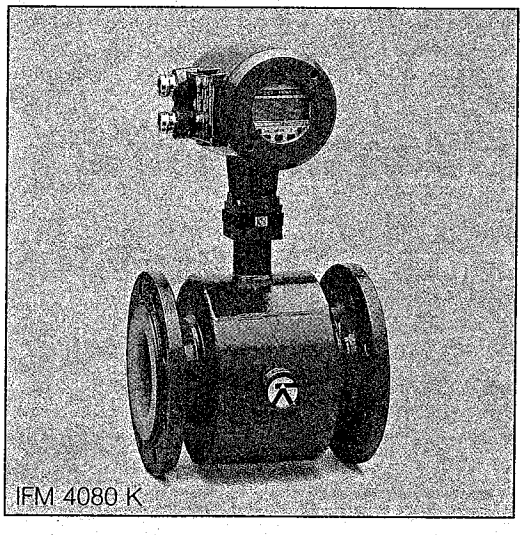
KROHNE

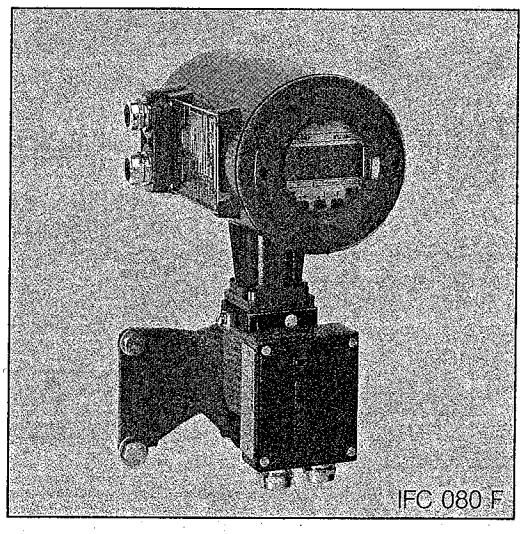
09/93

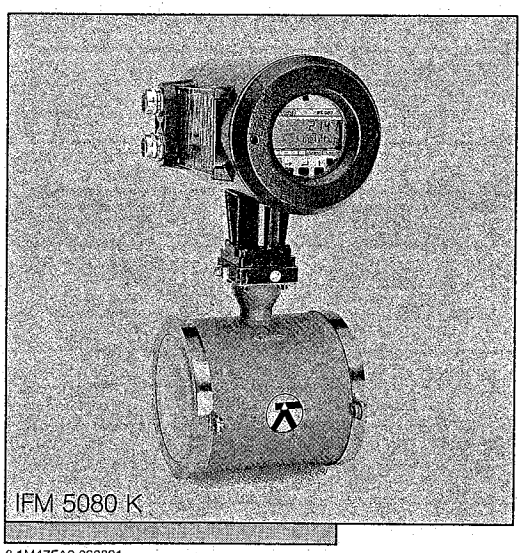
Compact magnetic inductive flowmeters

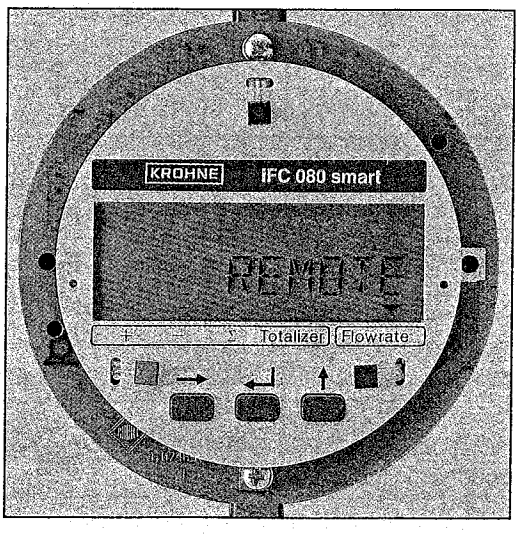
Installation and operating instructions

ALTOFLUX
IFM 1080 K
IFM 3080 K+F
IFM 4080 K+F
IFM 5080 K+F
K 480 S


IFM 4080 K


IFC 080 F


IFM 5080 K



Krohne Messtechnik GmbH & Co. KG certified by

TÜV CERT DIN ISO 9001

3.1M47EA3 093321

Order No. DIN A4: 7.02135.33.00
US Size: 7.02135.73.00

How to use these Installation and Operating Instructions

- For easy reference these Instructions are divided into 5 parts.
- Only **Part A** (pages 6-21) 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 (pages 6-21) Install flowmeter in the pipeline (Sect. 1), connect up (Sect. 2), power the flowmeter (Sect. 3), that's all!

The system is operative.

Part B (pages 22-37) Operator control and action of the IFC 080 K+F signal converter.

Part C (pages 38-52) Special applications, service, and functional checks.

Part D (pages 53-71) Technical data, dimensions, block diagram and measuring principle.

Part E (pages 72-74) Index

Product liability and warranty

These electromagnetic flowmeters are suitable solely for measuring the volumetric flowrate of electrically conductive liquids, slurries and pastes.

For use in hazardous areas, special codes and regulations are applicable which are specified in the special "Ex installation and operating instructions" (supplied only with hazardous-duty equipment).

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 ALTOFLUX flowmeters have to be returned to Krohne, please note the information given on page 75!

System description

The IFM 1080 K, IFM 3080 K+F, IFM 4080 K+F, K 480 S and IFM 5080 K+F electromagnetic flowmeters are precision instruments designed for the linear flow measurement of electrically conductive liquids, pastes and slurries with a minimum conductivity of $> 5\ \mu S/cm$ ($\mu mho/cm$) or $> 20\ \mu S/cm$ ($\mu mho/cm$) for demineralized cold water.

The full-scale range is adjustable between 6 liters per hour and 12 200 m^3 per hour, or 0.02 to 53 700 US gallons per minute, dependent on the meter size DN 2.5 to 600 or $^1/_{10}$" to 24". This corresponds to a flow velocity of 0.3 to 12 m/s or 1 to 40 ft/s.

K 480 S is available only as "Ex version".

Example of type designation

IFM 4 080 F

- **K** Compact flowmeter, signal converter mounted direct on primary housing.
- **F** Separate flowmeter, primary head with terminal box, IFC 080 F signal converter in rotatable field housing
- **080** Signal converter designation
- **4000** IFS 4000 primary head
- **5000** IFS 5000 primary head
- **3000** M 900 primary head
- **1000** Compact flowmeter with polysulfone measuring section
- **IFM** Electromagnetic flowmeter (system)
- **IFS** Primary head (sensor)
- **IFC** Signal converter

Available versions

Measuring section / liner	Meter size		Compact flowmeters	Separate systems		
	DN mm	inches		System	Primary head	Signal converter
Polysulfone	15 to 80	$^1/_2$ to 3	**IFM 1080 K**	———	———	———
Fused aluminium oxide	2.5 to 100	$^1/_{10}$ to 4	**IFM 5080 K**	**IFM 5080 F**	IFS 5000	IFC 080 F
PTFE	10 to 20	$^3/_8$ to $^3/_4$	**IFM 3080 K**	**IFM 3080 F**	M 900	IFC 080 F
Various	25 to 300	1 to 12				
PTFE	10 to 20	$^3/_8$ to $^3/_4$	**IFM 4080 K** **K 480 S-Ex**	**IFM 4080 F** ———	IFS 4000 ———	IFC 080 F ———
PFA	25 to 150	1 to 6				
Various	200 to 600	8 to 24				

Items included with supply

- **Compact flowmeter** as ordered
  primary head with mounted IFC 080 K signal converter and installation material according to the following table/list **or**
- **Separate-system flowmeter** as ordered
  - IFC 080 F signal converter in rotatable field housing
  - primary head with installation material according to the following table/list
  - signal cable (field current cable not supplied, to be provided by customer)
- Installation and operating instructions with pull-out condensed instructions for operation of the IFC 080 signal converter
- Certificate of system calibration data
- Report on factory setting of the signal converter

IFM 1080 K compact flowmeter

IFM 1080 K			Supplied...		X = Standard		O = Option
Meter size to...	Max. operating pressure 1)		...with centering material	...with stud bolts	...with grounding rings E and gaskets D1		without gaskets
	bar	psig			E	D1	D2 2)
... DIN 2501 (BS 4504)							
DN 15	< 40	< 580	4 x sleeves	4 x M12	X	X	no
DN 25	< 40	< 580	4 x sleeves	4 x M12	X	X	no
DN 40	< 25	< 360	4 x sleeves	4 x M16	X	X	no
DN 50	< 25	< 360	4 x sleeves	4 x M16	X	X	no
DN 80	< 16	< 230	6 x sleeves	8 x M16	X	X	no
... ANSI B16.5							
1/2"	< 20	< 290	–	4 x 1/2"	X	X	no
	< 40	< 580	4 x sleeves	4 x 1/2"	O	O	no
1"	< 20	< 290	–	4 x 1/2"	X	X	no
	< 40	< 580	4 x sleeves	4 x 5/8"	O	O	no
1 1/2"	< 20	< 290	4 x sleeves	4 x 1/2"	X	X	no
	< 25	< 360	4 x sleeves	4 x 3/4"	O	O	no
2"	< 20	< 290	–	4 x 5/8"	X	X	no
	< 25	< 360	–	8 x 5/8"	O	O	no
3"	< 16	< 230	4 x sleeves	4 x 5/8"	X	X	no
	< 16	< 230	6 x sleeves	8 x 3/4"	O	O	no

1) Max. admissible operating pressure is dependent on the product temperature, see Sect. 10.5!
2) Gaskets D2 not suplied with flowmeter, use commercial gaskets, customer supplied!

For arrangement of gaskets D1 + D2 see "grounding diagrams" in Sect. 1.2.3!

IFM 5080 K compact flowmeter and IFS 5000 primary head

IFM 5080 K and IFS 5000			Supplied...		X = Standard		O = Option	Size of gaskets		
Meter size to...	Max. operating pressure 1)		...with centering material	...with stud bolts	...with grounding rings E and gaskets D1+D2		...w/o grounding rings but with gaskets D3 and cable V	D1, D2 + D3 in mm (inches) 3)		
	bar	psig			D1	D1 + D2		da	di	s
... DIN 2501 (BS 4505)										
DN 2.5, 4, 6, 10	40	580	2 x rings	4 x M12	X			D1 are special O-rings 2)		
DN 15	40	580	2 x rings	4 x M12	X			D1 are special O-rings 2)		
DN 25	40	580	2 x rings	4 x M12		O	X	46 (1,81)	26 (1,02)	1.6 (0.06)
DN 40	40	580	4 x sleeves	4 x M16		O	X	62 (2,44)	39 (1,54)	1.6 (0.06)
DN 50	40	580	4 x sleeves	4 x M16		O	X	74 (2,91)	51 (2,01)	1.6 (0.06)
DN 80	40	580	6 x sleeves	8 x M16		O	X	106 (4,17)	80 (3,15)	1.6 (0.06)
DN 100	16	230	6 x sleeves	8 x M16		O	X	133 (5,24)	101 (3,98)	1.6 (0.06)
	25	360	6 x sleeves	8 x M20		O	X	133 (5,24)	101 (3,98)	1.6 (0.06)
... ANSI B16.5										
1/10, 1/8, 1/4, 3/8, 1/2"	< 20	< 290	2 x rings	4 x 1/2"	X			D1 are special O-rings 2)		
	< 40	< 580	2 x rings	4 x 1/2"	X			D1 are special O-rings 2)		
1"	< 20	< 290	4 x sleeves	4 x 1/2"		O	X	46 (1,81)	26 (1,02)	1.6 (0.06)
	< 40	< 580	2 x rings	4 x 5/8"		O	X	46 (1,81)	26 (1,02)	1.6 (0.06)
1 1/2"	< 20	< 290	4 x sleeves	4 x 1/2"		O	X	62 (2,44)	39 (1,54)	1.6 (0.06)
	< 40	< 580	4 x sleeves	4 x 3/4"		O	X	62 (2,44)	39 (1,54)	1.6 (006)
2"	< 20	< 290	4 x sleeves	4 x 5/8"		O	X	74 (2,91)	51 (2,01)	1.6 (0.06)
	< 40	< 580	6 x sleeves	8 x 5/8"		O	X	74 (2,91)	51 (2,01)	1.6 (0.06)
3"	< 20	< 290	4 x sleeves	4 x 5/8"		O	X	106 (4,17)	80 (3,15)	1.6 (0.06)
	< 40	< 580	6 x sleeves	8 x 3/4"		O	X	106 (4,17)	80 (3,15)	1.6 (0.06)
4"	< 20	< 290	6 x sleeves	8 x 5/8"		O	X	133 (5,24)	101 (3,98)	1.6 (0.06)
	< 25	< 360	6 x sleeves	8 x 3/4"		O	X	133 (5,24)	101 (3,98)	1.6 (0.06)

1) With ANSI pipe flanges, the max. admissible operating pressure is dependent on the product temperature!
2) Gaskets D2 not supplied with flowmeter, to be provided by customer!
For arrangements of gaskets D1, D2 and D3 see "grounding diagrams" in Sect. 1.2.3!

3) da = outside diameter
di = inside diameter
s = thickness of supplied gaskets

IFM 4080 K, K 480 S + IFM 3080 K compact flowmeters and IFS 4000 + M 900 primary heads

- Interconnecting cables V, see grounding diagrams in Sect. 1.3.8
- Grounding rings E (option), if ordered.

Supplied without installation material (stud bolts, gaskets), to be customer supplied!

Contents

Part A System installation and start-up

Part B IFC 080 Signal converter

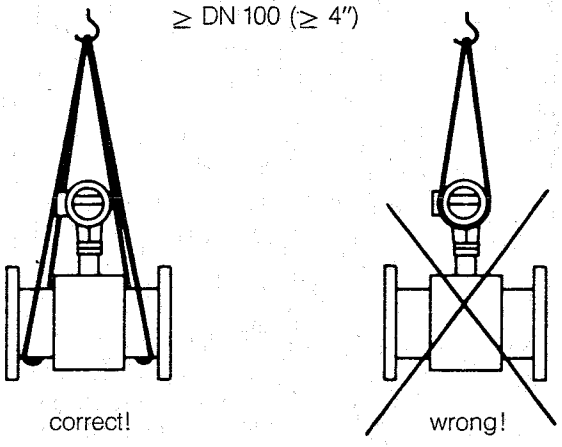
Part A System installation and start-up

1. Installation in the pipeline

1.1 Preliminary information

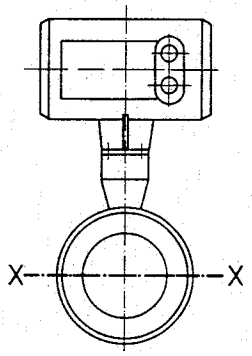
1.1.1 Transporting the compact flowmeter

Important: **Never** lift IFM 3080 K, IFM 4080 K, IFM 5080 K and K 480 S compact flowmeters sized DN 100 (4") and larger by the mounted signal converter



1.1.2 Selecting the installation location

1. **Location and position as required,** but electrode axis must be approximately horizontal.



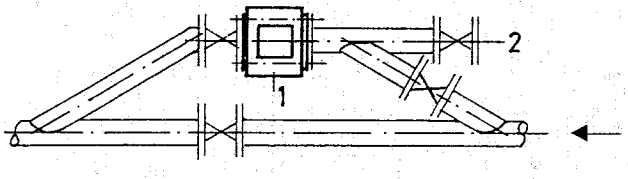
2. **Measuring tube must be completely filled at all times.**

3. **Flow direction +/–,** arrows on primary heads can normally be ignored. For exceptions, refer to Sect. 5.16 "factory setting".

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. **Heavily contaminated fluids:** install flowmeter in bypass.



1 Flowmeter
2 Draining and cleaning without interrupting system operation

7. **Large meter sizes, DN > 200 (8"):** use adapter pipes to permit axial shifting of counterflanges to facilitate installation.

8. **Straight inlet run minimum of 5 x DN and outlet run minimum of 2 x DN** (DN = meter size), measured from the electrode axis.

9. **Vortex or corkscrew flow:** increase inlet and outlet sections or install flow straighteners.

10. **Strong electromagnetic fields,** avoid in vicinity of flowmeter.

11. **Zero setting** is automatic in flowmeters with pulsed DC field. Electrode contamination does not therefore cause any zero drift.

    In water and waste water applications, it is frequently not practical to shut the flow off to check zero after major repair, recalibration or inadvertent and improper adjustment of the converter. In this case the primary head zero can be checked under flowing conditions as outlined in section 7.2.

    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 7.2.

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**
    Compact flowmeter:
    < 60° C (104°F) for product temperature ≤ 60° C (140°F)
    < 40° C (104°F) for product temperature > 60° C (140°F)

    Separate systems:
    < 60° C (140°F)

    Refer to Sect. 10.5 for temperature, pressure and vacuum limits due to material used for measuring section/liner.

14. **Pipeline along a wall:** where possible, distance between pipe centerline and wall to be > 0.5 m or 1.6 ft for compact flowmeters; if less, first connect all cables to terminals in the terminal box (power supply and outputs) and install an intermediate connection box before installing flowmeter in the pipeline.

15. **Insulated pipeline:** do not insulate compact flowmeters.

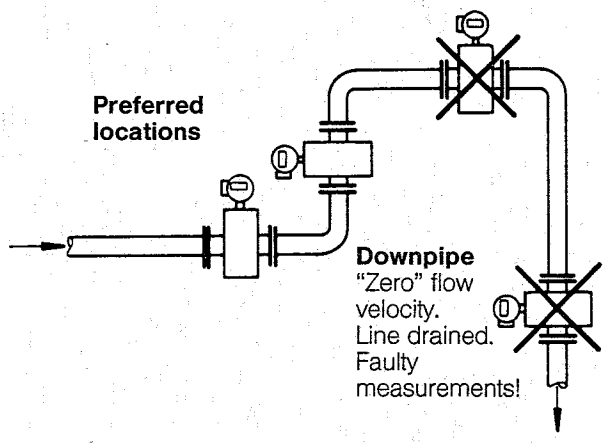
16. **Hard-to-get-at locations**
    If IFM 1080 K, IFM 3080 K, IFM 4080 K, IFM 5080 K and K 480 S compact flowmeters have not been ordered and supplied in accordance with Versions A – E (see Sect. 8.6), the configuration can be changed subsequently:

    - Turn the display circuit board through ± 90° or 180° to obtain horizontal positioning of the display (see Sect. 8.4).
    - Turn signal converter housing through ± 90° (see Sect. 8.5)
    - Conversion of compact flowmeter to separate system Retrofit kit available, please consult factory.

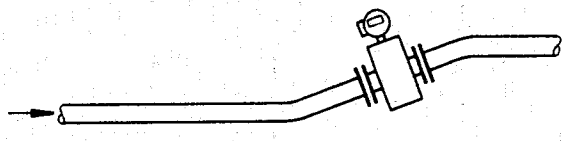
1.1.3 Suggestions for installation

To avoid measuring errors due to air inclusion and vacuum-induced damage to PTFE and rubber liners, please observe the following:

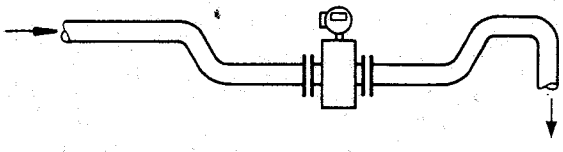
Highest point of pipe run
(Air bubbles collect in measuring tube – faulty measurements!)



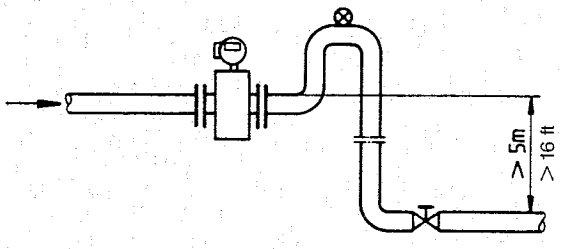
Horizontal pipe run
Install in slightly ascending pipe section. If not possible, assure adequate velocity to prevent air, gas or vapor from collecting in upper part of flow tube.



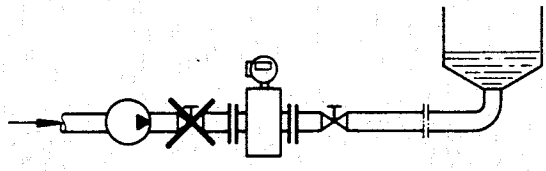
Open feed or discharge
Install meter in low section of pipe.



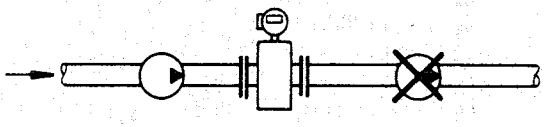
Downpipe over 5m (16 ft) length
Install air valve ⊗ downstream of flowmeter (vacuum).



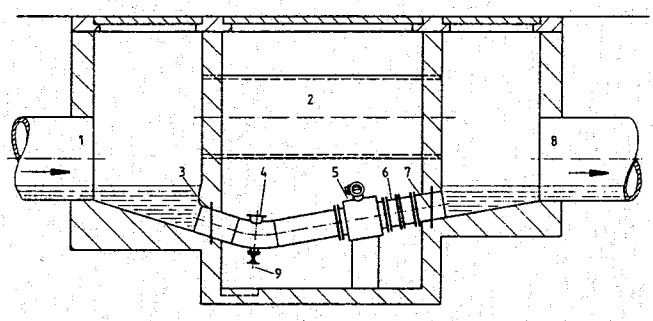
long pipeline
Always install control and shutoff valves downstream of flowmeter (vacuum!).



Pumps
Never install flowmeter on pump suction side (vacuum!).



Sluice underpass for sewage concrete pipe with built-in flowmeter



1 Intake
2 Overflow
3 Intake sill
4 Cleaning hole
5 Flowmeter
6 Removable section
7 Wall seal
8 Outlet
9 Drain valve

1.2 IFM 1080 K and IFM 5080 K compact flowmeters and IFS 5000 primary head

1.2.1 Installation requirements

Mounting material
see Page 3 "Items included with supply"

Pipe flanges and operating pressure
see Table "torques" in Sect. 1.2.4.

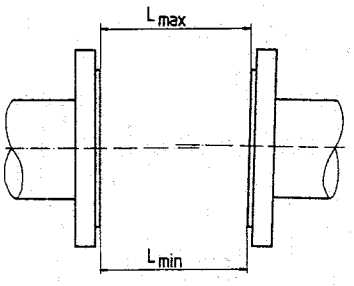
Pipe flanges spacing
- For arrangement of grounding rings and gaskets refer to diagram in Sect. 1.2.3.
- For size of gaskets D1, D2 and D3 refer to pape 3 "Items included with supply".

Compact flowmeters/primary head			Fitting dimensions "a" in mm (inches)	
Type	Meter size		with	without
	DN mm	inches	grounding rings	grounding rings
IFM 1080 K	15 + 25	1/2 + 1	65 (2.56) 1)	-
	40	1 1/2	89 (3,50) 1)	-
	50	2	112 (4.41) 1)	-
	80	3	162 (6.38) 1)	-
IFM 5080 K	2.5 - 15	1/10 - 1/2	65 (2.56) 1)	- 3)
and	25	1	68 (2.68) 2)	58 (2.28) 3)
IFS 5000	40	1 1/2	93 (3.66) 2)	83 (3.27) 3)
	50	2	113 (4.45) 2)	103 (4.06) 3)
	80	3	163 (6.42) 2)	153 (6.02) 3)
	100	4	213 (8.39) 2)	203 (7.99) 3)

1) **plus** 2 x thickness of gasket D2 between grounding rings and pipe flanges, gasket D2 not included with supply, customer supplied.
2) **incl.** gasket D2 between grounding rings and pipe flanges.
3) **incl.** gasket D3 between measuring tube and pipe flanges.

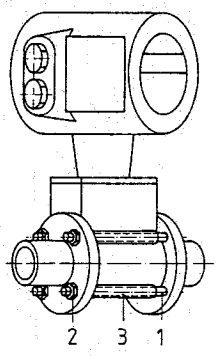
High-temperature pipelines
Where process temperatures exceed 100°C (212°F), provide for facilities to compensate for longitudinal expansion on heat-up of the pipeline:
- For **short** pipelines use resilient gaskets.
- For **long** pipelines install flexible pipe elements (e.g. elbows).

Position of flanges
- Install flowmeter in line with the pipe axis.
- Pipe flange faces must be parallel to each other, max. permissible deviation: $L_{max} - L_{min} \leq 0.5$ mm (0.02").



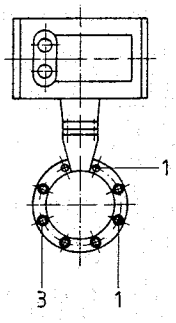
Arrangement of centering sleeves
For number of supplied centering sleeves see page 3 "Items included with supply".

with four centering sleeves



1 Stud bolts
2 Hex. nuts
3 Sleeves

with six centering sleeves



1.2.2 Grounding

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

1. Standard grounding for compact flowmeters
- The flowmeters are normally grounded via the **PE protective ground conductor** incorporated in the power supply cable.
- If to be connected to a functional extra-low voltage source (e.g. 24 V DC), an **FE functional ground** is required for measurement reasons; connect to one of the separate U-clamp terminals either in the terminal box of the signal converter or on the "neck" of the compact flowmeter.

2. Grounding of separate primary heads
For separate systems an **FE functional ground** must be connected to the "neck" of the primary head.

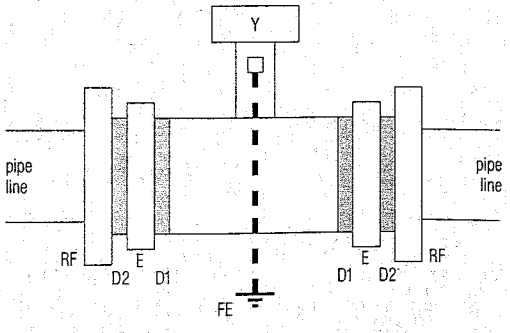
3. Grounding of compact flowmeters in the case of large potential differences
Install a **separate FE functional ground** if measuring problems are likely to occur because of the reference to protective ground (e.g. due to compensating currents resulting from large voltage differences between pipeline and protective conductor, proximity of electric furnaces or electrolysis plants) or if a protective ground conductor is not provided (DC voltage operation).
Caution: Do **not** connect up the PE protective ground conductor in the terminal box if the FE functional ground is connected. If the **AC supply voltage exceeds 50 V_{rms},** then the FE functional ground is required to act simultaneously as the protective ground conductor (combined protective/functional ground). Refer to appropriate national codes for specific requirements for this type of installation, which may require the addition of a ground fault detection circuit interrupter.

4. Grounding in hazardous areas
Special regulations applicable, refer to Sect. 6.1 and special "Ex" installation instructions.

1.2.3 Grounding diagrams

IFM 1080 K: DN 15 to 80 (1/2" to 3")
IFM 5080 K / IFS 5000: DN 2.5 to 15 (1/10" to 1/2")
Installation in metal pipes, with or without internal coating, and in plastic pipes

D1 **Gaskets,** glued to measuring tube
D2 **Gaskets,** customer supplied, for size refer to page 3 "Items included with supply"
E **Grounding rings,** screwed to housing
FE **Functional ground,** see Sect. 1.2.2, points 2 and 3: wire ≥ 4 mm² (10 AWG) Cu, connected to U-clamp terminal on "neck" of primary head. Wire not included with supply, to be provided by customer.
RF **Pipe flanges**
Y **Terminal box** (IFS 5000) **or signal converter** (IFM 1080 K / IFM 5080 K)



IFM 5080 K / IFS 5000: DN 25 to 100 (1″ to 4″)

Installation in metal pipes, not internally coated, without grounding rings

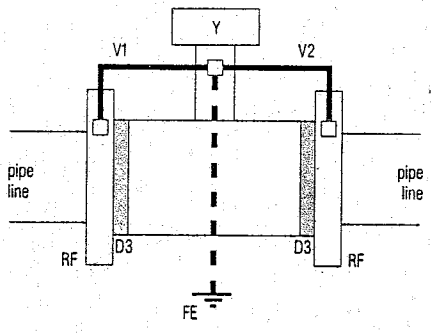
D3 **Gaskets,** glued to measuring tube

FE **Functional ground,** see Sect. 1.2.2, points 2 and 3: wire ≥ 4 mm² (10 AWG) Cu, connected to U-clamp terminal on "neck" of primary head. Wire not included with supply, to be provided by customer.

RF **Pipe flanges**

V1, V2 **Connecting wires,** bolted to the "neck" of the primary head; threaded holes for M6 bolts to be provided for flange-side connection

Y **Terminal box or signal converter**



Installation in plastic or internally coated metal pipes with grounding rings (option)

D1 **Gaskets,** glued to measuring tube

D2 **Gaskets,** glued to grounding rings (option)

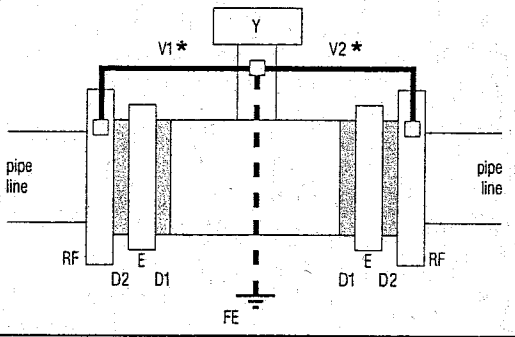
E **Grounding rings** with glued-on gasket D2 (option) are supplied loose and must be screwed to the housing, mounting material supplied

FE **Functional ground,** see Sect. 1.2.2, points 2 and 3: wire ≥ 4 mm² (10 AWG) Cu, connected to U-clamp terminal on "neck" of primary head. Wire not included with supply, to be provided by customer

RF **Pipe flanges**

V1, V2 **Connecting wires,** bolted to the "neck" of the primary head; threaded holes for M6 bolts to be provided for flange-side connection
* V1 and V2 not required for plastic pipes!

Y **Terminal box or signal converter**



1.2.4 Torques, pipe flanges and max. allowable operating pressure

Stud bolts and nuts:
tighten down uniformly at diametrically opposed points.

Max. torques 1st sequence: approx. 50%
2nd sequence: approx. 80%
3rd sequence: approx. 100%
} of max. torque, see Table

Meter size of measuring tube to ...	Pipe flanges		IFM 1080 Compact flowmeter				IFM 5080 K Compact flowmeter IFS 5000 Primary head							
			Max. operating pressure 1)+2)		Max. torques 3) with gaskets of built-up material		Max. operating pressure 2)		Max. torques with gaskets made of ...					
									... Gylon		... Chemotherm		... built-up material 3)	
			bar	psig	Nm	ft lbf	bar	psig	Nm	ft lbf	Nm	ft lbf	Nm	ft lbf
... DIN 2501 (= BS 4504)														
DN 2.5, 4, 6, 8, 10	DN 10,15	PN 40					≤ 40	≤ 580					32	23
DN 15	DN 15	PN 40	≤ 40	≤ 580	18	13.0	≤ 40	≤ 580					32	23
DN 25	DN 25	PN 40	≤ 40	≤ 580	34	24.6	≤ 40	≤ 580	22	16	32	23		
DN 40	DN 40	PN 40	≤ 25	≤ 360	67	48.4	≤ 40	≤ 580	47	34	66	48		
DN 50	DN 50	PN 40	≤ 25	≤ 360	119	86.0	≤ 40	≤ 580	58	42	82	59		
DN 80	DN 80	PN 40	≤ 16	≤ 230	93	67.2	≤ 40	≤ 580	48	35	69	50		
DN 100	DN 100	PN 16					≤ 16	≤ 230	75	54	106	77		
	DN 100	PN 25					≤ 25	≤ 360	94	68	133	96		
... ANSI B16.5														
1/10, 1/8, 1/4, 3/8″	1/2″	150 lbs					≤ 20	≤ 290					35	25
	1/2″	300 lbs					≤ 40	≤ 580					35	25
1/2″	1/2″	150 lbs	≤ 20	≤ 290	18	13	≤ 20	≤ 290					35	25
	1/2″	300 lbs	≤ 40	≤ 580	18	13	≤ 40	≤ 580					35	25
1	1″	150 lbs	≤ 20	≤ 290	34	25	≤ 20	≤ 290	24	17	33	24		
	1″	300 lbs	≤ 40	≤ 580	45	33	≤ 40	≤ 580	30	22	42	30		
1 1/2″	1 1/2″	150 lbs	≤ 20	≤ 290	52	38	≤ 20	≤ 290	38	28	54	39		
	1 1/2″	300 lbs	≤ 25	≤ 360	83	60	≤ 40	≤ 580	57	41	81	59		
2″	2″	150 lbs	≤ 20	≤ 290	119	86	≤ 20	≤ 290	58	42	83	60		
	2″	300 lbs	≤ 25	≤ 360	60	44	≤ 40	≤ 580	30	22	42	30		
3″	3″	150 lbs	≤ 16	≤ 230	186	135	≤ 20	≤ 290	98	71	138	100		
	3″	300 lbs	≤ 16	≤ 230	115	83	≤ 40	≤ 580	59	43	84	61		
4″	4″	150 lbs					≤ 20	≤ 290	75	75	108	78		
	4″	300 lbs					≤ 25	≤ 360	92	67	131	95		

1) The maximum allowable operating pressure is dependent on the process temperature, see Sect. 10.5!
2) For ANSI pipe flanges, the maximum allowable operating pressure is dependent on the process temperature!
3) Maximum torques is dependent on gaskets material. D2 gasket not supplied with flowmeter, must be provided by customer. 10 Nm ~ 7.23 ft lbf

1.3 IFM 3080 K / IFM 4080 K compact flowmeter and und IFS 4000 / M 900 Primary head

1.3.1 Neoprene and hard-rubber liners

Note temperature limits

- Storage: – 20 to + 60 °C (– 4 to + 140 °F), keep immobile
- Transport: – 5 to + 50 °C (+ 23 to + 122 °F)
- Process: Neoprene – 20 to + 60 °C (– 4 to + 140 °F)
  Hard rubber – 20 to + 90 °C (– 4 to + 194 °F)
  [Temperatures below – 5 °C (+ 23 °F) are only permissible if the pipe run is supported on both sides of the flowmeter, and providing there is only slight vibration and no water hammer in the pipe.]

Gaskets are necessary for hard-rubber liners, e.g. Neoprene or soft-rubber gaskets.

Max. torques: see Sect. 1.3.9, Column B

1.3.2 PTFE liner

Install to avoid an excessive vacuum condition at the meter.

The PTFE liner is formed around the ends of the flanges, **do not** remove or damage.

The flanges are factory-fitted with special **protection covers.** Do not remove these until just before installation. Replace by pieces of smooth sheet metal [0.3 to 0.6 mm (0.012" to 0.024") thick] when fitting the flowmeter between the pipe flanges (to be removed after installation).

Attached protective rings can optionally be supplied, in which case the above-mentioned sheet metal pieces are not required. These protective rings can simultaneously be used as grounding rings, see Sect. 1.3.6.

Max. torques: see Sect. 1.3.9, Column A.

1.3.3 Irethane liner

Important for IFM 4080 K / K 480 S / IFS 4000 with irethane liner, > 12 mm thick:

The flange connections are larger than the diameter of the measuring tube! Use pipe flanges according to the following tables.

Meter size DN in mm		Meter size in inches	
Measuring tube	Flanges	Measuring tube	Flanges
DN 350	DN 400	14"	16"
DN 400, 450	DN 500	16", 18"	20"
DN 500, 550	DN 600	20", 22"	24"
DN 600	DN 700	24"	28"

Max. torques (according to size of flanges!): see Sect. 1.3.9, Column B

1.3.4 Standard electrodes

IFM 4080 K / K 480 S / IFS 4000: DN 25 – 150 (1" – 6")
Primary heads with PFA liner are fitted with electrodes that are inserted from the outside such that the electrode head is flush with the inner surface of the liner. The electrodes are sealed by a specially shaped collar on the electrode shaft. Cup springs ensure constant pressure between these collars and a sealing surface moulded to the liner.

IFM 3080 K / M 900: DN 10 - 300 (3/8" - 12")
IFM 4080 K / K 480 S / IFS 4000: DN 10 - 20 (3/8" - 3/4")
DN 200 - 600 (8" - 24")

The electrode head, which is in contact with the process, has an elliptical shape, while the conical neck forms the sealing surface with the liner. Cup springs ensure constant pressure between this neck and the liner.

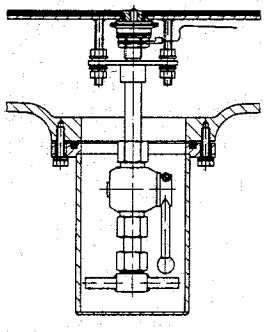
1.3.5 Field replaceable electrodes WE

IFM 3080 K / M 900: DN 50 - 300 (2" - 12")
IFM 4080 K / K 480 S / IFS 4000: DN 350 - 600 (14" - 24")

This design enables the electrodes to be removed under operating conditions and efficiently cleaned.

To remove, undo the holding screws on the protective caps. Unscrew the electrodes and pull them out until the ring mark is visible on the electrode shaft. Close valve and withdraw electrode completely.

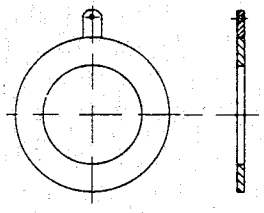
After cleaning, install in the reverse order.



1.3.6 Grounding rings / Protective rings

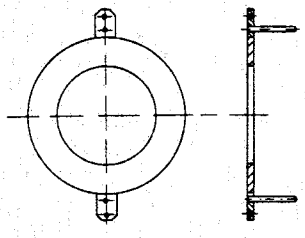
- Required in conjunction with plastic or internally coated pipes.
- Grounding rings form a conductive connection with the fluid.
- Material CrNi steel 1.4571 (SS 316 Ti-AISI), others on request.

1



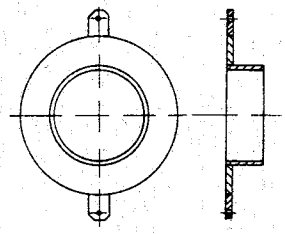
Grounding ring No. 1,
3 mm (0.12") thick.

2



Grounding/protective ring No. 2
for primary heads with PTFE liner, fitted to the flanges, 3 mm (0.12") thick.

3



Grounding/protective ring No. 3
with cylindrical neck, to protect the liner of the flowmeter particularly at the inlet edge in conjunction with abrasive fluids.

- Length 30 mm for DN 10 to 300 (3/8" to 12").
- Length 100 mm for DN 350 to 600 (14" to 24").

1.3.7 Grounding

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

1. Standard grounding for compact flowmeters

- The flowmeters are normally grounded via the **PE protective ground conductor** incorporated in the power supply cable.
- If to be connected to a functional extra-low voltage source (e.g. 24 V DC), an **FE functional ground** is required for measurement reasons; connect to one of the separate U-clamp terminals either in the terminal box of the signal converter or on the "neck" of the compact flowmeter.

2. Grounding of separate primary heads

For separate systems an **FE functional ground** must be connected to the "neck" of the primary head.

3. Grounding of compact flowmeters in the case of large potential differences

Install a **separate FE functional ground** if measuring problems are likely to occur because of the reference to protective ground (e.g. due to compensating currents resulting from large voltage differences between pipeline and protective conductor, proximity of electric furnaces or electrolysis plants) or if a protective ground conductor is not provided (DC voltage operation).

Caution: Do **not** connect up the PE protective ground conductor in the terminal box if the FE functional ground is connected. If the **AC supply voltage exceeds 50 V_{rms},** then the FE functional ground is required to act simultaneously as the protective ground conductor (combined protective/functional ground). Refer to appropriate national codes for specific requirements for this type of installation, which may require the addition of a ground fault detection circuit interrupter.

4. Grounding in hazardous areas

Special regulations applicable, refer to Sect. 6.1 and special "Ex" installation instructions.

1.3.8 Grounding diagrams

Installation in metal pipes, not internally coated, without grounding rings

D3 **Gaskets,** not included with flowmeter, to be provided by customer

F Flowmeter **flanges**

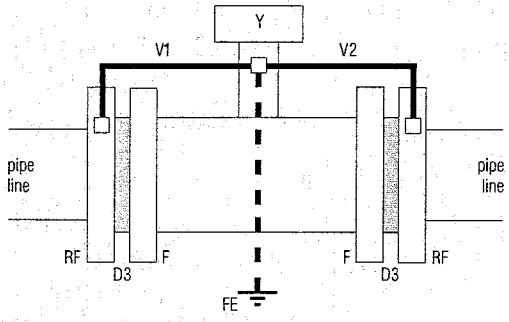
RF **Pipe flanges**

V1, V2 **Connecting wires,** bolted to the "neck" of the primary head (or to flange F on IFM 3080 K / M 900); provide threaded holes for M6 bolts (M8 bolts for IFM 3080 K / M 900: ≥ DN 50 or 1½") for flange-side connection.

Y **Terminal box or signal converter**

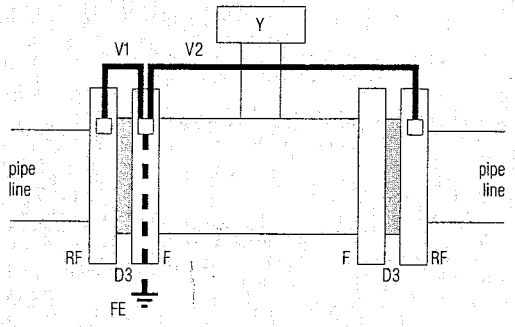
IFM 4080 K / K 480 S / IFS 4000, without grounding rings

FE **Functional ground,** see Sect. 1.3.7, points 2 and 3: wire ≥ 4 mm² (10 AWG) Cu, connected to U-clamp terminal on "neck" of primary head. Wire not included with supply, to be provided by customer.



IFM 3080 K / M 900, without grounding rings

FE **Functional ground,** see Sect. 1.3.7, points 2 and 3: wire ≥ 4 mm² (10 AWG) Cu, connected to flange F of the primary head by means of cable lug for M6 bolt (or M8 for ≥ DN 40 or ≥ 1½"). Wire and cable lug not included with flowmeter, to be provided by customer.



Installation in plastic pipes or internally coated metal pipes, with grounding rings (option)

D1, D2 **Gaskets,** not included with flowmeter, to be provided by customer

E **Grounding rings,** option

F **Flanges** on flowmeter

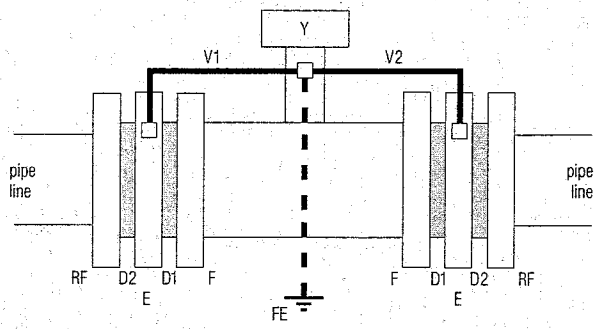
RF **Pipe flanges**

V1, V2 **Connecting wires,** bolted to the "neck" (or to flange F on IFM 3080 K / M 900) of the primary head; use supplied bolts for connection with the grounding rings

Y **Terminal box or signal converter**

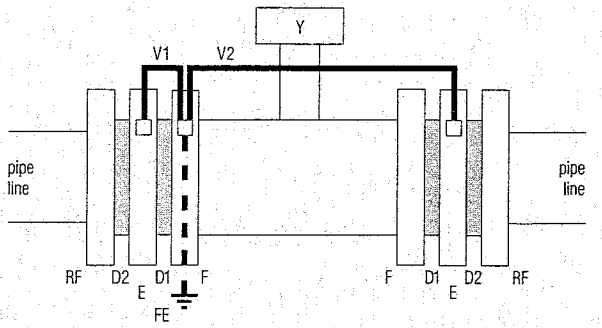
IFM 4080 K / K 480 S / IFS 4000, with grounding rings

FE **Functional ground,** see Sect. 1.3.7, points 2 and 3: wire ≥ 4 mm² (10 AWG) Cu, connected to U-clamp terminal on "neck" of primary head. Wire not included with supply, to be provided by customer



IFM 3080 K / M 900, with grounding rings

FE **Functional ground,** see Sect. 1.3.7, points 2 and 3: wire ≥ 4 mm² (10 AWG) Cu, connected to flange F of the primary head by means of cable lug for M6 bolt (or M8 for ≥ DN 40 or ≥ 1½"). Wire and cable lug not included with flowmeter, to be provided by customer.



1.3.9 Torques

Bolts: tighten uniformly in diagonally opposite sequence, see Table for number and type
Column A for PTFE and PFA liners
Column B for Neoprene, Irethane, hard and soft rubber liners
IFM 4080 K / K 480 S / IFS 4000 with Irethane liner, > 12 mm / > 0.50": maximum torques refer to nominal diameter of connecting flange and not to nominal diameter of measuring tube, see Sect. 1.3.3!
10 Nm ~ 1.0 kpm ~ 7.23 ft lbf.

Meter size DN mm	Presure rating PN	Bolts	Max. torque Nm (ft lbf) A		B	
10	40	4 x M 12	7.6	(5.5)	4.6	(3.3)
15	40	4 x M 12	9.3	(6.7)	5.7	(4.1)
20	40	4 x M 12	16	(11.6)	9.6	(6.9)
25	40	4 x M 12	22	(15.9)	11	(8.0)
32	40	4 x M 16	37	(26.8)	19	(13.0)
40	40	4 x M 16	43	(31.1)	25	(18.1)
50	40	4 x M 16	55	(39.8)	31	(22.4)
65	16	4 x M 16	51	(36.9)	42	(30.4)
65	40	8 x M 16	38	(27.5)	21	(15.2)
80	25	8 x M 16	47	(34.0)	25	(18.1)
100	16	8 x M 16	39	(28.2)	30	(21.7)
125	16	8 x M 16	53	(38.3)	40	(28.9)
150	16	8 x M 20	68	(49.2)	47	(34.0)
200	10	8 x M 20	84	(60.7)	68	(49.2)
200	16	12 x M 20	68	(49.2)	45	(32.5)
250	10	12 x M 20	78	(56.4)	65	(47.0)
250	16	12 x M 24	116	(83.9)	78	(56.4)
300	10	12 x M 20	88	(63.7)	76	(54.9)
300	16	12 x M 24	144	(104.2)	105	(75.9)
350	10	16 x M 20	97	(70.1)	75	(54.2)
400	10	16 x M 24	139	(100.5)	104	(75.2)
450	10	20 x M 24	127	(91.8)	93	(67.2)
500	10	20 x M 24	149	(107.7)	107	(77.4)
600	10	20 x M 27	205	(148.2)	138	(99.8)

Meter size inches	Body pressure rating psig	Bolts for ANSI class 150 flanges	Max. torque Nm (ft lbf) A		B	
3/8	580	4 x 1/2"	3.5	(2.5)	3.6	(2.6)
1/2	580	4 x 1/2"	3.5	(2.5)	3.6	(2.6)
3/4	580	4 x 1/2"	4.8	(3.5)	4.8	(3.5)
1	580	4 x 1/2"	6.7	(4.8)	4.4	(3.2)
1 1/4	580	4 x 1/2"	10	(7.2)	8	(5.8)
1 1/2	580	4 x 1/2"	13	(9.4)	12	(8.7)
2	580	4 x 5/8"	24	(17.4)	23	(16.6)
2 1/2	580	4 x 5/8"	27	(19.5)	24	(17.4)
3	360	4 x 5/8"	43	(31.1)	39	(28.2)
4	230	8 x 5/8"	34	(24.6)	31	(22.4)
5	230	8 x 3/4"	53	(38.3)	47	(34.0)
6	230	8 x 3/4"	61	(44.1)	51	(36.9)
8	145	8 x 3/4"	86	(62.2)	69	(49.9)
10	145	12 x 7/8"	97	(70.2)	79	(57.1)
12	145	12 x 7/8"	119	(86.1)	104	(75.2)
14	145	12 x 1"	133	(96.2)	93	(76.2)
16	145	16 x 1"	130	(94.0)	91	(65.8)
18	145	16 x 1 1/8"	199	(143.9)	143	(103.4)
20	145	20 x 1 1/8"	182	(131.6)	127	(91.8)
24	145	20 x 1 1/4"	265	(191.6)	180	(130.1)

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

1.3.10 IFM 3080 K / M 900 with sanitary connections

Versions
- Sanitary pipe union to DIN 11851, DN 10 to 125
- Clamp connection, measuring tube 3/8" to 4"

Dimensions
Refer to Section 10.6.3

Cleaning the measuring tube
by CIP (cleaning in place) using various chemicals, acids, alkalis, steam or water up to 140°C (284°F).

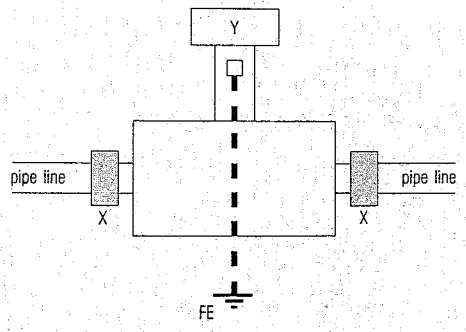
Installation
To prevent damage to the PTFE liner, the factory-supplied rubber gaskets must be fitted without fail.

Grounding

FE **Functional ground,** see Sect. 1.3.7, points 2 and 3: wire ≥ 4 mm² (10 AWG) Cu, connected to "neck" of primary head using M6 bolt (or M8 for ≥ DN 40 or ≥ 1½") with suitable cable lug. Wire and cable lug not included with flowmeter, to be provided by customer.

X **Sanitary connections** to DIN 11851, or **clamp connections**

Y **Terminal box or signal converter**



2. Electrical connection

Important information – please note!

1. Overvoltage class, contamination
In conformity with VDE 0110, equivalent to IEC 664, the flowmeters are designed for overvoltage category III in the supply circuits and overvoltage category II in the output circuits. The overall unit is protected against ingress of water and solid foreign bodies (≥ IP 65) and, assuming proper installation, is thus dimensioned to operate under contamination 4 conditions.

2. Safety isolation, line-side fuse protection
The flowmeter must be fitted with an isolating facility.
Because the EMC protective devices, in part, are arranged directly in the supply voltage input or in the outputs, it may be necessary to install suitable current limiters (e.g. additional fuse protection) to ensure that, in the event of failure of these devices due to, say, unacceptable voltage peaks in the supply or output cables, the flowmeter is not thermally overloaded due to the current rating of the line-side fuse or the downstream receiver instruments.

3. Insulation test voltages
Capacitors are located in the supply and output circuits so care must be taken to ensure that they are not overloaded during insulation tests. Therefore, please contact Krohne for test specifications before carrying out such tests.

2.1 IFM 1080 K / IFM 3080 K / IFM 4080 K / IFM 5080 K / K 480 S Compact flowmeters

2.1.1 Installation location and cable diameter

Location
- Do not expose the compact flowmeter to direct sunlight. Install a sunshade if necessary.
- Do not expose to intense vibration. If necessary, support the pipeline to the left and right of the flowmeter.

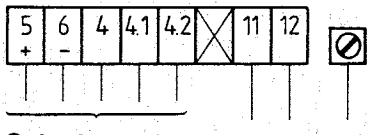
Cable diameter
To conform to protection category requirements, observe the following recommendations:
- Cable diameter: 8 to 13 mm (0.31" to 0.51")
- Enlarge inside diameter by removing the appropriate onion ring(s) from the seal of the screwed conduit entry only if cables have extremely tight fit.
- Fit blanking plug PG 16 and apply sealant to unused cable entries.
- Do not kink cables directly at conduit entries.
- Provide water drip point (U bend in cable).

Conduit installation, general wiring consideration
- When electrical codes require conduit, it must be installed in such a manner that the meter connection compartment remains **dry** at all times.
- Power and output wiring should be run in separate conduit.
- Use twisted pairs for output wiring.

Warning
Power wiring should utilize a grounded neutral conductor to avoid possible shock hazard damage to component parts.

2.1.2 Connection to power

- Note information given on the instrument nameplate (voltage, frequency)!
- Electrical connection in conformity with VDE 0100 "Regulations governing heavy-current installations with rated voltages up to 1000 V" or equivalent national standard.
- Special regulations apply to installation in **hazardous areas.** Refer to Sect. 6.1 and special "Ex" installation instructions.
- The **PE protective ground conductor** must be connected to the separate U-clamp terminal in the terminal box of the signal converter.
- In the case of extra-low voltages (24 V DC and 24/42 V AC), an **FE functional ground** must be connected to the separate U-clamp terminal in the terminal box of the signal converter (see connection diagrams in Sect. 2.2.5).
- **Power supply for primary head** via signal converter, terminals 7+8 in the separate terminal box of the IFC 080 F.
- Do not cross or loop the cables in the terminal box of the signal converter. Use separate PG or NPT screwed conduit entries for power and output cables.
- Ensure that the **screw thread and** the **gasket of the round cover** on the terminal box are well greased at all times.
- **Connection to power, IFC 080 K**

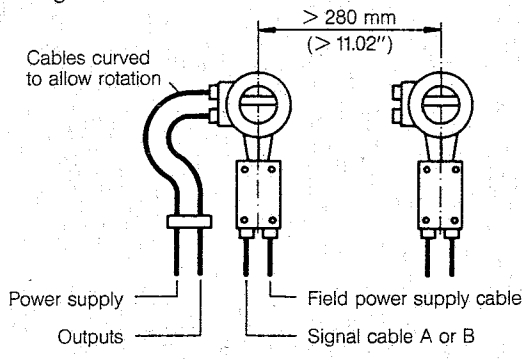


Outputs, connection see Sect. 2.3	N	L	PE	**AC**
	–	+	FE	**DC,** 24 Volt
	N	L	FE	**AC,** 24/42 Volt

2.2 IFC 080 F signal converter, separate version

2.2.1 Location

- Do not expose signal converter to direct sunlight. Install a sunshade, if necessary.
- Do not expose to intense vibration.
- Install signal converter as closely as possible to the primary head.
- The rotating design of the housing makes it easier to connect the two cables for power and outputs to the terminals in the rear terminal box.
- Cable routing



- On normal customer orders, the GKL (primary constant) of the signal converter is factory-set to match that of the primary head with which it is ordered. The GKL is engraved on the primary head nameplate and also shown on the converter nameplate. **These instruments should be installed together,** otherwise the converter will need to be reset (see Sect. 4.3 and 8.2, Fct. 3.1.4, 3.1.5 and 3.6.1).
- Use factory-supplied standard signal cable A (Type DS), standard length 10 m (30 ft); for longer lengths and bootstrap signal cable B (Type BTS), refer to Sect. 2.2.3 and 2.2.4.
- Always use the bootstrap signal cable B (Type BTS) for IFS 5000 primary heads, DN 2.5 to 10 (1/10" to $^3/_8$"), and in conjunction with contaminated fluids having a tendency to form electrically insulating deposits.

2.2.2 Connection to power

- Note the information given on the **instrument nameplates** on the primary head, signal converter (voltage, frequency)!
- **Electrical connection in conformity with VDE 0100** "Regulations governing heavy-current installations with rated voltages up to 1000 V" **or equivalent national standard.** Refer to connection diagrams, Sect. 2.2.5, for power connection to signal converter.
- Special regulations apply to installation in **hazardous areas.** Refer to Sect. 6.1 and special "Ex" installation instructions.
- The **PE protective ground conductor** must be connected to the separate U-clamp terminal in the terminal box of the signal converter.
- In the case of extra-low voltages (24 V DC and 24/42 V AC), an **FE functional ground** must be connected to the separate U-clamp terminal in the terminal box of the signal converter (see connection diagrams in Sect. 2.2.5).
- **Power supply for primary head** via signal converter, terminals 7+8 in the separate terminal box of the IFC 080 F.
- Do not cross or loop the **cables in the terminal boxes** of the primary head and signal converter. Use separate PG or NPT screwed conduit entries for each cable.
- **Shielding of signal cables A+B** must be reliably insulated from ground faults over its entire length.
- **Line resistance for 24 V DC and 24/42 V AC**

  max. internal resistance R_{max} of voltage supply
  (transformer or DC voltage source and cable)
  24 Volt DC / 24 Volt AC: $R_{max\,24} \leq 1.6$ ohms
  42 Volt AC: $R_{max\,42} \leq 2.8$ ohms

  max. length L_{max} of power cable
  $L_{max} = 28 \times A\ (R_{max}-R_i)$
  A Cross-section of power cable in mm^2 copper wire.
  R_{max} Internal resistance of voltage supply
  $R_{max\,24}$ or $R_{max\,42}$, see above
  R_i Internal resistance of transformer or
  DC voltage source

Example:
42 V AC / A = 1.5 mm^2 / R_i = 0.2 ohm / $R_{max\,42}$ = 2.8 ohms
L_{max} = [28 x 1.5 (2.8-0.2)] = 109.2 m
109.2 m x 3.3 $\frac{ft}{m} \approx$ 360 ft

Connection of several signal converters to 1 transformer
(n = number of converters)
Separate power cable: R_i increases by factor "n" ($R_i \times n$)
Common power cable: L_{max} decreases by factor "n"
(L_{max}/n)

2.2.3 Signal cables A + B

1. General

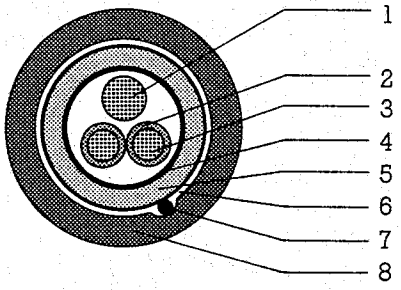
KROHNE signal cables A+B with foil and magnetic shields will ensure faultless system operation.

- 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 underwater and underground installations.
- Insulating material flame-retardant to IEC 332.1/VDE 0472
- Low in halogen and unplasticized.
- Flexible at low temperatures.

2. Signal cable A (Type DS)

with double shielding

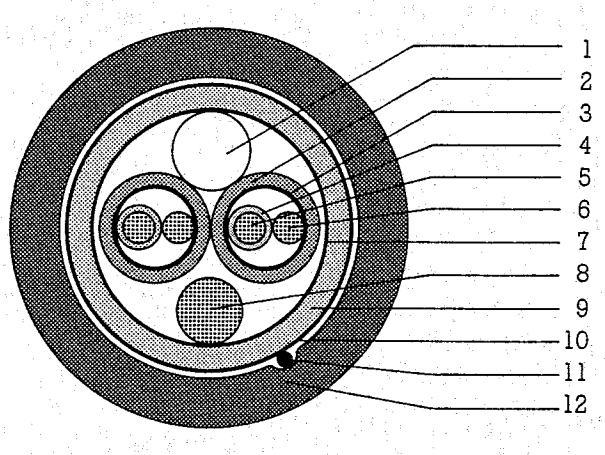
1 Stranded drain wire, 1st shield, 1.5 mm^2 (14 AWG)
2 Insulation
3 Stranded wire 0.5 mm^2 (20 AWG)
4 Special foil, 1st shield
5 Insulation
6 Mu-metal foil, 2nd shield
7 Stranded drain wire, 2nd shield, 0.5 mm^2 (20 AWG)
8 Outer sheath



3. Bootstrap signal cable B (Type BTS)

The signal converter automatically controls the individual wire 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 capacitances 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 mm^2 (20 AWG)
6 Stranded drain wire, 1st shield, 0.5 mm^2 (20 AWG)
7 Special foil, 2nd shield
8 Stranded drain wire, 2nd shield, 1.5 mm^2 (14 AWG)
9 Insulation
10 Mu-metal foil, 3rd shield
11 Stranded drain wire, 3rd shield, 0.5 mm^2 (20 AWG)
12 Outer sheath



2.2.4 Cable length

- **Signal cables A + B:** length is dependent on the electrical conductivity, $\varkappa$, of the fluid and the cross-section A_F of the field power cable C.
- **Field power supply cables:** length is dependent on cable cross-section A_F.
- Special regulations apply to **hazardous-area operation,** refer to Sect. 6.1 and special "Ex" installation instructions.
- **Abbreviations used in the following tables, diagrams and connection diagrams:**

A Signal cable A (Typ DS), with double shielding
B Signal cable B (Typ BTS), with triple shielding
} max. length, (L_{max}) see Diagram

C Field power supply cable, minimum cross-section (A_F) and length see Table
D High-temperature silicone cable, 3 x 1.5 mm² Cu / 3 x AWG 14, single shielding, length max. 5 m / 16 ft
E High-temperature silicone cable, 2 x 1.5 mm² Cu / 2 x AWG 14, length max. 5 m / 16 ft
A_F Cross-section of field power supply cable C see Table
L Cable length
$\varkappa$ electrical conductivity of liquid
ZD Intermediate connection box, required in conjunction with cables D and E for primary IFS 5000 and IFS 4000 primary heads where product temperatures exceed 150°C / 302°F

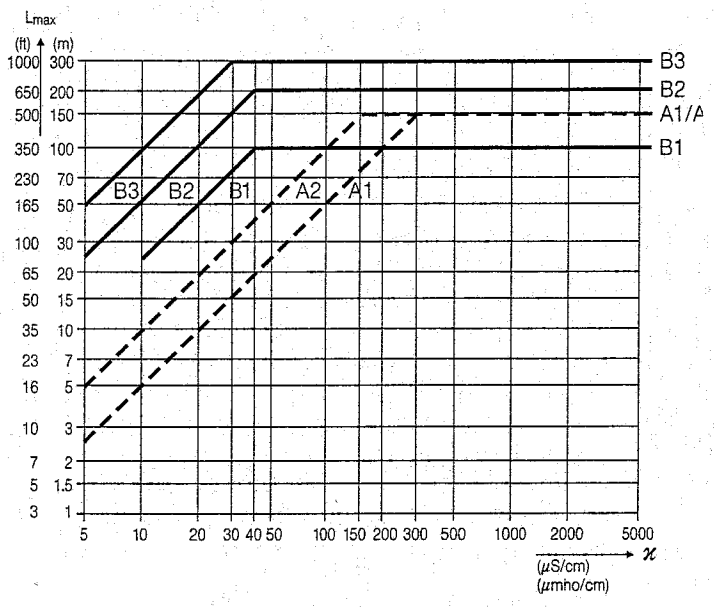
Length of signal cable

Primary head	Meter size		Signal cable
	DN mm	inches	
IFS 5000	2.5 4 to 15 25 to 100	1/10 1/6 to 1 1 to 4	B1 B2 A2 or B3
IFS 4000	10 to 600	3/8 to 24	A2 or B3
M 900	10 to 300	3/8 to 12	A1 or B2

- Always use the bootstrap signal cable B (Type BTS) for IFS 500 primary heads, DN 2.5 to 10 (1/10" to 3/8"), and in conjunction with contaminated fluids having a tendency to form electrically insulating deposits.

Field power supply cable C

Length L	Cross section A_F, minimum
0 to 150 m / 5 to 500 ft	2 x 0.75 mm² Cu / 2 x AWG 18
150 to 300 m / 500 to 1000 ft	2 x 1.50 mm² Cu / 2 x AWG 14



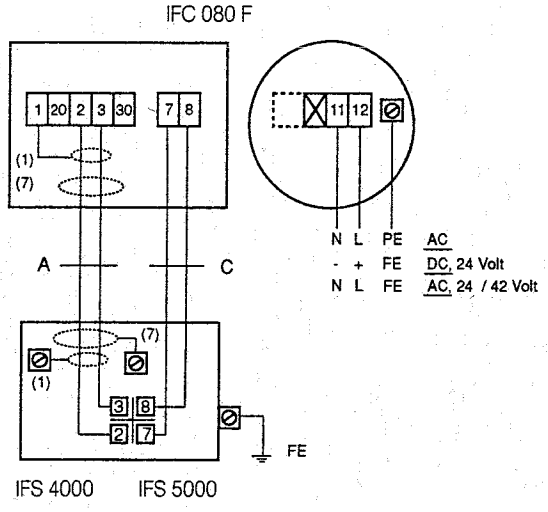
2.2.5 Connection diagrams I to VI

- **Selection table for connection diagrams,** see page 16
- Connect **hazardous-duty systems** according to the diagrams given in the special "Ex" installation instructions.

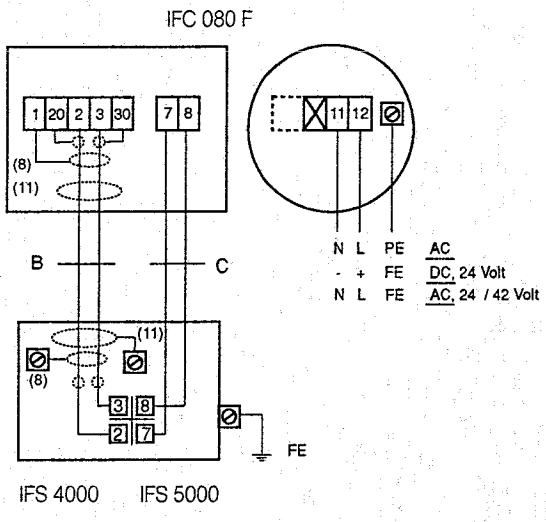
The figures in brackets refer to the stranded drain wires for the shields, refer to sectional drawings of signal cables A and B in Sect. 2.2.3 Refer to Sect. 2.2.4 for cable types C, D and E.

Product temperature	Primary head			Signal converter		Connection diagram	
	Type	Meter size		IFC 080 F	ZD	Signal cable	
		DN mm	inches			A	B
below 150°C 302°F	IFS 5000	2.5 to 15 25 to 100	1/10 to 1/2 1 to 4	X X		– I	II II
	IFS 4000	10 to 600	3/8 to 24	X		I	II
above 150°C 302°F	IFS 5000	2.5 to 15 25 to 100	1/10 to 1/2 1 to 4	X X	X X	– III	IV IV
	IFS 4000	10 to 600	3/8 to 24	X	X	III	IV
up to 180°C 356°F	M 900	10 to 300	3/8 to 12	X		V	VI

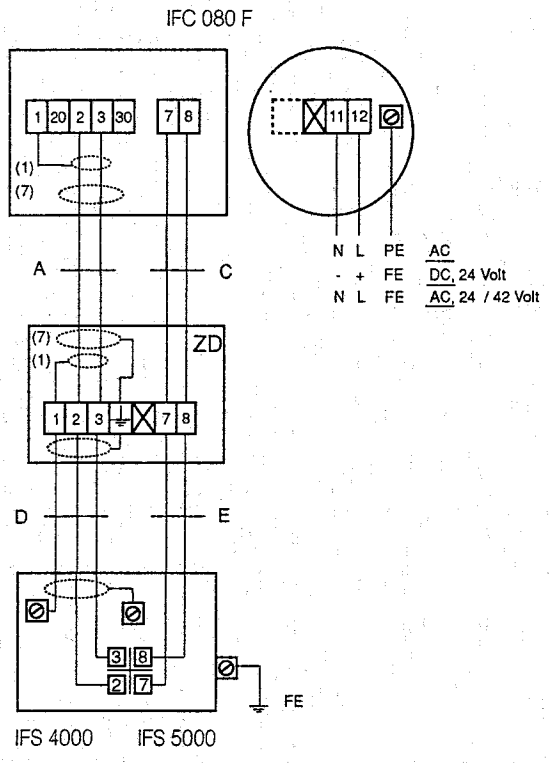
I



II



III



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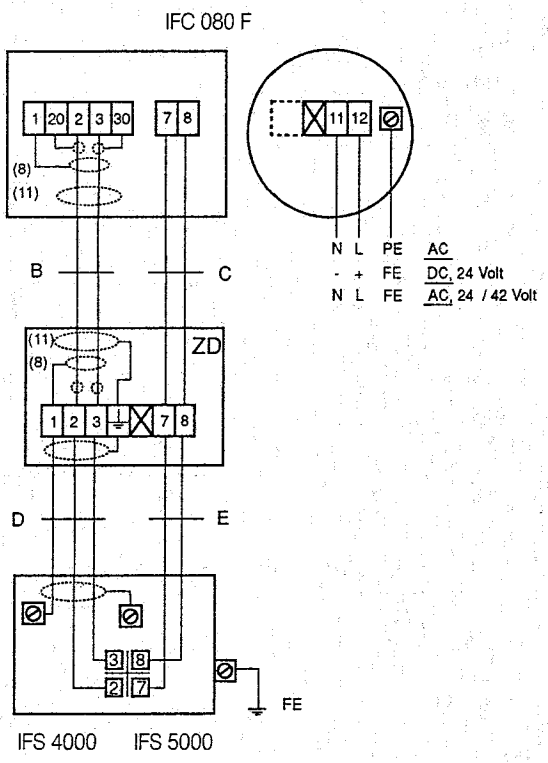
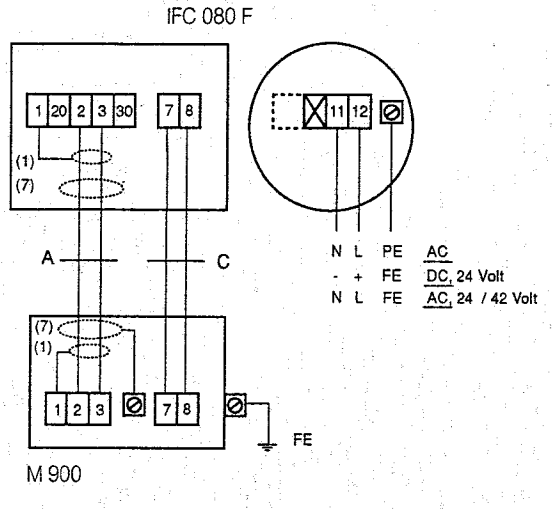
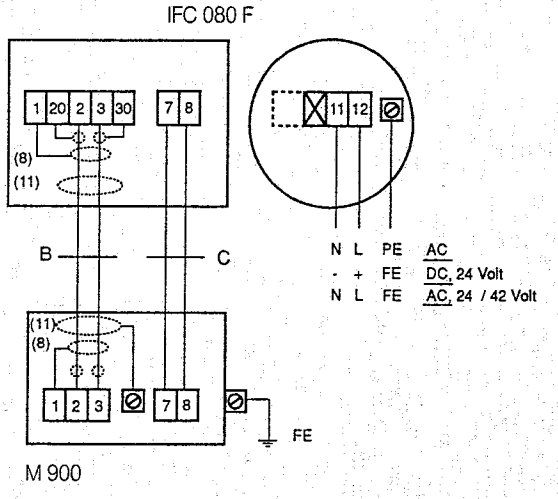


V



VI



2.3 Outputs

2.3.1 Abbreviations

Abbreviation	Stands for	Setting via Fct.No.	Description see Sect. .....
EC	Electronic totalizer	–	5.8
EMC	Electro-mechanical totalizer	–	5.8
F	Forward flow	–	5.10
P	Pulse output	3.3.1 et seq.	5.8
$P_{100\%}$	Pulses for Q = 100% flowrate **or** pulse value	3.4.2 + 3.4.3	5.8
P_{max}	Pulses at Q higher than 100% flow (max. 115% of $P_{100\%}$)	–	5.8
I	Current output	3.3.2	5.7
$I_{0\%}$	Current at Q = 0% flow	3.3.2	5.7
$I_{100\%}$	Current at Q = 100% flow	3.3.2	5.7
I_{max}	Current at Q = over 100% flow	3.3.2	5.7
$Q_{0\%}$	0% flowrate	–	5.3 (5.7 + 5.8)
$Q_{100\%}$	Full-scale range, 100% flowrate	**V:**3.1.1 / **R:**3.1.2	5.3 (5.7 + 5.8)
Q_{max}	Max. flow, Q greater than 100%, corresponding to I_{max} and P_{max}	–	5.3 (5.7 + 5.8)
R	Reverse flow	–	5.10
SMU-I / SMU-P	Low-flow cutoff for I + P	**I:**3.3.4 / **P:**3.4.6	5.9

2.3.2 Current output I

- **The current output is galvanically isolated** from all input and output circuits but **not** from pulse output P. Therefore only **one** grounded receiver instrument may be connected to either current output I or pulse output P.
- **All functions and operating data can be set,** see Sect. 4 + 5.7.
- **Factory-set data and functions** are listed in the enclosed report on settings. This can also be used to record any changes made to the operating parameters.
- **Max. load at terminals** 5/6 for $I_{100\%}$ (Fct. 3.3.2):

$$\text{max. load} = \frac{14\ \text{V}}{I_{100\%}\ [\text{mA}]}$$ (e.g. 0.7 kOhm for $I_{100\%}$ = 20 mA)

- **Time constant I,** adjustable between 0.2 and 3600 seconds (Fct. 3.3.3), see Sect. 5.7.
- **Low-flow cutoff SMU-I** (Fct. 3.3.4) adjustable independently of SMU-P (pulse output). Cut-off "on" value between 1 and 19% of $Q_{100\%}$, cut-off "off" value between 2 and 20% of $Q_{100\%}$, see Sect. 5.9.
- **Connection diagrams** 1, 5, 6, 7, 8, 9 + 10, refer to Sect. 2.3.4.

2.3.3 Pulse output P

- **The pulse output is galvanically isolated** from all input and output circuits but **not** from current output I. Therefore only **one** grounded receiver instrument may be connected to either pulse output P or current output I.
- **All functions and operating data can be set,** see Sect. 4 + 5.8.
- **Factory-set data and functions** are listed in the enclosed report on settings. This can also be used to record any changes made to the operating parameters.
- **Digital pulse division,** interpulse period non-uniform, therefore if frequency meters connected allow for minimum counting interval:

  gate time, counter $\geq \frac{1000}{P_{100\%}\ [Hz]}$, at least 0.4 second.

- **Active pulse output** for electromechanical totalizers **EMC** (terminals 4.1/4.2 or 4/4.1/4.2), 10 to 36000000 pulses/hr (0.0028 to 10000 Hz), amplitude max. 30 V, selectable pulse widths and load rating, see below.
- **Passive pulse output,** open collector for connection of active electronic totalizers EC or switchgear, input voltage 5 to 30 V, load current max. 100 mA, R_i = 100 ohms, selectable pulse widths, see below.
- **Pulse width** (Fct. 3.4.4) as a factor of frequency (pulse rate Fct. 3.4.2 + 3.4.3) and **maximum permissible load for active output** (term. 4.1/4.2 or 4/4.1/4.2), see also Sect. 5.8.

Pulse width	Frequency f = $P_{100\%}$			Load rating of active output	
				Load current	Load
500 ms	0.0028 Hz	< f ≤	1 Hz	≤ 150 mA	≥ 160 Ohm
200 ms	0.0028 Hz	< f ≤	2 Hz	≤ 150 mA	≥ 160 Ohm
100 ms	0.0028 Hz	< f ≤	3 Hz	≤ 150 mA	≥ 160 Ohm
100 ms	3 Hz	< f ≤	5 Hz	≤ 60 mA	≥ 400 Ohm
50 ms	0.0028 Hz	< f ≤	5 Hz	≤ 150 mA	≥ 160 Ohm
50 ms	5 Hz	< f ≤	10 Hz	≤ 60 mA	≥ 400 Ohm
30 ms	0.0028 Hz	< f ≤	6 Hz	≤ 150 mA	≥ 160 Ohm
30 ms	6 Hz	< f ≤	10 Hz	≤ 80 mA	≥ 300 Ohm
Pulse width* = $\frac{1}{2 \times P_{100\%}}$	10 Hz	< f ≤	10000 Hz	≤ 25 mA	≥ 1000 Ohm

* Pulse width is independent of setting in Fct. 3.4.4.

- **Time constant P,** adjustable to 0.2 second or same as current output I (Fct. 3.4.5 + 3.3.3)
- **Low-flow cutoff SMU-P** (Fct. 3.4.6), adjustable independently of SMU-I (current output). Cut-off "on" value between 1 and 19% of $Q_{100\%}$, cut-off "off" value between 2 and 20% of $Q_{100\%}$, see Sect. 5.9.
- **Connection diagrams** 2, 3, 4, 6, 7, 8 + 9, see Sect. 2.3.4.

2.3.4 Connection diagrams for outputs ① to ⑩

Output characteristics
Current output I: Diagrams I1 to I5 in Sect. 5.7
Pulse output P: Diagrams P1 to P4 in Sect. 5.8

R1 and R2 when electronic totalizers connected to term. 4/4.1/4.2, connection diagrams ③ + ⑧
R1 = 1 kOhm/1W
R2 = needed only for totalizers with input voltages U_{max} < 30 Volt

U_{max}	24 Volt	12 Volt	5 Volt
R2	3,9 kOhm	680 Ohm	180 Ohm

1 flow direction

① I: (term. 5/6)	② P_{active}: EMC/EC (term. 4.1/4.2)	③ P_{active}: EC (term. 4/4.1/4.2)	④ $P_{passive}$: EC (term. 4/4.1)	⑤ I: e.g. as operation indicator

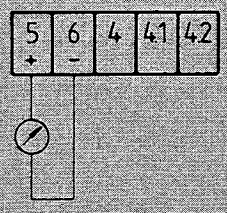
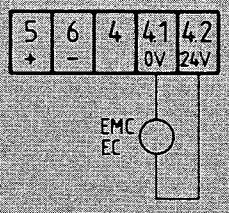
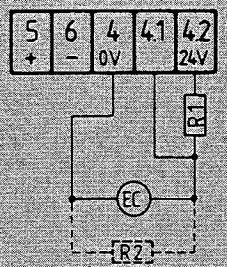
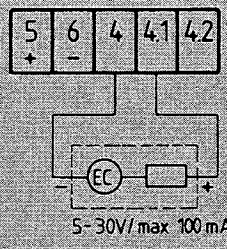
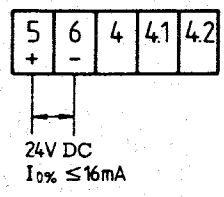
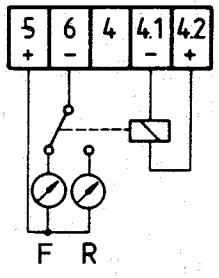
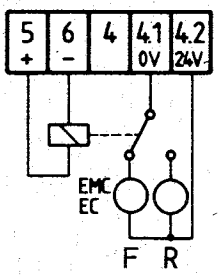
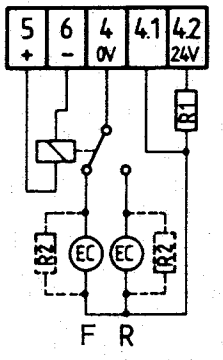
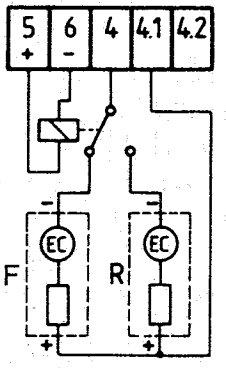
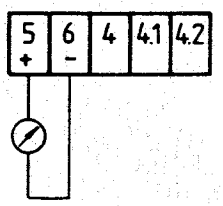

				

Diagram: I1	Diagram: P1	R1 + R2: see above Diagram: P1	Diagram: P1	Load: max. 24 V DC at $I_{0\%}$ ≤ 16 mA (set via Fct. 3.3.2) $I_{0\%}$ = U/R U = rated voltage and R = load resistance Diagram: I4

F/R operation / 2 flow directions

⑥ I: (term. 5/6)	⑦ P_{active}: EMC/EC (term. 4.1/4.2)	⑧ P_{active}: EC (term. 4/4.1/4.2)	⑨ $P_{passive}$: EC (term. 4/4.1)	⑩ I: (term. 5/6) e.g. in range of 0 to 20 mA
				
F/R relay: 24 V DC / R_{coil} ≥ 1 kOhm/ max. 25 mA (e.g. Siemens relay D1) Diagrams: I2 or P3	F/R relay: max. 24 V DC at I_{max} ≤ 22 mA (set via Fct. 3.3.2) I_{max} = U/R U = rated voltage and R = resistance of relay coil (e.g. Siemens relay D1) Diagrams: P2 or I3	F/R relay: max. 24 V DC at I_{max} ≤ 22 mA (set via Fct. 3.3.2) I_{max} = U/R U = rated voltage and R = resistance of relay coil (e.g. Siemens relay D1) R1 + R2: see above Diagrams: P2 or I3	F/R relay: max. 24 V DC at I_{max} ≤ 22 mA (set via Fct. 3.3.2) I_{max} = U/R U = rated voltage and R = resistance of relay coil (e.g. Siemens relay D1) Diagrams: P2 or I3	e.g. F: 10 to 20 mA R: 10 to 0 mA Diagram: I5

3. (Initial) Start-up

- Check that the system has been correctly installed as described in Sect. 1 and 2.
- With separate systems, check before initial start-up that the following details on the primary head nameplate agree with the data specified in the report of settings for the signal converter. If not, resetting will be necessary:

  Order No., see instrument nameplates
  Meter size (DN), Fct. 3.1.4, Sect. 5.3
  Primary constant GKL, Fct. 3.1.5, Sect. 5.14
  Flow direction, Fct. 3.1.6, Sect. 5.4 + 5.16
  Magnetic field frequency, Fct. 3.6.1, Sect. 5.14

- It is recommended to carry out a zero check, if the flow can be zeroed, as described in Sect. 7.2, before every start-up and particularly where fluid products with low electrical conductivity levels are concerned.
- When powered, the signal converter operates in the measuring mode. The Ident. No. of the signal converter appears on the display for about 3 seconds. This is followed by display of the actual flowrate and/or the internal count on a continuous or alternating basis (depends on setting, see report on settings).

Important: With regard to the factory setting, please note information given in Sect. 5.16!

Part B IFC 080 Signal converter

4. Operation of the signal converter

This section 4 is repeated in the form of pull-out condensed operating instructions between pages 38 and 39.

4.1 Operating and check elements

The operating elements are accessible after removing the cover of the electronics section using the special wrench.

Caution: Do not damage the screw thread and the gasket, never allow dirt to accumulate, and make sure they are well greased at all times.

① Display 1st (top) line
② Display 2nd (middle) line
③ Display 3rd (bottom) line: arrows (▼) to identify actual display

flowrate	Actual flowrate
Totalizer +	Totalizer (**F**orward flow)
–	Totalizer (**R**everse flow)
Σ	Sum totalizer (+ and –)

④ Keys for operator control of the signal converter, refer to "setting diagram" (on the right) and Sect. 4.2.3.
⑤ Magnetic sensors (option) to set the converter by means of a handheld bar magnet without opening the housing, refer to Sect. 6.4. Function of sensors same as keys ④.
⑥ Compass field, signals actuation of a key.

4.2. KROHNE operator control concept

4.2.1 Description

The operator control concept of the signal converter consists of 3 levels (horizontal). Each menu-level is split up into 4 (or 3) columns (vertical), see Setting Diagram on right. The menus are designed for the jobs to be carried out by the various

user groups (see below).

Setting level

This level is divided into 3 main menus. It is selected by pressing the ➡ key (and, if necessary, the 9-keystroke Entry Code 1 if *YES* is set under Fct. 3.5.2 *ENTRY. CODE 1*).

Fct. 1.0 OPERATION

Maintenance, repair, process management

This menu contains **only the most important parameters** and functions of Menu 3 (*INSTALL.*) to allow rapid changes to be made during the measuring mode.

Fct. 2.0 TEST

Maintenance, repair

Test menu for checking the signal converter (display, outputs, measuring range).

Fct. 3.0 INSTALL.

Project and installation groups

All flow measurement- and flowmeter-specific parameters and functions can be set in this menu.

Parameter check level

Fct. 4.0 PARAM.ERROR

This level is not selectable. After exiting from the "setting level", the signal converter checks new data for plausibility (inconsistency). If an error is established, the signal converter indicates *PARAM.-ERROR* in Fct. 4.0. In this menu, all functions can be scanned and those changed that are inconsistent.

Reset/acknowledge level (Quit)

Process management

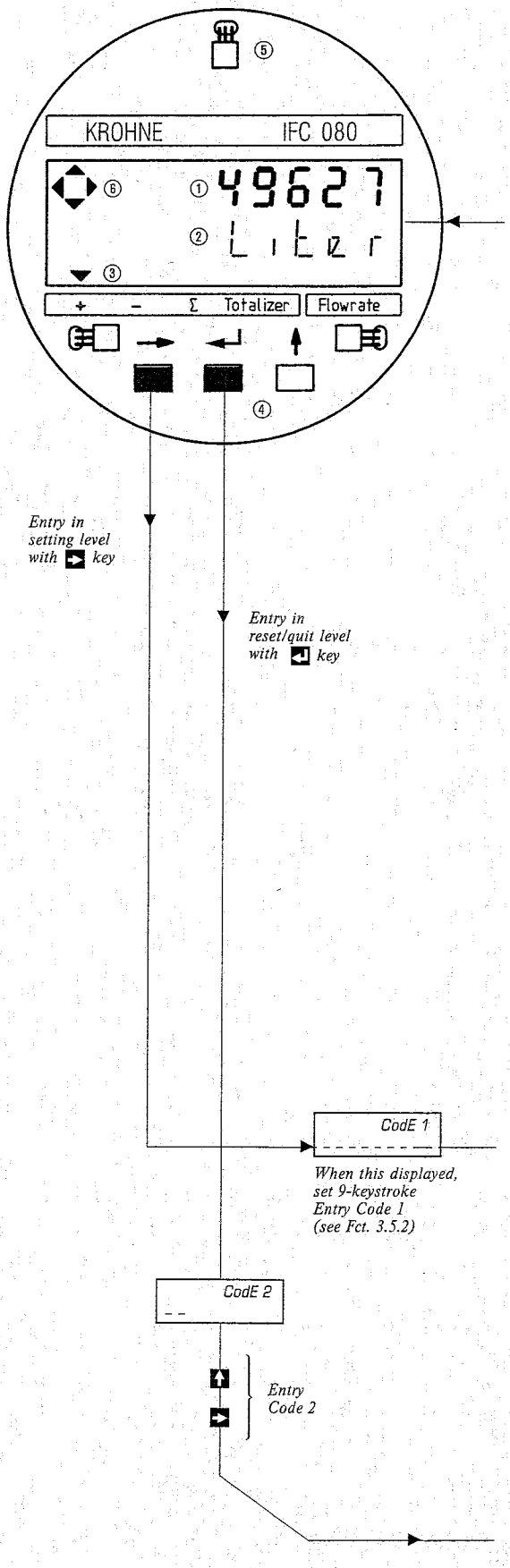
This menu has 2 tasks (A + B) and is selected via Entry Code 2 (➡ ⬆ ➡).

A) Separate resetting of "+" and "–" totalizers, provided that resetting is enabled under Fct. 3.5.8 *ENABL.RESET*,input *YES*. Resetting also affects the sum totalizers!

B) Error scanning and acknowledgement (Quit)

Errors that have occurred since the last acknowledgement are indicated in a list. After elimination of the cause(s) and acknowledgement, these errors are deleted from the list (see Sect. 4.4).

4.2.2 Setting diagram

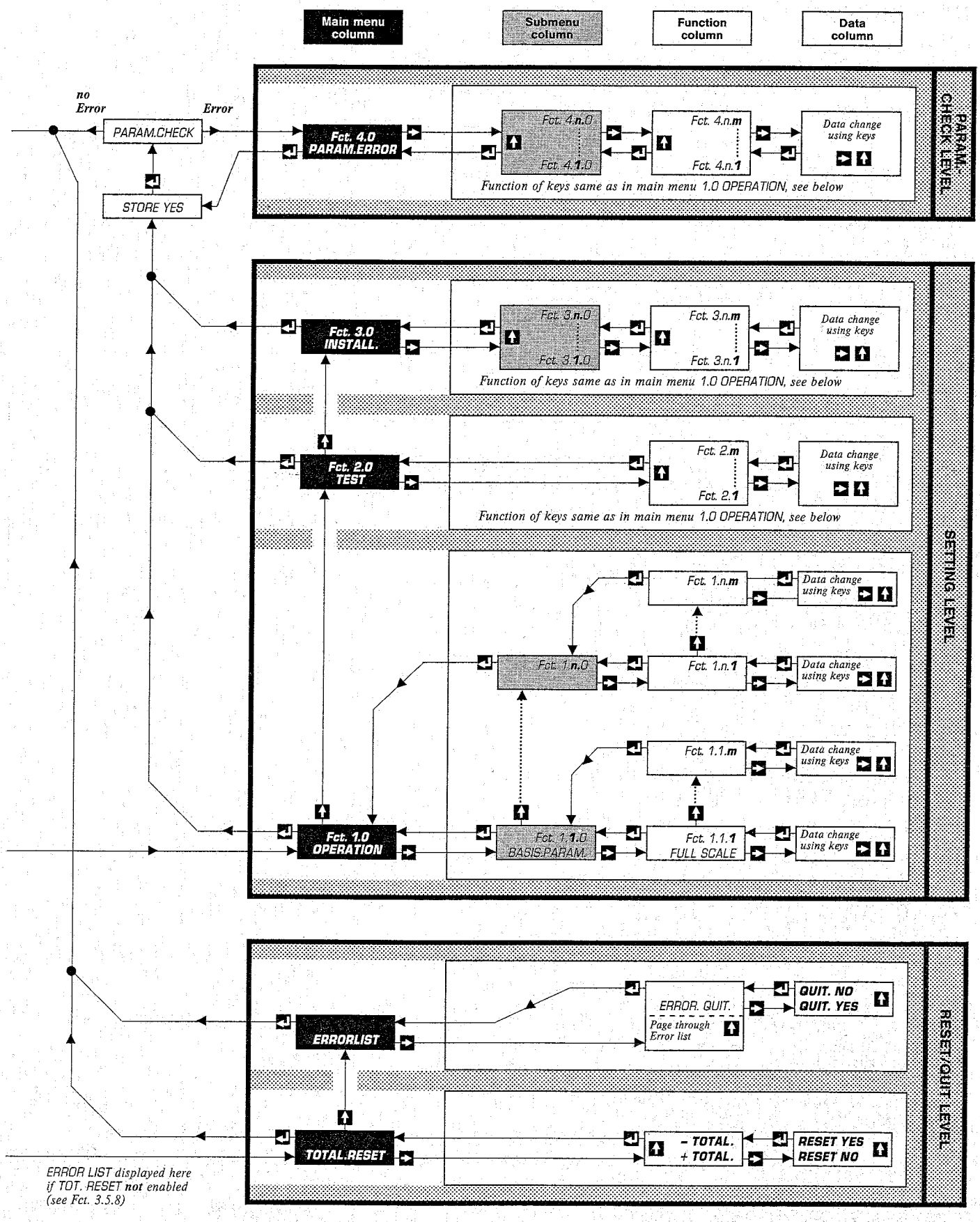


Notes on using the diagram

..... dotted line: press select key ⬆ as many times as is necessary until either the n^{th} submenu or the m^{th} function is displayed. For **Fct. No.**, see Sect. 4.3 "Functions Table".
A typical example of setting the signal converter is illustrated in a diagram in Sect. 4.2.4.
The cursor (flashing part of display) is shown in **bold** type.

n identifies a submenu
m identifies a function
black box = main menu
grey box = submenu
white box = functions and data

cf. Functions Table in Sect. 4.3



4.2.3 Operation of the signal converter, function of keys

To start		
	Actual display	Terminate measuring mode
Press ➡	*Fct. 1.0 OPERATION*	If this displayed, see next "box": function of keys
	or	
1st-8th place (key) 9th place (key)	*CodE 1* _ _ _ _ _ _ _ _ _	If this appears on the display, set the 9-keystroke **Entry Code 1** now. Factory setting: ➡ ➡ ➡ ↵ ↵ ↵ ↑ ↑ ↑
	CodE 1 ✲ ✲ ✲ ✲ ✲ ✲ ✲ ✲ ✲ _	Each keystroke acknowledged by "✲" in display.
	Fct. 1.0 OPERATION	If this appears on the display, see next "box": function of keys
	CodE 1 *[9 alpha characters]*	If this displayed it means that a wrong Entry Code 1 was keyed in. Press ↵ and ➡ keys and set the 9-keystroke Entry Code 1 again (see above).
		If you have forgotten Entry Code 1, the code can be decoded with the aid of the 9 alpha characters. Please consult factory.

Function of the keys in the 3 levels	
Cursor	is the flashing part of the display. This can be a digit, a text, a unit or a sign.
➡	The **cursor key** shifts the cursor to a new (different) position in the display. For the menu columns (see diagram in Sect. 4.2.2) this means: transfer to the next "right" column, i.e. from left to right, up to the data column. Only in the data column can parameters be changed and functions initiated.
↑	The **select key** changes the content (digit, text) of the flashing cursor. – Digit: Increase value by "1" (With *Fct. _ _ _*, display next main or submenu or next function) – Text/unit: Display (select) next text/unit from a list – Sign: Change from "+" to "–" or, with exponents, from "*E+*" to "*E–*", and vice versa.
↵	The **accept key** (return key) is used for: – acceptance of new parameters, – acknowledgement of displayed error messages in the reset/ackn. menu, and – execution of displayed functions. For the menu columns (see diagram in Sect. 4.2.2) this means: transfer to the next "left" column, i.e. from right to left, up to the main menu column. Only from the main menu column is it possible to exit from the 3 levels and return to the measuring mode.
Important	● If numerical values are set that are outside the permissible input range, the display will flash after the "Accept" key ↵ has been pressed. 1st line: permissible min. **or** max. value displayed 2nd line: *MIN VALUE* **or** *MAX VALUE* The incorrect numerical value is displayed again after pressing the ↵ key; set correct numerical value. ● Time-out function: if the signal converter is in the setting level and if no keystrokes are made for approx. 15 minutes, the signal converter will automatically revert to the measuring mode without accepting any previously changed data.

To terminate		
Press ↵ 1-4 times		Press ↵ key (1-4 times) until following appears on the display
	STORE YES	= acceptance of new parameters
		If the newly set parameters are not to be accepted or return to the setting level is desired, proceed as follows: Press ↑ *STORE NO*, from here press ↵ key to return to measuring mode (actual display) with the "old" parameters and functions. **or** again Press ↑ *RETURN*, from here press ↵ key to return to setting level, displayed: *Fct. 1.0 OPERATION*
Press ↵	*PARAM.CHECK*	= plausibility check, i.e. newly set parameters checked for plausibility (inconsistency).
	Actual display	**No Error** in plausibility check. Return to measuring mode
		Error(s) in parameter check, see following display
	Fct. 4.0 PARAM.ERROR	Main menu 4.0 parameter error(s) displayed.
		In this menu, all faulty functions can be scanned and corrected. The keys here have the same function as in menus 1.0, 2.0 and 3.0, see above: function of keys.

4.2.4 Example for setting of the signal converter

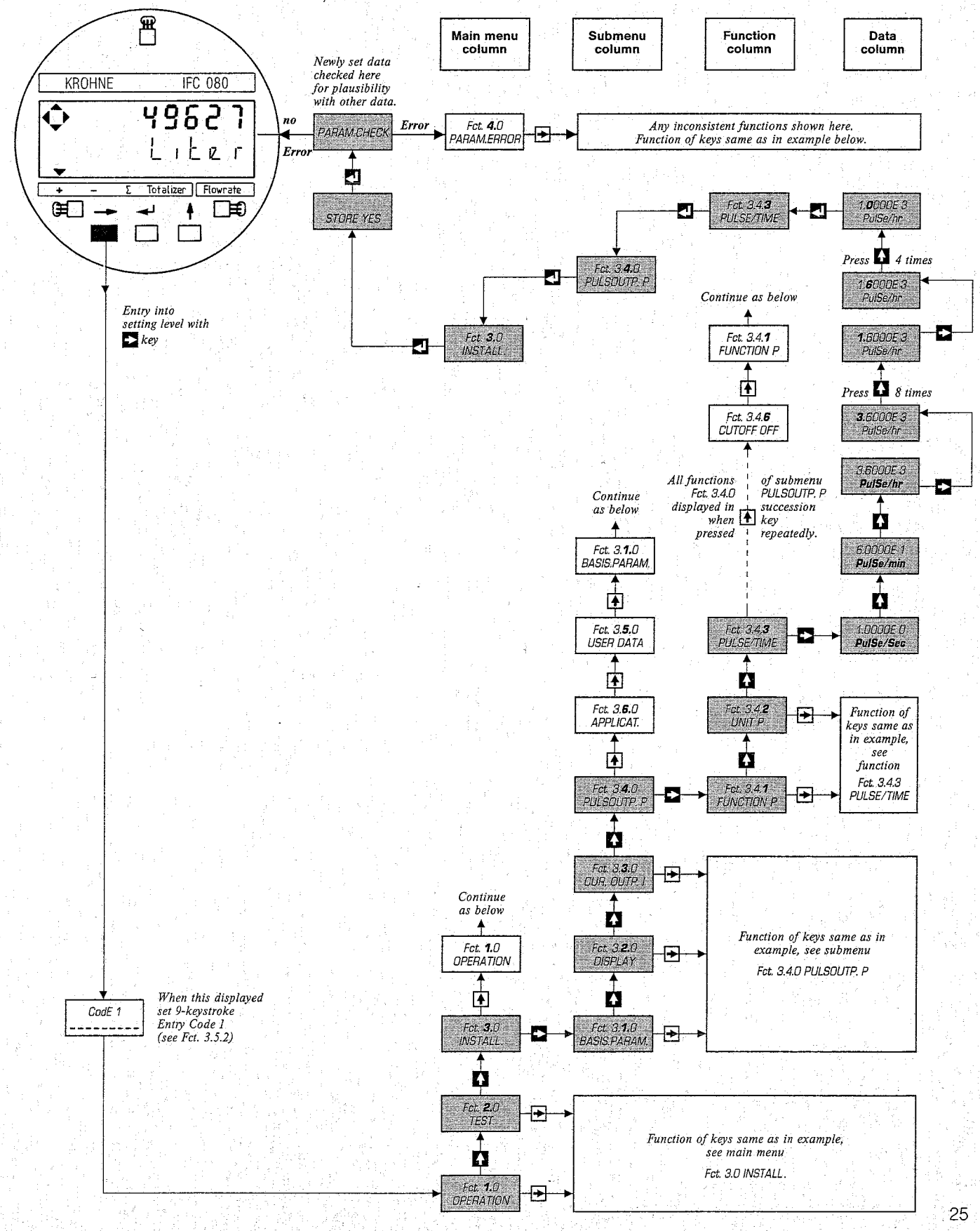
The following example shows how to change the pulse rate of the pulse output (function: *Fct. 3.5.2 PULSE/TIME*, see Functions Table in Sect. 4.3). The cursor (flashing part of display) is shown here in **bold** type.

- "old" setting: 1 pulse per second (*1.000E 0 PulSe/Sec*)
- change to: 1000 pulses per hour (*1.0000E 3 PulSe/hr*)

How to use the diagram

Grey boxes and black keys describe the path taken for the above example

White boxes and white keys identify paths taken to change data in the other main and submenus and/or functions, see Functions Table in Sect. 4.3.



4.3 Table of settable functions

Fct. No.	Text	Description and settings
1.00	OPERATION	**Main menu 1.0 Operation**
1.1.0	BASIS.PARAM.	**Submenu 1.1.0 Basis parameters**
1.1.1	FULL SCALE	**Full-scale range for flowrate $Q_{100\%}$** see Fct. 3.1.1
1.1.2	REV.SCALE	**Different range for reverse flow** required? See Fct. 3.1.2
1.1.3	ZERO SET	**Zero calibration** see Fct. 3.1.3
1.2.0	DISPLAY	**Submenu 1.2.0 Display**
1.2.1	DISP.FLOW	**Unit for flowrate display,** see Fct. 3.2.1
1.2.2	DISP. TOTAL	**Function of totalizer display,** see Fct. 3.2.2
1.2.3	CYCL.DISP.	**Cyclic display** required? see Fct. 3.2.4
1.3.0	CUR.OUTP.I	**Submenu 1.3.0 Current output I**
1.3.1	TIMECONST.I	**Time constant for current output I,** see Fct. 3.3.3
1.3.2	L.F.CUTOFF I	**Low-flow cutoff** (SMU) **for current output I** see Fct. 3.3.4
1.4.0	PULSOUTP. P	**Submenu 1.4.0 Pulse output P**
1.4.1	PULSE/TIME **or** PULSE/VOL.	**Pulses per unit time for 100% flowrate** or **Pulses per unit volume,** see Fct. 3.4.3
1.4.2	L.F.CUTOFF P	**Low-flow cutoff** (SMU) **for pulse output P,** see Fct. 3.4.6
2.0	TEST	**Main menu 2.0 Test functions**
2.1	TEST DISP.	**Test of the display** (Sect. 7.1.2.) Start with ➡ key (duration: approx. 15 sec.)
2.2	TEST I	**Test of current output I** (Sect. 7.1.3) Safety interrogation: *SURE NO* *SURE YES* ● *0 mA* ● *10 mA* ● *20 mA* ● *4 mA* ● *16 mA* ● *22 mA* Select with ↑ key Displayed value present directly at current output. Actual value again present at output after pressing the ↵ key.
2.3	TEST P	**Test of pulse output P** (Sect. 7.1.3) Safety interrogation: *SURE NO* *SURE YES* ● *1 Hz* ● *100 Hz* ● *10000 Hz* ● *10 Hz* ● *1000 Hz* Select with ↑ key. Displayed value present directly at pulse output. Actual value again present at output after pressing the ↵ key.
2.4	TEST Q	**Test of full-scale range** (Sect. 7.1.3) Safety interrogation: *SURE NO* *SURE YES* ● *−110 / −100 / − 50 / − 10 PCT.* ● *0 PCT.* ● *+ 10 / + 50 / +100 / +110 PCT.* ... of set full-scale range ($Q_{100\%}$). Select with ↑ key. Displayed value present directly at outputs I and P. Actual value again present at output after pressing the ↵ key.
3.0	INSTALL.	**Main menu 3.0 Installation**
3.1.0	BASIS.PARAM.	**Submenu 3.1.0 Basis parameters**
3.1.1.	FULL SCALE	**Full-scale range for flowrate $Q_{100\%}$** Selection of unit and setting ranges ● *0.0054 E0–0.3053 E6 m3/h* ● *0.0015 E0–0.8482 E5 Liter/Sec* ● *0.0234 E0–0.1344 E7 US Gal/min* (see Sect. 5.1, 5.2 + 5.3) ● *user-defined unit,* factory-set is *hLiter/hr* or *US.MGal/DAY* (hectoliters per hour **or** US million gallons per day), can be changed via Fct. 3.5.5 – 3.5.7 (Sect. 5.15). After selecting unit, call numerical value with ➡ key, 1st digit flashes.

Fct. No.	Text	Description and settings
3.1.2	REV.SCALE	**Different range for reverse flow** required? Set *NO* or *YES.* If *YES*, the full-scale range for the reverse flow must be set. Selection of unit and setting ranges same as in Fct. 3.1.1. Value not greater than that of Fct. 3.1.1!
3.1.3	ZERO SET	**Zero calibration** (Sect. 7.2) Perform only at "0" flow and with compl. filled measuring tube. 1) Query: *CALIB. NO* or *YES* 2) If *YES*: calibration, duration approx. 25 sec. with zero displayed as *PERCENT* of $Q_{100\%}$. 3) Query: *STORE NO* or *YES*
3.1.4	METER SIZE	**Table of meter sizes** Size from DN *2.5–600 mm,* equivalent to *1/10–24 inch.* Select from this table using ↑ key (Sect. 5.3.).
3.1.5	GK VALUE	**Primary head constant GKL** (see nameplate, primary head) value: *0.5* to *14*
3.1.6	FLOW. DIR.	**Define direction of forward flow** Set according to direction of arrow on primary head: + or −
3.2.0	DISPLAY	**Submenu 3.2.0 Display**
3.2.1	DISP.FLOW	**Unit for flowrate display** ● *m3/hr* ● *Liter/Sec* ● *US Gal/min* ● *user-defined unit,* factory-set is *Liter/hr* **or** *US.MGal/DAY* (liters per hour **or** US million gallons per day) can be changed via Fct. 3.5.5 – 3.5.7 (Sect. 5.15). ● *PERCENT* ● *NO DISPLAY*
3.2.2	DISP.TOTAL	**Function of totalizer display** ● *NO DISPLAY* (= totalizer switched on but not displayed) ● *TOTAL.OFF* (= totalizer switched off) ● *+ TOTAL.* (= forward flow totalizer) ● *− TOTAL.* (= reverse flow totalizer) ● *+/− TOTAL.* (forward and reverse flow totalizers, alternating) ● *SUM TOTAL.* (= sum of "+" and "−" totalizers) ● *ALL TOTAL.* (= sum, "+" and "−" totalizers, sequential)
3.2.3	UNIT TOTAL.	**Unit for totalizer display** ● *m3* ● *Liter* ● *US Gal* ● *user- defined unit,* see Fct. 3.5.5 – 3.5.7
3.2.4	CYCL.DISP.	**Cyclic display** required? Setting: *NO* or *YES*
3.2.5	ERROR MSG.	**Which error messages** to be displayed? (Sect. 4.4) ● *NO MESSAGE* (= no display of error messages) ● *ADC ERROR* (= ADC errors only) ● *TOTAL.ERROR* (= only errors of internal totalizer) ● *ALL ERROR* (= display all errors)
3.3.0	CUR.OUTP.I	**Submenu 3.3.0 Current output I**
3.3.1	FUNCTION I	**Function, current output I** ● *OFF* (= switched off) ● *F/R IND. P* (= F/R indication, for P) ● *1 DIR.* (= 1 flow direction) ● *I < I 0 PCT.* (= **F**orward and **R**everse flow, e.g. in 0 – 20 mA range: **F** = 10 – 20 mA **R** = 10 – 0 mA) ● *2 DIR.* (= forward/reverse flow, F/R measurement)

Fct. No.	Text	Description and settings
3.3.2	RANGE I	**Range fur current output I** ● FIXED 0-20 mA I_{max} = 22 mA ● FIXED 4-20 mA I_{max} = 22 mA ● VARIAB. (variable ranged) $I_{0\%}$ (Q = 0% flow): 00-16 mA $I_{100\%}$ (Q = 100% flow): 04-20 mA I_{max} (Q > 100% flow): 04-22 mA Note following conditions: $I_{100\%} - I_{0\%} \geq 4$ mA $I_{100\%} \leq I_{max}$ Display: e.g. for 5-10 mA, max. 15 mA 05-10 15 (top line) VARIAB. mA (bottom line)
3.3.3	TIMECONST.I	**Time constant for current output I** Value: 0.2 to 3600 Sec
3.3.4	L.F.CUTOFF I	**Low-flow cutoff** (SMU) **for current output I** required? Setting: NO or YES. If YES, setting ranges: "on" value: 01-19 PERCENT "off" value: 02-20 PERCENT Note following condition: Cutoff "on" value "minus" cutoff "off" value > 1% Display, e.g. for range: on = 2%, off = 6% 02-06 (top line) PERCENT (bottom line)
3.4.0	PULSOUTP. P	**Submenu 3.4.0 Pulse output P**
3.4.1	FUNCTION P	**Function of pulse output P** ● OFF (= switched off) ● F/R IND. I (= F/R indication, for I) ● 1 DIR. (= 1 flow direction) ● 2 DIR. (= forward/reverse flow, F/R measurement)
3.4.2	UNIT P	**Unit of pulse output P** ● PULSE/TIME (= setting in pulses per unit time) ● PULSE/VOL. (= setting in pulses per unit volume)
3.4.3	PULSE/TIME	**Pulses per unit time for 100% flowrate** see Fct. 3.1.1 (appears only if PULSE/TIME set under Fct. 3.4.2) Setting ranges 0.0028 E0-0.1000 E5 PulSe/Sec (=Hz) 0.1667 E0-0.6000 E6 PulSe/min 0.1000 E2-0.3600 E8 PulSe/hr After selecting unit, call numerical value with ➡ key, 1st digit flashes.
3.4.3	PULSE/VOL.	**Pulses per unit volume** (flowrate) (appears only if PULSE/VOL. set under Fct. 3.4.2) Setting ranges 0.0001 E0-0.9999 E9 PulS/m3 0.0001 E0-0.9999 E6 PulS/Liter 0.0001 E0-0.3785 E7 PulS/US.Gal (**no** input check but: $Q_{100\%}$ x pulse value $\leq 3.6 \times 10^7$ pulses/hr). After selecting unit, call numerical value with ➡ key, 1st digit flashes.
3.4.4	PULSWIDTH	**Pulse width for frequencies ≤ 10 Hz** ● 30 mSec ● 200 mSec ● 50 mSec ● 500 mSec ● 100 mSec
3.4.5	TIMECONST.P	**Time constant for pulse output P** ● 0.2 Sec ● SAME AS I (= time constant for P same as for I, see Fct. 3.3.3)
3.4.6	L.F.CUTOFF P	**Low-flow cutoff** (SMU) **for pulse output P** required? Setting: NO or YES If YES, setting ranges: "on" value: 01-19 PERCENT "off" value: 02-20 PERCENT Note following condition: Cut-off "off" value "minus" cutoff "on" value > 1% Display, e.g. for range: on = 2%, off = 6% 02-06 (top line) PERCENT (bottom line)

Fct. No.	Text	Description and settings
3.5.0	USER DATA	**Submenu 3.5.0 User data**
3.5.1	LANGUAGE	**Language for display texts** ● GB/USA (= English) ● D (= German) ● F (= French) ● others pending
3.5.2	ENTRY CODE 1	**Entry Code 1 for entry into setting level** required? ● NO = entry with ➡ key ● YES = entry with 9-keystroke code. Setting of code under Fct. 3.5.3
3.5.3	CODE 1	**Set Code 1** (9-keystroke combination) ● factory setting: ➡ ➡ ➡ ⬅ ⬅ ⬅ ⬆ ⬆ ⬆ ● If different code required: press any 9-keystroke combination, and then press the **same** keystroke combination again. Each keystroke acknowledged by "✳". WRONG CODE (= incorrect entry) appears if 1st and 2nd entries are **not equal.** Press ⬅ and ➡ keys and repeat entries.
3.5.4	LOCATION	Set **tag name** (measuring point No.), max. 10digits. Required only for flowmeters of "HHC" design (operator control via Hand-Held Communicator MIC 500, connected to current output). Factory setting: ALTOMETER Characters assignable to each place: A...Z / a...z / 0...9 / _ (underscore character = blank character)
3.5.5	UNIT TEXT	**Text for user-defined unit,** Sect. 5.15 Factory setting: Liter/hr **or** US.MGal/DAY (= liters per hour **or** US million gallons per day) Characters assignable to each place: A...Z / a...z / 0...9 / _ (underscore character = blank character) Fraction bar "/" in 7th place is unalterable.
3.5.6	FACT.QUANT.	**Conversion factor for quantity** (F_M), Sect. 5.15 Factory setting: 1.00000 E+3 (for liters) **or** 2.64172 E-4 (for US million gallons) Factor F_M = quantity per 1 m^3. Setting range: 0.00001 E-9 to 9.99999 E+9
3.5.7	FACT. TIME	**Conversion factor for time** (F_T) Sect. 5.15 Factory setting: 3.60000 E+3 (for hour) **or** 8.64000 E+4 (for day) Factor F_T in seconds Setting range: 0.00001 E-9 to 9.99999 E+9
3.5.8	ENABL.RESET	**Enable totalizer reset** for the RESET / QUIT menu, see Sect. 5.6 Query: NO or YES
3.6.0	APPLICAT.	**Submenu 3.6.0 Application**
3.6.1	FIELD FREQ.	**Magnetic field frequency,** Sect. 5.14+8.2 ● 1/6 ● 1/16 ● 1/32
3.6.2	NOISE	**Noise rejection,** Sect. 6.2 ● NO NOISE ● NOISE
3.6.3	REF. SEL.	**Selecting the reference voltage** Sect. 6.2 ● AUTO.REF. (= automatic reference) ● HIGH-FLOW (= high flow range) ● MED.1-FLOW (= 1st medium flow range) ● MED.2-FLOW (= 2nd medium flow range) ● MED.3-FLOW (= 3rd medium flow range) ● LOW-FLOW (= low flow range)

Fct. No.	*Text*	**Description** and settings
4.0	*PARAM.ERROR*	**Main menu 4.0** **Parameter errors**
4.1.0	*FLOW VELOC.*	**FLOW VELOCITY "v" incorrect:** Ensure condition 0.3 m/s $\leq$ v $\leq$ 12 m/s **or** 1 ft/s $\leq$ v $\leq$ 40 ft/s is met!
4.1.1	*FULL SCALE*	**Full-sclae range for flowrate $Q_{100\%}$** see Fct. 3.1.1
4.1.2	*METER SIZE*	**Meter size,**see Fct. 3.1.4
4.2.0	*F/R FLOW*	**FULL-SCALE RANGE(S) for forward/reverse flow incorrect:** Ensure condition F $\geq$ R is! met!
4.2.1	*FULL SCALE*	**Full-scale range $Q_{F100\%}$** (forward flow) see Fct. 3.1.1
4.2.2	*REV.SCALE*	**Different full-scale range for reverse flow** required? see Fct. 3.1.2
4.3.0	*P > 10 kHz*	**OUTPUT FREQUENCY too high:** must be less than 10 kHz!
4.3.1	*PULSE/VOL.*	**Pulse value for flow unit, see** Fct. 3.4.3
4.3.2	*FULL SCALE*	**Full-scale range for flow $Q_{100\%}$** see Fct. 3.1.1
4.4.0	*P < > PULSW.*	**FREQUENCY/PULSE WIDTH ASSIGNMENT is incorrect:** Refer to Table in Sect. 2.3.3.
4.4.1	*PULSWIDTH*	**Pulse width for frequencies $\leq$ 10 Hz** see Fct. 3.4.4
4.4.2	*PULSE/TIME*	**Pulse rate for 100% flowrate** see Fct. 3.4.3
4.4.2	*PULSE/VOL.*	**Pulse value for flow unit,** see Fct. 3.4.3
4.4.3	*FULL SCALE*	**Full-scale range for flow $Q_{100\%}$** see Fct. 3.1.1

4.4 Error messages (ERROR)

4.4.1 List of errors (ERRORLIST) and how shown in display

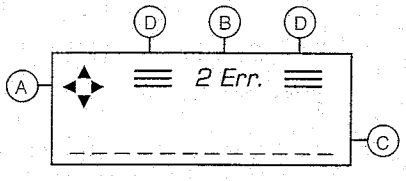
The following list gives all errors that can occur during process flow measurement.

List of errors

Error messages displayed in 2nd (middle) line	Description of error	Rectify instrument fault and/or clear error message	Error output in measuring mode via display (Fct. 3.2.5) dependent on setting				
			NO MESS.	*ADC ERROR*	*TOTAL. ERROR*	*ALL ERROR*	
CAL.DATA	**Calibration data lost or incorrect**	Return to factory for recalibration	**FATAL ERROR** All outputs go to min. values, same as for "zero" flow. Invoke Error List in Reset/Quit menu to check which of these 4 errors has occurred. Correct error as indicated. If not possible, consult factory.				
EEPROM 1	**Error in EEPROM 1, parameter error(s)**	Check all instrument parameters and correct if necessary					
ROM	**Check-sum error in ROM**	Switch power off and on again.					
RAM	**Check-sum error in RAM**	Switch power off and on again.					
TOTALIZER *	**Counts lost or totalizer overflow** Note: totalizer was reset	Cancel error in Reset/Quit menu, see Sect. 4.4.3	–	–	yes	yes	
EEPROM 2 *	**Error in EEPROM 2, totalizer** Note: totalizer deviation possible	Cancel error in Reset/Quit menu, see Sect. 4.4.3. Reset totalizer(s) if necessary.	–	–	yes	yes	
LINE INT. *	**Power failure** Note: no counting during power failure	Cancel error in Reset/Quit menu, see Sect. 4.4.3 Reset totalizer(s) if necessary.	–	–	yes	yes	
RESET *	**Power voltage fluctuation** Note: totalizer deviation possible	Cancel error in Reset/Quit menu, see Sect. 4.4.3 Reset totalizer(s) if necessary.	–	–	yes	yes	
CUR.OUTP. I *	**Current output overranged**	Cancel error in Reset/Quit menu, see Sect. 4.4.3. Eliminate cause, if necessary check and correct instrument parameters.	–	–	–	yes	
PULSOUTP. P *	**Pulse output overranged**	Cancel error in Reset/Quit menu, see Sect. 4.4.3. Eliminate cause, if necessary check and correct instrument parameters.	–	–	–	yes	
ADC *	**Analog/digital converter** overranged or defective	Cancel error in Reset/Quit menu, see Sect. 4.4.3	–	yes	–	yes	

* **When errors are displayed during the measuring mode and in the *ERRORLIST*** in the Reset/Quit menu, "a numeral" and "*Err.*" will appear in the 1st (top) line. The numeral gives the number of momentarily occurring errors that are displayed alternately with the actual measured value.

Error representation



(A) Compass field
(B) Number of errors that have occurred
(C) Plain text for error message(s)
(D) **With** bar: "new" errors, not yet acknowledged
Without bar: "old", acknowledged errors but cause not yet eliminated

see Sect. 4.4.3

4.4.2 Error display during measuring (display) mode

In the setting level under Fct. 3.2.5 *ERROR MSG.* (error messages), it is possible to select whether and, if so, which errors are to be displayed during measurement (display mode). Depending on setting under Fct. 3.2.4 *CYCL.DISP.* (cyclic display), set *YES* or *NO*, "measured value(s)" and "error message(s)" will either alternate automatically in the display or can be alternated manually by pressing the ▲ key. The errors will continue to be displayed until their cause has been eliminated. All displays, including measured values, flash!

4.4.3 Error list in Reset/Quit menu

All errors are stored in the *ERROR LIST* in the Reset/Quit menu. The errors are retained in this list until: **1** the cause of the error has been eliminated, **and 2** the error has been acknowledged.
Errors that have been acknowledged, but whose cause has not been eliminated, are retained in the Error List but are displayed **without** bar. This allows identification of "old" and "new" errors.

5. Description of functions

5.1 Physical units

Fct. 3.1.1 Full-scale range $Q_{100\%}$ (**F**orward flow)
Fct. 3.1.2 Full-scale range $Q_{100\%}$ (**R**everse flow)
Fct. 3.2.1 Units for flowrate display

- *m^3/hr* ● *Liter/Sec* ● *US Gal/min*
  (Gal = gallons)

- 1 user-defined unit, refer to Fct. 3.5.5 to 3.5.7, Sect. 5.15, for flowrate, e.g. liters per day, hectoliters per hour, or for mass flowrate where density is consistent and known, e.g. kg per hour or tonnes per day. *hLiter/hr* (hectoliters per hour) **or** *US MG/DAY* (US million gallons per day) for US version are factory-set here.

- *PERCENT* (%), only for Fct. 3.2.1 (flow display).

Fct. 3.1.4 Meter size (diameter)
in *mm* (millimeters or *inch* (inches).

Fct. 3.2.3 Unit for totalizer display
m^3, Liter, US Gal (Gal = gallons) and 1 user-defined unit, e.g. *d Liter* (deciliters), see above. Factory-set: *h Liter* (hectoliters) or US MG (US million gallons).

Fct. 3.4.2 Unit for pulse output P
Pulses/time: enter in pulses per second, minute or hour.
Pulses/unit volume: *PulS/m^3, PulS/Liter, PulS/US Gal*

5.2 Numerical format

- **Display of actual flowrate**
  Max. 7-digit with floating decimal point.

- **Display of internal totalizers**
  Max. 7-digit with floating decimal point. Where count values exceed 9 999 999, automatic changeover to exponent notation, max. *9.999 E19* (= 9.999 x 10^{19}).

- **Display overflow**
  The display format is fixed by the parameters set in submenu *"3.2.0 DISPLAY"*. The following display will appear when a displayed value exceeds the limit:
  - Top line ≡≡≡≡≡≡≡
  - Middle line Unit of measured variable
  - Bottom line Marker ▼ identifies the measured variable for which the selected display format is no longer adequate.

  Necessary action: check data in submenu *"3.2.0 DISPLAY"* and alter if necessary (e.g. select different unit.)

- **Setting numerical values in exponent notation**

Examples	Exponent notation	Setting
0.0008	0.8 x 10^{-3}	*0.8000 E -3*
0.5	0.5 x 10^{0}	*0.5000 E 0*
0.1378	0.1378 x 10^{0}	*0.1378 E 0*
10 000	0.1 x 10^{5}	*0.1000 E 5*
36 000 000	0.36 x 10^{8}	*0.3600 E 8*

5.3 Full-scale range $Q_{100\%}$ and meter size

Fct. 3.1.1 Full-scale range $Q_{100\%}$ (**F**orward flow)

Set full-scale range $Q_{100\%}$ depending on meter size DN, Fct. 3.13 (forward flow in the case of F/R measuring mode); if different full-scale range required for reverse flow, see Fct. 3.1.2.

- Selection of unit and setting ranges:
  - 0.0054 to 305 300 m^3/hr
  - 0.0015 to 84 820.0 Liter/Sec
  - 0.0234 to 1 344 000 US Gal/min
  - user-defined unit, factory-set: hLiter/hr (hectoliters per hour) or US MG/DAY (US million gallons per day), can be changed via Fct. 3.5.5 to 3.5.7 (see Sect. 5.15).
    Change of unit will cause automatic conversion of numerical value.

- If the numerical value is changed in Fct. 3.1.1, it is advisable to record the totalizer counts **first** and then reset the totalizers (see Sect. 5.6), otherwise an incorrect count will be displayed.

Fct. 3.1.2 Separate range required for reverse flow?
Set *"YES"* if a separate range is required for reverse flow which is different from the forward flow range. If not required, set *"NO"*.

If *"YES"* set, also set the full-scale range for reverse flow measurement.

- Selection of unit and setting ranges: see above, Fct. 3.1.1.

- The set value must be smaller than that set in Fct. 3.1.1, otherwise an error will occur during the parameter check (Fct. 4.2.0), see Sect. 4.4. This function has no effect on the totalizers.

Fct. 3.1.4 Table of meter sizes

- Select from table by pressing ↑ key:.
  Meter sizes from DN *2.5 – 600 mm* corresponding to *1/10 – 24 inch.*

- If the numerical value in Fct. 3.1.4 is changed, it is advisable to record the totalizers counts **first** and then reset the totalizers (see Sect. 5.6), otherwise an incorrect count will be displayed.

Special settings

- For Fct. 3.1.1, 3.1.2 + 3.4.3, set the unit first and then the numerical value.

- Proceed as follows: select appropriate Function No. and then press → key. The signal converter is now in the data column. The "unit" in the 2nd (middle) line of the display flashes. First select the unit by pressing the ↑ key. After pressing the → key, the left digit of the numerical value in the top line of the display will flash (= cursor). Pressing the ↑ key will increase the numerical value. Pressing the → key will shift the flashing digit (cursor) one place to the right.

- If the flashing digit (cursor) is in the last position (to the right) and the → key is pressed again, the unit in the 2nd (middle) line of the display will flash again.

- Press ↵ key to "back out" of the data column.

5.4 Flow direction

- The flow direction or, in the case of F/R operation, the direction of the forward flow is determined for the full-scale range $Q_{100\%}$ (see Fct. 3.1.1) under Fct. 3.1.6.
- Two arrows on the primary head identify the possible flow directions with *"+"* and *"–"*.
- Set *"+"* or *"–"* under Fct. 3.1.6 in accordance with the actual direction of flow.

Important
Please refer to Sect. 5.16 for factory settings!

5.5 Display

The following measured variables and functions can be shown in the display. Four markers ▼ identify the active display.

- Actual flowrate Q
- + totalizer (in F/R mode, forward totalizer)
- – totalizer (in F/R mode, reverse totalizer)
- Σ totalizer (sum of + and – totalizers)

If only one display is set, the marker indicates the active display continuously. If more than one display is set, the display sequences from one display to the next every 6 seconds (see Fct. 3.2.4), and the marker indicates the active display.

Note: The signs for + and – totalizers identify forward and reverse flow, resp., amd have nothing to do with definition of the flow direction "+/–" (see Sect. 5.4, Fct. 3.1.6). For example, assume forward flow according to the arrow on the primary head is the "–" direction. Forward flow, however, is always counted with the "+" totalizer.

Display overflow is shown as follows:

Top line: ≡≡≡≡≡≡≡

Middle line: Unit of measured variable

Bottom line: Marker ▼ identifies the measured variable for which the selected display format is no longer adequate.

Necessary action: check data in submenu *"3.2.0 DISPLAY"* and alter if necessary (e.g. select different unit).

Display for flow Q = 100% (full-scale range) **in F/R mode and setting in** *PERCENT* **(Fct. 3.2.1)**

The display always refers to the setting of the full-scale range for forward flow (Fct. 3.1.1).

Setting	Display
$Q_{F\ 100\%}$ equals $Q_{R\ 100\%}$ (Fct. 3.1.1/3.1.2 = *NO*)	**F:** 100% **R:** 100%
$Q_{F\ 100\%}$ greater than $Q_{R\ 100\%}$ (Fct. 3.1.1/3.1.2 = *YES*	**F:** 100% **R:** $\frac{Q_{R\ 100\%}}{Q_{V\ 100\%}} \times 100\%$

Fct. 3.2.1 Unit for flowrate display
Selectable units: see Sect. 5.1.
If *"NO DISPLAY"* is set, the actual flowrate is not displayed.

Fct. 3.2.2 Function of totalizer display

NO DISPLAY	Internal totalizer in operation but no display
TOTAL. OFF	Internal totalizer switched off
+ TOTAL.	Forward flow totalizer only
– TOTAL.	Reverse flow totalizer only
+/– TOTAL.	Forward and reverse flow totalizers, alternating
SUM TOTAL.	Sum of + and – totalizers
ALL TOTAL:	Sum, + and – totalizers, in sequence

Fct. 3.2.3 Unit for totalizer values on display
Selectable units, refer to Sect. 5.1.

Fct. 3.2.4 Cyclic display
Select whether measured value displays (and possibly error messages, see Fct. 3.2.5) are to sequence automatically approx. every 6 seconds (enter: *YES*) or manually by pressing the ↑ key (enter *NO*).

Fct. 3.2.5 Error messages
Select error messages for display (see Sect. 4.4).

NO MESSAGE	No error messages
ADC ERROR	ADC conversion errors
TOT.ERROR	Internal totalizer errors
ALL ERROR	All errors

Error messages alternate with actual flow data, either automatically or manually by pressing ↑ key, see Fct. 3.2.4.

Important
Please refer to Sect. 5.16 for factory settings!

5.6 Internal electronic totalizer

- The internal electronic totalizer counts the volume in mathematically determined volumetric units. These numerical values are put into a non-volatile memory (EEPROM), converted into the set physical units, and displayed every 0.3 second.

  Counting is interrupted in the event of a power failure or when the low-flow cutoff "on" value for P is activated. After these conditions have been eliminated, counting continues with the values stored prior to the interruption.
- The counting period without overflow is at least 1 year at 100% of flow ($Q_{100\%}$).
- Set the time constant under Fct. 3.4.5:
  0.2 Sec Time constant P = 0.2 second
  SAME AS I *Same time constant as used for* current output I (see Fct. 3.3.3)

Resetting the totalizer *(TOTAL.RESET)*

- *"+"* and *"–"* totalizers can be separately reset in the Reset/Quit menu if *"YES"* has been set under Fct. 3.5.8 *ENABL.RESET*! Resetting also affects the sum totalizers!

Key	DISPLAY
↵	*CodE 2*
↑ →	*TOTAL.RESET*
→	*+ TOTAL.*
(poss. ↑)	*– TOTAL.* (poss. select)
→	*RESET NO*
↑	*RESET YES*
↵	*+ TOTAL.* (if necessary, select „–" totalizer with ↑ key and also reset: → ↑ ↵
↵	*TOTAL.RESET*
↵	Measuring mode with actual display

- The measuring mode is **not** interrupted.
- Before changing the numerical values in Fct. 3.1.1, 3.1.4 and 3.1.5 (e.g. if the full-scale range is changed, see Fct. 3.1.1, or if in the case of separate systems the primary head is replaced, see Sect. 8.2), it is advisable to note down the totalizer counts first and then reset the totalizer, otherwise an incorrect count will be displayed.

Important
Please refer to Sect. 5.16 for factory settings!

5.7 Current output I

5.7.1 Application I (Fct. 3.3.1)

Application I	Setting via Fct. ...			Other functions which can be set via Fct. ...		Connection diagrams for outputs see Sect. 2.3.4	Charac-teristic of outputs see Sect. 5.7.3
	I 3.3.1	***P*** 3.4.1		***SMU I*** 3.3.4			
1 flow direction	*1 DIR.*	any		possible		①	I1
F/R operation F/R changeover via P	*2 DIR.*	*F/R IND. I*		possible		⑥	I2
Direction indication for P	*F/R IND. P*	*2 DIR.*		no		⑦⑧⑨	I3
e.g. operation indicator	*OFF*	any		no		⑤	I4
F/R operation with 1 indicating instrument	*I<10PCT.*	any		possible		⑩	I5

5.7.2 Other functions that can be set for I

Fct. 3.3.2 Ranges for current output I

Fixed ranges: *0* to *20 mA* or *4* to *20 mA*, in each case with *22 mA* current limitation.

Variable ranges: Lower range value ($I_{0\%}$), full-scale range ($I_{100\%}$) and max. output current (I_{max}) are freely selectable, see Function 3.3.2 *"VARIAB. mA"*.

Current for 0% flow ($I_{0\%}$)
Range from *00* to *16 mA* (e.g. 0.1 mA for an output range from 1 to 5 mA)

Current for 100% flow ($I_{100\%}$)
Range from *04* to *20 mA* (e.g. 5 mA for an output range from 1 to 5 mA). This value must be at least 4 mA greater than $I_{0\%}$, see above.

Maximum output current I_{max}
Range from *04* to *22 mA* (e.g. 06 mA at an output range from 1 to 5 mA, prevents damage to connected 5-mA instruments). This value must be greater than or equal to $I_{100\%}$, see above.

Fct. 3.3.3 Time constant for I
Range freely selectable between *0.2* and *3600 seconds*.

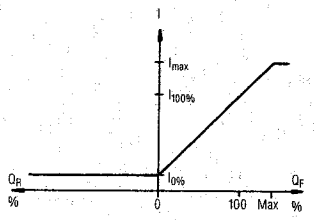
Fct. 3.3.4 Low-flow cutoff
Refer to Sect. 5.9.

Important
Please refer to Sect. 5.16 for factory settings!

5.7.3 Characteristics of current output I

I1

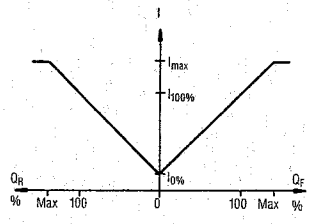
1 flow direction

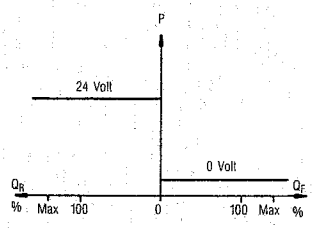


I2

F/R operation

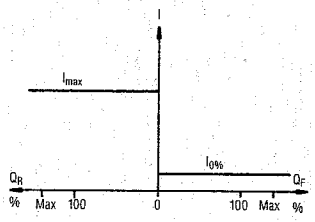
F/R changeover via P

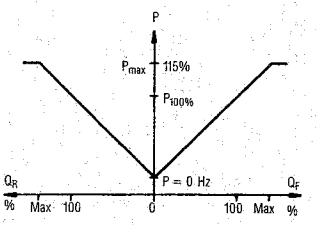




I3

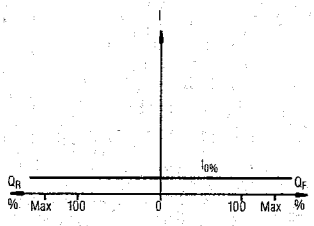
Direction indication for P





I4

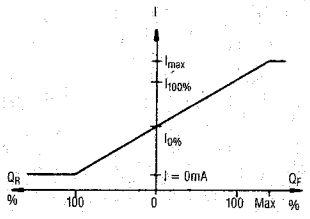
e.g. operation indicator



I5

F/R operation

with 1 indicating instrument



5.8 Pulse output P

5.8.1 Application P (Fct. 3.4.1)

Application P	Setting via Fct. ...			Other functions which can be set via Fct. ...		Connection diagrams for outputs see Sect. 2.3.4	Characteristik of outputs see Sect. 5.8.3
	P 3.4.1	***I*** 3.3.1		***SMU P*** 3.4.6			
1 flow direction	*1 DIR.*	any		possible		②③④	P1
F/R operation F/R changeover via I	*2 DIR.*	*F/R IND. P*		possible		⑦⑧⑨	P2
Direction indication for I	*F/R IND.I*	*2 DIR.*		no		⑥	P3
Switched off (≙ 0Hz/0 V)	*OFF*	any		no		–	P4

5.8.2 Other functions that can be set for P

Fct. 3.4.2 Unit for pulse output
PULSE/TIME Setting in pulses per unit time (see Fct. 3.4.3)
PULSE/VOL. Setting in pulses per unit volume (see Fct. 3.4.3)

Example of *PULSE/TIME*

Full-scale range:	1000 liters per second (set via Fct. 3.1.1)
Pulse rate	1000 pulses per second (set via Fct. 3.4.3)
Pulse value:	1 pulse per liter
Changeover of full-scale range:	2000 liters per second (changed via Fct. 3.1.1)
Pulse rate:	unchanged (see above), 1000 pulses per second
Pulse value **now:**	1 pulse per 2 liters

Example of *PULSE/VOL.*

Full-scale range:	1000 liters per second (set via Fct. 3.1.1)
Pulse value:	1 pulse per liter (set via Fct. 3.4.3)
at 1000 liters per second:	1000 pulses per second ≙ 1 pulse per liter
Changeover of full-scale range:	2000 liters per second (changed via Fct. 3.1.1)
Pulse value:	unchanged (see above), 1 pulse per liter
at 2000 liters per second:	2000 pulses per second ≙ 1 pulse per liter as before

Fct. 3.4.3 Pulses per unit time for 100% flow ($P_{100\%}$) (pulse rate)
(appears only if *"PULSE/TIME"* set in Fct. 3.4.2)
Setting ranges: *0.0028 E0 – 0.1000 E5 PulSe/Sec* (= Hz)
0.1667 E0 – 0.6000 E6 PulSe/min
0.1000 E2 – 0.3600 E8 PulSe/hr

Fct. 3.4.3 Pulses per unit volume (pulse value)
(appears only if *"PULSE/VOL."* set in Fct. 3.4.2)
Setting ranges: *0.0001 E0 – 0.9999 E9 PulS/m3*
0.0001 E0 – 0.9999 E6 PulS/Liter
0.0001 E0 – 0.3785 E7 Puls/US.Gal
Entry is **not** checked **but:**
$Q_{100\%}$ "times" pulse value must be less than/equal to 36 000 000 pulses/hr (equivalent to 10 kHz).

Frequency or pulses/unit time at pulse output for flow Q = 100% (full-scale range) for F/R operation and setting in *PULSE/TIME* (Fct. 3.4.2 + 3.4.3)

The frequency or pulses/unit time at the output always refer to the setting of the full-scale range for the forward range $P_{100\%}$ (Fct. 3.4.3).

Setting	Frequency or pulses per unit time
$Q_{F\,100\%}$ equals $Q_{R\,100\%}$ (Fct. 3.1.1 / Fct. 3.1.2 = *NO*)	**F:** $P_{100\%}$ **R:** $P_{100\%}$
$Q_{F\,100\%}$ greater than $Q_{R\,100\%}$ (Fct. 3.1.1 / Fct. 3.1.2 = *YES*)	**F:** $P_{100\%}$ **R:** $\frac{Q_{R\,100\%}}{Q_{F\,100\%}} \times P_{100\%}$

Fct. 3.4.4 Pulse width
Five pulse widths are selectable for frequencies less than or equal to 10 Hz: *30 / 50 / 100 / 200 / 500 m Sec.*
(Note output load and frequency ranges, see Table in Sect. 2.3.3)

Fixed pulse widths are provided for frequencies above 10 Hz (see Sect. 2.3.3), regardless of the pulse width (see above) that has been set.

Fct. 3.4.5 Time constant for P

0.2 Sec.	Time constant = 0.2 second (best for counting and/or batching processes)
SAME AS I	Same time constant as for current output I, see Fct. 3.3.3 (practical if pulse output P used for instantaneous-value measurements)

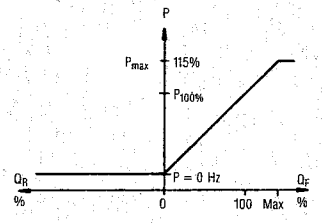
Fct. 3.4.6 Low-flow cutoff SMU
refer to Sect. 5.9.

Important
Please refer to Sect. 5.16 for factory settings!

5.8.3 Characteristics of pulse output P

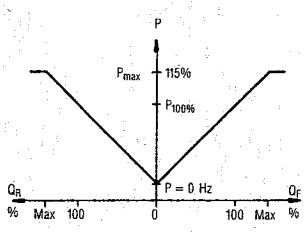
(P1)

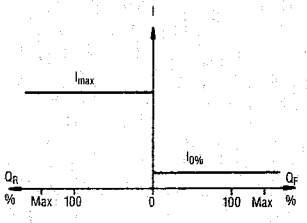
1 flow direction



(P2)

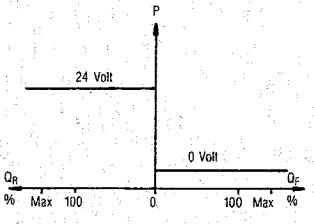
F/R operation
F/R changeover via I

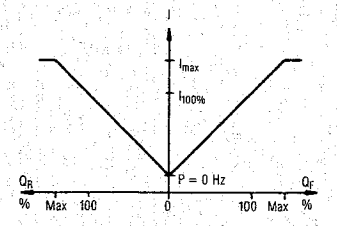




(P3)

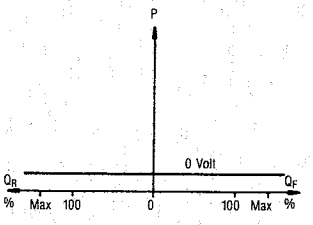
Direction indication for I





(P4)

Switched off



5.9 Low-flow cutoff (SMU) for I + P

- To avoid erroneous measurements at low flowrates, the SMU switches off the current and pulses outputs (I+P). I goes to 0/4 mA or $I_{0\%}$ (Fct. 3.3.2) and P to 0 Hz.
- If *"NO"* is set under functions 3.3.4 + 3.4.6, fixed cutoff "on" and cutoff "off" values of 0.1 and 0.25% (resp.) of $Q_{100\%}$ (full-scale range, see Fct. 3.1.1) act on outputs I+P.
- If *"YES"* is set under functions 3.3.4 + 3.4.6, the cutoff "on" and "off" values for I+P are separately adjustable in the ranges specified below.

Cutoff "on" value for SMU-I
Range: *01* to *19 PERCENT* of $Q_{100\%}$
The low-flow cutoff drives the current output to 0/4 mA or $I_{0\%}$ when the flow decreases to the cutoff "on" value (see Fct. 3.3.2).

Cutoff "off" value for SMU-I
Range: *02* to *20 PERCENT* of $Q_{100\%}$
This value must be greater than the cutoff "on" value I. When the flow returns to the cutoff "off" value, the output returns to normal.

Cutoff "on" value for SMU-P
Range: *01* to *19 PERCENT* of $Q_{100\%}$
The low-flow cutoff drives the pulse output to 0 Hz when the flow decreases to the cutoff "on" value.

Cutoff "off" value for SMU-P
Range: *02* to *20 PERCENT* of $Q_{100\%}$
This value must be greater than the cutoff "on" value P. When the flow returns to the cutoff "off" value, the output returns to normal.

5.10 F/R operation for I or P

For electrical connection, characteristics and setting of outputs, refer to Sect. 2.3, 5.7 + 5.8.

Fct. 3.1.6 Define direction of forward (normal) flow (+ or –)
For F/R operation, set the direction of the forward flow with *"+"* or *"–"* in accordance with the arrows marked "+" and "–" on the primary head.

Fct. 3.1.1 Full-scale range for flowrate $Q_{100\%}$
Set the full-scale range. For unit and range refer to Sect. 5.1 + 5.3.

Fct. 3.1.2 Separate range required for reverse flow?
Set *"YES"* only if the range required for reverse flow is different from the range for the normal (forward) flow. If not, set *"NO"*.

If *"YES"* set, set the full-scale range for the reverse flow. For unit and range refer to Sect. 5.1 + 5.3. This value must not be greater than that of Fct. 3.1.1, otherwise an error will occur during the parameter check (Fct. 4.2.0), see Sect. 4.3.

Note: Fct. 3.1.2 acts only on the current output!

Important
Please refer to Sect. 5.16 for factory settings!

5.11 Language of display texts

A choice of languages for the display texts is offered in Fct. 3.5.1:

- *GB/US* English
- *D* German
- *F* French

other languages pending

5.12 Coding desired for entry into setting level?

- Set *NO* or *YES* in Fct. 3.5.2.
- If *"NO"* set, all that needs to be done is to press the ➡ key to get into the setting level.
- If *"YES"* set, press the ➡ key and subsequently a 9-key-stroke combination to get to the setting level.
- **Factory-set Entry Code 1**
  ➡ ➡ ➡ ⬅ ⬅ ⬅ ⬆ ⬆ ⬆
- **Changing Entry Code 1**
  Select Fct. 3.5.2 *ENTRY.CODE 1*: set YES.
  Select Fct. 3.5.3 *CODE 1*.
  Press ➡ key, displayed: *Code 1* _ _ _ _ _ _ _ _ _
  Press any 9-keystroke combination; each keystroke acknowledged by "✳". Then press the **same** keystroke combination again. *WRONG CODE* (= incorrect entry) appears if 1st and 2nd entries are **not equal.**
  Press ⬅ and ➡ keys and repeat entries.

5.13 Measuring-point identification (tag name)

- A max. 10-figure tag name can be set under Fct. 3.5.4 (e.g. TQ1 53 21 I).
- Only required for smart flowmeters (HHC design): operator control via MIC 500 Hand-Held Communicator (remote control). Refer to special operating instructions for electrical connection to current output I and operation of the MIC 500.
- Characters assignable to each of the 10 places:
  alpha characters *A-Z / a-z*
  numbers *0-9* or
  blank character (= underscore character)
- Factory setting: *Altometer*

5.14 Primary head constant GKL and field frequency

Fct. 3.1.5 GK value (GKL)
The primary constant GKL is factory-set.

Range: *0.5* to *14*, dependent on primary head, refer to instrument nameplate.

Fct. 3.6.1 Field frequency
The magnetic field frequency is factory-set to *1/6, 1/16* or *1/32* of the power frequency, refer to signal converter nameplate.

Data of Fct. 3.1.5 and 3.6.1 must not be changed!
Exception: when a primary head pertaining to a separate system is replaced, refer to Sect. 8.2.

5.15 User-defined unit

An arbitrary volumetric flow unit or, if density of the fluid product is consistent and known, a unit of mass (weight) can be set in functions 3.5.5 to 3.5.7. The unit "*h Liter/hr*" (hecto-liters per hour) is factory-set unless another special unit is specified. US-version: "*US MGal/DAY*" (US million gallons per day).

Fct. 3.5.5 Text for user-defined unit

- Volumetric (or mass) unit per unit time
- Text for volume (mass): 6 characters (places)
- Text for time: 3 characters (places)
- The fraction bar "/" in the 7th place has a fixed position.
- Alpha characters A-Z and a-z, numbers 0-9, symbols + and – or blank character (= underscore) are selectable for every place.
- Pressing the ⇧ key will sequence the alpha characters and numbers in the order given above.
- The ⇨ key shifts the cursor 1 place to the right.
- Text examples are given in the following Tables in brackets (...../...).

Fct. 3.5.6 Conversion factor Quantity F_M

Set the factor F_M = quantity per 1 m^3.

Volumetric unit	Factor F_M	Setting
Cubic meters (*m 3*)	1.0	*1.00000 E 0*
Liters (*Liter*)	1 000	*1.00000 E 3*
Hecto-liter (*h Liter*)	10	*1.00000 E 1*
Deci-liter (*d Liter*)	10 000	*1.00000 E 4*
Centi-liter (*c Liter*)	100 000	*1.00000 E 5*
Milli-liter (*m Liter*)	1 000 000	*1.00000 E 6*
US gallons (*US Gal*)	264.172	*2.64172 E 2*
US million gallons (*US MGal*)	0.000264172	*2.64172 E – 4*
Imperial gallons (*GB Gal*)	219.969	*2.19969 E 2*
Imperial mega-gallons (*GB MGal*)	0.000219969	*2.19969 E – 4*
Cubic feet (*Foot 3*)	35.3146	*3.53146 E 1*
Cubic inches (*inch 3*)	61 024.0	*6.10240 E 4*
US barrels liquid	8.38364	*8.38364 E 0*
US fluid ounces	33 813.5	*3.38135 E 4*

Fct. 3.5.7 Conversion factor Time F_T

Set the factor F_T in seconds.

Time unit	Factor F_T [seconds]	Setting
Second (*Sec*)	1	*1.00000 E 0*
Minute (*min*)	60	*6.00000 E 1*
Hour (*hr*)	3 600	*3.60000 E 3*
Day (*DAY*)	86 400	*8.64000 E 4*
Year (*YR*) (≙ 365 days)	31 536 000	*3.15360 E 7*

Examples of volume per unit time

Desired units:	Hecto-liters per year	Deci-liters per hour
Volumetric unit in Fct. 3.5.5	*h Liter*	*d Liter*
Factor F_M (see Table)	10	10 000
Setting in Fct. 3.5.6	*1.00000 E 1*	*1.00000 E 4*
Time unit in Fct. 3.5.5	*YR*	*hr*
Factor F_T (see Table)	31 536 000 (seconds)	3600 (seconds)
Setting in Fct. 3.5.7	*3.15360 E 7*	*3.60000 E 3*

Examples of mass per unit time

Product density ϱ = 1.2 g/cm^3 = 1200 kg/m^3 = constant
Mass of 1 m^3 product = 1200 kg = 2646 pounds.

Desired unit:	Kilograms per minute	Pounds per hour
Mass unit in Fct. 3.5.5	*kg*	*to*
Factor F_M (see Table)	1200	2646
Setting in Fct. 3.5.5	*1.20000 E 3*	*2.64600 E 3*
Time unit in Fct. 3.5.5	*min*	*hr*
Factor F_T (see Table)	60	3600
Setting in Fct. 3.5.7	*6.00000 E 1*	*3.60000 E 3*

5.16 Factory settings

To facilitate easy and rapid initial start-up, current output and pulse output are set to process flow measurement in "2 flow directions" (Fct. 3.3.1 + 3.4.1) so that the instantaneous flowrate is displayed and the volume flow counted independent of the flow direction ("+" or "–", Fct. 3.1.6). Measured values may possibly be displayed with a "–" sign.

This factory setting may possibly lead to measuring errors, particularly in the case of volume flow counting:

For example, if pumps are switched off and a "backflow" occurs which is not within the range of the low-flow cutoff (SMU-I, Fct. 3.3.4 and SMU-P, Fct. 3.4.6, see also Sect. 5.9), or if separate displays and counts are required for both flow directions.

To avoid faulty measurements, therefore, it may be necessary to change the factory setting of some or all of the following functions:

- flow direction, Fct. 3.1.6 (Sect. 5.4)
- current output, Fct. 3.3.1 (Sect. 5.7 + 5.10)
- pulse output, Fct. 3.4.1 (Sect. 5.8 + 5.10)
- low-flow cutoff, Fct. 3.3.4 and 3.4.6 (Sect. 5.9)
- display, Fct. 3.2.1 and 3.2.2 (Sect. 5.5 + 5.6).

Part C Special applications, functional checks and service

6. Special applications

6.1 Use in hazardous areas

6.1.1 European standards

ALTOFLUX IFM 4080 K-Ex, IFM 5080 K-Ex, IFM 4080 F-Ex , IFM 5080 F-Ex and K 480 S-Ex electromagnetic flowmeters are certified to European standard as electrical appliances suitable for use in hazardous areas.

Allocation of temperature class to temperature of the fluid, meter size and material of the measuring tube liner is specified in the test certificate.

Test certificate, certificate of conformity and wiring instructions are attached to the Installation and Operating Instructions (applies only to hazardous-duty equipment).

6.1.2 American standards

The FM approvals for ALTOFLUX IFM 4080 K-Ex, IFM 5080 K-Ex, IFM 4080 F-Ex and IFM 5080 F-Ex for Division 2 and 1 are pending.

6.2 Short response time in conjunction with rapid changes in flowrate

The signal converter is equipped with an internal automatic reference unit which ensures optimum adjustment to the input signal from the primary head during changing flowrates.

In the case of rapidly changing flowrates, e.g. batching processes and where operation with reciprocating pumps is involved, it may be necessary to influence or cut out this automatic unit via Fct. 3.6.2 and 3.6.3.

With Fct. 3.6.2, the response time of the automatic unit is decreased by up to 30%.

The automatic unit is switched off via Fct. 3.6.3. However, this reduces the measuring accuracy of the signal converter.

Since there are no hard and fast rules for applying Fct. 3.6.2 and 3.6.3, it is advisable to determine the optimum setting as follows.

- Set Function 3.2.5 *(ERROR MSG)* to *"ADC ERROR"*.
- Start the flow.
- The optimum setting for the signal converter is found when the *"ADC ERROR"* message is **no longer** displayed.
- If *"ADC ERROR"* does show, reset the signal converter in the following order until the error message is no longer displayed.

Order	Fct. 4.08	Fct. 4.09
1st	*NOISE*	*AUTO. REF.*
2nd	*NO NOISE*	*HIGH FLOW*
3rd	*NO NOISE*	*MED.1–FLOW*
4th	*NO NOISE*	*MED.2–FLOW*
5th	*NO NOISE*	*MED.3–FLOW*
6th	*NO NOISE*	*LOW FLOW*

- Subsequently, reset Fct. 3.2.5 according to its original application.
- If the above procedure does not lead to the desired effect, please consult factory.

6.3 Stable signal outputs when measuring tube empty

Output values can be stabilized to values as for "zero" flow to prevent random output signals when the measuring tube is empty or when the electrodes are not wetted in the event the measuring tube is partially full.

This means:

Totalizer display → does not accumulate random counts
Current output → value of $I_{0\%}$ (see Fct. 3.3.2)
Pulse output → 0 V (= no pulses)

Preconditions

- Electrical conductivity of fluid ≥ 200 μS/cm (μmho/cm) [≥ 500 μS/cm (μmho/cm) in conjunction with IFM 5080 K and IFS 5000, DN ≤ 15 or ≤ $^1/_2$"]
- For separate systems max. signal cable length 50 m (165 ft), for cable type DS or BTS.

Changes on input amplifier PCB
(see components drawing, Sect. 9.2)

- Insert two resistors R_{X1} and R_{X2} = 10 Mohms
- Insert soldering jumper "⊥".

Additional change to setting
Set low-flow cutoff (SMU) for current output I and pulse output P as follows (minimum values):

Fct. 3.3.4 for I and Fct. 3.4.6 for P
Set low-flow cutoff for I and P to *YES*.
Range: *01-02 PERCENT*

6.4 Magnetic sensors, setting with hand-held bar magnet

- The signal converter can **optionally** be equipped with magnetic sensors, see Sect. 4.1, Item 5, standard for all "smart" and "Ex" versions of the signal converter.
- This allows setting of the signal converter by means of a hand-held bar magnet. Function of sensors without removing the front cover is the same as the corresponding keys. Sensor response is acknowledged by compass field in the 1st line of the display.
- Hold the bar magnet by the black rubber cap. Apply blue end of the magnet (north pole) to the glass pane above the magnetic sensors.

Condensed Instructions

KROHNE

09/93

IFC 080 Signal converter

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Telefax (02 03) 301 389

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Setting diagram

Notes on using the diagram

..... dotted line: press select key as many times as is necessary until either the n^{th} submenu or the m^{th} function is displayed. For **Fct. No.**, see "Functions Table".
The cursor (flashing part of display) is shown in **bold** type.

n identifies a submenu
m identifies a function
black box = main menu
grey box = submenu
white box = functions and data

cf. Functions Table

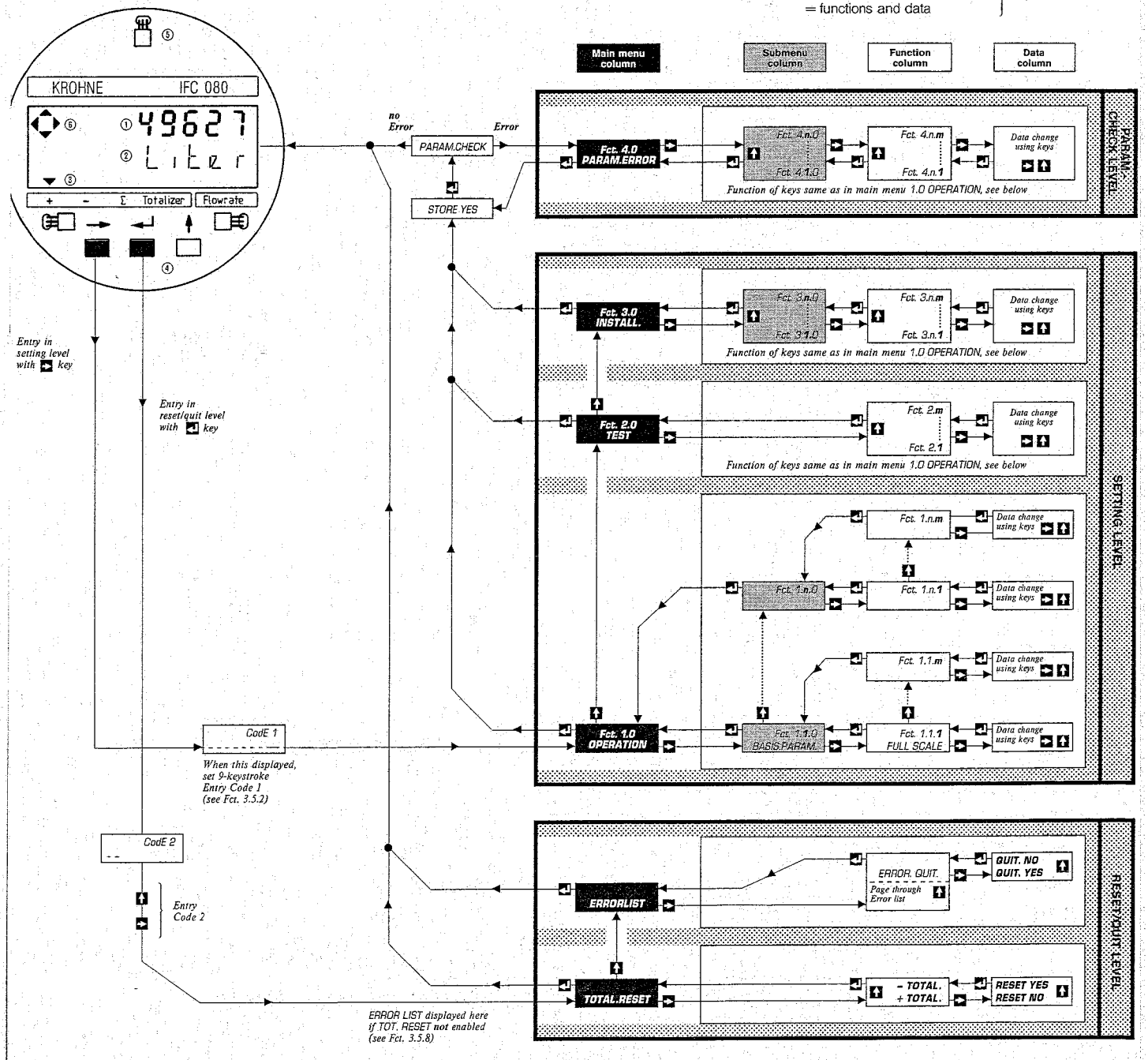


Table of settable functions

The Sect. Nos. referred to in these Condensed Instructions will be found in the Installation and Operating Instructions.

Fct. No.	Text	Description and settings
1.00	OPERATION	**Main menu 1.0 Operation**
1.1.0	BASIS.PARAM.	**Submenu 1.1.0 Basis parameters**
1.1.1	FULL SCALE	**Full-scale range for flowrate $Q_{100\%}$** see Fct. 3.1.1
1.1.2	REV.SCALE	**Different range for reverse flow** required? See Fct. 3.1.2
1.1.3	ZERO SET	**Zero calibration** see Fct. 3.1.3
1.2.0	DISPLAY	**Submenu 1.2.0 Display**
1.2.1	DISP.FLOW	**Unit for flowrate display,** see Fct. 3.2.1
1.2.2	DISP. TOTAL	**Function of totalizer display,** see Fct. 3.2.2
1.2.3	CYCL.DISP.	**Cyclic display** required? see Fct. 3.2.4
1.3.0	CUR.OUTP.I	**Submenu 1.3.0 Current output I**
1.3.1	TIMECONST.I	**Time constant for current output I,** see Fct. 3.3.3
1.3.2	L.F.CUTOFF I	**Low-flow cutoff** (SMU) **for current output I** see Fct. 3.3.4
1.4.0	PULSOUTP. P	**Submenu 1.4.0 Pulse output P**
1.4.1	PULSE/TIME **or** PULSE/VOL.	**Pulses per unit time for 100% flowrate** or **Pulses per unit volume,** see Fct. 3.4.3
1.4.2	L.F.CUTOFF P	**Low-flow cutoff** (SMU) **for pulse output P,** see Fct. 3.4.6
2.0	TEST	**Main menu 2.0 Test functions**
2.1	TEST DISP.	**Test of the display** (Sect. 7.1.2.) Start with → key (duration: approx. 15 sec.)
2.2	TEST I	**Test of current output I** (Sect. 7.1.3) Safety interrogation: *SURE NO* *SURE YES* ● *0 mA* ● *10 mA* ● *20 mA* ● *4 mA* ● *16 mA* ● *22 mA* Select with ↑ key Displayed value present directly at current output. Actual value again present at output after pressing the ← key.
2.3	TEST P	**Test of pulse output P** (Sect. 7.1.3) Safety interrogation: *SURE NO* *SURE YES* ● *1 Hz* ● *100 Hz* ● *10000 Hz* ● *10 Hz* ● *1000 Hz* Select with ↑ key. Displayed value present directly at pulse output. Actual value again present at output after pressing the ← key.
2.4	TEST Q	**Test of full-scale range** (Sect. 7.1.3) Safety interrogation: *SURE NO* *SURE YES* ● *−110 / −100 / − 50 / − 10 PCT.* ● *0 PCT.* ● *+ 10 / + 50 / +100 / +110 PCT.* ... of set full-scale range ($Q_{100\%}$). Select with ↑ key. Displayed value present directly at outputs I and P. Actual value again present at output after pressing the ← key.
3.0	INSTALL.	**Main menu 3.0 Installation**
3.1.0	BASIS.PARAM.	**Submenu 3.1.0 Basis parameters**
3.1.1.	FULL SCALE	**Full-scale range for flowrate $Q_{100\%}$** Selection of unit and setting ranges ● *0.0054 E0–0.3053 E6 m3/h* ● *0.0015 E0–0.8482 E5 Liter/Sec* ● *0.0234 E0–0.1344 E7 US Gal/min* (see Sect. 5.1, 5.2 + 5.3) ● *user-defined unit,* factory-set is *hLiter/hr* or *US.MGal/DAY* (hectoliters per hour **or** US million gallons per day), can be changed via Fct. 3.5.5 – 3.5.7 (Sect. 5.15). After selecting unit, call numerical value with → key, 1st digit flashes.

Fct. No.	Text	Description and settings
3.1.2	REV.SCALE	**Different range for reverse flow** required? Set *NO* or *YES*. If *YES*, the full-scale range for the reverse flow must be set. Selection of unit and setting ranges same as in Fct. 3.1.1. Value not greater than that of Fct. 3.1.1!
3.1.3	ZERO SET	**Zero calibration** (Sect. 7.2) Perform only at "0" flow and with compl. filled measuring tube. 1) Query: *CALIB. NO* or *YES* 2) If *YES*: calibration, duration approx. 25 sec. with zero displayed as *PERCENT* of $Q_{100\%}$. 3) Query: *STORE NO* or *YES*
3.1.4	METER SIZE	**Table of meter sizes** Size from DN *2.5–600 mm,* equivalent to *1/10–24 inch,* Select from this table using ↑ key (Sect. 5.3.).
3.1.5	GK VALUE	**Primary head constant GKL** (see nameplate, primary head) value: *0.5* to *14*
3.1.6	FLOW. DIR.	**Define direction of forward flow** Set according to direction of arrow on primary head: + or −
3.2.0	DISPLAY	**Submenu 3.2.0 Display**
3.2.1	DISP.FLOW	**Unit for flowrate display** ● *m3/hr* ● *Liter/Sec* ● *US Gal/min* ● *user-defined unit,* factory-set is *Liter/hr* **or** *US.MGal/DAY* (liters per hour **or** US million gallons per day) can be changed via Fct. 3.5.5 – 3.5.7 (Sect. 5.15). ● *PERCENT* ● *NO DISPLAY*
3.2.2	DISP.TOTAL	**Function of totalizer display** ● *NO DISPLAY* (= totalizer switched on but not displayed) ● *TOTAL.OFF* (= totalizer switched off) ● *+ TOTAL.* (= forward flow totalizer) ● *− TOTAL.* (= reverse flow totalizer) ● *+/− TOTAL.* (forward and reverse flow totalizers, alternating) ● *SUM TOTAL.* (= sum of "+" and "−" totalizers) ● *ALL TOTAL.* (= sum, "+" and "−" totalizers, sequential)
3.2.3	UNIT TOTAL.	**Unit for totalizer display** ● *m3* ● *Liter* ● *US Gal* ● *user- defined unit,* see Fct. 3.5.5 – 3.5.7
3.2.4	CYCL.DISP.	**Cyclic display** required? Setting: *NO* or *YES*
3.2.5	ERROR MSG.	**Which error messages** to be displayed? (Sect. 4.4) ● *NO MESSAGE* (= no display of error messages) ● *ADC ERROR* (= ADC errors only) ● *TOTAL.ERROR* (= only errors of internal totalizer) ● *ALL ERROR* (= display all errors)
3.3.0	CUR.OUTP.I	**Submenu 3.3.0 Current output I**
3.3.1	FUNCTION I	**Function, current output I** ● *OFF* (= switched off) ● *F/R IND. P* (= F/R indication, for P) ● *1 DIR.* (= 1 flow direction) ● *I < I 0 PCT.* (= **F**orward and **R**everse flow, e.g. in 0 – 20 mA range: **F** = 10 – 20 mA **R** = 10 – 0 mA) ● *2 DIR.* (= forward/reverse flow, F/R measurement)

Fct. No.	Text	Description and settings
3.3.2	*RANGE I*	**Range fur current output I** ● *FIXED 0-20 mA* I_{max} = *22 mA* ● *FIXED 4-20 mA* I_{max} = *22 mA* ● *VARIAB.* (variable ranged) $I_{0\%}$ (Q = 0% flow): *00-16 mA* $I_{100\%}$ (Q = 100% flow): *04-20 mA* I_{max} (Q > 100% flow): *04-22 mA* Note following conditions: $I_{100\%} - I_{0\%} \geq 4$ mA $I_{100\%} \leq I_{max}$ Display: e.g. for 5-10 mA, max. 15 mA *05-10 15* (top line) *VARIAB. mA* (bottom line)
3.3.3	*TIMECONST.I*	**Time constant for current output I** Value: *0.2* to *3600 Sec*
3.3.4	*L.F.CUTOFF I*	**Low-flow cutoff** (SMU) **for current output I** required? Setting: *NO* or *YES*. If *YES*, setting ranges: "on" value: *01-19 PERCENT* "off" value: *02-20 PERCENT* Note following condition: Cutoff "on" value "minus" cutoff "off" value > 1% Display, e.g. for range: on = 2%, off = 6% *02-06* (top line) *PERCENT* (bottom line)
3.4.0	*PULSOUTP. P*	**Submenu 3.4.0 Pulse output P**
3.4.1	*FUNCTION P*	**Function of pulse output P** ● *OFF* (= switched off) ● *F/R IND. I* (= F/R indication, for I) ● *1 DIR.* (= 1 flow direction) ● *2 DIR.* (= forward/reverse flow, F/R measurement)
3.4.2	*UNIT P*	**Unit of pulse output P** ● *PULSE/TIME* (= setting in pulses per unit time) ● *PULSE/VOL.* (= setting in pulses per unit volume)
3.4.3	*PULSE/TIME*	**Pulses per unit time for 100% flowrate** see Fct. 3.1.1 (appears only if *PULSE/TIME* set under Fct. 3.4.2) Setting ranges *0.0028 E0-0.1000 E5 PulSe/Sec* (=Hz) *0.1667 E0-0.6000 E6 PulSe/min* *0.1000 E2-0.3600 E8 PulSe/hr* After selecting unit, call numerical value with ➡ key, 1st digit flashes.
3.4.3	*PULSE/VOL.*	**Pulses per unit volume** (flowrate) (appears only if *PULSE/VOL.* set under Fct. 3.4.2) Setting ranges *0.0001 E0-0.9999 E9 PulS/m3* *0.0001 E0-0.9999 E6 PulS/Liter* *0.0001 E0-0.3785 E7 PulS/US.Gal* (**no** input check but: $Q_{100\%}$ x pulse value $\leq$ 3.6 x 10^7 pulses/hr). After selecting unit, call numerical value with ➡ key, 1st digit flashes.
3.4.4	*PULSWIDTH*	**Pulse width for frequencies $\leq$ 10 Hz** ● *30 mSec* ● *200 mSec* ● *50 mSec* ● *500 mSec* ● *100 mSec*
3.4.5	*TIMECONST.P*	**Time constant for pulse output P** ● *0.2 Sec* ● *SAME AS I* (= *time constant for P same as* for I, see Fct. 3.3.3)
3.4.6	*L.F.CUTOFF P*	**Low-flow cutoff** (SMU) **for pulse output P** required? Setting: *NO* or *YES* If *YES*, setting ranges: "on" value: *01-19 PERCENT* "off" value: *02-20 PERCENT* Note following condition: Cut-off "off" value "minus" cutoff "on" value > 1% Display, e.g. for range: on = 2%, off = 6% *02-06* (top line) *PERCENT* (bottom line)

Fct. No.	Text	Description and settings
3.5.0	*USER DATA*	**Submenu 3.5.0 User data**
3.5.1	*LANGUAGE*	**Language for display texts** ● *GB/USA* (= English) ● *D* (= German) ● *F* (= French) ● others pending
3.5.2	*ENTRY CODE 1*	**Entry Code 1 for entry into setting level** required? ● *NO* = entry with ➡ key ● *YES* = entry with 9-keystroke code. Setting of code under Fct. 3.5.3
3.5.3	*CODE 1*	**Set Code 1** (9-keystroke combination) ● factory setting: ➡ ➡ ➡ ⬅ ⬅ ⬅ ⬆ ⬆ ⬆ ● If different code required: press any 9-keystroke combination, and then press the **same** keystroke combination again. Each keystroke acknowledged by "*". *WRONG CODE* (= incorrect entry) appears if 1st and 2nd entries are **not equal.** Press ⬅ and ➡ keys and repeat entries.
3.5.4	*LOCATION*	Set **tag name** (measuring point No.), max. 10digits. Required only for flowmeters of "HHC" design (operator control via Hand-Held Communicator MIC 500, connected to current output). Factory setting: *ALTOMETER* Characters assignable to each place: *A...Z / a...z / 0...9 / _* (underscore character = blank character)
3.5.5	*UNIT TEXT*	**Text for user-defined unit,** Sect. 5.15 Factory setting: *Liter/hr* **or** *US.MGal/DAY* (= liters per hour **or** US million gallons per day) Characters assignable to each place: *A...Z / a...z / 0...9 / _* (underscore character = blank character) Fraction bar "/" in 7th place is unalterable.
3.5.6	*FACT.QUANT.*	**Conversion factor for quantity** (F_M), Sect. 5.15 Factory setting: *1.00000 E+3* (for liters) **or** *2.64172 E-4* (for US million gallons) Factor F_M = quantity per 1 m^3. Setting range: *0.00001 E-9* to *9.99999 E+9*
3.5.7	*FACT. TIME*	**Conversion factor for time** (F_T) Sect. 5.15 Factory setting: *3.60000 E+3* (for hour) **or** *8.64000 E+4* (for day) Factor F_T in seconds Setting range: *0.00001 E-9* to *9.99999 E+9*
3.5.8	*ENABL.RESET*	**Enable totalizer reset** for the *RESET / QUIT* menu, see Sect. 5.6 Query: *NO* or *YES*
3.6.0	*APPLICAT.*	**Submenu 3.6.0 Application**
3.6.1	*FIELD FREQ.*	**Magnetic field frequency,** Sect. 5.14+8.2 ● *1/6* ● *1/16* ● *1/32*
3.6.2	*NOISE*	**Noise rejection,** Sect. 6.2 ● *NO NOISE* ● *NOISE*
3.6.3	*REF. SEL.*	**Selecting the reference voltage** Sect. 6.2 ● *AUTO.REF.* (= automatic reference) ● *HIGH-FLOW* (= high flow range) ● *MED.1-FLOW* (= 1st medium flow range) ● *MED.2-FLOW* (= 2nd medium flow range) ● *MED.3-FLOW* (= 3rd medium flow range) ● *LOW-FLOW* (= low flow range)

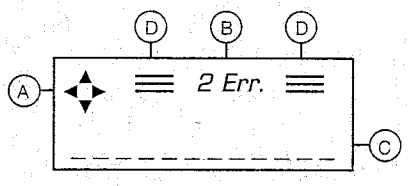
Fct. No.	Text	Description and settings
4.0	PARAM.ERROR	**Main menu 4.0 Parameter errors**
4.1.0	FLOW VELOC.	**FLOW VELOCITY "v" incorrect:** Ensure condition 0.3 m/s $\leq$ v $\leq$ 12 m/s **or** 1 ft/s $\leq$ v $\leq$ 40 ft/s is met!
4.1.1	FULL SCALE	**Full-sclae range for flowrate $Q_{100\%}$** see Fct. 3.1.1
4.1.2	METER SIZE	**Meter size,** see Fct. 3.1.4
4.2.0	F/R FLOW	**FULL-SCALE RANGE(S) for forward/reverse flow incorrect:** Ensure condition F $\geq$ R ist met!
4.2.1	FULL SCALE	**Full-scale range $Q_{F100\%}$** (forward flow) see Fct. 3.1.1
4.2.2	REV.SCALE	**Different full-scale range for reverse flow** required? see Fct. 3.1.2
4.3.0	P> 10 kHz	**OUTPUT FREQUENCY too high:** must be less than 10 kHz!
4.3.1	PULSE/VOL.	**Pulse value for flow unit, see** Fct. 3.4.3
4.3.2	FULL SCALE	**Full-scale range for flow $Q_{100\%}$** see Fct. 3.1.1
4.4.0	P<> PULSW.	**FREQUENCY/PULSE WIDTH ASSIGNMENT is incorrect:** Refer to Table in Sect. 2.3.3
4.4.1	PULSWIDTH	**Pulse width for frequencies $\leq$ 10 Hz** see Fct. 3.4.4
4.4.2	PULSE/TIME	**Pulse rate for 100% flowrate** see Fct. 3.4.3
4.4.2	PULSE/VOL.	**Pulse value for flow unit,** see Fct. 3.4.3
4.4.3	FULL SCALE	**Full-scale range for flow $Q_{100\%}$** see Fct. 3.1.1

List of errors

Error messages displayed in 2nd (middle) line		Description of error
FATAL ERROR	CAL.DATA	**Calibration data lost or incorrect**
	EEPROM 1	**Error in EEPROM 1, parameter error(s)**
	ROM	**Check-sum error in ROM**
	RAM	**Check-sum error in RAM**
TOTALIZER *		**Counts lost or totalizer overflow** Note: totalizer was reset
EEPROM 2 *		**Error in EEPROM 2, totalizer** Note: totalizer deviation possible
LINE INT. *		**Power failure** Note: no counting during power failure
RESET *		**Power voltage fluctuation** Note: totalizer deviation possible
CUR.OUTP. I *		**Current output overranged**
PULSOUTP. P *		**Pulse output overranged**
ADC *		**Analog/digital converter** overranged or defective

* **When errors are displayed during the measuring mode and in the *ERRORLIST*** in the Reset/Quit menu, "a numeral" and "*Err.*" will appear in the 1st (top) line. The numeral gives the number of momentarily occurring errors that are displayed alternately with the actual measured value.

Error representation



(A) Compass field

(B) Number of errors that have occurred

(C) Plain text for error message(s)

(D) **With** bar:
"new" errors, not yet acknowledged
Without bar:
"old", acknowledged errors but cause not yet eliminated

Error display during measuring (display) mode

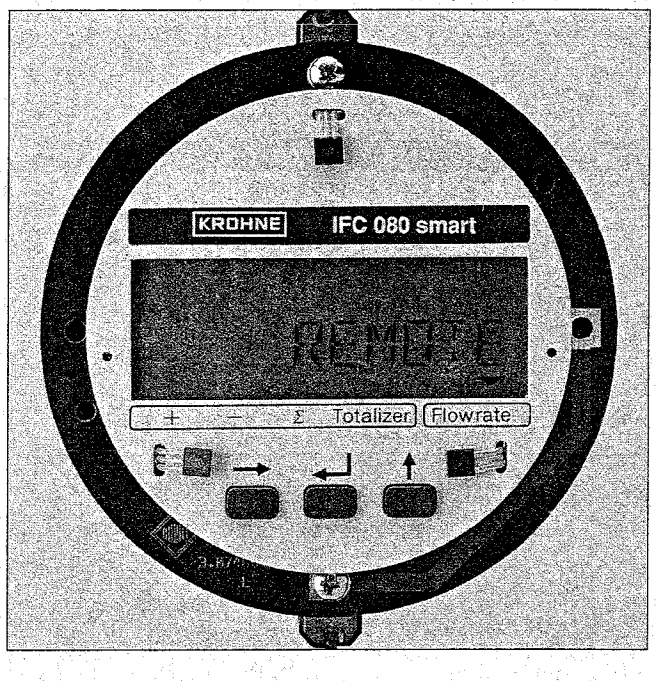
In the setting level under Fct. 3.2.5 *ERROR MSG.* (error messages), it is possible to select whether and, if so, which errors are to be displayed during measurement (display mode). Depending on setting under Fct. 3.2.4 *CYCL.DISP.* (cyclic display), set *YES* or *NO,* "measured value(s)" and "error message(s)" will either alternate automatically in the display or can be alternated manually by pressing the ↑ key. The errors will continue to be displayed until their cause has been eliminated. All displays, including measured values, flash!

Error list in Reset/Quit menu

All errors are stored in the *ERROR LIST* in the Reset/Quit menu. The errors are retained in this list until: **1** the cause of the error has been eliminated, **and 2** the error has been acknowledged.
Errors that have been acknowledged, but whose cause has not been eliminated, are retained in the Error List but are displayed **without** bar. This allows identification of "old" and "new" errors.

6.5 IFC 080 smart signal converter

smart signal converters are identifiable by the **black "bar"** on the front panel, see photo.



These signal converters can be operated by remote control using the MIC 500 hand-held communicator. The MIC 500 is connected to the two cables of the current output, max. distance from signal converter: 1600 m or 6000 ft. Receiver instruments, milliammeters, recorders, etc. that are also connected to the current output are not affected by the MIC 500. For tag names, refer to Sect. 5.1.3, Fct. 3.5.4.

The smart signal converters are equipped with magnetic sensors, see Sect. 6.4.

Please refer to the MIC 500 operating instructions for further details on connection and operator control.

7. Functional checks

7.1 Test functions of the IFC 080 signal converter

7.1.1 Main menu 2.0 Test functions

2.0	TEST	Main menu 2.0 Test functions
2.1	TEST DISP.	**Test of the display** (Sect. 7.1.2) Start with ➡ key (duration: approx. 15 sec.)
2.2	TEST I	**Test of current output I** (Sect. 7.1.3) Safety interrogation: *SURE NO* *SURE YES* ● *0 mA* ● *10 mA* ● *20 mA* ● *4 mA* ● *16 mA* ● *22 mA* Select with ↑ key Displayed value present directly at current output. Actual value again present at output after pressing the ↵ key.
2.3	TEST P	**Test of pulse output P** (Sect. 7.1.3) Safety interrogation: *SURE NO* *SURE YES* ● *1 Hz* ● *100 Hz* ● *10000 Hz* ● *10 Hz* ● *1000 Hz* Select with ↑ key Displayed value present directly at current output. Actual value again present at output after pressing the ↵ key.
2.4	TEST Q	**Test of full-scale range** (Sect. 7.1.3) Safety interrogation: *SURE NO* *SURE YES* ● *–110 / –100 / –50 / –10 PCT.* ● *0 PCT.* ● *+10 / +50 / +100 / +110 PCT.* ... of set full-scale range ($Q_{100\%}$). Select with ↑ key. Displayed value present directly at outputs I and P. Actual value again present at output after pressing the ↵ key.

7.1.2 Test of display (Fct. 2.1)

- Select Function 2.1, as described in Sect. 4.2 and 4.3.
- Press ➡ key to start the display test, duration: approx. 15 seconds.
- All segments in the 3 lines of the display are activated sequentially.

7.1.3 Test of current output I (Fct. 2.2), pulse output P (Fct. 2.3) and measuring range Q (Fct. 2.4)

PLEASE NOTE!
Simulated values are present at outputs I and P when these 3 test functions are operative. To avoid faulty measurements, false alarms, etc., proceed as follows:
- deactivate external alarm contacts
- switch controllers to manual operation
- take readings of internal and external volumetric meters/totalizers before and after the tests.

Test of current output

- A milliammeter must be connected to terminals 5 and 6 for this test, see Sect. 2.3.3 and 2.3.4, connection diagram ①.
- Select Function 2.2 as described in Sect. 4.2 and 4.3, and press ➡ key.
- Safety interrogation: *SURE NO* / *SURE YES* } select with ↑ key
- After *SURE YES*, press the ↵ key to display the 1st value in the following list.
- Select current value with ↑ key:
  - *0 mA*
  - *4 mA*
  - *10 mA*
  - *16 mA*
  - *20 mA*
  - *22 mA*

  The milliammeter indicates the current value selected.
- Press the ↵ key to terminate the test and display the actual value again.

Test of pulse output P, Fct. 2.3

- An electronic totalizer (EC) must be connected to terminals 4.1/4.2, 4/4.1/4.2 or 4/4.1 for this test; see Sect. 2.3.3 and 2.3.4, connection diagrams ②, ③ and ④.
- Select Function 2.3 as described in Sect. 4.2 and 4.3, and press ➡ key.
- Safety interrogation: *SURE NO* / *SURE YES* } select with ⬆ key
- After *SURE YES,* press the ↵ key to display the 1st value in the following list.
- Select frequency value with ⬆ key:
  - *1 Hz*
  - *10 Hz*
  - *100 Hz*
  - *1 000 Hz*
  - *10 000 Hz*

  The totalizer indicates the frequency value selected.
- Press the ↵ key to terminate the test and display the actual value again.

Test of measuring range Q, Fct. 2.4

- For this test a measured value in the range of –110 to +110 percent of $Q_{100\%}$ (set full-scale range, see Fct. 3.1.1) can be simulated.
- Select Function 2.4 as described in Sect. 4.2 and 4.3, and press ➡ key.
- Safety interrogation: *SURE NO* / *SURE YES* } select with ⬆ key
- After *SURE YES,* press the ↵ key to display the 1st value in the following list.
- Select measured value with ➡ key:
  - *0 PCT.*
  - ± *10 PCT.*
  - ± *50 PCT.*
  - ± *100 PCT.*
  - ± *110 PCT.*

  Current output I and pulse output P indicate corresponding values.
- Press the ↵ key to terminate the test; the actual values are then again present at the outputs.

7.2 Zero check

Always switch off power source before connecting and disconnecting cables!

Set **"zero" flow** in the pipeline, but make sure that the **primary head** is **completely filled** with liquid.

Switch on the signal converter and wait 15 minutes.

Press the following keys for zero measurement (Fct. 1.1.3):

Key	Display		Description
➡			If Entry Code 1 selected, see Fct. 3.5.2, set 9-keystroke Code 1 now
	1.0	*OPERATION*	
➡	*1.1.0*	*BASIS.PARAM.*	
➡	*1.1.1*	*FULL SCALE*	
2x ⬆	*1.1.3*	*ZERO SET*	
➡		*CALIB. NO*	
⬆		*CALIB. YES*	
↵	*0.0*	*PERCENT*	Zero measurement in progress (approx. 50 seonds duration), Display: actual flowrate as 0.0% of full-scale range, max. deviation ± 0.2%; if greater, check whether flowrate is actually "zero".
		STORE NO	If new value not to be accepted, press ↵ key 5 times = return to measuring mode.
⬆		*STORE YES*	
↵	*1.1.3*	*ZERO SET*	Zero set to new value
4x ↵	.....	.....	Measuring mode with new zero value.

For separate systems only

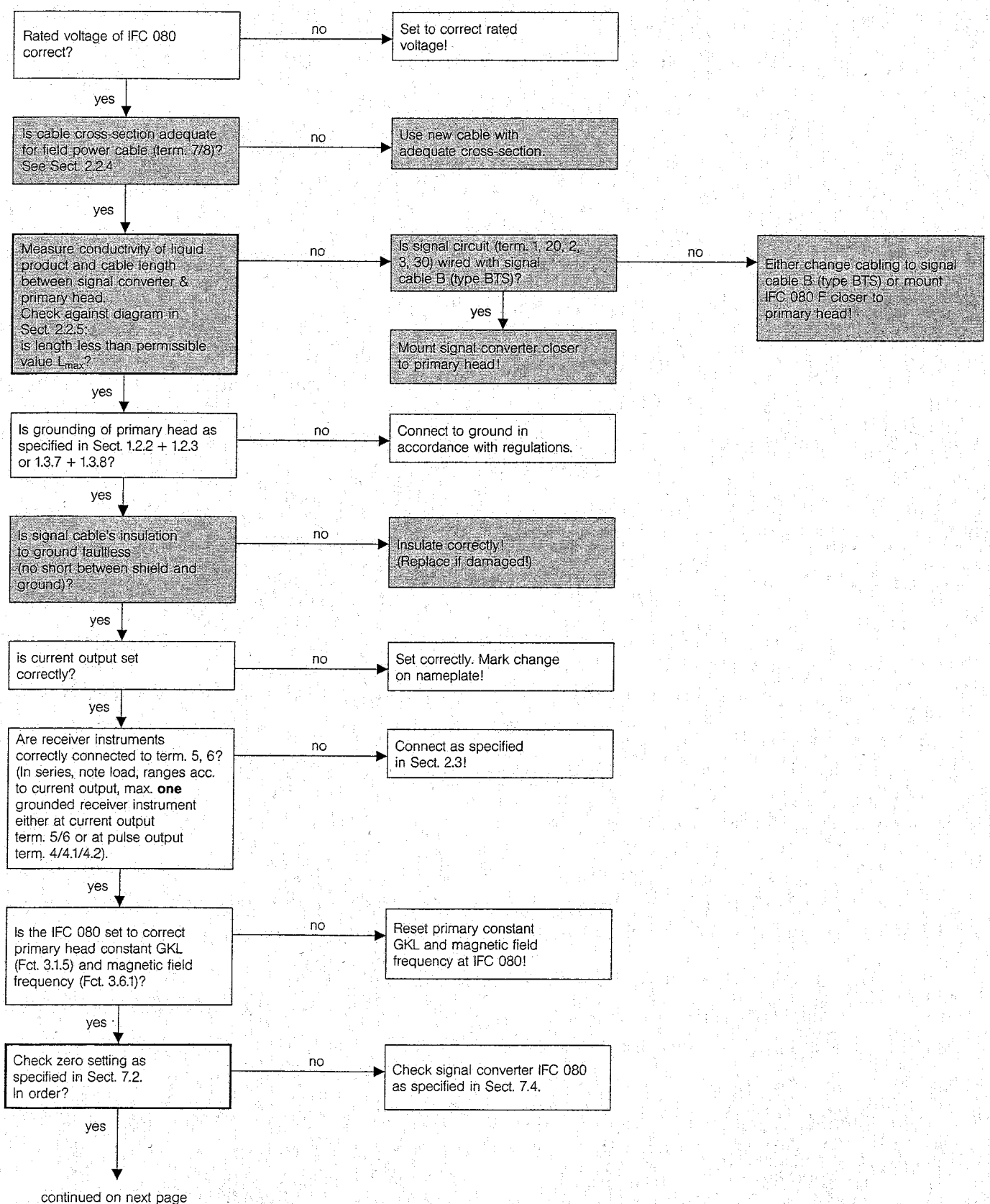
If "zero" flow in the pipeline cannot be set, switch off signal converter, disconnect signal cable from terminals 1, 2 + 3 in the converter terminal box, and short terminals 1, 2 + 3.

7.3 System check-out

Always switch off power source before connecting and disconnecting cables!
The test points in boxes with thin line borders need only be checked when:
1. the system has been newly installed,
2. signal converter or primary head has been replaced,
3. the wiring arrangement has been changed.

The test points in boxes with **rhick** line borders should be checked every time the system is tested.

The test points in the grey-coloured boxes can only be carried out on systems with separate signal converter!



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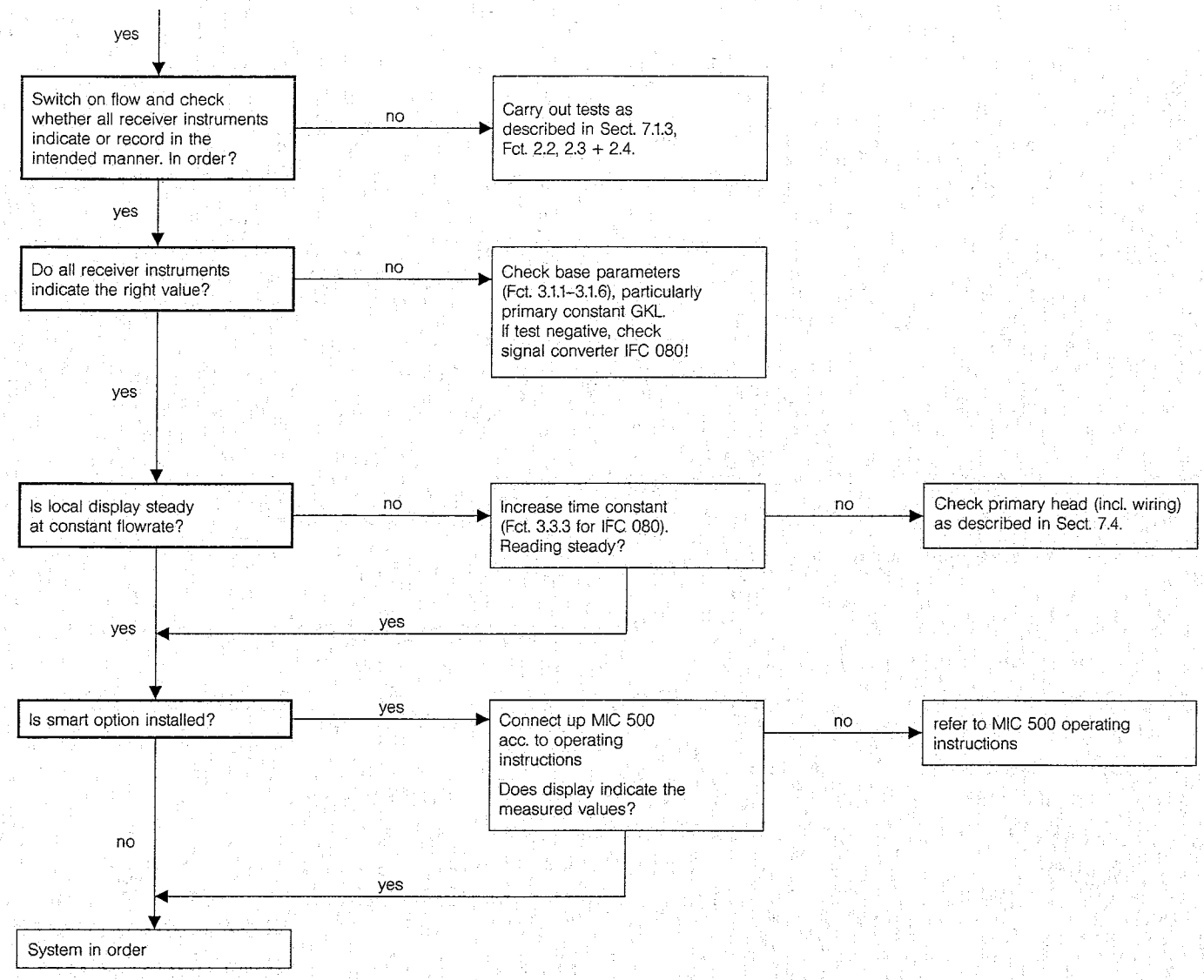
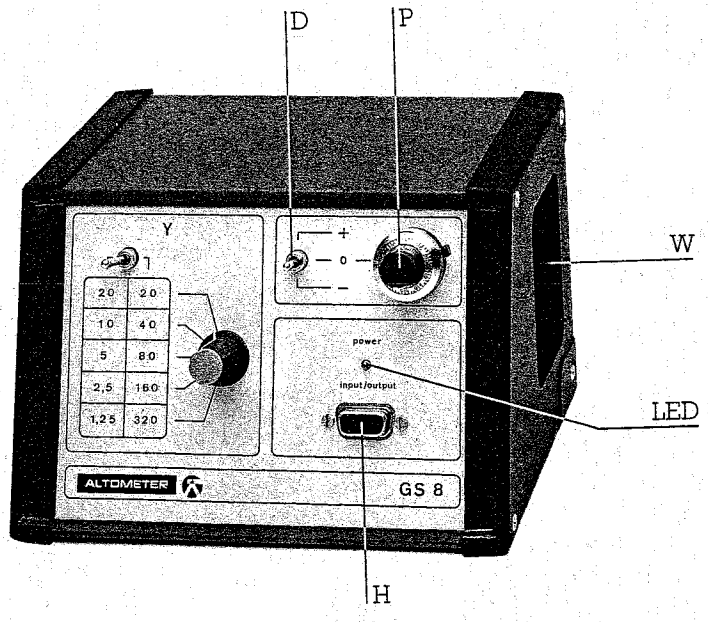


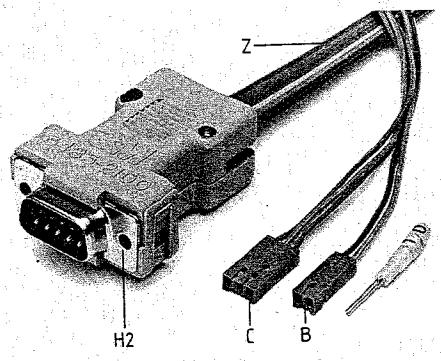
If you have to return your ALTOFLUX flowmeter to Krohne, please note information given on page 75!

7.4 Setpoint display IFC 080 with primary head simulator GS 8

7.4.1 GS 8: Operating elements and connection cable

D switch, flow direction
H socket for plug **H2** of connection cable **Z**
LED power supply "on"
P potentiometer "zero point"
W compartment for connection cable
Y switch measuring ranges
Z connection cable between IFC 080 and GS 8

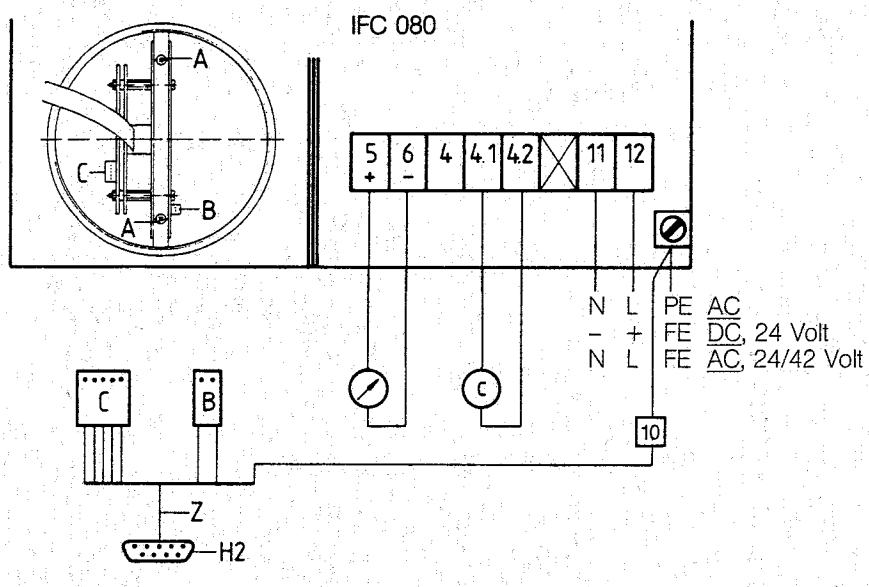




7.4.2 Electrical connection between IFC 080 and GS 8

1. **Switch off power source!**
2. Remove cover from terminal and electronic compartments.

   Important:
   make sure screw threads are neither damaged nor dirty.
3. Remove screws A in electronic compartment and fold display circuit board to side. Carefully pull out plug connectors B (2-pin) and C (5-pin) by the connector shell **(not by the cables!)**
4. Electrical connection as shown in the following diagram using ribbon cable **Z.** Insert plug connector **H2** into socket **H** on the front panel of the GS8.
5. Provisionally refix display circuit board (short-circuit risk!).



Ⓜ = milliammeter
accuracy class 0.1

R_i < 600 ohms

range 0 to 20 mA

Ⓒ = electronic frequency counter
input resistance min. 1 kOhm
(see connection diagrams of pulse output in Sect. 2.3.4)

range 0 to 10 kHz

time base min. 1 second

7.4.3 Check of setpoint display

1. Switch of power source, allow at least 15 minutes' warm-up time.
2. Set switch **D** (front panel GS8) to "0" position.
3. Adjust zero with the 10-turn potentiometer **P** (front panel GS8) to $I_{0\%} \pm < 10\ \mu A$.
4. Determine position of switch **Y** and setpoints I and f as follows:

4.1 $$X = \frac{2 \times Q_{100\%} \times K}{GKL \times DN^2}$$

$Q_{100\%}$ = full-scale range (100%) in volumetric units **(V)** per unit time **(t)**

GKL = primary constant (see primary head nameplate)

DN = meter size in mm, use only the "mm" value for calculation. To convert "inch" to "mm" see Table "meter size" in Fct. 3.1.4.

t = time in seconds (Sec.) minutes (min), hours (hr)

V = volume

K = constant, see following Table

DN	**V** \ **t**	Sec.	min	hr
mm	Liter	25464	424.4	7.074
	m^3	25464800	424413	7074
	US gallons	96396	1607	26.78

Note: Sticker on the GS 8 primary head simulator still gives values for "inch" flowmeters. **Do not use any more!**

4.2 Determine position of switch Y

Use table (front panel GS8) to determine the value Y which comes closest to the factor X and meets condition $Y \leq X$.

4.3 Calculate setpoint reading (I) for current output

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

$I_{0\%}$ = current at 0% flowrate, see Fct. 3.3.2 (e.g. 4 mA, at 4 to 20 mA)

$I_{100\%}$ = current at 100% flowrate, see Fct. 3.3.2 (e.g. 20 mA, at 0/4 to 20 mA)

4.4 Calculate setpoint reading (f) for pulse output

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

$P_{100\%}$ = pulses per second at 100% flowrate, see Fct. 3.4.2 and 3.4.3 *„PULSE/TIME"*.

5. Set switch **D** (front panel GS8) to position "+" or "–" (forward or reverse flow).
6. Set switch **Y** (front panel GS8) to the value determined by the method described above.
7. Check setpoint readings I or f (see Points 4.3 and 4.4).
8. Deviation < 1.5% of setpoint! If greater, exchange electronics of IFC 080, see Sect. 8.1.
9. Linearity test: adjust lower Y values, readings will drop in proportion to the determined Y value (see Point 4.2).
10. **Switch off power source** after completing the test.
11. Disconnect GS8.
12. Reconnect plug connectors B and C.
13. Replace housing cover. **The screw threads and gaskets of the two covers on the IFC 080 must always be well greased.**
14. The system is ready for operation after the power source has been switched on.

7.4.4 Example

Full scale range	$Q_{100\%}$	= 280 m^3/hr (Fct. 3.1.1)
Meter size	**DN**	= 80 mm (≙ 3") (Fct. 3.1.4)
Current at $Q_{0\%}$ Current at $Q_{100\%}$	$I_{0\%}$ $I_{100\%}$	= 4 mA = 20 mA } (Fct. 3.3.2)
Pulses at $Q_{100\%}$	$P_{100\%}$	= 280 pulses/hr (Fct. 3.4.2 + 3.4.3)
Primary head constant	**GKL**	= 3,571 (see nameplate)
Constant (**V** in m^3, **t** in hr / **DN** in mm)	**K**	= 7074 (see Table)

Calculation **„X"** and position of switch **„Y"**

$$X = \frac{2 \times Q_{100\%} \times K}{GKL \times DN^2} = \frac{2 \times 280 \times 7074}{3.571 \times 80 \times 80} = \mathbf{173.33}$$

Y = 160, position of switch Y, see front panel GS8 (comes closest to X value and is smaller than X)

Calculation setpoint reading **I** and **f**

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

$$4\ mA + \frac{160}{173.33}(20\ mA - 4\ mA) \approx \mathbf{18.8\ mA}$$

Deviations are permissible between 18.5 and 19.1 mA (equivalent to ± 1.5%).

$$f = \frac{Y}{X} \times P_{100\%} = \frac{160}{173.33} \times 280\ pulses/hr \approx \mathbf{258.5\ pulses/hr}$$

Deviations are permissible between 254.6 and 262.3 pulses/hr (equivalent to ± 1.5%).

If you have to return your ALTOFLUX flowmeter to Krohne, please note information given on page 75!

7.5 Testing the primary head

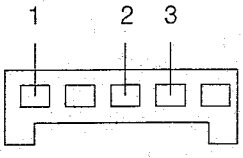
7.5.1 Primary head in compact systems

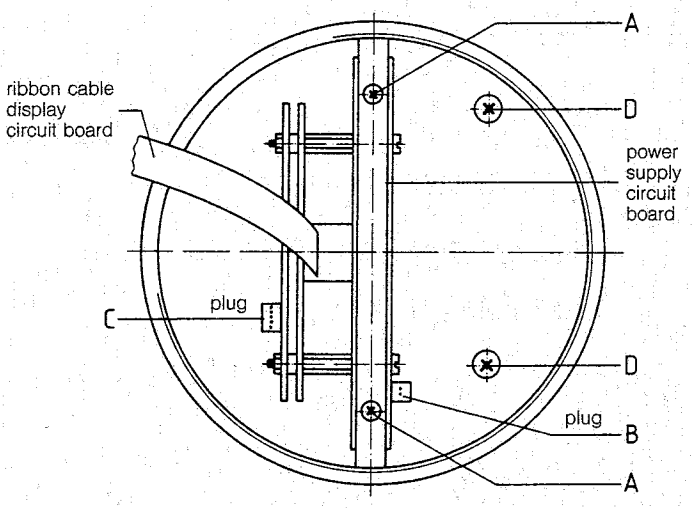
Always switch off power source before connecting and disconnecting cables!

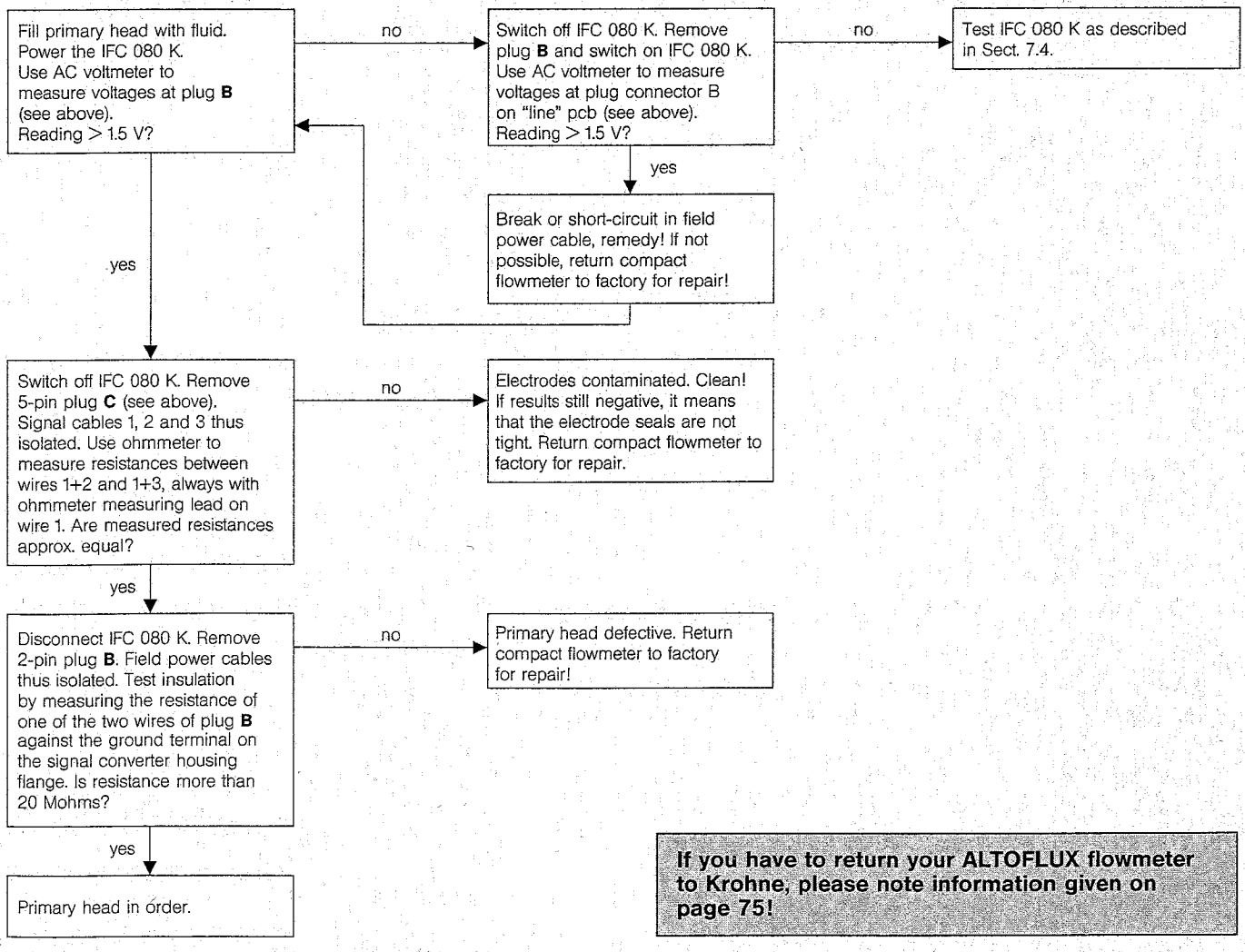
Required measuring instruments and tools:
- Ohmmeter with at least 6 V range, or AC voltage/resistance bridge
- AC voltage multirange instrument
- Special wrench for housing cover

Preparatory work

- Switch off power source!
- Use the special wrench to remove the cover from the electronic compartment.
- Remove screws **A** and fold display board to side. Be sure it does **not come into contact with the housing** – short-circuit risk!
- Wire identifier at plug **C:**





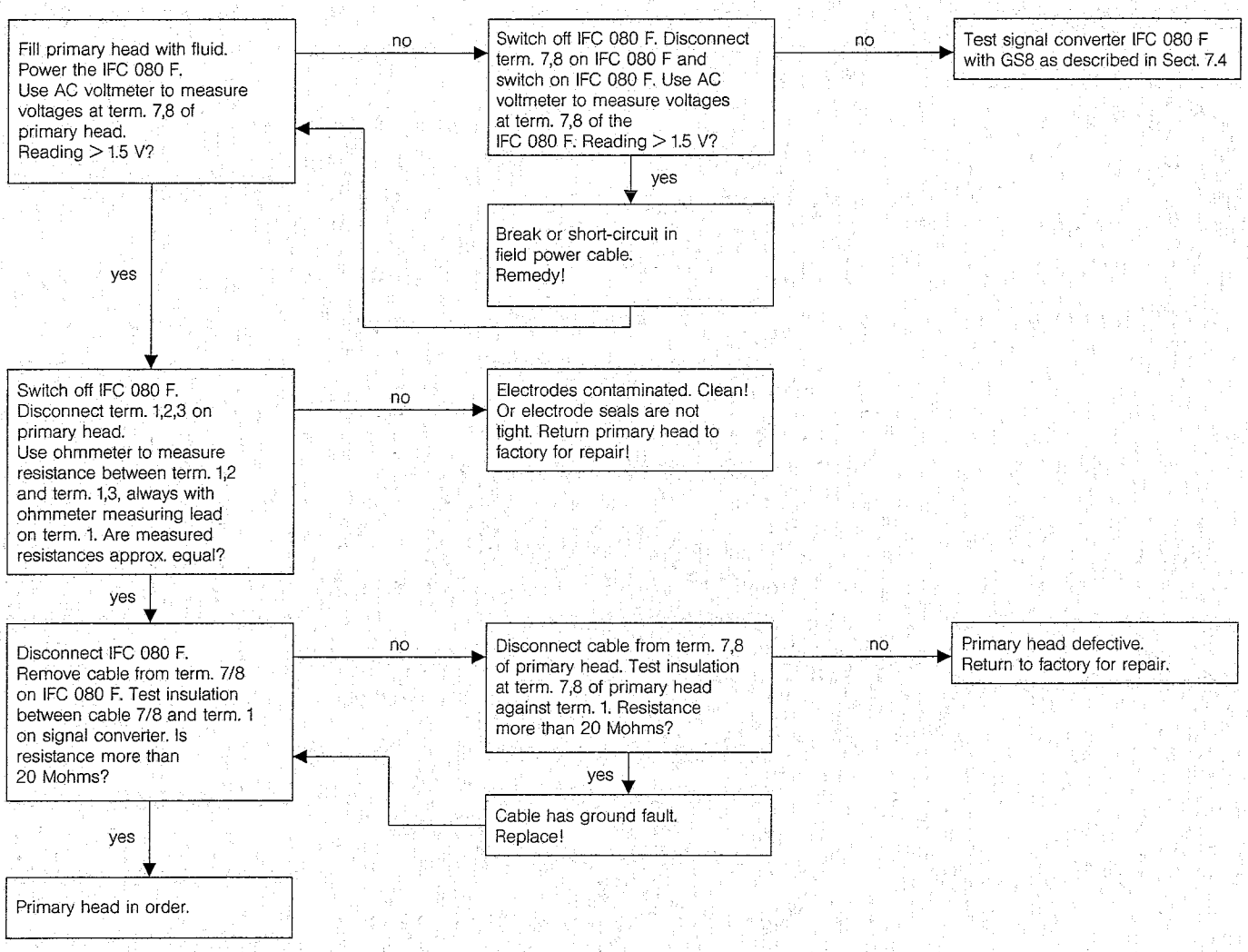


If you have to return your ALTOFLUX flowmeter to Krohne, please note information given on page 75!

7.5.2 Primary head in separate systems

Always switch off power source before connecting and disconnecting cables!

Required measuring instruments:
Ohmmeter with at least 6 V range, or AC voltage/resistance bridge
AC voltage multirange instrument



If you have to return your ALTOFLUX flowmeter to Krohne, please note information given on page 75!

8. Service

8.1 Replacement of electronic unit of signal converter

Order No. of electronic unit **IFC 080 smart/S,** refer to Sect. 9.3 (S = Service).

The **IFC 080 smart/S** electronic unit can be used as **replacement unit for the following signal converters** (compact flowmeters):

IFC 080 K (IFM 1080 K, IFM 3080 K, IFM 4080 K, IFM 5080 K, K 480 S)
IFC 080 K/MP (IFM 1080 K/MP, IFM 3080 K/MP, IFM 4080 K/MP, IFM 5080 K/MP, K 480 S/MP)
IFC 080 K smart (IFM 1080 K smart, IFM 3080 K smart, IFM 4080 K smart, IFM 5080 K smart, K 480 S smart)
IFC 080 F
IFC 080 F/MP
IFC 080 F smart
} (F = field housing, separate system)

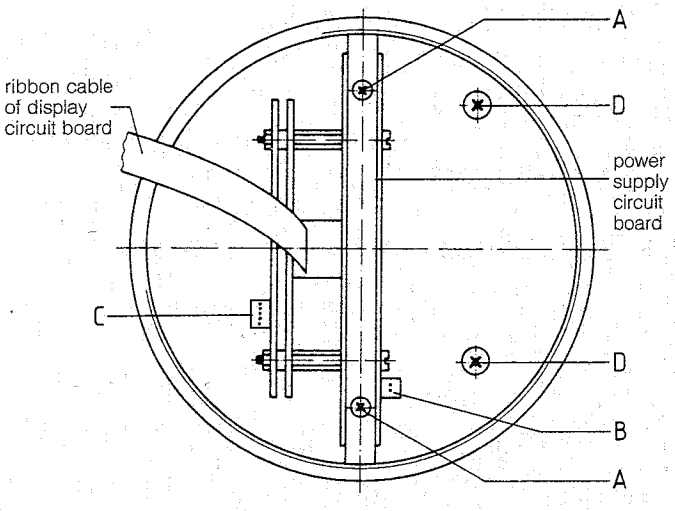
SC 80 AS (K 180 AS, K 280 AS, K 380 AS, K 480 AS)
SC 80 AS/MP (K 180 AS/MP, K 280 AS/MP, K 380 AS/MP, K 480 AS/MP)
SC 80 AS/F
SC 80 AS/MP/F
} (F = field housing, separate system)

SC 80 A (K 180 A, K 280 A, K 380 A, K 480 A)
SC 80 A/MP (K 180 A/MP, K 280 A/MP, K 380 A/MP, K 480 A/MP)

A special electronic unit is available for **hazardous-duty** versions (see separate "Ex" installation instructions).

Always switch off power source before commencing work!

1. Use the special wrench to remove the cover from the terminal box.
2. Disconnect all cables from the terminals:
   IFC 080 and SC 80 AS: term. 5/6/4/4.1/4.2/11/12
   SC 80 A : term. 5/6/4/4.1/11/12
3. Use the special wrench to remove the cover from the electronic compartment.



4. Remove screws **A** and fold display board to side.
5. Remove plug **B** (2-pin, field power cable) and plug **C** (signal cable).
   IFC 080 and SC 80 AS: plug C / **5**-pin
   SC 80 A : plug C / **3**-pin
6. Remove screws **D** using a screwdriver for recessed-head screws (size 2, blade length min. 200 mm [8"]), and carefully remove the complete electronics.

7.1 On the new electronic unit, check the supply voltage and fuse F9, and change over/replace if necessary, see Sect. 8.3.

7.2 The following **applies only to SC 80 A** because terminal assignment is different!
- Clean the housing partition in the terminal box with methylated spirit or similar. Then stick the self-adhesive terminal marking tag over the terminal numbers in the cast metal. Make sure positioning is correct!
- Connect to power as described in Sect. 2.1.2 or 2.2.2.
- Connect current output as described in Sect. 2.3.1, 2.3.2 + 2.3.4.
- Connect pulse output as described in Sect. 2.3.1, 2.3.3 + 2.3.4.

Important: Ensure that the screw thread and the gaskets of the covers on the electronic and terminal compartments are well greased at all times.

8. Reassemble in reverse order (Points 6 to 1).
9. All data must be reset after replacement of the electronic unit. The supplied report on settings contains the standard factory setting. Customer-specific data should be recorded in the report before resetting as described in Sect. 4 + 5.
10. Subsequently be sure to check the zero and store the new zero value, see Sect. 7.2 and Fct. 3.1.3.

8.2 Replacement of primary head in separate systems

Always switch off power source before commencing work!

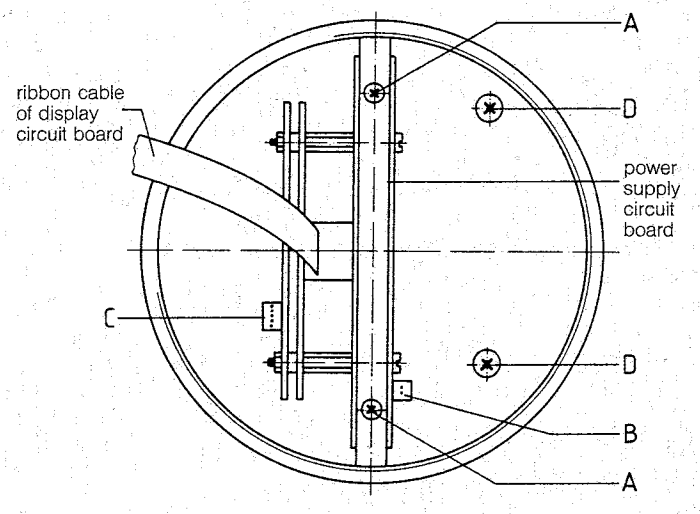
- Specific calibration data for each primary head, specified on the nameplate, are determined during factory calibration. This includes the primary head constant GKL and the magnetic field frequency.
- The signal converter must be