Set data for primary head

**DIA METER**
Select size from meter size table
DN 2.5 – 3000 mm (1/10 – 120 inch)
Select with \( \text{key} \).

**Press \( \text{key} \) to change to subfunction “FULL SCALE”**.

**FULL SCALE**
Full-scale range for flow \( Q_{\text{MAX}} \).
To set, refer to Fct. 1.01 “FULL SCALE”.
**Press \( \text{key} \) to change to subfunction “FULL SCALE”**.

**GK VALUE**
Set primary constant \( Gk \)
See instrument nameplate of primary head.
Range:
- \( 1.0000 – 9.9999 \)

**Press \( \text{key} \) to change to subfunction “GK VALUE”**.

**FIELD FREQ.**
Magnetic field frequency
Values: 1/2, 1/6, 1/18 and 1/36 of power frequency, see instrument nameplate.
**Press \( \text{key} \) to change to subfunction “FIELD FREQ.”**.

**FLOW DIR.**
Define flow direction (in F/R mode: forward flow).
Set according to direction of arrow on primary head:
- \( + \ \text{DIR} \)
- \( - \ \text{DIR} \)
Select using \( \text{key} \).

**Press \( \text{key} \) 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:
- \( \text{CALIB. NO} \)
- \( \text{CALIB. YES} \)

**Press \( \text{key} \) to return to Fct. 3.03 “ZERO SET”**.

**STORE NO** do not store new zero value
**STORE YES** store new zero value
Select using \( \text{key} \).

**Press \( \text{key} \) to return to Fct. 3.03 “ZERO SET”**.

#### 3.04 ENTRY CODE
Entry code required to enter setting mode?
- **NO** entry with \( \rightarrow \ \text{key} \) only
- **YES** entry with \( \rightarrow \ \text{key} \) and Code 1: \( \rightarrow \rightarrow \rightarrow \leftarrow \leftarrow \leftarrow \uparrow \uparrow \uparrow \)

**Press \( \text{key} \) to return to Fct. 3.04 “ENTRY CODE”**.

#### 3.05 USER UNIT
Set any required unit for flow rate and counting

**TEXT VOL.**
Set text for required flow rate 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 \( \text{key} \) to transfer to subfunction “FACT. VOL.”**.

**FACT. VOL.**
Set conversion factor \( F_M \) for volume
Factory setting “1.00000 E+3” for “Liter” or “2.64172 E-4” for “US MGal” (exponent notation, here \( 10^3 \) or \( 2.64172 \times 10^{-4} \))
Factor \( F_M = \text{volume per 1}\ m^3 \).
Setting range
- \( 1.00000 \ E-9 \text{ to } 9.99999 \ E+9 \) (=10^{-9} to 10^{10})

**Press \( \text{key} \) to transfer to subfunction “FACT. VOL.”**.

**TEXT TIME**
Set text for any time (max. 3 characters)
Factory settings = “hr” (hours)
Characters which can be assigned to each place:
- A-Z, a-z, 0-9 or “-” (=blank character)

**Press \( \text{key} \) to transfer to subfunction “FACT. TIME”**.

**FACT. TIME**
Set conversion factor \( F_T \) for time
Factory setting “3.60000 E+3” for “hr” (exponent notation, here \( 3.6 \times 10^3 \)),
Set factor \( F_T \) in seconds.
Setting range
- \( 1.00000 \ E-9 \text{ to } 9.99999 \ E+9 \) (=10^{-9} to 10^{10})

**Press \( \text{key} \) to return to Fct. 3.05 “USER UNIT”**.

#### 3.06 APPLICAT.
Set modulation range of A/D converter

**FLOW**
- \( \text{STEADY} \) (150% of \( Q_{\text{MAX}} \))
- \( \text{PULSATING} \) (1000% of \( Q_{\text{MAX}} \))
For partly filled flowmeters, this option should always be set to “PULSATING”!
**Press \( \text{key} \) to change to subfunction “ADC GAIN”**.
ADC GAIN
Set gain of A/D converter
• AUTO • 10 • 30 • 100
Select with ↑ or ↓ key
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. 6.7.
• NO Press ↓ key to change to Fct. 3.06 “APPLICAT.”
• YES Press ↓ key to change to subfunction “LIMIT VAL.”

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 Q
See Fct. 3.02, subfunction “FULL SCALE”
Press ↓ key to change to subfunction “LIMIT CNT.”

LIMIT CNT.
Totalizer active when exceeding limit value
(see “LIMIT VAL.” above)
Setting range: 001-250
Press ↓ key to return to Fct. 3.06 “APPLICAT.”.

HARDWARE Determine hardware functions

TERMA1 Terminal A1
• PULSOUTP.
• STATUSOUTP.
Select with ↑ key.
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
For partly filled flowmeters this option must be set to “INTERNAL”!
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>
<tbody>
<tr>
<td>LINE INT.</td>
<td>Power failure Note: no counting during power failure</td>
<td>Cancel error in RESET/QUIT. menu. Reset totalizer if necessary.</td>
</tr>
<tr>
<td>OVERFLOW 1 or OVERFL. 12</td>
<td>Current output overranged. (flow rate &gt; measuring range)</td>
<td>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.</td>
</tr>
<tr>
<td>OVERFLOW P or OVERFL. P2</td>
<td>Pulse output P or Pulse output range P2 exceeded (flow rate &gt; modulation range)</td>
<td>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.</td>
</tr>
<tr>
<td>I SHORT or I2 SHORT</td>
<td>Current output I or I2 externally shorted or load &lt; 15 Ω.</td>
<td>Check mA loop and increase load using additional resistor if necessary. After increasing load, the error message is cancelled automatically.</td>
</tr>
<tr>
<td>I OPEN or I2 OPEN</td>
<td>mA loop interrupted by current output I or I2 or load &gt; 500 Ω.</td>
<td>Check mA loop and reduce load to 500 Ω if necessary. After reducing load, the error message is cancelled automatically.</td>
</tr>
<tr>
<td>TOTALIZER</td>
<td>Overflow of internal totalizer</td>
<td>Delete error message in RESET/QUIT menu, see sect. 4.6.</td>
</tr>
<tr>
<td>ADC</td>
<td>Analog/digital converter range exceeded</td>
<td>Set Fct. 3.06, subfunction ADC GAIN to “10”. See sections 6.4 and 6.7. If error message does not disappear, consult factory.</td>
</tr>
<tr>
<td>ADC-PARAM.</td>
<td>Check sum error</td>
<td>Replace ADC printed circuit board</td>
</tr>
</tbody>
</table>
### Hardware Errors

<table>
<thead>
<tr>
<th>Error Code</th>
<th>Description</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADC-HARDW.</td>
<td>Hardware error A/D converter</td>
<td>Replace ADC printed circuit board</td>
</tr>
<tr>
<td>ADC GAIN</td>
<td>Hardware error A/D converter</td>
<td>Replace ADC printed circuit board</td>
</tr>
<tr>
<td>FC-HARDW.</td>
<td>Hardware error on field current PCB</td>
<td>Replace field current PCB</td>
</tr>
<tr>
<td>FATAL.ERROR</td>
<td>Fatal error, measurement interrupted</td>
<td>Replace electronic unit or consult factory.</td>
</tr>
</tbody>
</table>

### 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 ↓ key 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 ↓ key 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>
5. Description of functions

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

**Fct. 1.01 FULL SCALE**

Press \(\uparrow\) key

Select unit for full-scale range \(Q_{100\%}\)
- \(\text{m}^3/\text{hr}\) (cubic meters per hour)
- \(\text{Liter/Sec}\) (liters per second)
- \(\text{US.Gal/min}\) (US gallons per minute)
- User-defined unit, factory setting = “\text{Liter/hr}\” (liters per hour) or “\text{US Mgal/day}\”， see sect. 5.14

Select with \(\uparrow\) and \(\downarrow\) keys.
Use \(\uparrow\) 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):

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

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

(refer to flow table in Section 10.1)

Change flashing number (cursor) with \(\uparrow\) and \(\downarrow\) keys.
Use \(\leftarrow\) and \(\rightarrow\) keys to shift cursor 1 place to left or right.
Flashing numbers (cursor) can also be directly set with the 10-key keyboard.
Press \(\downarrow\) key to return to Fct. 1.1 FULL SCALE

Please note that if “VALUE P” or “VALUE P2” is displayed after pressing \(\downarrow\) 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:

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

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

Change pulse value accordingly, see sect. 5.8 Pulse output P, Fct. 1.06 and/or 2nd pulse output A1, Fct. 1.07.

5.2 Time constant

**Fct. 1.02 TIMECONST.**

Press \(\uparrow\) key

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

Select with \(\uparrow\) and \(\downarrow\) keys.
Press \(\downarrow\) key to change to numerical setting, 1st number (cursor) flashes.

Set numerical value
- 0.2 – 99.9 s (seconds)

Change flashing number (cursor) with \(\uparrow\) and \(\downarrow\) keys.
Use \(\leftarrow\) and \(\rightarrow\) keys to shift cursor 1 place to left or right.
Flashing numbers (cursor) can also be directly set with the 10-key keyboard.
Press \(\downarrow\) 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 ↑ and ↓ keys (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 ↑ and ↓ keys.
Use ← and → keys to shift cursor 1 place to left or right.
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 flowrate, press → key.
• NO DISP no display
• m³/hr cubic meters per hour
• Liter/Sec liters per second
• US Gal/min US Gallons per minute
• User-defined unit, factory setting = “Liter/hr” (liters per hour) or “US Mgal/day”, see sect. 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. SUM (Σ) • ALL (sequential)
• - TOTAL. • +/- TOTAL.

Select with ↑ and ↓ keys.
Press ↓ key to change to display unit setting.
• m³ cubic meters
• Liter liters
• US.Gal US Gallons
• user-defined unit, factory setting = “Liter” (liters) or “US Mgal/day”, see sect. 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 change to subfunction “DISP.LEVEL.”.

→ DISP.LEVEL = measured relative level desired in measuring mode, press → key
• NO no display
• YES display measured relative height, 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 2.5.7 “Standard factory settings”

5.5 Internal electronic counter
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>inch</td>
<td>in m³</td>
</tr>
<tr>
<td>200</td>
<td>8</td>
<td>0 – 9 999 999.9999999</td>
</tr>
<tr>
<td>250 – 600</td>
<td>10 – 24</td>
<td>0 – 99 999 999.9999999</td>
</tr>
</tbody>
</table>

Only a 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 sect. 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 V DC (observe polarity)
Ri = approx. 15 Ω
I ≤ 100 mA

Connection diagrams, see sect. 2.5.6.

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 measurement in one direction, refer to selection of main flow direction in Fct. 3.02 FLOW METER, subfunction “FLOW DIR.”
• - DIR see “+ DIR”.
• 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.
Changing flashing number (cursor) with keys ↑ and ↓. Use ← and → keys to shift cursor 1 place to left or right.
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 fixed ranges
• mA any value: I_0%: 0 – 16 mA, I_{100%}: 4 – 20 mA
Note: value I_0% < I_{100%}!

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 the left or right.
Flashing numbers (cursor) can also be directly set with the 10-key keyboard.
Press ↓ key to change to subfunction “I ERROR”
\[ \text{ERROR} = \text{set error value}, \text{press} \rightarrow \text{key} \]

- **22 mA** fixed value
- **0.0 \text{ to } 1.0\% \text{ mA}** variable value, only variable when \( I_{0\%} \geq 1 \text{ mA} \), see “RANGE I” above

Select with \( \uparrow \) and \( \downarrow \) keys.

Change flashing number (cursor) with keys \( \uparrow \) and \( \downarrow \). Use \( \leftarrow \rightarrow \text{keys} \) to shift cursor 1 place to the left or right. Flashing numbers (cursor) can also be directly set with the 10-key keyboard.

Press \( \downarrow \) key to return to Fct. 1.05 CUR. OUTP. 1

---

**Please refer to sect. 2.5.7 “Standard factory settings”**

Refer to sect. 2.5.6 for connection diagrams and to sect. 5.16 for characteristics.

### 5.8 Pulse outputs P and A1

<table>
<thead>
<tr>
<th>To be used for ...</th>
<th>Pulse output P</th>
<th>2nd pulse output A1</th>
</tr>
</thead>
<tbody>
<tr>
<td>...</td>
<td>electronic totalizer</td>
<td>electromechanical or electronic totalizer</td>
</tr>
</tbody>
</table>

**Terminals**

- P and P
- A1 and A

**\( \text{F}_{\text{max}} \) at full-scale range \( Q_{100\%} \)**

- 10,000 pulses/s
- 50 pulses/s

**\( \text{F}_{\text{min}} \) at full-scale range \( Q_{100\%} \)**

- 10 pulses/hr
- 10 pulses/hr

Max. switching current

- 30 mA (AC or DC)
- 200 mA (DC polarized)

**Remark**

- “PULSOUTP.” must be selected in Fct. 3.07 HARDWARE, subfunction “Terminal A1”

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

Press \( \rightarrow \text{key} \) and/or Press \( \rightarrow \text{key} \)

**\( \rightarrow \text{FUNCT. P} = \text{select function for pulse output}, \text{press} \rightarrow \text{key} \)**

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

Select with \( \uparrow \text{ and } \downarrow \text{ keys} \).

Press \( \downarrow \text{ key to change to subfunction “SELECT P”} \).

**Exception:** when “OFF” is selected, return to Fct. 1.06 PULS P or Fct. 1.07 PULS2 A1.

**\( \rightarrow \text{SELECT P} = \text{select pulse type}, \text{press} \rightarrow \text{key} \)**

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

Select with \( \uparrow \text{ and } \downarrow \text{ keys} \).

Press \( \downarrow \text{ key to change to subfunction “PULSWIDTH”} \).
→ **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 s.

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 left or right.
Flashing numbers 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/liter
- PulS/US.Gal
- PulS/user-defined unit, factory setting = “Liter” or “US Mgal/day”, see sect.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:
  \[ P_{\text{min}} = \frac{F_{\text{min}}}{Q_{100\%}} \quad P_{\text{max}} = \frac{F_{\text{max}}}{Q_{100\%}} \]

Change flashing number (cursor) with keys ↑ and ↓. Use ← and → keys to shift cursor 1 place to left or right.
Flashing numbers 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 P2** = 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/hr
- XXXX PulSe/user-defined unit, factory setting = “hr” or “day”, see sect. 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 left or right.
Flashing numbers 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 2.5.7 “Standard factory settings”.

Refer to sect. 2.5.6 for connection diagrams and to sect. 5.16 for characteristics.
### 5.9 Status outputs A1 / A2 and D1 / D2

**PLEASE NOTE:**
Connection diagrams see sect. 2.5.6.

<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.</td>
<td>1.07</td>
<td>1.08</td>
<td>1.09</td>
<td>1.10</td>
</tr>
<tr>
<td>then press → key</td>
<td></td>
<td></td>
<td></td>
<td></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 or DC)</td>
<td>100 mA (AC or DC)</td>
<td>100 mA (AC or DC)</td>
</tr>
</tbody>
</table>

**Remark**
“STATUSOUTP.” must be selected in Fct. 3.07 HARDWARE, subfunction “TERMINALS”.

**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
- **SIGN P/P2** F/R mode
- **OVERFL. I** Exceeding output ranges
- **OVERFL. P/P2** Exceeding output ranges
- **INVERS. A1** 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. D1** switches output D2 inverse to D1. D1 and D2 then operate as change-over elements with common centre grounding contact D⊥.
- **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 ratio, 1:20 to 1:25, value must be higher than that of Fct. 1.03 L.F. CUTOFF).
- **FULL SCALE**

Select flow direction (characteristic) for full-scale range

- + DIR.
- - DIR.
- 2 DIR.

Define full-scale range

<table>
<thead>
<tr>
<th>XXX</th>
<th>YYY</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-150%</td>
<td>0-150%</td>
</tr>
</tbody>
</table>

- 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 left or right. Flashing numbers can also be directly set with the 10-key keyboard.

Press ↓ key to return to Fct. 1.07, 1.08, 1.09 and 1.10 for status outputs A1, A2, D1 and D2.
### Characteristic of status outputs

<table>
<thead>
<tr>
<th></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. (automatic 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>current 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 ERRORS</td>
<td>error</td>
<td>no error</td>
</tr>
<tr>
<td>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 sect. 2.5.7.

#### 5.10 Control inputs C1 and C2

**Fct. 1.11 CONTROL C1**

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

- • OFF  switched off, no function
- • OUTP. HOLD  hold output values  Function also acts on display and totalizer
- • OUTP. ZERO  set outputs to “min. values”  Function also acts on display and totalizer
- • TOTAL. RESET  reset totalizer
- • ERROR. RESET  acknowledge/delete error messages
- • EXT. RNG.  external range change for automatic range change, see sect. 5.20.  
  Settling range 5 – 80 PERCENT = low to high ratio 1:20 to 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 left or right. Flashing numbers 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 sect. 2.5.7 for factory settings.

**Connection diagram see sect. 2.5.6.**

#### 5.11 Language

**Fct. 3.01 LANGUAGE**

Press → key

Select language for texts in display

- • D  German
- • GB/USA  English
- • F  French
Select with ↑ and ↓ keys.
Press ↓ key to return to Fct. 3.01 LANGUAGE.

<table>
<thead>
<tr>
<th>5.12</th>
<th>Entry code</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fct. 3.04 ENTRY CODE</strong></td>
<td></td>
</tr>
</tbody>
</table>
| *Press → key*

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

Select with ↑ and ↓ keys.
Press ↓ key to return to Fct. 3.04 ENTRY CODE.

<table>
<thead>
<tr>
<th>5.13</th>
<th>Primary head</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fct. 3.02 FLOW METER</strong></td>
<td></td>
</tr>
</tbody>
</table>
| *Press → key*

→ **DIAMETER** = set meter size (see instrument nameplate), *press → key*
Select size from table of meter sizes:
DN 2.5 – 3000 equivalent to 1/10 – 120 inch

Select with ↑ and ↓ keys.
Press ↓ key to change to subfunction “FULL SCALE”.

→ **FULL SCALE** = set full scale range, *press → key*
Set as described in sect. 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 sect. 5.08 Pulse output P, Fct. 106 and/or 2nd pulse output A1, Fct. 1.07.

→ **GK VALUE** = set primary head 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 left or right. Flashing numbers 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** (1/2, 1/6, 1/18 or 1/36 of power frequency, see instrument nameplate,
- **1/18** do not change setting.

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 supply)
  • 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 primary head;
  • - DIR. F/R mode: identification of “positive” flow direction

Select with ↑ and ↓ keys.
*Press ↓ key to return to Fct. 3.02 FLOWMETER.*

**Zero check**, see Fct. 3.03 and sect. 7.1.

---

**Please refer to sect. 2.5.7 “Standard 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 left or right.*
*Flashing numbers can also be directly set with the 10-key keyboard.*
*Press ↓ key to change to subfunction “FACT. VOL.”.*

→ **FACT. VOL.** = set factor F_M for volume, press → key
  • 1.00000 E+3 factory setting “1000” / Factor F_M = volume per 1 m^3.
    Setting range: 1.00000 E-9 to 9.99999 E+9 (=10^-9 to 10^10)

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

→ **TEXT TIME** = set text for required time, press → key
  • hr max. 3 places, factory setting = “hr” 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 left or right.*
*Flashing numbers can also be directly set with the 10-key keyboard.*
*Press ↓ key to change to subfunction “FACT. TIME”.*

→ **FACT. TIME.** = set factor F_T for time, press → key
  • 3.60000 E+3 factory setting “3600” / set factor F_T in seconds.
    Setting range: 1.00000 E-9 to 9.99999 E+9 (=10^-9 to 10^10)

*Change flashing number (cursor) with keys ↑ and ↓. Use ← and → keys to shift cursor 1 place to left or right.*
*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 $F_M$

<table>
<thead>
<tr>
<th>Volumetric unit</th>
<th>TEXT VOL.</th>
<th>Factor $F_M$</th>
<th>Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cubic meters</td>
<td>$m^3$</td>
<td>1.0</td>
<td>$1.00000 \times 10^0$</td>
</tr>
<tr>
<td>Liter</td>
<td>Liter</td>
<td>1000</td>
<td>$1.00000 \times 10^3$</td>
</tr>
<tr>
<td>Hectoliters</td>
<td>h Lit</td>
<td>10</td>
<td>$1.00000 \times 10^1$</td>
</tr>
<tr>
<td>Deciliters</td>
<td>d Lit</td>
<td>10000</td>
<td>$1.00000 \times 10^4$</td>
</tr>
<tr>
<td>Centiliters</td>
<td>c Lit</td>
<td>100000</td>
<td>$1.00000 \times 10^5$</td>
</tr>
<tr>
<td>Milliliters</td>
<td>m Lit</td>
<td>1000000</td>
<td>$1.00000 \times 10^6$</td>
</tr>
<tr>
<td>US gallons</td>
<td>USGal</td>
<td>264.172</td>
<td>$2.64172 \times 10^2$</td>
</tr>
<tr>
<td>Millions US gallons</td>
<td>USMG</td>
<td>0.0000264172</td>
<td>$2.64172 \times 10^{-4}$</td>
</tr>
<tr>
<td>Imperial gallons</td>
<td>GBGal</td>
<td>219.969</td>
<td>$2.19969 \times 10^2$</td>
</tr>
<tr>
<td>Mega imperial gallons</td>
<td>GBMG</td>
<td>0.0000219969</td>
<td>$2.19969 \times 10^{-4}$</td>
</tr>
<tr>
<td>Cubic feet</td>
<td>Feet3</td>
<td>35.3146</td>
<td>$3.53146 \times 10^1$</td>
</tr>
<tr>
<td>Cubic inches</td>
<td>inch3</td>
<td>61024</td>
<td>$6.10240 \times 10^4$</td>
</tr>
<tr>
<td>US barrels liquid</td>
<td>US BaL</td>
<td>8.36364</td>
<td>$8.38364 \times 10^1$</td>
</tr>
<tr>
<td>US barrels ounces</td>
<td>USBaO</td>
<td>33813.5</td>
<td>$3.38135 \times 10^4$</td>
</tr>
</tbody>
</table>

### Factors for time $F_T$

<table>
<thead>
<tr>
<th>Time unit</th>
<th>TEXT TIME</th>
<th>Factor $F_T$</th>
<th>Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seconds</td>
<td>sec</td>
<td>1</td>
<td>$1.00000 \times 10^0$</td>
</tr>
<tr>
<td>Minutes</td>
<td>min</td>
<td>60</td>
<td>$6.00000 \times 10^1$</td>
</tr>
<tr>
<td>Hours</td>
<td>hr</td>
<td>3600</td>
<td>$3.60000 \times 10^3$</td>
</tr>
<tr>
<td>Day</td>
<td>DAY</td>
<td>86400</td>
<td>$8.64000 \times 10^4$</td>
</tr>
<tr>
<td>Year</td>
<td>YR</td>
<td>31536000</td>
<td>$3.15360 \times 10^7$</td>
</tr>
</tbody>
</table>

#### 5.15 F/R mode, forward/reverse flow measurement

- **Refer to Section 2.5.6 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 primary head.
  - “-” 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 behavior of outputs in case of “SIGN I, P or P2” see Section 5.9.
- **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

I current output
I_0% 0 or 4 mA
I_100% 20 mA

P pulse outputs P and A1 (P2)
P_100% pulses at Q_100%, full-scale range

Q_F 1 flow direction, forward flow in F/R mode
Q_R reverse flow in F/R mode
Q_100% full-scale range

S Status outputs A1, A2, D1 and D2

— switch open
— switch closed

1 flow direction

2 flow directions

\[ I(%) = \frac{Q}{Q_{max}} \times 100 \]

\[ P(%) = \frac{Q}{Q_{max}} \times 100 \]

\[ S(%) = \frac{Q}{Q_{max}} \times 100 \]
5.17 Applications

Fct. 3.06 APPLICAT.
Press → key twice

Set flow characteristics, select with ↑ or ↓ keys
- STEADY steady flow
- PULSATING pulsating flow, standard setting for Tidalflux applications. Do not change this setting!

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 sect. 6.6.

5.18 Hardware settings

Fct. 3.07 HARDWARE
Press → key

→ TERM. A1 = define function of terminal A1, press → key
- PULSOUTP. = puls output
- STATUSOUTP. = status output
Select with ↑ or ↓ keys, press ↓ key to change to “SELFCHECK”.

→ SELFCHECK = carry out self check during measurement?, press → key
- NO
- YES
Select with ↑ or ↓ keys. What is checked?
   a) ADC gain and other parameters are continuously checked for their permissible values and deviations.
   b) Field current supply is checked for impermissible 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 sect. 4.6), the tests described in a) and b) above are re-started. Test duration 4 to 20 minutes.

Press ↓ key to change to “FIELDCUR.”.

→ FIELDCUR. = Select field current supply, press → key
- INTERNAL
- EXTERNAL
For this type of flowmeters this option should always be set to “INTERNAL”.
Select with ↑ or ↓ keys.
Press ↓ key to return to Fct. 3.07 “HARDWARE”.

43
5.19  Limit switches

Fct. 1.07 – 1.10 Status outputs A1, A2, D1 and D2
(Define operating mode of output terminals A1, see sect. 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 option flow direction:

Select:
• + DIR.
• - DIR.
• 2 DIR.

Select with ↑ or ↓ keys, press ↓ key to confirm and 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 left or to right.

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 behavior (NO / NC contact) and hysteresis are adjustable

Normally Open (NO) contact
XXX value > YYY value
Switch closes when flow exceeds XXX value

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

Normally Closed (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 signaled.

5.20  Range change

Automatic range change by status output

Fct. 1.07 – 1.10 Status outputs A1, A2, D1 and 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 left or to right. 
Flashing numbers (cursor) can also be directly set with the 10-key keyboard.

Setting range:  5 – 80 PERCENT of Q100% (=low to high range ratio 1:20 to 1:1.25)
Press \( \downarrow \) 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 \( \rightarrow \) key*

*Press \( \uparrow \) key as often as required to set one of the control inputs C1 or C2 to range change “EXT. RNG.”.

*Press \( \downarrow \) key to change to numerical setting, 1st number (cursor) flashes. Change flashing number (cursor) with keys \( \uparrow \) and \( \downarrow \). Use \( \leftarrow \) and \( \rightarrow \) keys to shift cursor 1 place to left or to right. Flashing numbers (cursor) can also be directly set with the 10-key keyboard.*

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

*Press \( \downarrow \) key to return to Fct. 1.11 or 1.12, control inputs C1 or C2.*
Part C  Special Applications, Functional Checks, Service and Order Numbers

6. Special applications

6.1 Use in hazardous areas

The IFS 4000 PF can optionally be delivered with a factory-supplied certificate for Eex zone 2 or Eex N. The signal converter IFC 110 PF must always be installed outside the hazardous area. Installation must proceed according to Eex standards.

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 sect. 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 color 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 housing.
5) Put down the electronic unit with the front panel facing down.
6) Unscrew the $S_{LP}$ screw from the I/O printed circuit board (inputs/outputs) and carefully pull the PCB out of the plug base (see illustration in sect. 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 in sect. 8.3).
8) Re-assemble in reverse order (items 6 to 1).

6.4 RS 232 adapter incl. CONFIG software (optional)

An RS 232 adapter including CONFIG 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 sect. 4.2).

6.5 Pulsating flow

For Tidalflux applications, this function (Fct.3.06 APPLICAT.) should always be put on the “pulsating” option.

6.6 Unstable display and outputs

Unstable displays and outputs may occur:
- with high amounts of solids
- with inhomogenities
- with badly blended mixtures
- after constant chemical reactions in the process liquid
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
and
OVERFL. LP and/or P2 = one or several output ranges exceeded

<table>
<thead>
<tr>
<th>Change procedure A</th>
</tr>
</thead>
<tbody>
<tr>
<td>PLEASE NOTE:</td>
</tr>
<tr>
<td>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.</td>
</tr>
<tr>
<td>• Fct. 1.02 TIMECONST. (change time constant)</td>
</tr>
<tr>
<td>- Set to “ONLY 1”; set to “ALL” when pulse output is also unsteady.</td>
</tr>
<tr>
<td>- Set time constant to approx. 20 seconds, check if display remains unsteady and correct if necessary.</td>
</tr>
<tr>
<td>• Fct. 3.06 APPLICAT.</td>
</tr>
<tr>
<td>- Check if setting in subfunction “FLOW” is “PULSATING.”</td>
</tr>
<tr>
<td>- When the green LED and red LED continue to flash, change the setting of subfunction “ADC GAIN” to “30”. Should the green LED and the red LED continue to flash frequently, set value to “10”.</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Change procedure B</th>
</tr>
</thead>
<tbody>
<tr>
<td>PLEASE NOTE:</td>
</tr>
<tr>
<td>Do not proceed according to change procedure B unless the steps of change procedure A proved unsuccessful.</td>
</tr>
<tr>
<td>The following settings result in a modified dynamic behavior of the system which is no longer defined by the setting of the time constant in Fct. 1.02.</td>
</tr>
<tr>
<td>• Fct. 1.02 TIMECONST.</td>
</tr>
<tr>
<td>Change setting to 3 seconds.</td>
</tr>
<tr>
<td>• Fct. 3.06 APPLICAT.</td>
</tr>
<tr>
<td>- Select “YES” in subfunction “SPEC. FILT.” to activate a special noise filter.</td>
</tr>
<tr>
<td>- 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 Q100% 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: full-scale range Q100% 500 m³/hr ripple mean value ± 25 m³/hr = ± 5% of full-scale range Q100% set amplitude to e.g., ± 2% 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… ΔQmax / ΔT [% / s] = LIMIT VAL. / TIMECONST. (Fct. 1.02) formula applying to the above example: ΔQmax / ΔT [% / s] = 2 % / 3 s = 0.66 % / s. The delay required for passing on major changes of flow to the display and outputs is defined in subfunction “LIMIT CNT.”.</td>
</tr>
</tbody>
</table>
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 x line frequency, see Fct. 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 Stable signal outputs with empty measuring tube

All output signals (including display) will be stable (0%) when the level is lower than 10% of the inner diameter.
7. Functional checks

7.1 Checking the zero with IFC 110 PF 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 at least 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>CALIB. YES</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>- - - - - -</td>
<td>- - - - / - -</td>
</tr>
</tbody>
</table>

If “YES” is selected in Fct. 3.04 ENTRY CODE key in 9-stroke CODE 1 now: → → ↓ ↓ ↑ ↑ ↑ ↑. 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.

STORE NO If new value is not to be stored, press ↓ key (3 times) (4 times = return to measuring mode).
STORE YES Store new zero value

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 Q100%
  (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>SURE YES</td>
</tr>
<tr>
<td>↓</td>
<td>0</td>
<td>PCT.</td>
</tr>
<tr>
<td>↑</td>
<td>± 10</td>
<td>PCT.</td>
</tr>
<tr>
<td>↑</td>
<td>± 50</td>
<td>PCT.</td>
</tr>
<tr>
<td>↑</td>
<td>± 100</td>
<td>PCT.</td>
</tr>
<tr>
<td>↑</td>
<td>± 110</td>
<td>PCT.</td>
</tr>
<tr>
<td>↓</td>
<td>Fct. 2.01</td>
<td>TEST Q</td>
</tr>
<tr>
<td>(2x) 3x ↓</td>
<td>- - - - - -</td>
<td>- - - - / - -</td>
</tr>
</tbody>
</table>

End of test, actual measured values again available at outputs Back to measuring mode

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 4 “windows”. These 8 status codes
allow your flowmeter to be subjected to a simple and rapid diagnosis.

• 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>
</tbody>
</table>

→ tot MODUL ADC - - - - - - 1st window

↓ → MODUL I/O - - - - - - 2nd window

Example for status code:
3.25105.02 (8-character code, 1st line)

↓ → MODUL DISP. - - - - - - 3rd window

3A47F01DB1 (10-character code, 2nd line)

↓ → MODUL RS - - - - - - 4th window

PLEASE NOTE DOWN ALL 8 STATUS CODES!

In “MODUL RS” there are a few possible “error codes” that can possibly be solved by the customer. Therefore the 10-character status code (2nd line) must be used:

10-character code: 9 8 7 6 5 4 3 2 1 0

### Errors regarding partly filled situations

<table>
<thead>
<tr>
<th>Errors regarding partly filled situations</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipe less than 10% filled (see note 1)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Error in IFS 4000 PF primary head (see note 2)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parity error in communication between primary head and signal converter (see note 3)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Timeout error in communication between primary head and signal converter (see note 4)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**note 1:** The level in the measuring tube is too low. Flow indication will be turned off (0 %). Please take precautions to ensure that the level is increased above 10 percent to make flow measuring possible again

**note 2:** There are one or more errors in the primary head electronics. See sect. 7.6

**note 3:** Communication between the primary head (IFS 4000 PF) and the signal converter (IFC 110 PF) is not valid. Please check that the data cable is connected according to sect. 1.5.6.

**note 4:** There is no communication between the primary head (IFS 4000 PF) and the signal converter (IFC 110 PF). The displayed value is being calculated assuming a fully filled pipe. In most cases (pipeline not fully filled), the displayed value will be too high. Check the connections of the communication cable, see also sect. 1.5.6.

**Example:** If in “modul RS” of the hardware info menu the 10-digits code is given as “0001272292” the “character 6”-value is “1”. In the table you can then see that the pipe is less than 10% filled.
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 test 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>2x ↑</td>
<td>Fct. 2.03</td>
<td>Hardware test</td>
</tr>
<tr>
<td>→</td>
<td></td>
<td>if “YES” is selected in Fct. 3.04 ENTRY CODE, key in 9-stroke CODE 1 now: → → ↓ ↓ ↑ ↑ ↑.</td>
</tr>
<tr>
<td>↑</td>
<td></td>
<td>Hardware test in progress, duration approx. 60 seconds</td>
</tr>
<tr>
<td>↓</td>
<td></td>
<td>1st error</td>
</tr>
<tr>
<td>↑</td>
<td></td>
<td>2nd error</td>
</tr>
<tr>
<td>↑</td>
<td></td>
<td>3rd error</td>
</tr>
<tr>
<td>(2x) 3x ↓</td>
<td>Fct. 2.03</td>
<td>Terminate hardware test</td>
</tr>
<tr>
<td></td>
<td></td>
<td>back to measuring mode</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.

<table>
<thead>
<tr>
<th>Group LED</th>
<th>Display</th>
<th>Cause</th>
<th>Remedial action</th>
</tr>
</thead>
</table>
| LED 1     | Both LED’s flash| A/D converter range exceeded| • Check if setting in Fct. 3.06 (menu “FLOW”) is “PULSATING”.
<p>|           |                 |                              | • Reduce flow rate; if unsuccessful, test as described in sect. 7.6. |
|           |                 | Level too low in measuring tube | Fill measuring tube up to at least 10 percent, see also sect. 7.3. |
|           |                 | Problems in primary head     | • No communication between primary head IFS 4000 PF and signal converter IFC 110 PF, check data cable according to sect. 1.5.6. |
|           |                 |                              | • General failure in primary head, see sect. 7.6. |</p>
<table>
<thead>
<tr>
<th>LED 2</th>
<th>Red LED flashes</th>
<th>Fatal error, hardware and/or software fault</th>
<th>Replace signal converter, see sect. 8.3</th>
</tr>
</thead>
<tbody>
<tr>
<td>LED 3</td>
<td>Cyclic flashing of red LED, approx. 1 sec.</td>
<td>Hardware fault</td>
<td>Replace signal converter, see sect. 8.3</td>
</tr>
<tr>
<td>LED 4</td>
<td>Red LED on continuously</td>
<td>Hardware fault</td>
<td>Replace signal converter, see sect. 8.3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group D</th>
<th>Display</th>
<th>Cause</th>
<th>Remedial action</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1</td>
<td>LINE INT.</td>
<td>Power failure</td>
<td>Delete error message in RESET/QUIT menu, reset totalizer if necessary.</td>
</tr>
<tr>
<td>D2</td>
<td>OVERFL. I</td>
<td>Current output range exceeded</td>
<td>Check instrument parameters and correct if necessary. Reset totalizer. Error message is deleted automatically after cause has been eliminated.</td>
</tr>
<tr>
<td>D3</td>
<td>OVERFL. P</td>
<td>Pulse output range exceeded</td>
<td>Check instrument parameters and correct if necessary. Reset totalizer. Error message is deleted automatically after cause has been eliminated.</td>
</tr>
<tr>
<td>D4</td>
<td>ADW</td>
<td>A/D converter range exceeded</td>
<td>Error message is deleted automatically after cause has been eliminated.</td>
</tr>
<tr>
<td>D5</td>
<td>FATAL.ERROR</td>
<td>Fatal error, all outputs are set to “min” values</td>
<td>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.</td>
</tr>
<tr>
<td>D6</td>
<td>TOTALIZER</td>
<td>Counts lost (overflow, data error)</td>
<td>Delete error message in RESET/QUIT menu.</td>
</tr>
<tr>
<td>D7</td>
<td>I SHORT</td>
<td>Short circuit at current output</td>
<td>Check electrical connection acc. to Sect. 2.2 and correct if necessary. Load $\geq 15 \Omega$!</td>
</tr>
<tr>
<td>D8</td>
<td>I OPEN</td>
<td>Open current output</td>
<td>Provide load $\leq 500 \Omega$!</td>
</tr>
<tr>
<td>D9</td>
<td>ADC PARAM.</td>
<td>Fault detected on the ADC printed circuit</td>
<td>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.</td>
</tr>
<tr>
<td>D10</td>
<td>ADC HARDW.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D11</td>
<td>ADC GAIN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D12</td>
<td>STARTUP, cyclic flashing</td>
<td>Hardware fault</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>D13</td>
<td>BUSY</td>
<td>Displays for flow, totalizers and messages disabled</td>
<td>Change setting in Fct. 1.4</td>
</tr>
<tr>
<td>D14</td>
<td>unsteady display</td>
<td>Low electrical conductivity, high solids content, pulsating flow</td>
<td>Increase time constant in Fct. 1.2</td>
</tr>
<tr>
<td>D15</td>
<td>No display</td>
<td>Power supply OFF</td>
<td>Switch on power supply.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Check power supply fuse F7 (F1 and possibly F2 for DC versions) in terminal compartment</td>
<td>Replace if blown, see sect. 8.1</td>
</tr>
<tr>
<td>Group</td>
<td>Faults / Symptoms</td>
<td>Cause</td>
<td>Remedial action</td>
</tr>
<tr>
<td>-------</td>
<td>-------------------</td>
<td>-------</td>
<td>----------------</td>
</tr>
</tbody>
</table>
| **I1** | Receiver instrument indicates “0”.  
Invoke test function 2.03 for analysis see Sect. 7.4 | Display shows… | Eliminate short circuit, load must be $\geq 15 \Omega$! |
<p>|  |  | <strong>I SHORT</strong> | Current output shorted, load $&lt; 15 \Omega$ |
|  |  | <strong>I OPEN</strong> | Load $&gt; 500 \Omega$ |
| <strong>No information displayed after test</strong> | as described for faults I2 and I9 | |
| <strong>I2</strong> | Receiver instrument indicates “0”. | Wrong connection / polarity | Connect properly, see sect. 2.5.2 and 2.5.6. |
|  |  | Defective circuit and/or receiver instrument | Check circuit and receiver instrument at $I^+ / I^-$ and replace if necessary. Check fuse F9 on I/O PCB and replace if necessary, see sect. 8.4 and 8.5. |
|  |  | 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. |
| <strong>I3</strong> | 22 mA are available at current output (fault current) | Range of current output I is exceeded | Check instrument parameters and correct if necessary (see sect. 2.5.2 and 5.7) or consult Krohne Service, having first noted down hardware information and error status, see sect. 7.3, Fct. 2.02. |
| <strong>I4</strong> | 22 mA are available at current output (fault current) and red LED flashes | Fatal error | Replace signal converter or consult Krohne Service, having first noted down hardware information and error status, see sect. 7.3, Fct. 2.02. |
| <strong>I5</strong> | Unsteady display | Electric conductivity of process liquid to low | Increase time constant (see sect. 5.2, Fct.1.2). Also refer to sect. 6.7. |
| <strong>I6</strong> | Receiver instrument indicates “constant value” | Control input C1 or C2 is set to “Hold outputs” and is activated | Change setting (see sect. 5.10, Fct. 1.11 and 1.12), or deactivate control input. |
| <strong>I7</strong> | Jumping current values | Current output is set to automatic range change | Change hysteresis or tripping ranges, see sect. 5.19. |
| <strong>I8</strong> | F/R mode: different displays for identical flow volumes in both directions | Different range set for “forward flow” and “reverse flow” | Change setting, see sect. 5.15, Fct. 1.05 “Rev. range”. |
| <strong>I9</strong> | Receiver instruments indicates “min. values”. | Control input C1 or C2 is set to “Zero outputs” or “Hold outputs” and is activated | Change setting (see sect. 5.10, Fct. 1.11 and 1.12) or deactivate control input. |</p>
<table>
<thead>
<tr>
<th>Group P</th>
<th>Faults / Symptoms</th>
<th>Cause</th>
<th>Remedial action</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>Totalizer connected but does not count pulses</td>
<td>Wrong connection / polarity</td>
<td>Connect properly, see sect. 2.5.3 and 2.5.6, note recommended resistances !</td>
</tr>
<tr>
<td></td>
<td>Totalizer or external voltage source defective</td>
<td>Check connections, totalizer and external voltage source and replace if necessary.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Internal power supply (E+ E-) is voltage source, shorted or defective pulse output</td>
<td>Check connections and cables, see sect. 2.5.3 and 2.5.6. Voltage between E+ and E- approx. 24 V. If voltage is a lot smaller, switch off the instrument, eliminate the short circuit and replace fuses F1 and F8 on the I/O PCB if necessary. Switch the instrument back on. If it still does not operate, pulse output is defective. Replace I/O PCB or complete electronic unit, see sect. 8.3 and/or 8.4.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pulse output switched off or wrong flow direction setting</td>
<td>Switch on pulse output and change flow, see sect. 5.8 and 5.13, Fct. 1.06 (P), 1.07 (A1) and 3.02.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fatal error, red LED is on</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>
<td></td>
</tr>
<tr>
<td></td>
<td>Control input C1 or C2 is set to “Zero outputs” and is activated</td>
<td>Change settings, see sect. 5.10, Fct. 1.11 and 1.12 or deactivate control input.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>These causes only apply to the 2nd pulse output P2, terminal A1 !</td>
<td>Terminals A1 and A⊥ are not defined as a 2nd pulse output</td>
<td>Switch on in Fct. 3.07 and set in Fct. 1.07.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Resistance of totalizer too low for DC operation, I &gt; 100 mA.</td>
<td>Re-position jumper X4 on I/O PCB to suit DC operation, see sect. 6.3.</td>
</tr>
<tr>
<td>P2</td>
<td>Constant output of totalizer pulses</td>
<td>Control input C1 or C2 is set to “Hold outputs” 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>P3</td>
<td>Unsteady pulse rate</td>
<td>Electrical conductivity of process liquid is too low</td>
<td>Increase time constant (see Sect. 6.5-6.7) or consult Krohne Service.</td>
</tr>
<tr>
<td>P4</td>
<td>Pulse rate too high or too low</td>
<td>Incorrect pulse output settings</td>
<td>Correct settings in Fct. 1.06 (P) or 1.07 (A1).</td>
</tr>
</tbody>
</table>
### Group S

<table>
<thead>
<tr>
<th>Faults / Symptoms</th>
<th>Cause</th>
<th>Remedial action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Defective signaling instrument(s) or external voltage source</td>
<td>Check signaling instrument(s) or external voltage source and replace if necessary.</td>
<td></td>
</tr>
<tr>
<td>Internal power supply (E+/E-) is voltage source shorted one or several pulse outputs defective</td>
<td>Check connections and cables, change if necessary (see sect. 2.5.6). Voltage between E+ and E- approx. 24 V. Check fuse F8 on the I/O PCB and replace if necessary (see sect. 8.5). If instrument still does not operate check fuses F_ on the I/O PCB for the status outputs and replace if necessary: F2 for terminals A1 and A⊥ F3 for terminals A2 and A⊥ F4 for terminals D1 and D⊥ F5 for terminals D2 and D⊥ If it still does not operate, one or several pulse outputs are defective.</td>
<td></td>
</tr>
<tr>
<td>Control inputs C1 and C2 are set to “Hold outputs” or to “0”.</td>
<td>Replace I/O PCB, see sect. 8.4, change setting, see sect. 4.4 and 5.10, Fct. 1.11 and 1.12.</td>
<td></td>
</tr>
<tr>
<td>“All Error” or “Fatal Error” settings</td>
<td>Check settings in Fct. 1.07-1.10 and change if necessary, see sect. 4.4 and 5.9.</td>
<td></td>
</tr>
<tr>
<td>Terminal “A1” not defined as status output</td>
<td>Adjust in Fct. 3.07.</td>
<td></td>
</tr>
<tr>
<td>Wrong connection/polarity</td>
<td>Observe polarity for driver capacity 0.1 &lt; I £ 0.2 A see sect. 6.3. A1 = “+” and A⊥ = “-“</td>
<td></td>
</tr>
</tbody>
</table>

### Group C

<table>
<thead>
<tr>
<th>Faults / Symptoms</th>
<th>Cause</th>
<th>Remedial action</th>
</tr>
</thead>
<tbody>
<tr>
<td>No function of control inputs</td>
<td>Wrong connection</td>
<td>Connect properly, see sect. 2.5.5 and 2.5.6.</td>
</tr>
<tr>
<td>Defective control input C or voltage source (internal or external)</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>
<td></td>
</tr>
<tr>
<td>Wrong setting of control inputs</td>
<td>Change setting, see sect. 4.4 and 5.10.</td>
<td></td>
</tr>
</tbody>
</table>
7.6 Checking the primary head

Since the primary head consists of two “separated” parts (velocity measurement and level measurement), the checking is separated in two parts.

If you encounter problems with the level meter, see section 7.6.1, in case of problems with the velocity measurement see section 7.6.2.

7.6.1 Checking the level meter

• Most faults concerning the level meter of the flowmeter can be eliminated by following the instructions in the following tables.

Note: please make sure that the level indication is turned on in Fct. 1.04 as described in sect. 5.4.

<table>
<thead>
<tr>
<th>Faults / symptoms</th>
<th>Cause</th>
<th>Remedial action</th>
</tr>
</thead>
<tbody>
<tr>
<td>level too high</td>
<td>inner side of tube heavily contaminated</td>
<td>clean inner side of tube</td>
</tr>
<tr>
<td></td>
<td>cable connections incorrect</td>
<td>check all cable connections acc. to connection diagram in sect. 1.5.6.</td>
</tr>
<tr>
<td>level indicated is zero; red LED of IFC 110 PF flashes; indicated flow too high</td>
<td>no communication between IFS 4000 PF and IFC 110 PF.</td>
<td>check all cable connections acc. to sect. 1.5.6.</td>
</tr>
</tbody>
</table>

7.6.2 Checking the velocity meter

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 of the IFC 110 PF.
• 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 sect. 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).

Action
Resistance measurements at plug-in terminals SC (5-pin, signal line) and FP (4-pin, field current supply line) | Typical result | Incorrect result for 1-3 = defective primary head, return to factory for repair, refer to last-but-one page!
<table>
<thead>
<tr>
<th>Action</th>
<th>Typical result</th>
<th>Incorrect result for 1-3 = defective primary head, return to factory for repair, refer to last-but-one page!</th>
</tr>
</thead>
</table>
| 1      | Measure resistance between wires 7 and 8. | 30 – 170 Ω | - If lower: interwinding fault
- If higher: wire break. |
| 2      | Measure resistance between wires 1 and 7 or between wires 1 and 8. | > 20 MΩ | If lower: interwinding fault to PE or FE. |
| 3      | Measure resistance between wires 1 and 2 and between 1 and 3 (same measuring conductor always on wire 1 !) | 1 kΩ - 1 MΩ (see “Note” above) Both values should be approx. equal | - If lower: drain measuring tube and repeat measurement; if still too low, short-circuit in electrode wires.  
- If higher: break in electrode wires or electrodes contaminated.  
- If values differ considerably: break in electrode wires or... |
4 When signal line 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 > 20 MΩ If lower: line fault. Check connection cables, replace signal line is necessary.

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

Connection of GS 8 A to signal converter

100-230 V AC: N L PE
24 V AC / DC: 0L~ 1L~ FE
**Caution:** Do not remove the internal connection (conductor) in the terminal compartment of the signal converter (yellow/green conductor) between U-clamp terminal and terminal 10.

**Switch off the power supply before starting work.**

1) Remove the cover from the terminal compartment of the signal converter.
2) Disconnect all primary head cables from terminals 1, 2, 3, 7, 8, 20, 30, C, D and E 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 I+/I-: inaccuracy 0.1% 
   \[ R_i = 15 – 500 \ \Omega \]
   range 20 mA
6) Connect the electronic totalizer to terminals P / P: range 0 – 10 kHz 
   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 sect. 2.5.6.
7) Test as described on the following pages.
8) When the test is completed, disconnect the GS 8 A and reconnect the primary head 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) \[ X = \frac{Q_{100\%}}{GK} \times \frac{K}{DN^2} \]

\( Q_{100\%} \) full-scale range (100%) in unit volume V per unit time t.
GK primary head constant, see instrument nameplate
DN meter size DN in mm., not inches, see instrument nameplate.
\( t \) time in seconds (sec.), minutes (min.) or hours (hr).
V unit volume
K constant according to the following table

<table>
<thead>
<tr>
<th>V</th>
<th>t</th>
<th>Sec</th>
<th>min</th>
<th>hr</th>
</tr>
</thead>
<tbody>
<tr>
<td>liters</td>
<td>25 464</td>
<td>424.4</td>
<td>7.074</td>
<td></td>
</tr>
<tr>
<td>m³</td>
<td>25 464 800</td>
<td>424 413</td>
<td>7074</td>
<td></td>
</tr>
<tr>
<td>US Gallons</td>
<td>96 396</td>
<td>1 607</td>
<td></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 $Y \leq X$. 
4.3) Calculate setpoint reading “I” for current output:

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

- \( I_{0\%} \): current (0/4 mA) at 0% flow rate
- \( I_{100\%} \): current (20 mA) at 100% flow rate

4.4) Calculate setpoint reading “f” for pulse output:

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

- \( P_{100\%} \): 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 I 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.

13) The system is ready for operation after the power supply is switched on again.

**Example**

- Full-scale range: \( Q_{100\%} = 113.1 \text{ m}^3/\text{hr} \) (Fct. 1.01)
- Meter size: \( DN = 200 \text{ mm} = 8 \text{ inch} \) (Fct. 3.02)
- Current at \( Q_{0\%} \): \( I_{0\%} = 4 \text{ mA} \) (Fct. 1.05)
- Current at \( Q_{100\%} \): \( I_{100\%} = 20 \text{ mA} \) (Fct. 1.05)
- Pulses at \( Q_{100\%} \): \( P_{100\%} = 280 \text{ pulses/hr} \) (Fct. 1.06)
- Primary head constant: \( GK = 3.571 \) (see instrument nameplate)

Constant \( K \) (in m^3):

\[ K = 7074 \text{ (see table)} \]

Constant \( K \) (in mm):

\[ K = DN^2 \times 3.572 = 7074 \]

Calculation of “X” and setting of “Y”:

\[ X = \frac{Q_{100\%} \times K}{GK \times DN^2} = \frac{113.1 \times 7074}{3.572 \times 200 \times 200} = 5.6 \]

\( Y = 5 \), 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

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

\( I_{0\%} = 4 \text{ mA} \)

\( I_{100\%} = 20 \text{ mA} - 4 \text{ mA} = 16 \text{ mA} \)

\[ f = \frac{Y}{X} \times P_{100\%} = \frac{5}{5.6} \times 280 \text{ pulses/hr} = 250 \text{ pulses/hr} \]

Deviations are permissible between 18.03 and 18.57 mA (equivalent to ± 1.5 %).

Deviations are permissible between 246.3 and 253.8 pulses/hr (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. Service

8.1 Replacing the power supply fuse

Power supply fuse in IFC 110 PF signal converter

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 F1/F7, type 5x20 G, breaking capacity 1500 A (for Order No., see sect. 9)
   - F7: value for 100–230 V AC (85-255 V AC) 0.8 A T
   - F1: value for 24 V AC / DC (20.4-26.4 V AC / 18-31.2 V DC) 2.0 A T

Power supply fuse in IFS 4000 PF primary head

Switch off the power supply before opening the housing!
1) Remove the cover from the primary head.
2) Replace fuse in terminal compartment, type 5x20 G, breaking capacity 1500 A
   - value for 230 V AC: 0.1 A T
   - 115 V AC: 0.2 A T
   - 24 V AC: 1.0 A T

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 out the complete electronic unit of the signal converter housing.
5) Put down the electronic unit with the front panel F facing down (see illustration on the next 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 insulation strip. Slip the MP PCB and insulation 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 PL_{MP}.
7) Fix the MP PCB with special steel tooth lock washer and nut S_{MP} 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 PL_{MP}.
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 sect. 4.2, items ² and ³.
8.3 Replacing the complete electronic unit of the IFC 110 PF 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 out the complete electronic unit of the signal converter housing.
5) Carefully remove the data EEPROM IC14 (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 this page and to the illustrations of the printed circuit boards in sect. 8.5.
6) Re-assemble in reverse order (items 4 – 1 above).

ADC  printed circuit board of A/D converter (ADC)  NT  printed circuit board for power unit
BDE  motherboard  OP  connection plug for additional modules
F  front panel  PLMP  5-pin plug connector for connection of the printed circuit board MP for the magnetic sensors
F1  power supply fuse, see Sect. 8.1 and 9.  S  7 nuts for fastening the electronic unit to front panel
FSV  printed circuit board for field current supply  SLp  screws for fastening the PCB's
H  3 retaining clips at the back of the front panel  SMP  nut and special steel tooth lock washer for fixing the MP PCB for the magnetic sensors
IC14  data EEPROM (8-pin)
I/O  printed circuit board for outputs and inputs
MP  printed circuit board for magnetic sensors (optional), see sect. 6.2 and 8.2
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, take hold of the handle on the upper end of the front panel and carefully pull out the complete electronic unit of the signal converter housing.
5) Put down the electronic unit with the front panel F facing down.
6) Remove screw(s) SP from the PCB(s) to be replaced and carefully pull out the PCB(s) of the plug base(s). Fit new PCB(s), refer to the illustration in sect. 8.3.
   - 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 IC14 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 sect. 8.5.
7) Re-assemble in reverse order (items 6 – 1 above)

8.5 Illustrations of printed circuit boards (PCBs)

Power unit PCB, NT, 100 – 230 V AC

| X1  | plug-in terminals inside terminal compartment |
| X2  | internal connection to motherboard          |
| T   | transformer                                  |

Small fuses TR5, values and Order No. see sect. 9:
F1  5 V voltage
F2  field current supply
F3  current output and power supply
F4  auxiliary voltage
F7  power supply
F8-F10 coupling elements

Inputs/outputs PCB, I/O
### 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

Small fuses TR5, values and Order No. see sect. 9:

- **F1** terminal P  
- **F2** terminal A1  
- **F3** terminal A2  
- **F4** terminal D1  
- **F5** terminal D2  
- **F6** terminal C1  
- **F7** terminal C2  
- **F8** terminal E+  
- **F9** terminal E-
Analog/digital converter PCB, ADC

X1  internal connection to motherboard  IC 12  microprocessor
X2  plug-in terminals in terminal compartment  IC 14  data EEPROM
X4  multipoint connector  D3  green LED on front panel
IC 11  peripheral IC incl. control program  D4  red LED on front panel
## Order numbers

<table>
<thead>
<tr>
<th>Spare parts</th>
<th>Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electronic unit with display 100-230 V AC without magnetic sensors</td>
<td>2106680000</td>
</tr>
<tr>
<td>100-230 V AC with magnetic sensors</td>
<td>2109400000</td>
</tr>
<tr>
<td>24 V AC / DC without magnetic sensors</td>
<td>2107870000</td>
</tr>
<tr>
<td>Power supply fuses</td>
<td></td>
</tr>
<tr>
<td>F7: 100-230 V AC 0.8 A T</td>
<td>5080850000</td>
</tr>
<tr>
<td>Various small fuses TR5 fuses primary head not added</td>
<td></td>
</tr>
<tr>
<td>• I/O PCB (inputs/outputs)</td>
<td></td>
</tr>
<tr>
<td>F2, F8 T 250 mA</td>
<td>5075640000</td>
</tr>
<tr>
<td>F1, F3-F7, F9 T 160 mA</td>
<td>5075900000</td>
</tr>
<tr>
<td>• NT PCB (power unit)</td>
<td></td>
</tr>
<tr>
<td>F1 T 1.6 A</td>
<td>5090700000</td>
</tr>
<tr>
<td>F2 T 630 mA</td>
<td>5080190000</td>
</tr>
<tr>
<td>F3 T 500 mA</td>
<td>5075860000</td>
</tr>
<tr>
<td>F8, F9, F10 T 50 mA</td>
<td>5075780000</td>
</tr>
<tr>
<td>plug-in terminals</td>
<td></td>
</tr>
<tr>
<td>3-pin power supply</td>
<td></td>
</tr>
<tr>
<td>8-pin outputs D and P, inputs C</td>
<td>3161180100</td>
</tr>
<tr>
<td>8-pin outputs A and I, internal power supply E</td>
<td>3160220100</td>
</tr>
<tr>
<td>4-pin field current supply</td>
<td>3160230100</td>
</tr>
<tr>
<td>5-pin signal line</td>
<td>3160200100</td>
</tr>
<tr>
<td>RS 232 adapter incl. CONFIG operator software</td>
<td></td>
</tr>
<tr>
<td>(from version V 3.1 onwards)</td>
<td></td>
</tr>
<tr>
<td>German</td>
<td>V 035100131</td>
</tr>
<tr>
<td>English</td>
<td>V 035100132</td>
</tr>
<tr>
<td>Conversion kit MP for magnetic sensors</td>
<td>V 150100004</td>
</tr>
<tr>
<td>(complete retrofitting kit)</td>
<td></td>
</tr>
<tr>
<td>Bar magnet for operating the magnetic sensors</td>
<td>2070530000</td>
</tr>
<tr>
<td>Primary head simulator GS 8A</td>
<td>2070680200</td>
</tr>
<tr>
<td>Adapter to make older versions of GS 8 simulators suitable for use with IFC 110 PF</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 meter</td>
<td>3137030000</td>
</tr>
<tr>
<td>ADC PCB (A/D converter)</td>
<td>2105380000</td>
</tr>
<tr>
<td>I/O PCB (inputs/outputs)</td>
<td>2109000000</td>
</tr>
<tr>
<td>FSV PCB (field current supply)</td>
<td>2105750000</td>
</tr>
<tr>
<td>NT PCB (power unit) 100-230 V AC</td>
<td>2105720000</td>
</tr>
<tr>
<td>NT PCB (power unit) 24 V AC / DC</td>
<td>2107890000</td>
</tr>
</tbody>
</table>
## 10. Technical data

### 10.1 Primary head IFS 4000 PF

#### 10.1.1 General information

**Meter sizes and versions**
- **Meter sizes**: DN200 – 1600 / 8” – 64”
- **Connecting flanges**:
  - DIN2501: DN200 – 600 / PN 10
  - ANSI B16.5: 8” – 24” / 150 lb
  - AWWA and others: on request
- **Protection category**: IP 67, equivalent to NEMA 6 (IEC 529 / EN 60529)
- **Hazardous-duty version**: optionally Ex N, Zone 2

**Process data**
- **Liquid product**: water and waste water
- **Electrical conductivity**: ≥ 50 µS/cm
- **Flow level in pipe**: min. 10% of inside tube diameter
- **Process temperature**: -5 to +60°C / +23 to +140°F
- **Ambient temperature**: -25 to +60°C / -13 to +140°F
- **Operating pressure**: max. 10 bar / 150 psig

**Integrated flow measuring system**
- **Measuring principle**: electromagnetic flow measurement
- **Full-scale range**: in pipe running full between 34 m³/h or 160 US Gal / min (minimum for DN200 / 8”)
  and 100 000 m³/h or 500 000 US Gal / min (maximum for DN1600 / 64”)
- **Equivalen flow velocity**: 0.3 – 12 m/s or 1 – 40 ft/s
- **Electrode design**: 1 pair of electrodes, solidly fitted, surface polished
- **Power for field coils**: from signal converter
- **Grounding rings**: available as an option

**Integrated level measuring system**
- **Measuring principle**: capacitive level measurement, built into the measuring tube liner
- **Pipe filling**: min. 10% of inside tube diameter, outputs go to “zero” below 10% filling
- **Power**:
  - Voltage, frequency: 230 / 115 V AC, 50 – 60 Hz, others on request
  - Power consumption: 14 VA
- **Communication with converter**: via RS485 interface
- **Electronics housing**: compact, mounted on primary head
- **Cable entries**: 3 x PG 16 and 1 x PG 9, optionally ½” NPT or ½” PF

**Materials of construction**
- **Measuring tube**: stainless steel 1.4301 (or higher material numbers) / AISI 304
- **Liner**: Irathane®, 12 mm / 0.47”
- **Electrodes**: Hastelloy C4, others on request
- **Connecting flanges**: steel 1.0038 (RST 37.2)
- **Converter housing**: sheet steel
- **Electronics housing**: cast aluminium
- **PG cable entries**: nickel-plated brass
- **Grounding rings (option)**: stainless steel 1.4571 / AISI 316 Ti

- with polyurethane finish 143 RAL 5015
10.1.2 Dimensions and weight IFS 4000 PF

<table>
<thead>
<tr>
<th>Meter size to …</th>
<th>Dimensions in mm (inches)</th>
<th>Approx. weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIN 2501</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mm</td>
<td>PN</td>
<td>a</td>
</tr>
<tr>
<td>DN 200</td>
<td>10</td>
<td>8”/150lb</td>
</tr>
<tr>
<td>DN 250</td>
<td>10</td>
<td>10”/150lb</td>
</tr>
<tr>
<td>DN 300</td>
<td>10</td>
<td>12”/150lb</td>
</tr>
<tr>
<td>DN 350</td>
<td>10</td>
<td>14”/150lb</td>
</tr>
<tr>
<td>DN 400</td>
<td>10</td>
<td>16”/150lb</td>
</tr>
<tr>
<td>DN 500</td>
<td>10</td>
<td>18”/150lb</td>
</tr>
<tr>
<td>DN 600</td>
<td>10</td>
<td>20”/150lb</td>
</tr>
</tbody>
</table>

Dimensions in mm (inch)

10.2 Signal converter IFC 110 PF

10.2.1 General information

Versions
IFC 110 PF / D
IFC 110 PF / D / MP

Interfaces (optional)
HART (add-on modules)

Extras (optional)
CONFIG software and adapter for operator control by MS-DOS PC, connection to internal ImoCom interface (bus)
Others in preparation

Current output
Function
All operating data adjustable
Galvanically isolated from all input and output circuits

Current: fixed ranges
0 – 20 mA and 4 – 20 mA

Variable ranges
for Q = 0 % \( I_{0\%} = 0 – 16 \) mA
for Q = 100 % \( I_{100\%} = 4 – 20 \) mA
for Q > 100 % \( I > 20 \) (22 mA max.)

Load
15 – 500 Ω

Error identification
0 / 22 mA and variable

Forward/reverse mode
direction identified via status output
### Pulse outputs (passive)

<table>
<thead>
<tr>
<th>Terminals</th>
<th>P / P</th>
<th>A1 / A1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulse rate</td>
<td>0 – 10 000 pulses per s</td>
<td>0 – 50 pulses per s</td>
</tr>
<tr>
<td>Electrical data</td>
<td>galvanically isolated</td>
<td>galvanically isolated, not from A2</td>
</tr>
<tr>
<td>Pulse width</td>
<td>automatic: pulse duty factor 1:1, ( P_{100%} ) ( \geq \frac{1000}{P_{100%} \text{ [Hz]}} )</td>
<td>gating of totalizer</td>
</tr>
</tbody>
</table>

### Status outputs (passive)

<table>
<thead>
<tr>
<th>Terminals</th>
<th>D1 / D2 / A1 / A2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical data</td>
<td>galvanically isolated</td>
</tr>
</tbody>
</table>

### Control inputs C1 and C2 (passive)

<table>
<thead>
<tr>
<th>Terminals</th>
<th>C1 / C1 and C2 / C1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical data</td>
<td>galvanically isolated</td>
</tr>
</tbody>
</table>

### Internal power supply

<table>
<thead>
<tr>
<th>Terminals</th>
<th>E+ and E-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical data</td>
<td>galvanically isolated</td>
</tr>
</tbody>
</table>

### Time constant

| Time constant | 0.2 – 99.9 s, adjustable in steps of 0.1 s |

### Low-flow cutoff (SMU)

- **“ON” value**: 1 – 19 % of \( Q_{100\%} \), adjustable in steps of 1 %
- **“OFF” value**: 2 – 20 % of \( Q_{100\%} \), adjustable in steps of 1 %
### Local display
- **Display**: 3-line LCD
- **Function**: current flow, forward, reverse and sum totalizers (7-digit) or 25-digit bar graph with percentage display and status messages
- **Units**: actual flow
  - m³/hr, Liter/Sec, US gallons/min. or user-defined unit such as Liter/day or US MGal/day
  - m³, Liter or US gallons or user-defined unit such as hectoliters or US MGal (adjustable counting time up to overflow)
- **Language of clear texts**: German, English, French
- **Display**: 1st line
  - 8-digit, 7-segment display for numbers/signs and symbols, for key acknowledgement
- **2nd line**: 10-character, 14 segment text display
- **3rd line**: 6 markers to identify current display in measuring mode

### Field current supply
- **Type**: bipolar, pulsed DC field, galvanically isolated from all output and input circuits
- **Terminals**: 7 and 8, each provided twice
- **Current/voltage**: ± 0.125 A (± 5%) / max. 40 V
- **Clock frequency**: 1/36 to 1/2 of line frequency, adjustable acc. to calibration data of primary head load: max. 220 Ω

### Power supply
- **Type**: AC version - standard, AC / DC version - optional
- **Voltage range** (without change-over)
  - AC: 100 – 230 V
  - DC: 24 V
- **Tolerance range**
  - AC: 85 – 255 V
  - DC: 20.4 – 26.4 V
- **Frequency**
  - AC: 48 – 63 Hz
  - DC: 48 – 63 Hz
- **Power input**
  - AC: 12 W, typical (max. 18 W)
  - DC: 12 W, typical (max. 18 W)

When connected to a functional extra-low voltage, 24 V AC/DC, safety separation (PELV) must be ensured (VDE 0100 / VDE 0106, IEC 536 or equivalent national regulations).

### Field housing
- **Material**: Diecast aluminium with polyurethane coating
- **Ambient temperature**
  - in operation: -25 to +60 °C / -13 to +140 °F
  - when stored: -40 to +60 °C / -40 to +150 °F
- **Type of enclosure**
  - (IEC 529 / EN 60529): IP 65, equivalent to NEMA 4/4X
10.2.2 Dimension and weight IFC 110 PF

Weight approx. 4.1 kg (9.0 lb)

Dimensions in mm (inch)

10.3 Complete system IFM 4110 PF

10.3.1 Full-scale range $Q_{100\%}$

Full-scale range $Q_{100\%}$
Flow rate $Q = 100\%$ 34 up to 12200 m³/hr, adjustable as required, equivalent flow velocity 0.3 – 12 m/s

Unit m³/hr, Liter/Sec, US gallons/min. or user-defined unit, e.g. Liter/day or US Mgal/day
### Flow table

$v =$ flow velocity in m/s

<table>
<thead>
<tr>
<th>Meter size</th>
<th>Full-scale range in m$^3$/hr</th>
<th>$v =$ flow velocity in ft/s</th>
</tr>
</thead>
<tbody>
<tr>
<td>DN mm</td>
<td>inch</td>
<td>v=0.3 m/s (minimum)</td>
</tr>
<tr>
<td>200</td>
<td>8</td>
<td>33.93</td>
</tr>
<tr>
<td>250</td>
<td>10</td>
<td>53.02</td>
</tr>
<tr>
<td>300</td>
<td>12</td>
<td>76.35</td>
</tr>
<tr>
<td>400</td>
<td>16</td>
<td>135.8</td>
</tr>
<tr>
<td>500</td>
<td>20</td>
<td>212.1</td>
</tr>
<tr>
<td>600</td>
<td>24</td>
<td>305.4</td>
</tr>
</tbody>
</table>

#### 10.3.2 Error limits under reference conditions

- **Fully filled**
  - $\leq 1\%$ of measuring value ($v \geq 1 \text{ m/s}$)
  - $\leq 0.5\%$ of measuring value + 5 mm/s ($v < 1 \text{ m/s}$)

- **Partly filled**
  - $\leq 1\%$ of full scale value (full scale value $\geq 1 \text{ m/s}$)
LC display
15 keys
3 magnetic sensors (optional)

- EEPROM
- µP

KSA 04

- µP
- EEPROM
- PWM
- I+
- I-

A1 (P2)
A2
D1
D2
C1
C2
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)

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 primary head.
- Operating and calibrating data are stored in an EEPROM so the PCB can be easily replaced without the need for re-calibration.

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.

I/O printed circuit board, inputs and outputs
- Groups, input and outputs are galvanically isolated from each other and from all other circuits.
- Power supply source for the inactive inputs and outputs.
- Specific 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.

ImoCom bus plug
Connecting external operating and testing devices, e.g. RS232 adapter and CONFIG software for operator control of signal converter by MS-DOS PC or laptop.

Slots for plug-in modules, for upgrading or converting the signal converter
12 Measuring principle

The TIDALFLUX IFM 4110 PF is an electromagnetic flowmeter with an integrated capacitive level measurement system, designed for electrically conductive process liquids.

The flow rate $Q(t)$ through the tube is: $Q(t) = v \times A$

$v$ = flow velocity of liquid product

$A$ = wetted area of tube section.

Flow velocity $v$ is determined on the basis of the known electromagnetic measurement principle. The two measuring electrodes are located in the lower part of the measuring tube, on a level of approx. 0.1 x inside tube diameter in order to get a reliable measurement down to a level of 10%.

The wetted area $A$ is computed from the known inside diameter of the tube by the patented capacitive level measurement system that is built into the measuring tube liner. The required electronics unit is accommodated in a compact housing that is mounted on top of the primary head. Communicating with the separate IFC 110 PF converter is by way of an RS485 interface.
### Part E Index

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A</strong></td>
<td></td>
<td></td>
<td><strong>Electronic totalizer</strong></td>
<td>2.5.3, 5.8</td>
<td>1.06</td>
</tr>
<tr>
<td>A1 status or 2nd pulse output</td>
<td>2.5.3, 2.5.6, 5.8, 5.18</td>
<td>1.07, 3.07</td>
<td>Electromechanical totalizer</td>
<td>2.5.3, 2.5.6, 5.8, 5.17</td>
<td>1.07, 3.07</td>
</tr>
<tr>
<td>A1/A2 status outputs</td>
<td>2.5.4, 2.5.6, 5.9</td>
<td>1.07, 1.08</td>
<td>Entry (programming)</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Abbreviations</td>
<td>1.3.4, 2.1, 4.1, 4.4</td>
<td></td>
<td>Error</td>
<td>4.5</td>
<td></td>
</tr>
<tr>
<td>ADC see analog/digital converter</td>
<td></td>
<td></td>
<td>Error list</td>
<td>4.5</td>
<td></td>
</tr>
<tr>
<td>Additional function = option</td>
<td>6.2, 6.4, 10.2</td>
<td></td>
<td>Error (messages)</td>
<td>- eliminate 4.5</td>
<td></td>
</tr>
<tr>
<td>Analog/digital converter</td>
<td>4.5, 12</td>
<td></td>
<td>- limits 10.3.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Applications</td>
<td>5.17</td>
<td>3.06</td>
<td>- reset (delete) 4.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Automatic range change</td>
<td>2.5.6, 5.20</td>
<td>1.05, 1.07-1.10</td>
<td>- search 7.1 et seq.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>B</strong></td>
<td></td>
<td></td>
<td>EU standards</td>
<td>page 0/4</td>
<td></td>
</tr>
<tr>
<td>Bar magnet</td>
<td>4.2, 6.2, 8.2</td>
<td></td>
<td>External totalizers</td>
<td>2.5.3, 2.5.6, 5.8</td>
<td>1.06, 1.07</td>
</tr>
<tr>
<td>Block diagram</td>
<td>11</td>
<td></td>
<td><strong>F</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BTS bootstrap signal line</td>
<td>1.5.3</td>
<td></td>
<td>F = forward flow</td>
<td>4.4, 5.1, 5.15</td>
<td>1.04-1.07, 3.02</td>
</tr>
<tr>
<td><strong>C</strong></td>
<td></td>
<td></td>
<td>Factory setting(s)</td>
<td>2.5.7</td>
<td></td>
</tr>
<tr>
<td>C1/C2 control inputs</td>
<td>2.5.5, 2.5.6, 5.10</td>
<td>1.11, 1.12</td>
<td>Fatal error</td>
<td>4.5</td>
<td></td>
</tr>
<tr>
<td>Cable length</td>
<td>1.5.5</td>
<td></td>
<td>Field current supply</td>
<td>5.13, 10.3, 11.12</td>
<td></td>
</tr>
<tr>
<td>Characteristic of outputs</td>
<td>5.16</td>
<td></td>
<td>Flow</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Code for entering setting level</td>
<td>5.12</td>
<td>3.04</td>
<td>- pulsating</td>
<td>6.6</td>
<td>3.06</td>
</tr>
<tr>
<td>CONFIG software</td>
<td>6.4</td>
<td></td>
<td>- quickly changing</td>
<td>4.4, 5.1, 5.15</td>
<td></td>
</tr>
<tr>
<td>Connection and operating points</td>
<td></td>
<td></td>
<td>Flow direction</td>
<td>4.4, 5.1</td>
<td>3.02</td>
</tr>
<tr>
<td>- front panel</td>
<td>4.2</td>
<td></td>
<td>Flow rate</td>
<td>4.4, 5.1</td>
<td>3.02</td>
</tr>
<tr>
<td>- printed circuit boards</td>
<td>8.5</td>
<td></td>
<td>Flow velocity</td>
<td>2.5.3, 5.8</td>
<td>3.03</td>
</tr>
<tr>
<td>Connection diagrams</td>
<td></td>
<td></td>
<td>Frequency output, see pulse output</td>
<td>4.4, 5.1</td>
<td>1.06</td>
</tr>
<tr>
<td>- GS 8 A simulator</td>
<td>7.7</td>
<td></td>
<td>Full-scale range</td>
<td></td>
<td>1.01, 3.02</td>
</tr>
<tr>
<td>- IFC 110 PF/IFS 4000 PF</td>
<td>1.5.6</td>
<td></td>
<td>Functional check</td>
<td>7.3</td>
<td></td>
</tr>
<tr>
<td>- inputs / outputs</td>
<td>2.5.5, 4.4, 5.10</td>
<td></td>
<td>- hardware information</td>
<td>7.2</td>
<td>2.02</td>
</tr>
<tr>
<td>Control inputs C</td>
<td></td>
<td></td>
<td>- measuring range</td>
<td>7.6</td>
<td></td>
</tr>
<tr>
<td>Conversion factor</td>
<td>4.4, 5.14</td>
<td>3.05</td>
<td>- primary head</td>
<td>7.7</td>
<td></td>
</tr>
<tr>
<td>- volume</td>
<td>4.4, 5.14</td>
<td>3.05</td>
<td>- signal converter</td>
<td>7.7</td>
<td></td>
</tr>
<tr>
<td>- time</td>
<td>2.5.2, 5.7</td>
<td></td>
<td>- setpoint readings</td>
<td>7.5</td>
<td></td>
</tr>
<tr>
<td>Current output I</td>
<td></td>
<td></td>
<td>- system</td>
<td>7.1</td>
<td></td>
</tr>
<tr>
<td><strong>D</strong></td>
<td></td>
<td></td>
<td>- zero</td>
<td>4.1</td>
<td>3.03</td>
</tr>
<tr>
<td>D1/D2 status outputs</td>
<td>2.5.4, 2.5.6, 5.9</td>
<td>1.09, 1.10</td>
<td>Function level</td>
<td></td>
<td>1.01 et seq., 2.01 et seq., 1.01 et seq.</td>
</tr>
<tr>
<td>Data</td>
<td>4.4</td>
<td></td>
<td>Function of keys</td>
<td>4.4</td>
<td></td>
</tr>
<tr>
<td>Data error</td>
<td>4.5</td>
<td></td>
<td>Function(s)</td>
<td>8.1, 8.5, 9</td>
<td></td>
</tr>
<tr>
<td>Data interface</td>
<td>4.1-4.3</td>
<td></td>
<td>Fuses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data level</td>
<td>4.6</td>
<td></td>
<td>Grounding</td>
<td>1.2, 1.4</td>
<td></td>
</tr>
<tr>
<td>Delete error messages</td>
<td>10.1.2, 10.2.2</td>
<td></td>
<td>- primary head</td>
<td>2.3, 1.5.6</td>
<td></td>
</tr>
<tr>
<td>Dimensions</td>
<td>2.1</td>
<td></td>
<td>- signal converter</td>
<td>1.5.6</td>
<td></td>
</tr>
<tr>
<td>Disconnection</td>
<td>4.2, 5.4</td>
<td>1.04</td>
<td>- system</td>
<td>7.7</td>
<td></td>
</tr>
<tr>
<td>Display</td>
<td>4.4, 5.11</td>
<td>3.01</td>
<td>GS 8 A primary simulator</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- language</td>
<td>6.6</td>
<td></td>
<td><strong>E</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- unsteady</td>
<td>1.5.3</td>
<td></td>
<td>E+/E- internal power supply for inputs/output</td>
<td>5.6</td>
<td></td>
</tr>
<tr>
<td>EC electronic totalizer</td>
<td>2.5.1, 2.5.5, 2.5.3, 2.5.6, 5.8</td>
<td>1.06</td>
<td><strong>F</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>H</strong></td>
<td></td>
<td></td>
<td>Hardware</td>
<td>7.3</td>
<td></td>
</tr>
<tr>
<td>Hazardous areas</td>
<td>5.4</td>
<td></td>
<td>- information</td>
<td>5.18</td>
<td>2.02</td>
</tr>
<tr>
<td>Height measurement</td>
<td>2.5.2, 5.7</td>
<td></td>
<td>- setting(s)</td>
<td>7.4</td>
<td>3.07</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- test</td>
<td>6.1, page 0/4</td>
<td>2.03</td>
</tr>
<tr>
<td></td>
<td>7.7</td>
<td>2.5.6</td>
<td>5.16</td>
<td>6.4, 8.5</td>
<td>1.05</td>
</tr>
<tr>
<td>---------------------</td>
<td>------</td>
<td>-------</td>
<td>------</td>
<td>----------</td>
<td>------</td>
</tr>
<tr>
<td>Electrical connection</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- GS 8 A simulator</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- inputs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- outputs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- power supply</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- primary head</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electromagnetic compatibility</td>
<td>4.4</td>
<td>5.10</td>
<td>1.11, 1.12</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5.7</td>
<td>1.05</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5.8</td>
<td>1.06, 1.07, 3.07</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5.9</td>
<td>1.07-1.10, 3.07</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Installation location</td>
<td>6.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interface adapter RS 232</td>
<td>1.1, 2.1, 2.2</td>
<td>6.4, 10.2</td>
<td>2.1, 2.5.6, 5.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internal power supply (E+/E-)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>K</td>
<td>4.1-4.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Keys</td>
<td>4.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4.1-4.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4.1-4.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>4.4, 5.11, 3.01</td>
<td>4.2, 4.4, 4.5.4</td>
<td>5.4</td>
<td>1.04</td>
<td></td>
</tr>
<tr>
<td>Language of display texts</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LCD display</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level measurement</td>
<td>3, 4, 2, 8.5</td>
<td>2.5.4, 2.5.6, 5.19</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Light-emitting diode (LED)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Limit (indicator)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Line voltage see power supply</td>
<td>4.4, 5.3</td>
<td>1.03</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low-flow cutoff (SMU)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>4.4, 5.13, 3.03</td>
<td>4.2, 6.2, 8.2</td>
<td>4.1</td>
<td>1.00, 2.00, 3.00</td>
<td></td>
</tr>
<tr>
<td>Magnetic field frequency</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Magnetic sensors</td>
<td>1.00, 2.00, 3.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Main menu level</td>
<td>12</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Main menus</td>
<td>1.00, 2.00, 3.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measuring principle</td>
<td>4.1, 4.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Menu</td>
<td>4.4, 5.13, 3.02</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meter size</td>
<td>4.2, 6.2, 8.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MP magnetic sensors</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>6.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Noise suppression</td>
<td>5.4, 5.5</td>
<td>1.04</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number format of display</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>O</td>
<td>5.3</td>
<td>1.03</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Off value for low-flow cutoff</td>
<td>5.3</td>
<td>1.03</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>On value for low-flow cutoff</td>
<td>6.2, 6.4, 10.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overcurrent (al = supplementary equipment)</td>
<td>9</td>
<td>1.04</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Order numbers</td>
<td>5.4</td>
<td>1.04</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overranging</td>
<td>2.5.2, 2.5.6, 1.05</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- I (current output)</td>
<td>5.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- P (pulse output)</td>
<td>2.5.3, 2.5.6, 1.06, 1.07</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5.8</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>2.5.4, 4.4, 5.9</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Signal converter</td>
<td>4.2, 8.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- connect. and operating parameters</td>
<td>2.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- connection of power supply</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- error limits</td>
<td>7.1-7.5, 7.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- functional checks</td>
<td>2.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- location</td>
<td>4.1-4.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- operation/operator control</td>
<td>10.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>6.1, 9</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>1.07-1.10</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q = flow rate</td>
<td>4.4, 5.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q_{\text{vis}}</td>
<td>1.01, 3.02</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>4.4, 5.15</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R = reverse flow</td>
<td>2.5.6, 5.20</td>
<td>1.04-1.07, 3.02</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Range change</td>
<td>2.5.6, 5.20</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- automatic</td>
<td>4.4, 5.1</td>
<td>1.06, 1.07</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- external</td>
<td>4.4, 5.1</td>
<td>1.06, 1.07</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Range setting</td>
<td>8.3, 8.4, 8.5</td>
<td>1.06, 1.07-1.10</td>
<td>3.02</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Replacement</td>
<td>8.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- electronic unit</td>
<td>4.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- power supply fuse(s)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resetting of totalizer</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Return of signal converter (form)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Return to</td>
<td>4.1-4.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- function level</td>
<td>4.1-4.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- main menu level</td>
<td>4.1-4.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- measuring mode</td>
<td>4.1-4.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- submenu level</td>
<td>4.4, 5.15</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reverse flow (R)</td>
<td>6.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RS 232 adapter</td>
<td>1.04-1.07, 3.02</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>P</strong></td>
<td><strong>8.5</strong></td>
<td><strong>6.4</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------</td>
<td>---------</td>
<td>---------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>P = pulse outputs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>PCB = printed circuit board</strong></td>
<td>1.1, 1.4, 1.5, 2.1, 2.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>PC software</strong></td>
<td>1.5, 2.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>PE = protective conductor</strong></td>
<td>4.5, 7.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Power supply</strong></td>
<td>10.1, 10.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- connection</td>
<td>2.5.1, 2.5.6, 2.5.1, 10.1, 10.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- failure</td>
<td>5.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- frequency</td>
<td>8.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- input</td>
<td>4.4, 5.13</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- internal</td>
<td>3.07 (1.06, 1.07)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- voltage</td>
<td>1.01</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Printed circuit board (PCB)</strong></td>
<td>10.1.2, 10.2.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Primary constant GK</strong></td>
<td>10.3.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Technical data</strong></td>
<td>10.2, 10.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- dimensions and weight</td>
<td>2.1, 2.5.6, 5.18</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- error limits</td>
<td>3.07 (1.06, 1.07)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- signal converter</td>
<td>5.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Terminals</strong></td>
<td>5.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Tests see functional checks</strong></td>
<td>1.02</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Time constant T</strong></td>
<td>1.06</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Totalizer (internal, electronic)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>U</strong></td>
<td>4.4, 5.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Unit</strong></td>
<td>1.04</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- display</td>
<td>4.4, 5.8</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- flow</td>
<td>6.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- pulse output</td>
<td>4.4, 5.14</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Unsteady display, outputs</strong></td>
<td>3.05</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>User-defined unit</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>V</strong></td>
<td>4.4, 5.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>v = flow velocity</strong></td>
<td>3.03</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>VDE standards</strong></td>
<td>1.1 et seq.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>W</strong></td>
<td>10.1.2, 10.2.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Weight (dimensions)</strong></td>
<td>7.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Z</strong></td>
<td>3.03</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Zero check (setting)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
If you need to return flowmeters for testing or repairing to Krohne

Your electromagnetic flowmeter has been carefully manufactured and tested by a company with ISO 9001 certification.
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 stationary 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 substances (directions on how you can find out whether the primary head 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 can not service your flowmeter unless accompanied by such a certificate.

S P E C I M E N certificate

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

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

Tel. No.: ......................................................

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: