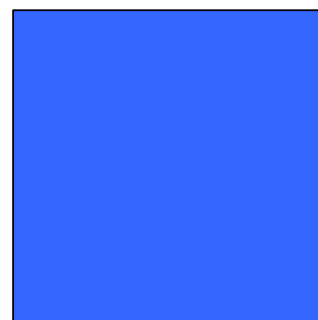


KROHNE

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**Electromagnetic
flowmeter**
in partially filled pipes
for water and waste water

**Installation and
operating
instructions**

**TIDALFLUX
IFM 4110 PF**



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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.
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Product liability and warranty

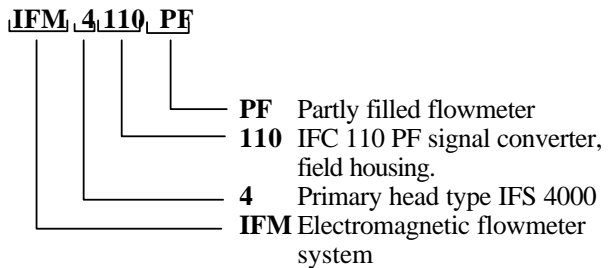
These electromagnetic flowmeters are suitable solely for measuring the volumetric flowrate of electrically conductive liquids, slurries and pastes.
Responsibility as to suitability and intended use of our instruments rests solely with the operator.

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 **mS/cm** (**mho/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:



Available version

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

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 $\pm 2^\circ$.
2. **Slope of measuring section, primary head with in- and outlet sections**, is allowed to have maximum deviation of $\pm 1\%$ 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 Tidalflex. 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":

Meter size DN mm	Pressure rating [PN]	Bolts	Max. torque Nm (ft lbf)
200	10	8x M20	68 (49.2)
250	10	12x M20	65 (47.0)
300	10	12x M20	76 (54.9)

350	10	16x M20	75 (54.2)
400	10	16x M24	104 (75.2)
500	10	20x M24	107 (77.4)
600	10	20x M27	138 (99.8)

Meter size inches	Body pressure rating psig	Bolts for ANSI class 150 flanges	Max. torque Nm (ft lbf)
8	145	8 x 3/4"	69 (49.9)
10	145	12 x 7/8"	79 (57.1)
12	145	12 x 7/8"	104 (75.2)
14	145	12 x 1"	93 (76.2)
16	145	16 x 1"	91 (65.8)
18	145	16 x 1 1/8"	143 (103.4)
20	145	20 x 1 1/8"	127 (91.8)
24	145	20 x 1 1/4"	180 (130.1)

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

Other meter sizes on request.

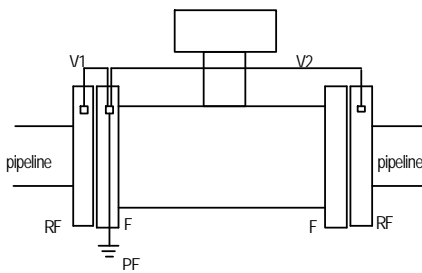
1.4 Grounding IFS 4000 PF

- 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

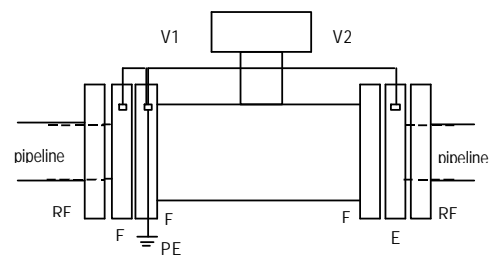
Grounding without grounding rings



- E** Grounding rings, option, see sect. 1.2.
F Flowmeter flanges
PE Protective earth, wire $\geq 4 \text{ mm}^2$ (10 AWG) Cu, not included with supply, to be provided by customer. IFS 4000 PF connected to U-clamp terminal on "neck" of primary head.

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

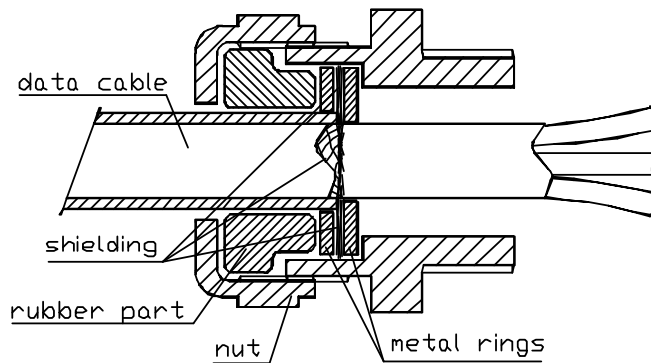
“Regulations governing heavy-current installations with rated voltages up to 1000 V” or equivalent national standard.

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: $3 \times 1,5 \text{ mm}^2$, 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:



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.

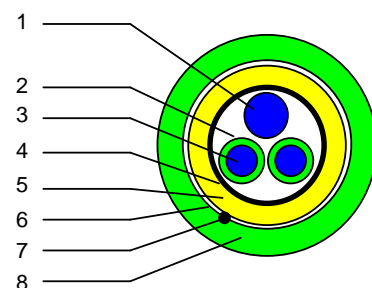
- The signal cable must be a rigid installation. Cables must be secured so they do not move, or must be run in conduit.
- No separate installation of signal and field power supply cables required - can be run in same conduit along with other signal and field power cables. Do not run in same conduit with 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, $1,5 \text{ mm}^2$ (14 AWG)
- 2 Insulation
- 3 Stranded wire $0,5 \text{ mm}^2$ (20 AWG)
- 4 Special foil, 1st shield
- 5 Insulation
- 6 Mu-metal foil, 2nd shield
- 7 Stranded drain wire, 2nd shield, $0,5 \text{ mm}^2$ (20 AWG)

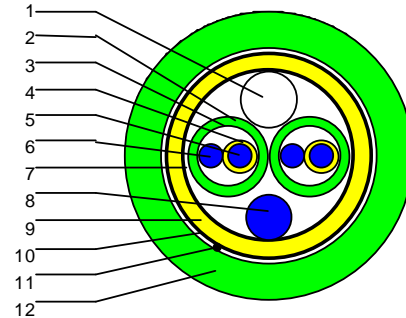


8 Outer sheath

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:

length	Cross-section
0 – 150 m (0 – 500 ft)	2 x 0.75 mm ² Cu (2 x 18 AWG)
150-300 m (500 – 1000 ft)	2 x 1.5 mm ² Cu (2 x 14 AWG)
300 – 600 m (1000 – 2000 ft)	4 x 1.5 mm ² Cu (4 x 14 AWG)

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:

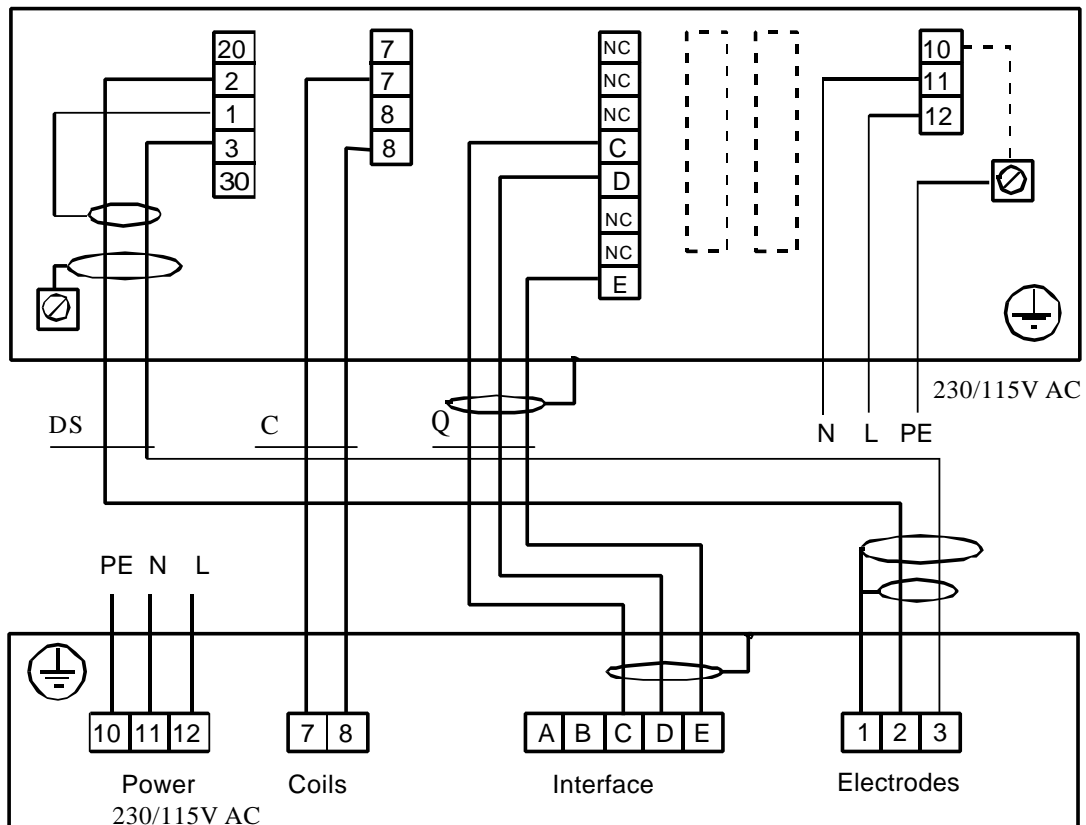
electr. conductivity γ [μ S/cm]	max. length [m]
50	120
100	200
200	400
400	600

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”.

IFC110 PF



IFS4000 PF

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_F) 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**:

Output and input group	Symbol	Terminals	Remarks
Current output	I	I+/-	Always active
Pulse output	P	P / P	For electronic totalizers
Pulse output	A1* (P2)	A1* / A⊥	For electromechanical counters
Status outputs	A1* and A2	A1* / A⊥ / A2	A⊥ common centre grounding contact
Status outputs	D1 and D2	D1 / D⊥ / D2	D⊥ common centre grounding contact
Control inputs	C1 and C2	C1 / C⊥ / C2	C⊥ common centre grounding contact
Internal power supply	E	E+ / E-	For active mode of outputs and inputs

* Output 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_{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**.

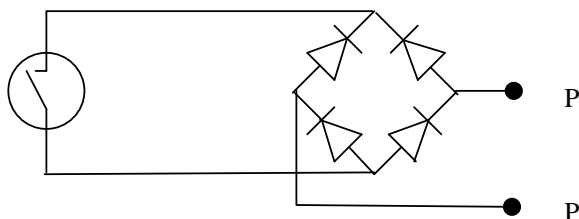
2.5.2 Current output I

- The continuously active **current output is electrically isolated** from all others circuits.
- **All operating data and functions are adjustable**.
- **Allowed load:** 15-500 Ω
- **Selfcheck:** -interrupting the mA loop, and
-short-circuit of mA loop via test function, see Fct. 2.03
or when power supply is switched on in Fct. 3.07
Error message on display (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, $U_{ext} < 32$ V DC / 24 V AC, $I \leq 30$ mA
- **Max. adjustable frequency 10 kHz**
- **Scaling** in pulses per unit time (e.g. 1000 pulses/s at $Q_{100\%}$ flow) or
in pulses per unit volume (e.g. 100 pulses/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.

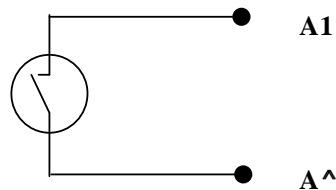


2.5.3.2 Pulse output A1 for electromechanical totalizers

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_L) **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, $U_{ext} \leq 32 \text{ V DC} / 24 \text{ V AC}$, $I \leq 100 \text{ mA}$ ($I \leq 200 \text{ mA}$ 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/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 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.



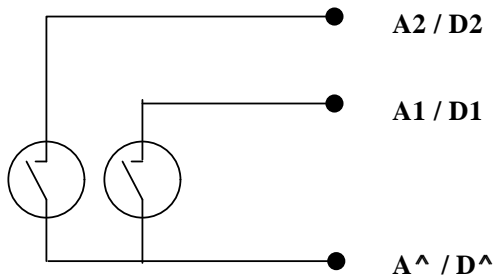
2.5.4 Status outputs A1 / A2 / D1 / D2

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_L and B_L 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, $U_{ext} \leq 32 \text{ V DC} / 24 \text{ V AC}$, $I \leq 100 \text{ mA}$ ($I \leq 200 \text{ mA}$ for A1 in case of polarized DC operation).
- 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_L or D_L.

- **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.



2.5.5 Control inputs C1 and C2

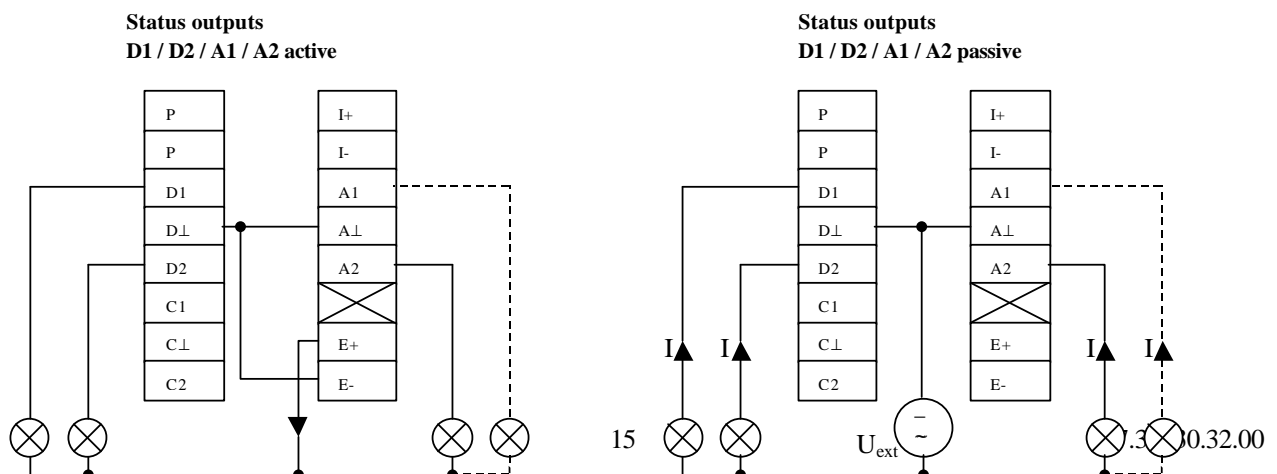
- **Control inputs C1 and C2 are electrically connected** (common centre grounding contact C \perp) but **electrically isolated from all other circuits.**
- **All operating data and functions are adjustable**, see Fct. 1.11-1.12.
- **Active mode:** uses the internal power supply, terminals E+/E-
- **Passive 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

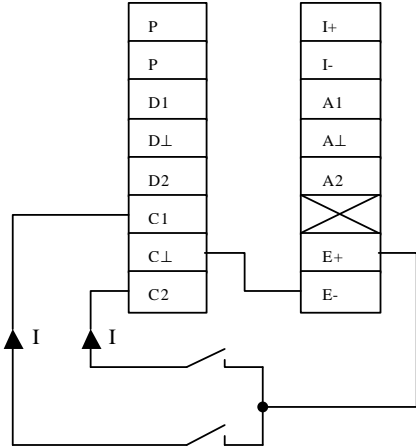
- **Active mode:** The IFC 110 PF supplies the power required for operating (driving) the receiver instruments. Observe the max. operating data (terminals E+/E-).
- **Passive mode:** an external power supply source (U_{ext}) is required for operating (driving) the receiver instruments.

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

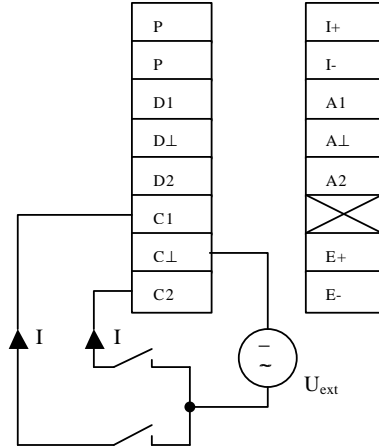


**Control inputs
C1 / C2 active**



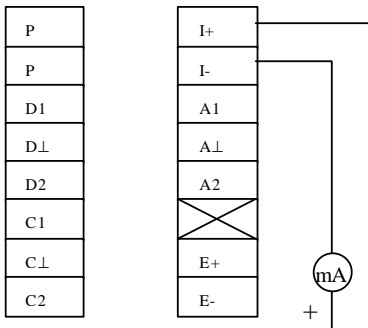
Contacts 24 V, 10 mA
 $I \leq 7 \text{ mA}$

**Control inputs
C1 / C2 passive**



$U_{\text{ext}} \leq 32 \text{ V DC} / \leq 24 \text{ V AC}$
 $I \leq 10 \text{ mA}$

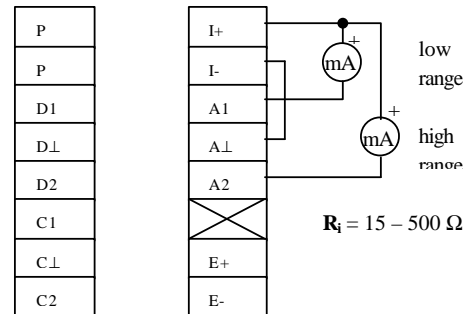
Current output I



$R_i = 15 - 500 \Omega$

**Current output I with
automatic range change BA**

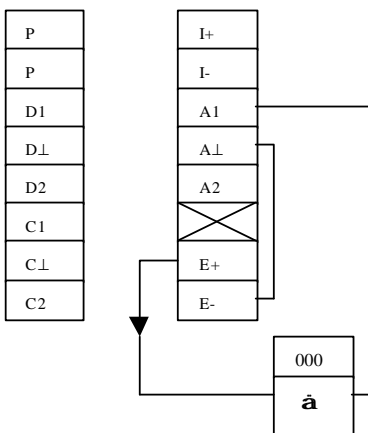
without external change-over relay



$R_i = 15 - 500 \Omega$

Pulse output A1 active

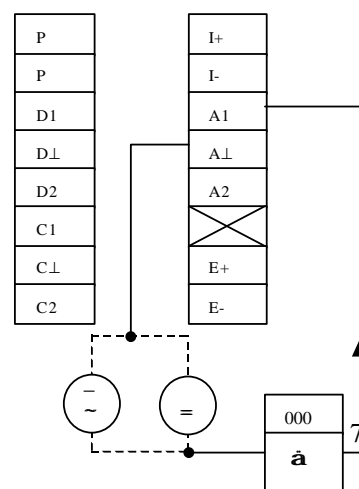
for electromechanical totalizers



$R_i \geq 160 \Omega$ $I \leq 100 \text{ mA}$

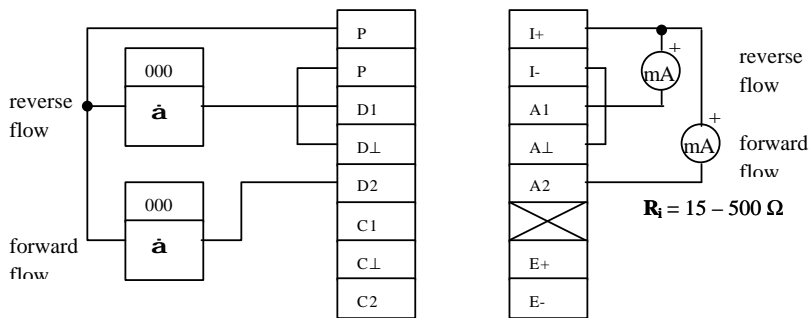
Pulse output A1 passive

for electromechanical totalizers



7.30830.32.00

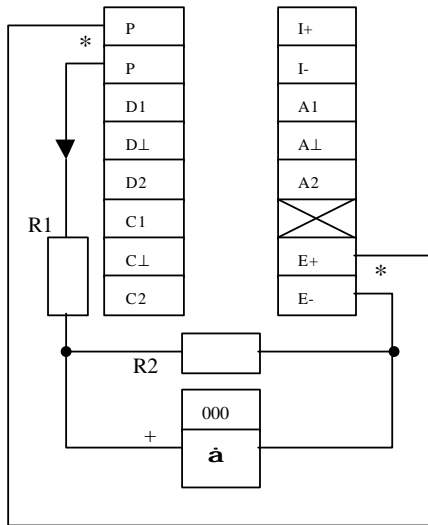
Forward / reverse flow measurement (F/R mode)
 for pulse and current outputs (P and I)
 without external change-over relay



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

Pulse output P_{active} for electronic counters

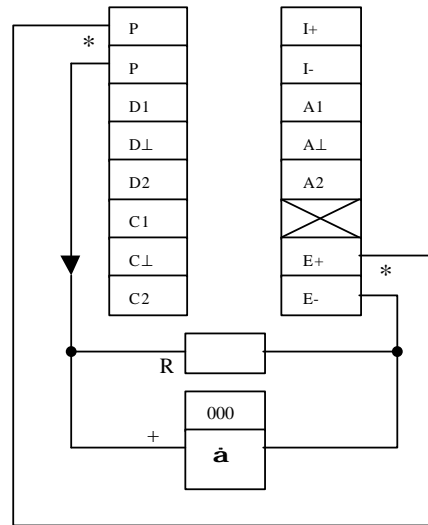
for frequencies ≤ 1 kHz



$R_1 = 1 \text{ k}\Omega / 0.5 \text{ W}$ $I \leq 20 \text{ mA}$
 $R_{iEC} > 100 \text{ k}\Omega$

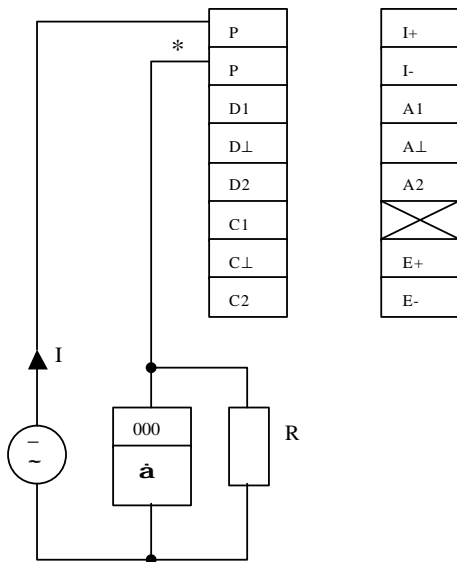
$R_2 / 0.2 \text{ W}$		10 k Ω		1 k Ω		270 Ω
$I_{L_{max}}$		22 V		12 V		5 V

for frequencies > 1 kHz



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

Pulse output P_{passive} for electronic totalizers



for frequencies ≤ 1 kHz

$U_{\text{ext.}} \leq 32 \text{ V DC} / \leq 24 \text{ V AC}$
 $I \leq 30 \text{ mA}$
 $R = 1 - 10 \text{ k}\Omega$
 $P_R \geq U_{\text{ext.}}^2 / R$

for frequencies > 1 kHz

$U_{\text{ext.}} = 24 \text{ V DC} / \text{AC}$
 $R_{iEC} \geq 100 \text{ k}\Omega$

I		30 mA		18 mA
R		560 Ω		1 k Ω
P_R		0.5 W		0.35 W
U_{EC}		16 V		18 V

* **Shielded cables** must be used to prevent radio interference at pulse output frequencies > 100 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 totalized, 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

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

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”.

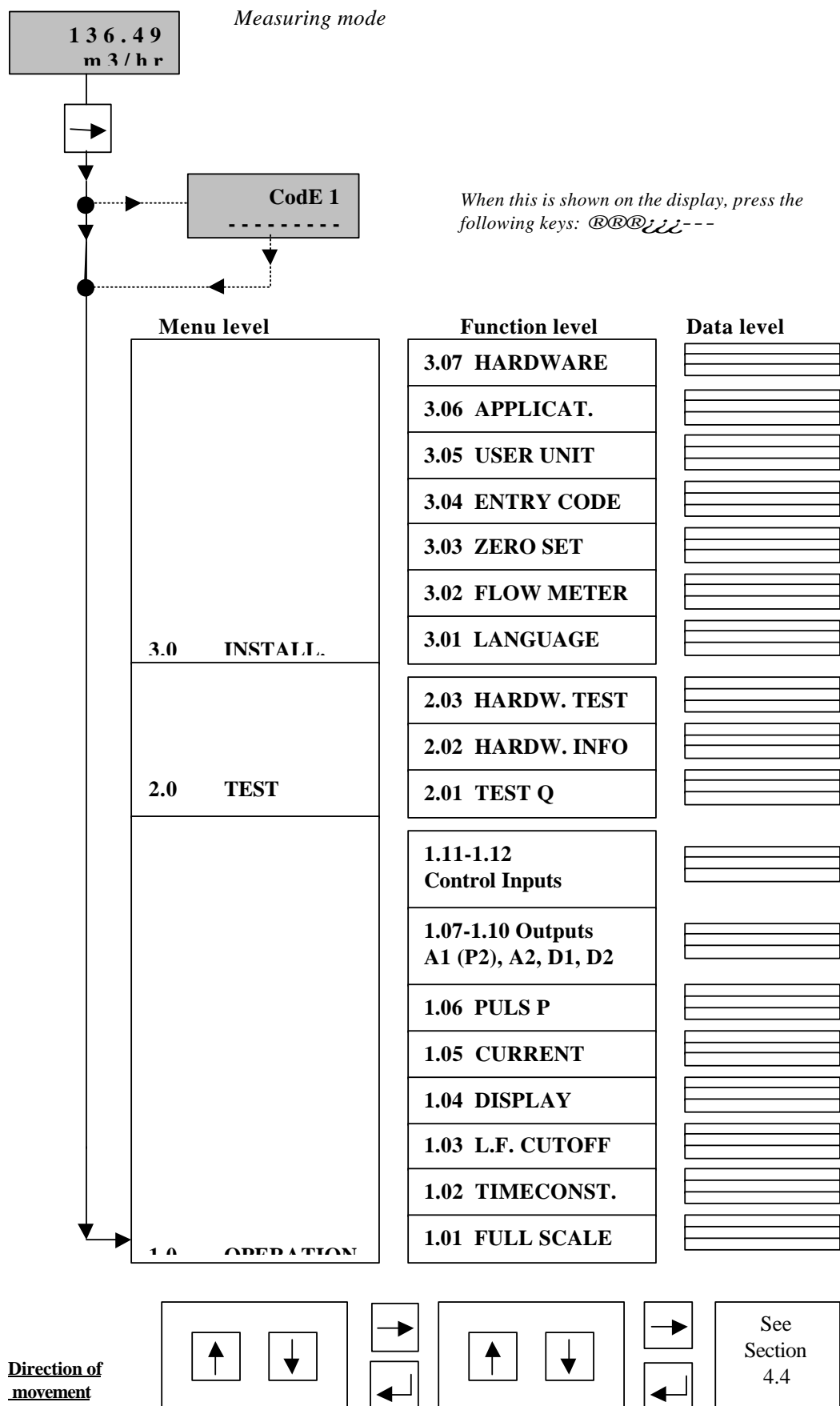
- Switch on the power supply. The flowmeter immediately begins to measure the flow.
- When the power supply is switched on, the display successively shows **START UP** and **READY**. Then the current flow rate and/or the current totalizer count are displayed. Displays are either steady or cyclic depending 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.

LED displays	Status of measurement
Green “normal” LED is flashing	Everything O.K.
Green “normal” LED and red “error” LED are flashing alternately	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.
Red “error” LED is flashing	Fatal Error, see sections 7.3 and 7.4.

Part B Signal converter IFC 110 PF

4. Operating the signal converter

4.1 Krohne operating concept



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

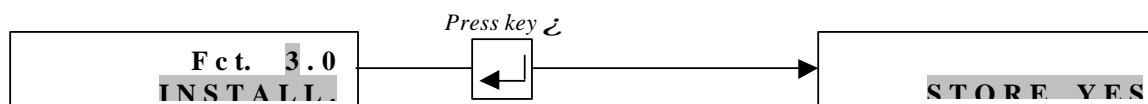
Fct. 1.0
OPERATION

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.



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

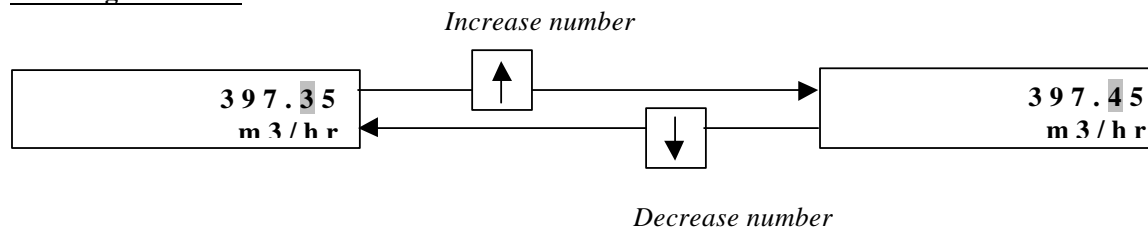
New parameters not to be stored: Press key - to display “STORE NO”. Measuring mode is continued with the “old” parameters after pressing key ↵.

Keyboard with 10 keys

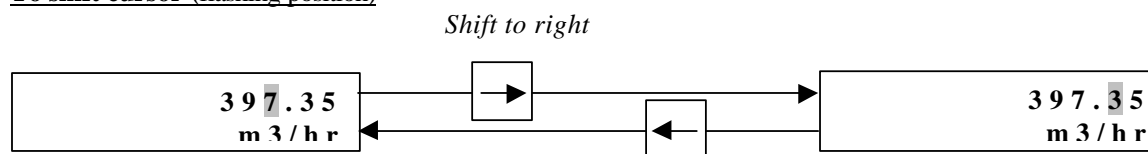
The keyboard with the 10 keys (0-9) is used for **setting all flashing numbers (cursor)**.

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

To change numbers



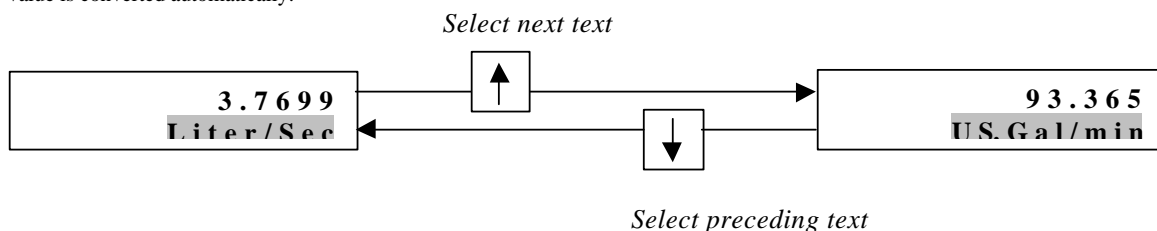
To shift cursor (flashing position)



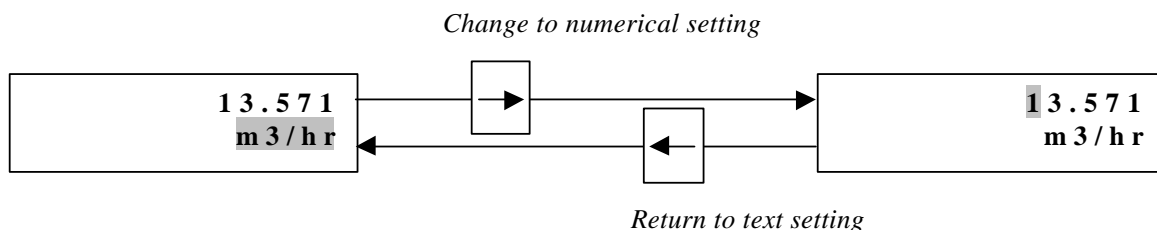
Shift to left

To alter text (units)

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

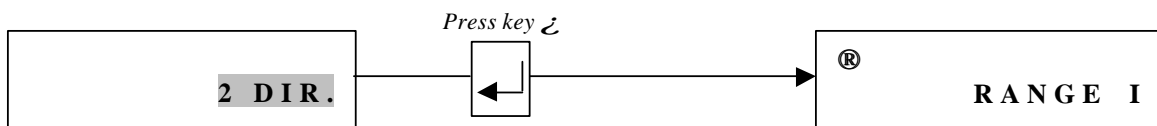


To change from text (unit) to numerical setting

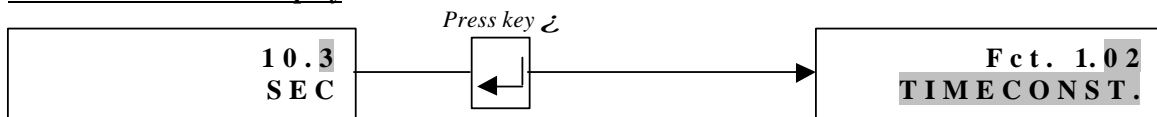


To change to subfunction

Subfunctions have no "Fct. No." and are identified by a "→" in the upper left corner.



To revert to function display





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
- F_{max}** = 1/2 x pulse width (s)
≤ 1 kHz if "AUTO" or "SYM." are selected in subfunction "PULSWIDTH"
- F_{min}** = 10 pulses/hr
- F_M** Conversion factor volume for any unit, see Fct. 3.05 "FACT. VOL."
- F_T** Conversion factor time for any unit, see Fct. 3.05 "FACT. TIME"
- GK** Primary head constant
- I** Current output
- I_{0%}** Current at 0% flow rate
- I_{100%}** Current at 100% flow rate

- P (P2)** Pulse output (2nd pulse output A1)
- P_{max}** = F_{max}/Q_{100%}
- P_{min}** = F_{min}/Q_{100%}
- Q** Current flow rate
- Q_{100%}** 100% flow rate = full scale range
- Q_{max}** = π/4 x DN² x v_{max} (= max. full-scale range
Q_{100%} at v_{max} = 12 m/s or 40 ft/s)
- Q_{min}** = π/4 x DN² x v_{min} (= min. full-scale range
Q_{100%} at v_{min} = 0.3 m/s or 40 ft/s)
- SMU** Low-flow cutoff for I and P
- v** Flow velocity
- v_{max}** Maximum flow velocity (12 m/s or 40 ft/s) at Q_{100%}
- v_{min}** Minimum flow velocity (0.3 m/s or 1 ft/s) at Q_{100%}
- F/R** Forward/reverse flow in F/R measuring mode

		Press ζ key to change to subfunction "RANGE I"
	® RANGE I	Selecting the measuring range <ul style="list-style-type: none"> • 0-20 mA • 4-20 mA (fixed ranges) • mA (user-defined range: $I_{0\%}$: 0-16 mA; $I_{100\%}$: 4-20 mA; Value $I_{0\%} < I_{100\%}$!) Press ® key to change to numerical setting. Press ζ key to change to subfunction "I ERROR".
	® I ERROR	Selecting the error value <ul style="list-style-type: none"> • 22 mA • 0.0 to $I_{0\%}$ mA (variable when $I_{0\%} \geq 1$ mA, see above) Press ® key to change to numerical setting. Press ζ key to return to Fct. 1.05 "CURRENT OUTPUT I".
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 <ul style="list-style-type: none"> • OFF • + DIR. • - DIR. (measuring in one flow direction only) • 2 DIR. (forward/reverse flow, F/R mode) Press ζ key to change to subfunction "SELECT P".
	® SELECT P	Selecting the type of pulse <ul style="list-style-type: none"> • PULSE/VOL. (pulses per unit volume, flow rate) • PULSE/TIME (pulses per unit time for 100% flow rate) Press ζ key to change to subfunction "PULSWIDTH".
	® PULSWIDTH	Selecting the pulse width <ul style="list-style-type: none"> • 0.01 – 1.00 s (only for $F_{max} < 50$ pulses/s) • AUTO (automatic = 50% of cycle duration of 100% output frequency) • SYM (symmetric = pulse duty factor approx. 1:1 across the entire range) Press ζ key to change to subfunction "VALUE P".
	® VALUE P	Setting the pulse value per unit volume (only displayed when "PULSE/VOL." is selected in "SELECT P" above). <ul style="list-style-type: none"> • xxxx PulS/m³ • xxxx PulS/Liter • xxxx PulS/US.Gal • xxxx PulS/user unit, factory setting "Liter" or "US Mgal" (see Fct. 3.05) Setting range "xxxx" depends on pulse width and full-scale range: $P_{min} = F_{min} / Q_{100\%}$, $P_{max} = F_{max} / Q_{100\%}$ Press ζ 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 in "SELECT P" above). <ul style="list-style-type: none"> • xxxx PulSe/Sec (=Hz) • xxxx PulSe/min • xxxx PulSe/hr • PulSe/user unit, factory setting "hr" (see Fct. 3.05). Setting range "xxxx" depends on pulse width (see above). Press ζ key to return to Fct. 1.06 PULS P.
1.07	STATUS A1 or PULS2 A1	Status output A1  A1 = terminal connected as status or pulse output (P2) 2nd pulse output A1  see Fct. 3.07 HARDWARE, "Terminal A1"
	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.P2	Selecting the function for pulse output P2 <ul style="list-style-type: none"> • OFF • + DIR. • - DIR. (measuring in one flow direction only) • 2 DIR. (forward/reverse flow, F/R mode) Press ζ key to change to subfunction "SELECT P2".
	® SELECT P2	Selecting the type of pulse <ul style="list-style-type: none"> • PULSE/VOL. (pulses per unit volume, flow rate) • PULSE/TIME (pulses per unit time for 100% flow rate) Press ζ key to change to subfunction "PULSWIDTH".
	® PULSWIDTH	Selecting the pulse width <ul style="list-style-type: none"> • 0.01 – 1.00 s (only for $F_{max} < 50$ pulses/s) • AUTO (automatic = 50% of cycle duration of 100% output frequency) • SYM (symmetric = pulse duty factor approx. 1:1 across the entire range) Press ζ key to change to subfunction "VALUE P2".
	® VALUE P2	Setting the pulse value per unit volume (only displayed when "PULSE/VOL." is selected in "SELECT P2" above). <ul style="list-style-type: none"> • xxxx PulS/m³ • xxxx PulS/Liter • xxxx PulS/US.Gal • xxxx PulS/user unit, factory setting "Liter" or "US Mgal" (see Fct. 3.05) Setting range "xxxx" depends on pulse width and full-scale range: $P_{min} = F_{min} / Q_{100\%}$, $P_{max} = F_{max} / Q_{100\%}$ Press ζ key to return to Fct. 1.07 PULS2 A1.
	® VALUE P2	Setting the pulse value per unit time (only displayed when "PULSE/TIME" is selected in "SELECT P2" above). <ul style="list-style-type: none"> • xxxx PulSe/Sec (=Hz) • xxxx PulSe/min • xxxx PulSe/hr • PulSe/user unit, factory setting "hr" (see Fct. 3.05). Setting range "xxxx" depends on pulse width (see above). Press ζ key to return to Fct. 1.07 PULS2 A1.
1.07	STATUS A1	Status output A1 (terminal A1 connected as status output A1 or as a 2nd pulse output A1, see Fct. 3.07 HARDWARE, "terminal A1").
1.08	STATUS A2	Status output A2
1.09	STATUS D1	Status output D1
1.10	STATUS D2	Status output D2

Fct.	Text	Description and settings
3.0	INSTALL.	Installation menu
3.01	LANGUAGE	Select language for display texts <ul style="list-style-type: none"> • GB / USA (English) • D (German) • F (French) <i>Press ↵ key to return to Fct. 3.01 "LANGUAGE".</i>
3.02	FLOWMETER	Set data for primary head
	Ⓜ <i>DIAMETER</i>	Select size from meter size table DN 2.5 – 3000 mm (1/10 – 120 inch) Select with - key. <i>Press ↵ key to change to subfunction "FULL SCALE".</i>
	Ⓜ <i>FULL SCALE</i>	Full-scale range for flow $Q_{100\%}$. To set, refer to Fct. 1.01 "FULL SCALE". <i>Press ↵ key to change to subfunction "GK VALUE".</i>
	Ⓜ <i>GK VALUE</i>	Set primary constant GK See instrument nameplate of primary head. Range: • 1.0000 – 9.9999 <i>Press ↵ key to change to subfunction "FIELD. FREQ.".</i>
	Ⓜ <i>FIELD. FREQ..</i>	Magnetic field frequency Values: 1/2, 1/6, 1/18 and 1/36 of power frequency, see instrument nameplate. <i>Press ↵ key to change to subfunction "FLOW DIR.".</i> <i>On DC instruments change to subfunction "LINE FREQ.".</i>
	Ⓜ <i>LINE FREQ..</i>	Power frequency customary in the country where the instrument is used Please note: this function to suppress line frequencies interferences is limited to instruments with DC supply unit (24 V DC). Value: 50 Hz and 60 Hz. <i>Press ↵ key change to subfunction "FLOW DIR.".</i>
	Ⓜ <i>FLOW DIR.</i>	Define flow direction (in F/R mode: forward flow). Set according to direction of arrow on primary head: • + DIR. • - DIR. Select using ↑ key. <i>Press ↵ key to return to Fct. 3.02 "FLOWMETER".</i>
3.03	ZERO SET	Zero calibration Note: Carry out only at "0" flow and with completely filled measuring tube! Precautionary query: <ul style="list-style-type: none"> • CALIB. NO <i>Press ↵ key to return to Fct. 3.03 "ZERO SET".</i> • CALIB. YES <i>Press ↵ key to start calibration.</i> Duration approx. 15-90 s (depending on magnetic field frequency), current flow rate displayed in the selected unit (s. Fct. 1.04 "DISP. FLOW"). A "WARNING" sign appears when flow rate ">0"; <i>acknowledge by pressing ↵ key.</i> <ul style="list-style-type: none"> • STORE NO do not store new zero value • STORE YES store new zero value Select using - key. <i>Press ↵ key to return to Fct. 3.03 "ZERO SET".</i>
3.04	ENTRY CODE	Entry code required to enter setting mode? <ul style="list-style-type: none"> • NO entry with → key only • YES entry with → key and Code 1: → → → ↵ ↵ ↵ ↵ ↑ ↑ ↑ <i>Press ↵ key to return to Fct. 3.04 "ENTRY CODE".</i>
3.05	USER UNIT	Set any required unit for flow rate and counting
	Ⓜ <i>TEXT VOL.</i>	Set text for required flow rate unit (max. 5 characters) Factory setting = Liter or US Mgal Characters which can be assigned to each place: <ul style="list-style-type: none"> • A-Z, a-z, 0-9 or "" (=blank character) <i>Press ↵ key to transfer to subfunction "FACT. VOL.".</i>
	Ⓜ <i>FACT. VOL.</i>	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 2.64172×10^{-4}) Factor F_M = volume per 1 m^3 . Setting range <ul style="list-style-type: none"> • 1.00000 E-9 to 9.99999 E+9 (= 10^{-9} to 10^{+10}) <i>Press ↵ key to transfer to subfunction "TEXT TIME".</i>
	Ⓜ <i>TEXT TIME</i>	Set text for any time (max. 3 characters) Factory settings = "hr" (hours) Characters which can be assigned to each place: <ul style="list-style-type: none"> • A-Z, a-z, 0-9 or "" (=blank character). <i>Press ↵ key to transfer to subfunction "FACT. TIME"</i>
	Ⓜ <i>FACT. TIME</i>	Set conversion factor F_T for time Factory setting "3.60000 E+3" for "hr" (exponent notation, here 3.6×10^3). Set factor F_T in seconds. Setting range <ul style="list-style-type: none"> • 1.00000 E-9 to 9.99999 E+9 (= 10^{-9} to 10^{+10}) <i>Press ↵ key to return to Fct. 3.05 "USER UNIT".</i>
3.06	APPLICAT.	Set modulation range of A/D converter
	Ⓜ <i>FLOW</i>	<ul style="list-style-type: none"> • STEADY (150% of $Q_{100\%}$) • PULSATING (1000% of $Q_{100\%}$) For partly filled flowmeters, this option should always be set to "PULSATING"! <i>Press ↵ key to change to subfunction "ADC GAIN".</i>

	Ⓢ ADC GAIN	Set gain of A/D converter <ul style="list-style-type: none"> • AUTO • 10 • 30 • 100 <i>Select with - or ^ key</i> <i>Press ↵ key to change to subfunction "SPEC. FILT."</i>
	Ⓢ SPEC. FILT.	Activate special filter for noise/interference suppression? Please note information and examples given in Sect. 6.7. <ul style="list-style-type: none"> • NO <i>Press ↵ key to change to Fct. 3.06 "APPLICAT."</i> • YES <i>Press ↵ key to change to subfunction "LIMIT VAL."</i>
	Ⓢ 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 _{100%} See Fct. 3.02, subfunction "FULL SCALE" <i>Press ↵ key to change to subfunction "LIMIT CNT."</i>
	Ⓢ LIMIT CNT.	Totalizer active when exceeding limit value (see "LIMIT VAL." above) (appears only when "YES" is selected under "SPEC. FILT.") Setting range: 001-250 <i>Press ↵ key to return to Fct. 3.06 "APPLICAT."</i>
3.07	HARDWARE	Determine hardware functions
	Ⓢ TERM.A1	Terminal A1 <ul style="list-style-type: none"> • PULSOUTP. • STATUSOUTP. <i>Select with - key.</i> <i>Press ↵ key to transfer to subfunction "SELFCHECK"</i>
	Ⓢ SELFCHECK	Carry out self check? See Section 5.18. <ul style="list-style-type: none"> • YES • NO (testing different parameters) <i>Press ↵ key to transfer to subfunction "FIELD CURRENT"</i>
	Ⓢ FIELD CUR.	Determine field current <ul style="list-style-type: none"> • INTERNAL • EXTERNAL For partly filled flowmeters this option must be set to "INTERNAL" ! <i>Press ↵ key to return to Fct. 3.07 "HARDWARE"</i>

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."

Error message	Description of error	Elimination of error
LINE INT.	Power failure <u>Note:</u> no counting during power failure	Cancel error in RESET/QUIT. menu Reset totalizer if necessary.
OVERFLOW I or OVERFL. I2	Current output overranged. (flow rate > measuring range)	Check instrument parameters and correct if necessary. After elimination of the cause, the error message is cancelled automatically. See sections 6.4 and 6.7.
OVERFLOW P or OVERFL. P2	Pulse output P or Pulse output range P2 exceeded (flow rate > modulation range)	Check instrument parameters and correct if necessary. After elimination of the cause, the error message is cancelled automatically. See Sections 6.4 and 6.7.
I SHORT or I2 SHORT	Current output I or I2 externally shorted or load < 15 Ω.	Check mA loop and increase load using additional resistor if necessary. After increasing load, the error message is cancelled automatically.
I OPEN or I2 OPEN	mA loop interrupted by current output I or I2 or load > 500 Ω.	Check mA loop and reduce load to 500 Ω if necessary. After reducing load, the error message is cancelled automatically.
TOTALIZER	Overflow of internal totalizer	Delete error message in RESET/QUIT menu, see sect. 4.6.
ADC	Analog/digital converter range exceeded	Set Fct. 3.06, subfunction ADC GAIN to "10". See sections 6.4 and 6.7. If error message does not disappear, consult factory.
ADC-PARAM.	Check sum error	Replace ADC printed circuit board

ADC-HARDW.	Hardware error A/D converter	Replace ADC printed circuit board
ADC GAIN	Hardware error A/D converter	Replace ADC printed circuit board
FC-HARDW.	Hardware error on field current PCB	Replace field current PCB
FATAL.ERROR	Fatal error, measurement interrupted	Replace electronic unit or consult factory.

4.6 Resetting the totalizer and deleting error messages, RESET/QUIT menu

Delete error messages in RESET/QUIT menu

Key	Display	Description
	-----	-----/----
	-----	-----/----
↵	CodE 2	--
↑ →		ERROR QUIT.
→		QUIT. NO
↑		QUIT. YES
↵		ERROR QUIT.
↵	-----	-----/----

Reset totalizer in RESET/QUIT menu

Key	Display	Description
	-----	-----/----
	-----	-----/----
↵	CodE 2	--
↑ →		ERROR QUIT.
↑		TOTAL.RESET
→		RESET NO
↑		RESET YES
↵		TOTAL.RESET
↵	-----	-----/----

5. Description of functions

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

Fct. 1.01 FULL SCALE

Press @ key

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

- **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

Select with - and ^ keys.

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

Set full-scale range $Q_{100\%}$

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

$$Q_{\min} = \frac{\pi}{4} \times DN^2 \times v_{\min} \quad Q_{\max} = \frac{\pi}{4} \times DN^2 \times v_{\max} \quad (\text{refer to flow table in Section 10.1})$$

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. 1.1 FULL SCALE

Please note that if “VALUE P” or “VALUE P2” is displayed after pressing ↵ key:

PULSE/VOL. is set in Fct. 1.06 PULS P and/or in Fct. 1.07 PULS 2 A1, subfunction “SELECT P” and/or “SELECT P2”.

Due to the changed full-scale range $Q_{100\%}$, the output frequency (F) of the pulse outputs is either exceeded or not reached:

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

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 @ key

Select

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

Select with - and ^ keys.

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

Set numerical value

- **0.2 – 99.9 s (seconds)**

Change flashing number (cursor) with - 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. 1.02 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.** • **- TOTAL.** • **+/- TOTAL.** • **SUM (S)** • **ALL (sequential)**

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.

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	\leq	100 mA

Connection diagrams, see sect. 2.5.6.

5.7 Current output I

Fct. 1.05 CUR. OUTP. I

Press $\text{\textcircled{R}}$ key

$\text{\textcircled{R}}$ FUNCT. I = select function for current output, press $\text{\textcircled{R}}$ 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 $\bar{}$ keys.

Press $\text{\textcircled{Z}}$ 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".

$\text{\textcircled{R}}$ REV. RANGE = select full-scale range for reverse flow

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

Press $\text{\textcircled{R}}$ 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 $\bar{}$ keys.

Press $\text{\textcircled{R}}$ key to change to numerical setting.

Changing flashing number (cursor) with keys - and $\bar{}$. Use \leftarrow and $\text{\textcircled{R}}$ keys to shift cursor 1 place to left or right.

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

Press $\text{\textcircled{Z}}$ key to change to subfunction "RANGE I".

$\text{\textcircled{R}}$ Range I = select the measuring range, press $\text{\textcircled{R}}$ 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 $\text{\textcircled{R}}$ key to change to numerical setting.

Select with - and $\bar{}$ keys.

Change flashing number (cursor) with keys - and $\bar{}$. Use \leftarrow and $\text{\textcircled{R}}$ 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 $\text{\textcircled{Z}}$ key to change to subfunction "I ERROR"

Ⓜ I ERROR = set error value, press Ⓜ key

- **22 mA** fixed value
- **0.0 – I_{0%} mA** variable value, only variable when I_{0%} ≥ 1 mA, see “RANGE I” above

Select with - and $\bar{\quad}$ keys.

Change flashing number (cursor) with keys - and $\bar{\quad}$. Use \leftarrow and \rightarrow 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 ζ 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		
	Pulse output P	2nd pulse output A1
To be used for ...	electronic totalizer	electromechanical or electronic totalizer
Terminals	P and P \perp	A1 and A \perp
F_{max} at full-scale range Q_{100%}	10.000 pulses/s	50 pulses/s
F_{min} at full-scale range Q_{100%}	10 pulses/hr	10 pulses/hr
Max. switching current	30 mA (AC or DC)	100 mA (AC or DC) 200 mA (DC polarized) see sect. 6.3
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 Ⓜ key

Press Ⓜ key

Ⓜ FUNCT. P = select function for pulse 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 $\bar{\quad}$ keys.

Press ζ 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.

Ⓜ SELECT P = select pulse type, press Ⓜ key

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

Select with - and $\bar{\quad}$ keys.

Press ζ 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 $\bar{\quad}$ keys.

Press Ⓢ key to change to numerical setting.

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

Press ζ 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 $\bar{\quad}$ keys.

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

Set numerical value

- **XXXX** setting range depends on pulse width and full-scale range:

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

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

Press ζ 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 $\bar{\quad}$ 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 $\bar{\quad}$. Use \rightarrow and Ⓢ keys to shift cursor 1 place to left or right. Flashing numbers can also be directly set with the 10-key keyboard.

Press ζ 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.

Status outputs	A1	A2	D1	D2
Select Fct. _ . _ _ then press → key	1.07	1.08	1.09	1.10
Terminals	A1 / A⊥	A2 / A⊥	D1 / D⊥	D2 / D⊥
Max. switching current	<ul style="list-style-type: none"> • 100 mA (AC or DC) • 200 mA (DC polarized) see sect. 6.3	100 mA (AC or DC)	100 mA (AC or DC)	100 mA (AC or DC)
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. *Select with - and ⊃ keys.*

Define full-scale range

XXX - YYY

- 0-150% 0-150% **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	Switch open	Switch closed
OFF (switched off)	no function	
ON (e.g. operation indicator)	power supply OFF	power supply ON
SIGN I (F/R mode)	forward flow	reverse flow
SIGN P/P2 (F/R mode)	forward flow	reverse flow
FULL SCALE (full-scale indicator)	inactive	active
AUTO. RNG. (automatic range change)	high range	low range
OVERFL. I (I range exceeded)	current output O.K.	current output range exceeded
OVERFL. P/P2 (P range exceeded)	pulse output O.K.	pulse output range exceeded
ALL ERRORS	error	no error
FATAL. ERRORS	error	no error
INVERS A1: Status output A2...	when A1 is closed	when A1 is open
INVERS D1: Status output D2...	when D1 is closed	when D1 is open
EMPTY PIPE (empty tube identification option)	when measuring tube is empty	when measuring tube is full

For factory settings please refer to sect. 2.5.7.

5.10 Control inputs C1 and C2

Fct. 1.11 CONTROL C1

Press @ key

and/or

Fct. 1.12 CONTROL C2

Press @ key

Select function for the control inputs, press - or ~ key

- **OFF** switched off, no function
- **OUTP. HOLD** hold output values 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 $\bar{\quad}$ keys.
Press ζ key to return to Fct. 3.01 LANGUAGE.

5.12 Entry code

Fct. 3.04 ENTRY CODE

Press @ key

Select

- NO no code, enter programming mode by pressing \rightarrow key.
- YES enter programming mode by pressing \rightarrow key and Code 1: $\rightarrow \rightarrow \rightarrow \downarrow \downarrow \downarrow \uparrow \uparrow \uparrow$.

Select with - and $\bar{\quad}$ keys.
Press ζ key to return to Fct. 3.04 ENTRY CODE.

5.13 Primary head

Fct. 3.02 FLOW METER

Press @ key

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

Select size from table of meter sizes:

DN 2.5 – 3000 equivalent to **1/10 – 120 inch**

Select with - and $\bar{\quad}$ keys.
Press ζ key to change to subfunction “FULL SCALE”.

@ FULL SCALE = set full scale range, press @ key

Set as described in sect. 5.1.

Press ζ key to change to subfunction “GK VALUE”.

Please note that if “VALUE P” or “VALUE P2” is displayed after pressing ζ 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:

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

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 $\bar{\quad}$. Use \leftarrow and @ keys to shift cursor 1 place to left or right.
Flashing numbers can also be directly set with the 10-key keyboard.
Press ζ key to change to subfunction “FIELD FREQ.”.

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

- 1/2 • 1/6 (1/2, 1/6, 1/18 or 1/36 of power frequency, see instrument nameplate,
- 1/18 • 1/36 do **not** change setting.

Select with - and $\bar{\quad}$ keys.
Press ζ 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 $\bar{\quad}$ keys.

Press ζ 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 $\bar{\quad}$ keys.

Press ζ 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 $\bar{\quad}$. Use \rightarrow and Ⓢ keys to shift cursor 1 place to left or right.
Flashing numbers can also be directly set with the 10-key keyboard.

Press ζ 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 m³.
Setting range: 1.00000 E-9 to 9.99999 E+9 (=10⁻⁹ to 10⁺¹⁰)

Change flashing number (cursor) with keys - and $\bar{\quad}$. Use \rightarrow and Ⓢ keys to shift cursor 1 place to left or right.
Press ζ 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 $\bar{\quad}$. Use \rightarrow and Ⓢ keys to shift cursor 1 place to left or right.
Flashing numbers can also be directly set with the 10-key keyboard.

Press ζ 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 $\bar{\quad}$. Use \rightarrow and Ⓢ keys to shift cursor 1 place to left or right.
Press ζ 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

Volumetric unit	TEXT VOL.	Factor F_M	Setting
Cubic meters	m³	1.0	1.00000 E+0
Liter	Liter	1000	1.00000 E+3
Hectoliters	h Lit	10	1.00000 E+1
Deciliters	d Lit	10000	1.00000 E+4
Centiliters	c Lit	100000	1.00000 E+5
Milliliters	m Lit	1000000	1.00000 E+6
US gallons	USGal	264.172	2.64172 E+2
Millions US gallons	USMG	0.000264172	2.64172 E-4
Imperial gallons	GBGal	219.969	2.19969 E+2
Mega imperial gallons	GBMG	0.000219969	2.19969 E-4
Cubic feet	Feet3	35.3146	3.53146 E+1
Cubic inches	inch3	61024	6.10240 E+4
US barrels liquid	US BaL	8.36364	8.38364 E+0
US barrels ounces	US BaO	33813.5	3.38135 E+4

Factors for time F_T

Time unit	TEXT TIME	Factor F_T	Setting
Seconds	sec	1	1.00000 E+0
Minutes	min	60	6.00000 E+1
Hours	hr	3600	3.60000 E+3
Day	DAY	86400	8.64000 E+4
Year	YR	31536000	3.15360 E+7

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”.

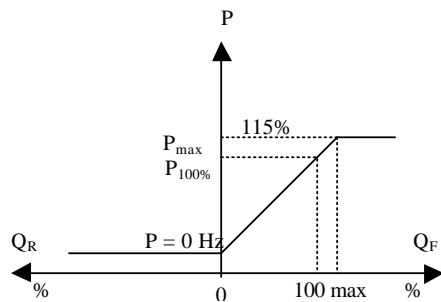
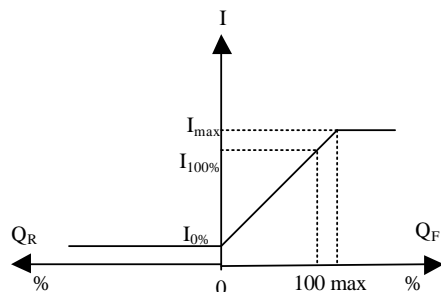
5.16 Output characteristics

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

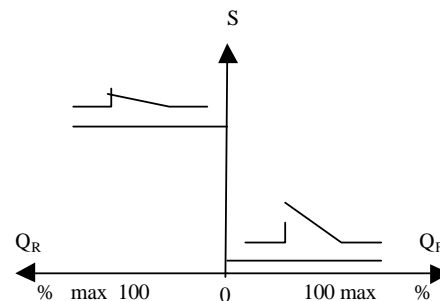
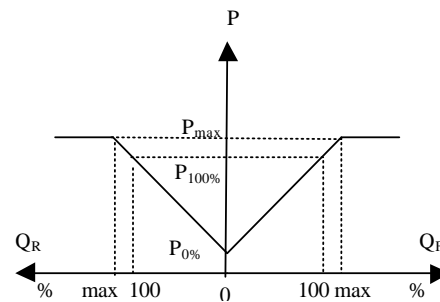
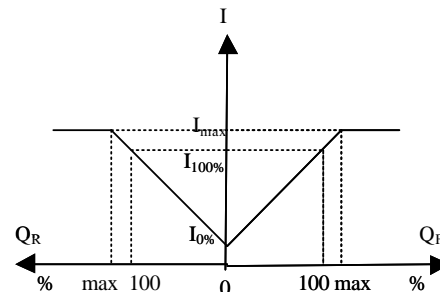
 switch open

 switch closed

1 flow direction



2 flow directions



5.17 Applications

Fct. 3.06 APPLICAT.

Press $\text{\textcircled{R}}$ key twice

Set flow characteristics, select with - or $\bar{\text{~}}$ keys

- **STEADY** steady flow
- **PULSATING** pulsating flow, standard setting for Tidalflux applications. Do not change this setting!

Press $\text{\textcircled{Z}}$ key to change to subfunction "ADC GAIN".

Set ADC GAIN, select with - or $\bar{\text{~}}$ 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 $\text{\textcircled{Z}}$ 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 $\text{\textcircled{R}}$ key

$\text{\textcircled{R}}$ TERM. A1 = define function of terminal A1, press $\text{\textcircled{R}}$ key

- **PULSOUTP.** = puls output
- **STATUSOUTP.** = status output

Select with - or $\bar{\text{~}}$ keys, press $\text{\textcircled{Z}}$ key to change to "SELFCHECK".

$\text{\textcircled{R}}$ SELFCHECK = carry out self check during measurement?, press $\text{\textcircled{R}}$ key

- **NO**
- **YES**

Select with - or $\bar{\text{~}}$ 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 $\text{\textcircled{Z}}$ key to change to "FIELDCUR."

$\text{\textcircled{R}}$ FIELDCUR. = Select field current supply, press $\text{\textcircled{R}}$ key

- **INTERNAL**
- **EXTERNAL**

For this type of flowmeters this option should always be set to "INTERNAL".

Select with - or $\bar{\text{~}}$ keys.

Press $\text{\textcircled{Z}}$ key to return to Fct. 3.07 "HARDWARE".

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 $\bar{}$ keys, press \checkmark key to confirm and to change to numerical setting, 1st number (cursor) flashes.

Change flashing number (cursor) with keys - and $\bar{}$. Use \leftarrow and @ keys to shift cursor 1 place to left or to right.

- **Display: XXX – YYY**

Setting ranges: XXX value: 0 – 150% of $Q_{100\%}$.

YYY value: 0 – 150% of $Q_{100\%}$.

hysteresis $\geq 1\%$ (=difference between XXX and YYY values)

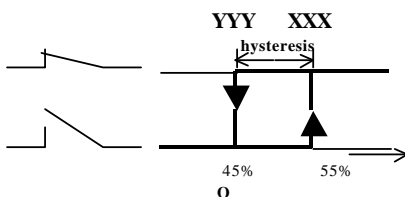
Switching behavior (NO / NC contact) and hysteresis are adjustable

Normally Open (NO) contact

XXX value > YYY value

Switch **closes** when flow **exceeds** XXX value
value

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

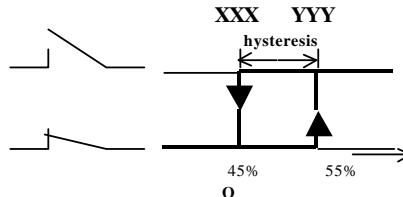


Normally Closed (NC) contact

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 \checkmark key to change to numerical setting, 1st number (cursor) flashes.

Change flashing number (cursor) with keys - and $\bar{}$. Use \leftarrow 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 $Q_{100\%}$ (=low to high range ratio 1:20 to 1:1.25)

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

External range change by control input

Fct. 1.11 or 1.12 Control inputs C1 or C2

Press ® key

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

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

Change flashing number (cursor) with keys - and -. Use ⇐ and ® keys to shift cursor 1 place to 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 ⌵ 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 $I \leq 200$ mA (factory setting: $I \leq 100$ 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 Tidalflex 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 \downarrow key 4 times to return to measuring mode.

The following displays are possible in measuring mode:

ADC = A/D converter range exceeded

and

OVERFL. I,P and/or **P2** = one or several output ranges exceeded

Change procedure A

PLEASE NOTE:

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

- **Fct. 1.02 TIMECONST.** (change time constant)
 - Set to "ONLY I"; set to "ALL" when pulse output is also unsteady.
 - Set time constant to approx. 20 seconds, check if display remains unsteady and correct if necessary.
- **Fct. 3.06 APPLICAT.**
 - Check if setting in subfunction "FLOW" is "PULSATING".
 - 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".

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

Change procedure B

PLEASE NOTE:

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

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.

- **Fct. 1.02 TIMECONST.**
Change setting to 3 seconds.
 - **Fct. 3.06 APPLICAT.**
 - Select "YES" in subfunction "SPEC. FILT." to activate a special noise filter.
 - Subfunction "LIMIT VAL." defines a window with a width (somewhere around the mean flow) equivalent to the value in PERCENT of the full-scale range $Q_{100\%}$ set here (Fct. 3.02, subfunction "FULL SCALE"). This value must always be **a lot smaller** than the amplitude of the display ripple (peak to peak).
Example:
full-scale range $Q_{00\%}$ 500 m³/hr
ripple mean value ± 25 m³/hr = $\pm 5\%$ of full-scale range $Q_{100\%}$
set amplitude to e.g. $\pm 2\%$
- Signals outside the \pm **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...

$\Delta Q_{\max} / \Delta T$ [% / s] = LIMIT VAL. / TIMECONST. (Fct. 1.02)

formula applying to the above example:

$\Delta Q_{\max} / \Delta T$ [% / 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."

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:

Key	Display		Description
→			If “YES” is selected in Fct. 3.04 ENTRY CODE key in 9-stroke CODE 1 now: → → → ↵ ↵ ↵ ↑ ↑ ↑.
2x ↑	Fct. 1.00	OPERATION	
→	Fct. 3.00	INSTALL.	
2x ↑	Fct. 3.01	LANGUAGE	
→	Fct. 3.03	ZERO SET	
↑	CALIB. NO		
↵	CALIB. YES		
↵	0.00	-----/----	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	
↵	Fct. 3.03	ZERO SET	Store new zero value
(2x) 3x ↵	-----	-----/----	Measuring mode with new zero

7.2 Checking the measuring range Q, Fct. 2.01

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

Key	Display		Description
→			If “YES” is selected in Fct. 4.04 ENTRY CODE key in 9-stroke CODE 1 now: → → → ↵ ↵ ↵ ↑ ↑ ↑.
↑	Fct. 1.00	OPERATION	
→	Fct. 2.00	TEST	
→	Fct. 2.01	TEST Q	
↑		SURE NO	
↑		SURE YES	
↵	0	PCT.	Current, pulse and status outputs indicate corresponding values.
↑	± 10	PCT.	
↑	± 50	PCT.	
↑	± 100	PCT.	
↑	± 110	PCT.	
↵	Fct. 2.01	TEST Q	End of test, actual measured values again available at outputs
(2x) 3x ↵	-----	-----/----	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:

Key	Display		Description
→ ↑ → ↑	Fct. 1.00 Fct. 2.00 Fct. 2.01 Fct. 2.02	OPERATION TEST TEST Q. HARDW. INFO	If "YES" is selected in Fct. 3.04 ENTRY CODE, key in 9-stroke CODE 1 now: → → → ↵ ↵ ↵ ↑ ↑ ↑.
→	→ MODUL ADC	- . - - - - . - - - - - - - - - -	1st window
↵	→ MODUL I/O	- . - - - - . - - - - - - - - - -	2nd window
↵	→ MODUL DISP.	- . - - - - . - - - - - - - - - -	3rd window
↵	→ MODUL RS	- . - - - - . - - - - - - - - - -	4th window
PLEASE NOTE DOWN ALL 8 STATUS CODES !			
↵ (2x) 3x ↵	Fct. 2.02 - - - - - - - -	HARDW. INFO - - - - - / - - -	Terminate hardware information back to measuring mode

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



"character 6"- value	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
	Errors regarding partly filled situations															
Pipe less than 10 % filled (see note 1)		X		X		X		X		X		X		X		X
Error in IFS 4000 PF primary head (see note 2)			X	X			X	X			X	X			X	X
Parity error in communication between primary head and signal converter (see note 3)					X	X	X	X					X	X	X	X
Timeout error in communication between primary head and signal converter (see note 4)									X	X	X	X	X	X	X	X

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.

Key	Display		Description
→ ↑ → 2x ↑ → ↑	Fct. 1.00 Fct. 2.00 Fct. 2.01 Fct. 2.03	OPERATION TEST TEST Q HARDW. TEST SURE NO SURE YES	if “YES” is selected in Fct. 3.04 ENTRY CODE, key in 9-stroke CODE 1 now: → → → ↵ ↵ ↵ ↑ ↑ ↑. Hardware test
↵ ↑ ↑		WAIT ----- ----- -----	Hardware test in progress, duration approx. 60 seconds 1st error List of errors see sect. 4.5. Errors are 2nd error always displayed independent of setting in 3rd error Fct. 1.04. If no error is detected, refer to next line.
↵ (2x) 3x ↵	Fct. 2.03 -----	HARDW. TEST ----- / ---	Terminate hardware test back to measuring mode

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.

Group LED	Display	Cause	Remedial action
LED 1	Both LED's flash	A/D converter range exceeded	<ul style="list-style-type: none"> • Check if setting in Fct. 3.06 (menu “FLOW”) is “PULSATING”. • 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	<ul style="list-style-type: none"> • 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

LED 2	Red LED flashes	Fatal error, hardware and/or software fault	Replace signal converter, see sect. 8.3
LED 3	Cyclic flashing of red LED, approx. 1 sec.	Hardware fault	Replace signal converter, see sect. 8.3
LED 4	Red LED on continuously	Hardware fault	Replace signal converter, see sect. 8.3
Group D	Display	Cause	Remedial action
D1	LINE INT.	Power failure <u>Note:</u> no counting during power failure	Delete error message in RESET/QUIT. menu, reset totalizer if necessary.
D2	OVERFL. I	Current output range exceeded	Check instrument parameters and correct if necessary. Reset totalizer. Error message is deleted automatically after cause has been eliminated.
D3	OVERFL. P	Pulse output range exceeded <u>Note:</u> totalizer deviation is possible	Check instrument parameters and correct if necessary. Reset totalizer. Error message is deleted automatically after cause has been eliminated.
D4	ADW	A/D converter range exceeded	Error message is deleted automatically after cause has been eliminated.
D5	FATAL.ERROR	Fatal error, all outputs are set to "min" values	Replace signal converter, see sect. 8.3 or consult Krohne Service, having first noted down hardware information and error status, see sect. 7.3, Fct. 2.02.
D6	TOTALIZER	Counts lost (overflow, data error)	Delete error message in RESET/QUIT. menu.
D7	I SHORT	Short circuit at current output	Check electrical connection acc. to Sect. 2.2 and correct if necessary. Load $\geq 15 \Omega$!
D8	I OPEN	Open current output	Provide load $\leq 500 \Omega$!
D9	ADC PARAM.	Fault detected on the ADC printed circuit	Check measuring accuracy. Replace ADC printed circuit board (see Sect. 8.4) or consult Krohne Service, having first noted down hardware information and error status, see Sect. 7.3, Fct. 2.02
D10	ADC HARDW.		
D11	ADC GAIN		
D12	STARTUP, cyclic flashing	Hardware fault	Replace signal converter or consult Krohne Service, having first noted down hardware information and error status, see sect. 7.3, Fct. 2.02
D13	BUSY	Displays for flow, totalizers and messages disabled	Change setting in Fct. 1.4
D14	unsteady display	Low electrical conductivity, high solids content, pulsating flow	Increase time constant in Fct. 1.2.
D15	No display	Power supply OFF	Switch on power supply.
		Check power supply fuse F7 (F1 and possibly F2 for DC versions) in terminal compartment	Replace if blown, see sect. 8.1.

Group I	Faults / Symptoms	Cause	Remedial action
I1	Receiver instrument indicates "0". Invoke test function 2.03 for analysis see Sect. 7.4	Display shows...	
		I SHORT Current output shorted, load < 15 Ω	Eliminate short circuit, load must be ≥ 15 Ω!
		I OPEN Load > 500 Ω	Find interruption and eliminate.
		No information displayed after test	
		as described for faults I2 and I9	
I2	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.
I3	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.
I4	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.
I5	Unsteady display	Electric conductivity of process liquid too low	Increase time constant (see sect. 5.2, Fct.1.2). Also refer to sect. 6.7.
I6	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.
I7	Jumping current values	Current output is set to automatic range change	Change hysteresis or tripping ranges, see sect. 5.19.
I8	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".
I9	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.

Group P	Faults / Symptoms	Cause	Remedial action
P1	Totalizer connected but does not count pulses	Wrong connection / polarity	Connect properly, see sect. 2.5.3 and 2.5.6, note recommended resistances !
		Totalizer or external voltage source defective	Check connections, totalizer and external voltage source and replace if necessary.
		Internal power supply (E+ E-) is voltage source, shorted or defective pulse output	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,
		Pulse output switched off or wrong flow direction setting	see sect. 8.3 and/or 8.4. Switch on pulse output and change flow, see sect. 5.8 and 5.13, Fct. 1.06 (P), 1.07 (A1) and 3.02.
		Fatal error, red LED is on	Replace signal converter or consult Krohne Service, having first noted down hardware information and error status. see sect. 7.3, Fct. 2.02
		Control input C1 or C2 is set to "Zero outputs" and is activated	Change settings, see sect. 5.10, Fct. 1.11 and 1.12 or deactivate control input.
	These causes only apply to the 2nd pulse output P2, terminal A1 !	Terminals A1 and A _L are not defined as a 2nd pulse output	Switch on in Fct. 3.07 and set in Fct. 1.07.
		Resistance of totalizer too low for DC operation, I > 100 mA.	Re-position jumper X4 on I/O PCB to suit DC operation, see sect. 6.3.
P2	Constant output of totalizer pulses	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.
P3	Unsteady pulse rate	Electrical conductivity of process liquid is too low	Increase time constant (see Sect. 6.5-6.7) or consult Krohne Service.
P4	Pulse rate too high or too low	Incorrect pulse output settings	Correct settings in Fct. 1.06 (P) or 1.07 (A1).

Group S	Faults / Symptoms	Cause	Remedial action
S1 (A1, A2, D1, D2)	No reaction from connected signaling instrument(s)	Defective signaling instrument(s) or external voltage source	Check signaling instrument(s) or external voltage source and <u>replace if necessary.</u>
		Internal power supply (E+/E-) is voltage source: shorted, one or several pulse outputs defective.	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 doesn't not operate, check fuses F.. on the I/O PCB for the status outputs and replace if necessary: F2 for terminals A1 and A1 F3 for terminals A2 and A1 F4 for terminals D1 and D1 F5 for terminals D2 and D1 If it still does not operate, one or several pulse outputs are defective. Replace I/O PCB, see sect. 8.4.
		Control inputs C1 and C2 are set to "Hold outputs" or to "0".	Change setting, see sect. 4.4 and 5.10, Fct. 1.11 and 1.12.
		In addition to this, the red LED flashes = Fatal Error	Replace signal converter, see sect. 8.3.
S2 (A1, A2, D1, D2)	Signaling instrument(s) is (are) constantly tripped	"All Error" or "Fatal Error" settings	Check settings in Fct. 1.07-1.10 and change if necessary, see sect. 4.4 and 5.9.
S3 (only for A1)	No reaction of connected signaling instrument	Terminal "A1" not defined as status output	Adjust in Fct. 3.07
		Wrong connection/polarity	Observe polarity for driver capacity 0.1 < I £ 0.2 A see sect. 6.3. A1 = "+" and A^ = "-"
S4 (only for A1)	Cyclic tripping of signaling instrument	Terminal "A1" not defined as status output	Adjust in Fct. 3.07.
Group C	Faults / Symptoms	Cause	Remedial action
C1	No function of control inputs	Wrong connection	Connect properly, see sect. 2.5.5 and 2.5.6
		Defective control input C or voltage source (internal or external)	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 <u>necessary.</u>
		Wrong setting of control inputs	Change setting, see sect. 4.4 and 5.10.

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.

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

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

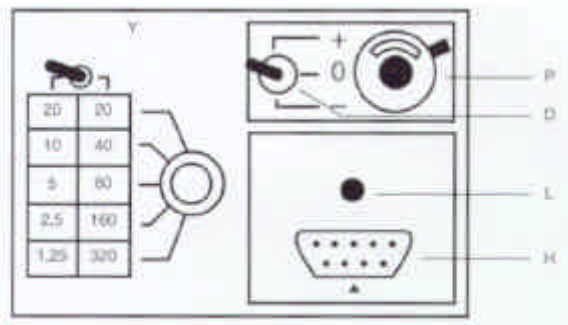
- **Switch off the power supply of the IFC 110 PF.**
- Remove the cover from the terminal compartment (remove 2 screws).
- Pull out the two plug-in terminals **SC** (5-pin, signal line) and **FP** (4-pin, field current supply line), see illustration in sect. 8.1.
- Fill the measuring tube of the flowmeter completely with process liquid.
- **Please note:** The following measurements must only be carried out for plug-in terminals which are occupied (used).

Action	Typical result	Incorrect result for
Resistance measurements at plug-in terminals SC (5-pin, signal line) and FP (4-pin, field current supply line)		1-3 = defective primary head, return to factory for repair, refer to last-but-one page!
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

			electrodes contaminated.
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.

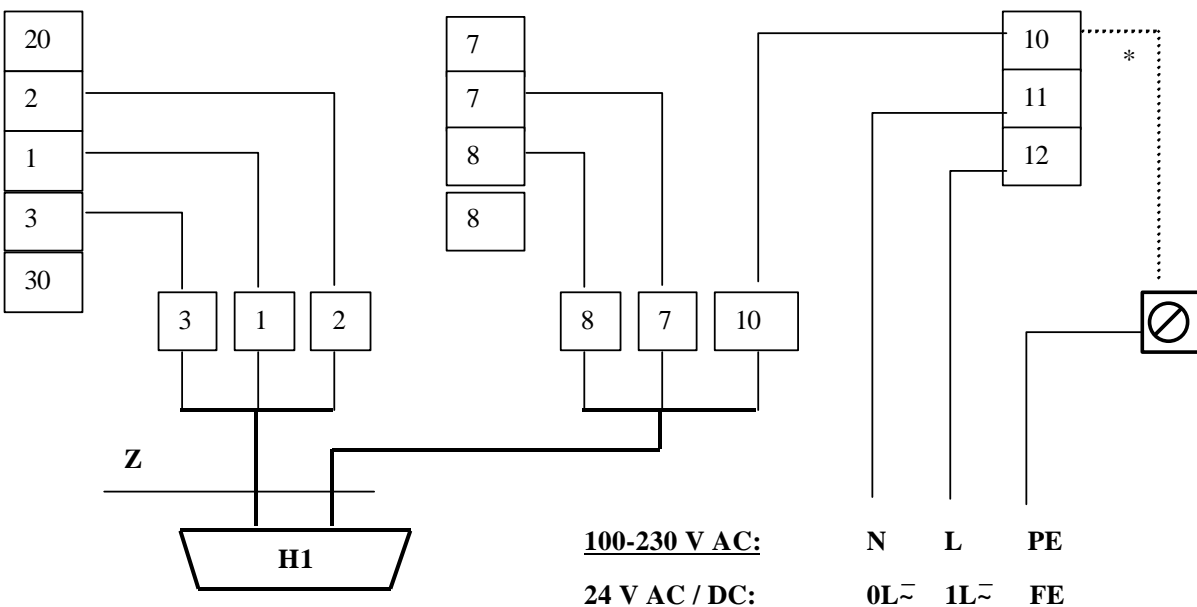
7.7 Checking the signal converter using a GS 8 A simulator (optional)

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



*** 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 $< \pm 10 \mu A$.
- 4) Calculate the position of switch **Y** and displayed setpoints “**I**” and “**P**”

4.1)
$$X = \frac{Q_{100\%} * K}{GK * DN^2}$$

- $Q_{100\%}$ 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

t	Sec	min	hr
V			
liters	25 464	424.4	7.074
m^3	25 464 800	424 413	7074
US Gallons	96 396	1 607	26.78

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:

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

$I_{0\%}$ 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:

$$f = \frac{Y}{X} * P_{100\%} \text{ in Hz}$$

$P_{100\%}$ 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 m ³ /hr (Fct. 1.01)
Meter size	DN	= 200 mm = 8 inch (Fct. 3.02)
Current at $Q_{0\%}$	$I_{0\%}$	= 4 mA (Fct. 1.05)
	$Q_{100\%}$	$I_{100\%}$ = 20 mA (Fct. 1.05)
Pulses at $Q_{100\%}$	$P_{100\%}$	= 280 pulses/hr (Fct. 1.06)
Primary head constant	GK	= 3.571 (see instrument nameplate)
Constant (V in m ³)		
(t in hr)	K	= 7074 (see table)
(DN in mm)		

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

$$X = \frac{Q_{100\%} * K}{GK * DN^2} = \frac{113.1 * 7074}{3.572 * 200 * 200} = 5.6$$

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

$$I = I_{0\%} + \frac{Y}{X} (I_{100\%} - I_{0\%}) = 4 \text{ mA} + \frac{5}{5.6} * (20 \text{ mA} - 4 \text{ mA}) = 18.3 \text{ mA}$$

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

$$f = \frac{Y}{X} * P_{100\%} = \frac{5}{5.6} * \text{pulses/hr} = 250 \text{ pulses/hr}$$

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.

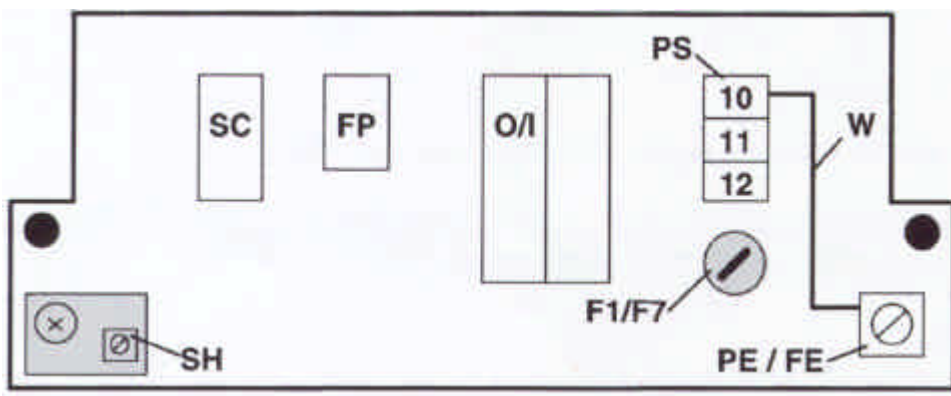
8. Service

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 insulation 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 ⑦ and ⑧.

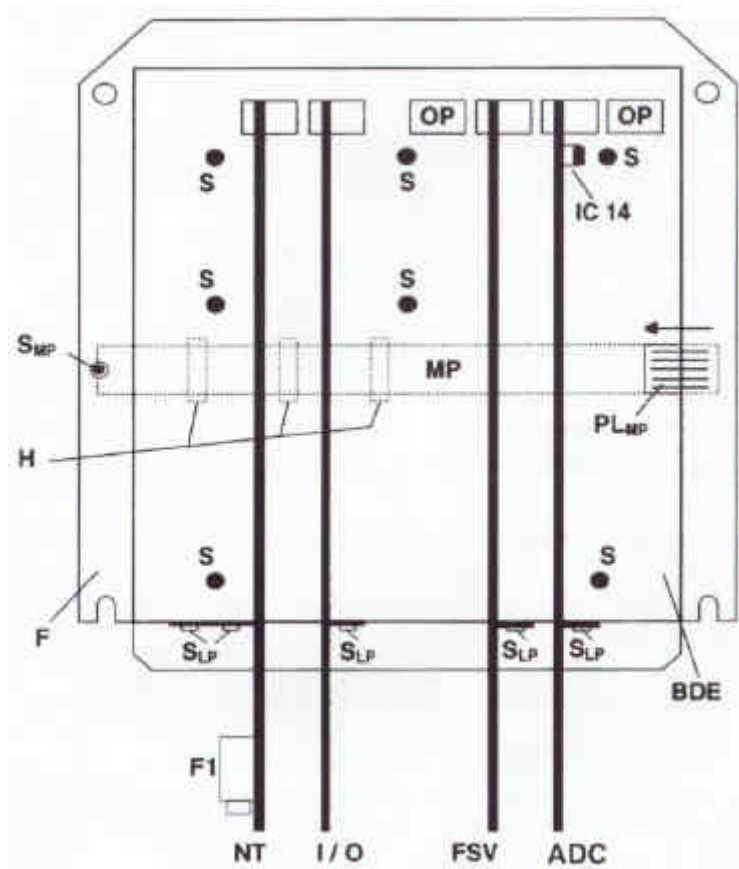
8.3 Replacing the complete electronic unit of the IFC 110 PF signal converter

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)
BDE motherboard
F front panel
F1 power supply fuse, see Sect. 8.1 and 9.
FSV printed circuit board for field current supply
H 3 retaining clips at the back of the front panel
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

NT printed circuit board for power unit
OP connection plug for additional modules
PL_{MP} 5-pin plug connector for connection of the printed circuit board MP for the magnetic sensors
S 7 nuts for fastening the electronic unit to front panel
S_{LP} nut and special steel tooth lock washer for fixing the MP PCB for the magnetic sensors



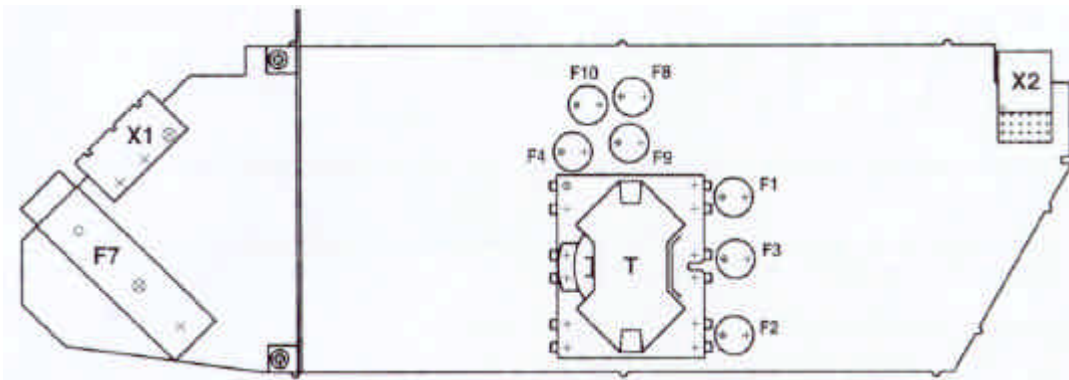
8.4 Replacing single printed circuit boards (PCBs)

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) **S_{LP}** 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



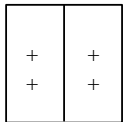
- X1** plug-in terminals inside terminal compartment
X2 internal connection to motherboard
T transformer

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

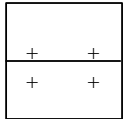
- F1** 5 V voltage
F2 field current supply
F3 current output and power supply
F4 auxiliary voltage
F7 power supply
F8-F10 coupling elements

Inputs/outputs PCB, I/O

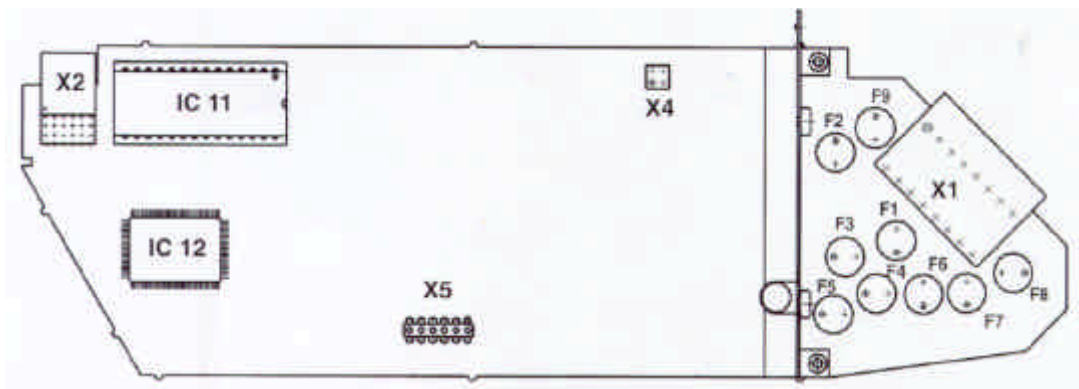
Jumper X4



DC operation ≤ 0.2 A



AC operation ≤ 0.1 A
(factory setting)

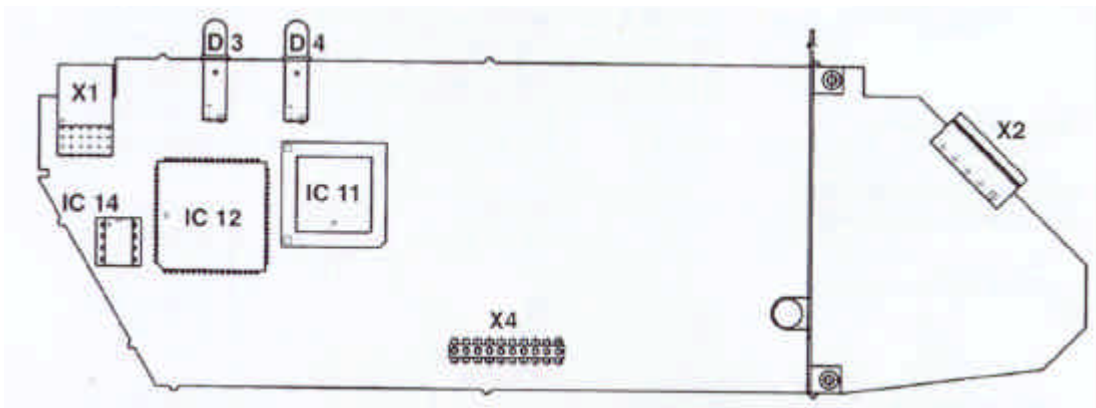


- X1** plug-in terminals inside terminal compartment
- X2** internal connection to motherboard
- X4** jumper, change-over of AC/DC operation of output A1, see sect. 6.3
- X5** multipoint connector
- IC 11** control program EPROM
- IC 12** microprocessor

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
X2 plug-in terminals in terminal compartment
X4 multipoint connector
IC 11 peripheral IC incl. control program

IC 12 microprocessor
IC 14 data EEPROM
D3 green LED on front panel
D4 red LED on front panel

9 Order numbers

Spare parts		Order No.
Electronic unit with display	100-230 V AC without magnetic sensors	2106680000
	100-230 V AC with magnetic sensors	2109400000
	24 V AC / DC without magnetic sensors	2107870000
Power supply fuses	F7: 100-230 V AC 0.8 A T	5080850000
Various small fuses TR5 fuses primary head not added		
• I/O PCB (inputs/outputs)	F2, F8 T 250 mA	5075640000
	F1, F3-F7, F9 T 160 mA	5075900000
• NT PCB (power unit)	F1 T 1.6 A	5090700000
	F2 T 630 mA	5080190000
	F3 T 500 mA	5075860000
	F8, F9, F10 T 50 mA	5075780000
plug-in terminals (printed and coded)	3-pin power supply	3161180100
	8-pin outputs D and P, inputs C	3160220100
	8-pin outputs A and I, internal power supply E	3160230100
	4-pin field current supply	3160200100
	5-pin signal line	3160210100
RS 232 adapter incl. CONFIG operator software (from version V 3.1 onwards)		
	German	V 035100131
for operator control of signal converter by MS-DOS PC or laptop	English	V 035100132
Conversion kit MP for magnetic sensors (complete retrofitting kit)		V 150100004
Bar magnet for operating the magnetic sensors		2070530000
Primary head simulator GS 8A		2070680200
Adapter to make older versions of GS 8 simulators suitable for use with IFC 110 PF		2107640000
Glass cover for housing		2106730000
Sealing material for housing cover , by the meter		3137030000
ADC PCB (A/D converter)		2105380000
I/O PCB (inputs/outputs)		2109000000
FSV PCB (field current supply)		2105750000
NT PCB (power unit) 100-230 V AC		2105720000
NT PCB (power unit) 24 V AC / DC		2107890000

Part D Technical Data, Measuring Principle and Block Diagram

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 + 140F	
Ambient temperature	- 25 to + 60°C / - 13 to + 140F	
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 m ³ /h or 160 US Gal / min (minimum for DN200 / 8”) and 100 000 m ³ /h or 500 000 US Gal / min (maximum for DN1600 / 64”) equivalent 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	

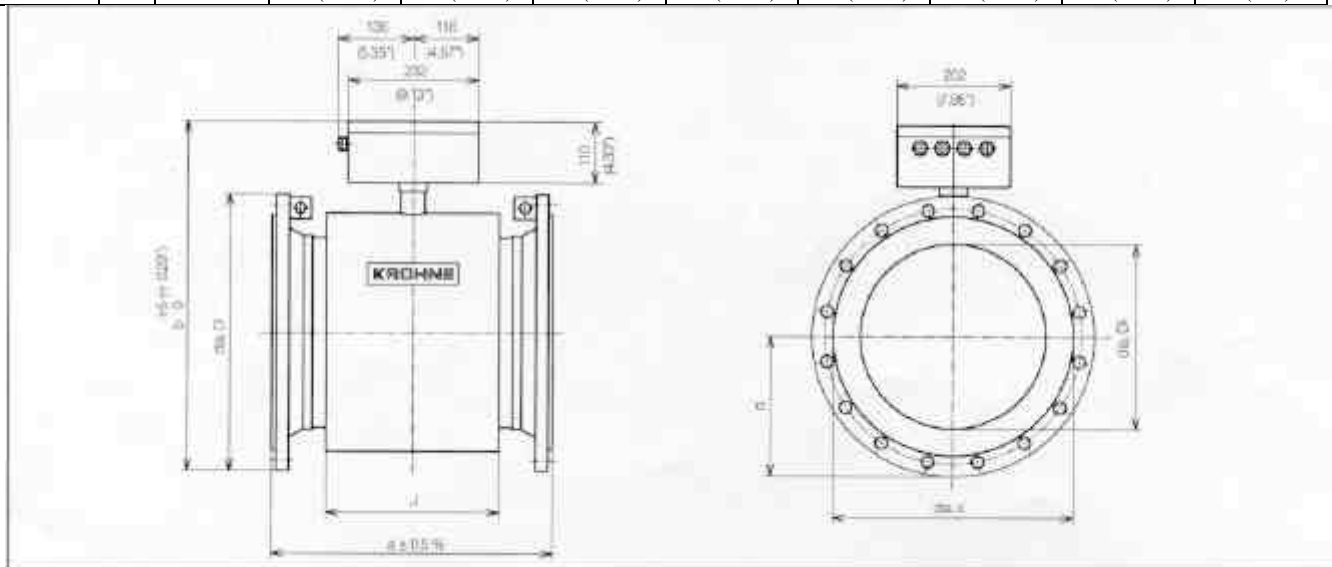
Materials of construction

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

Meter size to ...			Dimensions in mm (inches)							Approx. weight
DIN 2501		ANSI	a	b	Øc	D	j	ØD	ØDi	kg (lb)
Mm	PN	B16.5								
DN 200	10	8"/150lb	350 (13.78)	482 (18.98)	291 (11.46)	146 (5.75)	177 (6.97)	340 (13.39)	189 (7.44)	40 (90)
DN 250	10	10"/150lb	400 (15.75)	530 (20.87)	331 (13.03)	166 (6.54)	205 (8.07)	395 (15.55)	231 (9.09)	54 (120)
DN 300	10	12"/150lb	500 (19.69)	580 (22.83)	381 (15.00)	191 (7.52)	235 (9.25)	445 (17.52)	281 (11.06)	66 (145)
DN 350	10	14"/150lb	500 (19.69)	632 (24.88)	428 (16.85)	214 (9.80)	306 (12.05)	505 (19.88)	316 (12.44)	95 (210)
DN 400	10	16"/150lb	600 (23.62)	689 (27.13)	483 (19.02)	242 (9.53)	386 (15.20)	565 (22.24)	365 (14.37)	115 (255)
DN 500	10	18"/150lb	600 (23.62)	792 (31.18)	585 (23.03)	293 (11.54)	386 (15.20)	670 (26.38)	467 (18.39)	145 (320)
DN 600	10	20"/150lb	600 (23.62)	876 (34.49)	694 (27.32)	347 (13.66)	386 (15.20)	780 (30.71)	567 (22.32)	180 (400)



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

Display version, with local display and control elements (standard version for Tidalflex)
same as display version, but with magnetic sensors (MP) allowing the signal converter to be operated without opening the housing.

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 %

$I_{0\%} = 0 - 16 \text{ mA}$

for Q = 100 %

$I_{100\%} = 4 - 20 \text{ mA}$

for Q > 100 %

$I > 20 \text{ (22 mA max.)}$

Load

15 – 500 Ω

Error identification

0 / 22 mA and variable

Forward/reverse mode

direction identified via status output

Pulse outputs (passive)	P - for electronic totalizers - all operating data adjustable P / P 0 – 10 000 pulses per s [=Hz], min, hr, m ³ , Litre, etc., any scaling possible galvanically isolated U ≤ 32 V DC / ≤ 24 V AC I ≤ 30 mA, any polarity	A1 (also used as status output) - for electromechanical totalizers - all operating data adjustable A1 / A⊥ 0 – 50 pulses per s [=Hz], min, hr, m ³ , Litre, etc., any scaling possible galvanically isolated, not from A2 U ≤ 32 V DC / ≤ 24 V AC I ≤ 100 mA, any polarity or U ≤ 32 V DC, I ≤ 200 mA, observe polarity
Terminals		
Pulse rate		
Electrical data		
Pulse width	automatic: pulse duty factor 1:1, $P_{100\%} [\text{Pulse/s}] = f_{\text{max}} [\text{Hz}] = 1 / (2 \cdot \text{pulse width})$ digital pulse division, unequal pulse spacing, therefore comply with minimum counting time when connecting frequency and cycle duration measuring instruments: gating of totalizer $\geq \frac{1000}{P_{100\%} [\text{Hz}]}$	
Forward/reverse mode	direction identified via status output	
Status outputs (passive)	D1 / D2 / A2	A1
Function, adjustable for	limit values direction of flow automatic range change error messages overranging empty tube (optional)	(also used as a 2nd pulse output) limit values direction of flow automatic range change error messages overranging empty tube (optional)
Terminals	D1 / D⊥ D2 / D⊥ A2 / A⊥ Note: D⊥ common reference potential for D1 and D2 A⊥ common reference potential for A1 and A2	A1 / A⊥
Electrical data	galvanically isolated U ≤ 32 V DC / ≤ 24 V AC I ≤ 100 mA, any polarity	galvanically isolated, not from A2 U ≤ 32 V DC / ≤ 24 V AC I ≤ 100 mA, any polarity or U ≤ 32 V DC, I ≤ 200 mA, observe polarity
Control inputs C1 and C2 (passive)	range change, resetting of totalizer, resetting of errors, starting of selfcheck, setting outputs to min.values or holding current output values.	
Function, adjustable for		
Terminals	C1 / C⊥ and C2 / C⊥ Note: C⊥ is common reference potential for C1 and C2	
Electrical data	galvanically isolated U = 8 –32 V DC, I ≤ 10 mA, any polarity	
Internal power supply	for passive outputs/inputs and external receiver instruments	
Terminals	E+ and E-, observe polarity	
Electrical data	galvanically isolated U = 24 V DC R _i = approx. 15 Ω I ≤ 100 mA	
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	3-line LCD
Display function	current flow, forward, reverse and sum totalizers (7-digit) or 25-digit bar graph with percentage display and status messages
Units: actual flow totalizer	m ³ /hr, Liter/Sec, US gallons/min. or user-defined unit such as Liter/day or US MGal/day m ³ , 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	AC version	AC / DC version	
	standard	optional	
voltage range (without change-over)	100 – 230 V AC	24 V AC	24 V DC
Tolerance range	85 – 255 V AC	20.4 – 26.4 V AC	18 – 31.2 V DC
Frequency	48 – 63 Hz	48 – 63 Hz	-
Power input	12 W, typical (max. 18 W)	12 W, typical (max. 18 W)	12 W, typical (max. 18 W)

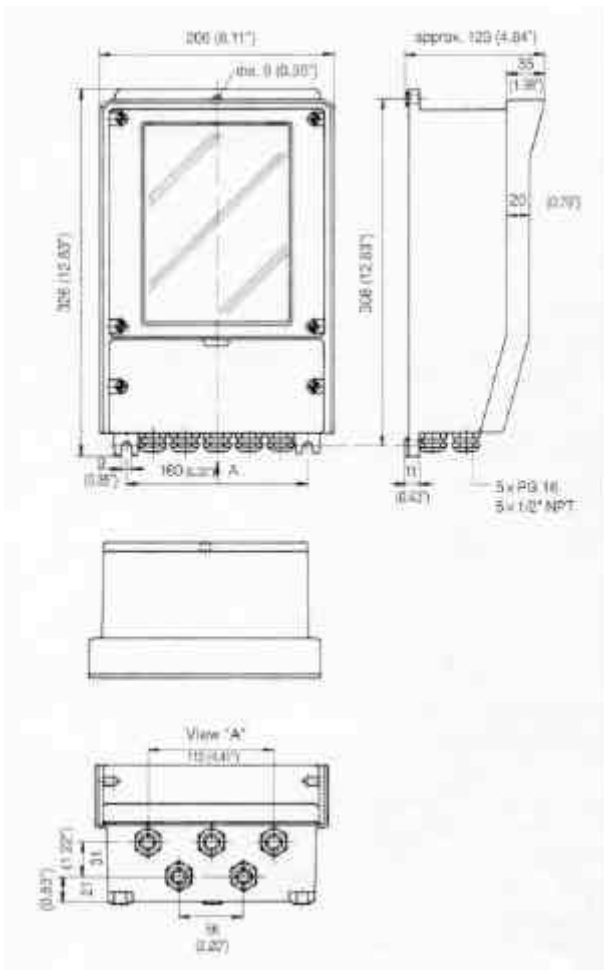
When connected to a functional extra-low voltage, **24 V AC/DC**, safety separation (PELV) must be ensured (VDE 0100 / VDE 0106, IEC 536 or equivalent national regulations).

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

Meter size		Full-scale range in m ³ /hr		
DN mm	inch	v=0.3 m/s (minimum)	v=1 m/s	v=12 m/s (maximum)
200	8	33.93	113.1	1357
250	10	53.02	176.7	2120
300	12	76.35	154.5	3053
400	16	135.8	452.4	5428
500	20	212.1	706.9	8482
600	24	305.4	1018	12215

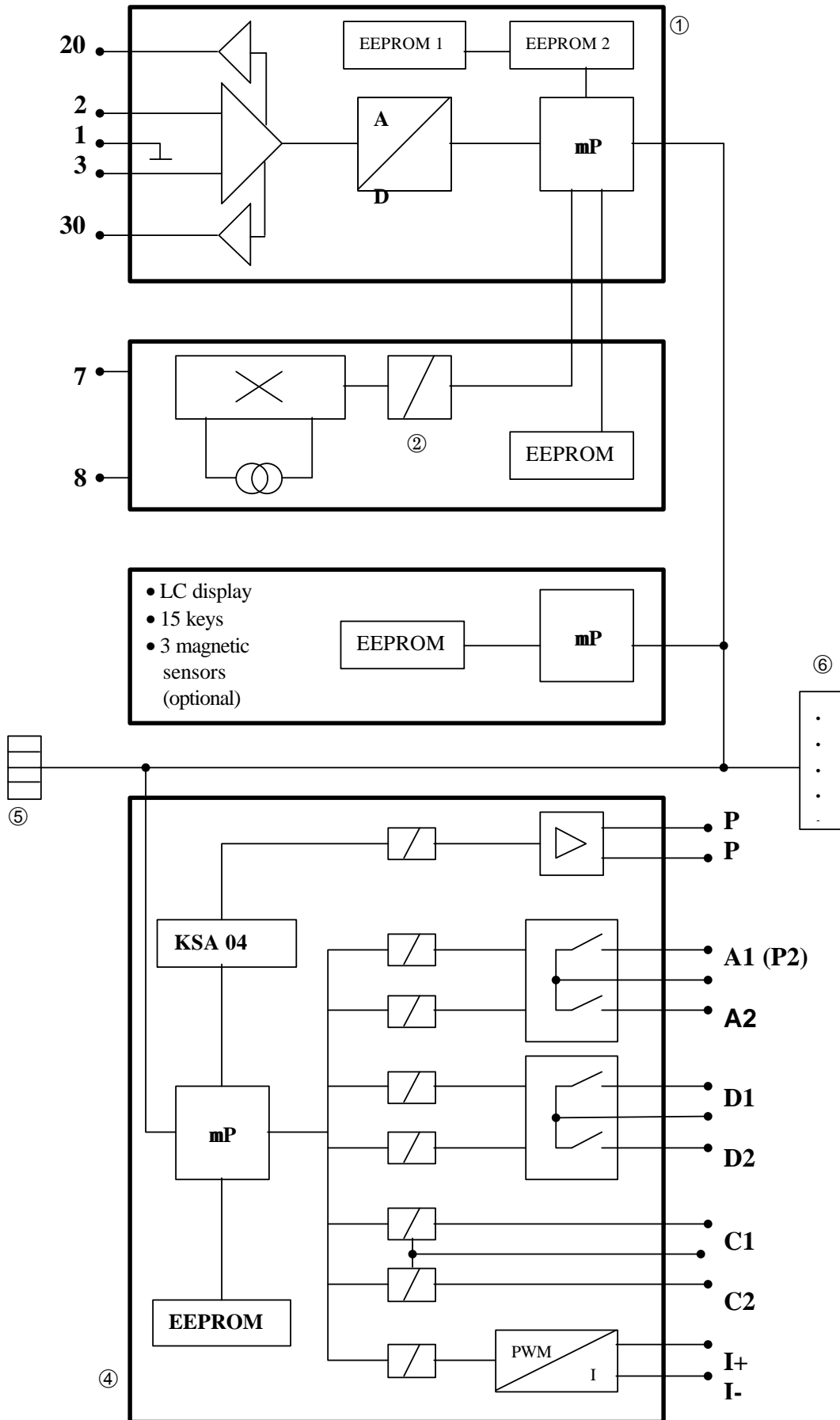
v = flow velocity in ft/s

Meter size		Full-scale range in US Gal/min	
DN mm	inch	v=1 ft/s (minimum)	v=40 ft/s (maximum)
200	8	149.43	5975
250	10	233.4	9334
300	12	336.2	13442
400	16	597.9	23899
500	20	933.9	37345
600	24	1345	53781

10.3.2 Error limits under reference conditions

Fully filled	$\leq 1\%$ of measuring value ($v \geq 1$ m/s) $\leq 0.5\%$ of measuring value + 5 mm/s ($v < 1$ m/s)
Partly filled	$\leq 1\%$ of full scale value (full scale value ≥ 1 m/s)

11 Block diagram



- ① **ADC printed circuit board, analog/digital converter** (terminals 1, 2, 3, 20 and 30)
 - Signal processor protected against overload, for quick and precise processing of flow peaks up to and exceeding 20 m/s or 60 ft/s.
 - Digital signal processor, sequential control and test routines.
 - Patented high-resolution analog/digital converter, digitally controlled and monitored.
 - Input amplifier allowing control of potential of signal line shielding (bootstrap).
 - User parameter and internal calibration values are stored in separate EEPROMs (easily replaceable)
- ② **FSV printed circuit board, field current supply** (terminals 7 and 8)
 - Large signal-to-noise ratio owing to low-loss field current supply with high frequencies and high currents.
 - Pulsed direct current which is precisely controlled electronically, for the magnetic coils of the primary head.
 - Operating and calibrating data are stored in an EEPROM so the PCB can be easily replaced without the need for re-calibration.
- ③ **BDE printed circuit board, motherboard**
 - Large illuminated LC display.
 - 15 keys for operator control of signal converter.
 - Can be retrofitted with optional operator control by bar magnet.
 - Distribution of general signals such as ImoCom bus, power supply.
- ④ **I/O printed circuit board, inputs and outputs**
 - Groups, 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**.
- ⑤ **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.
- ⑥ **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

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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: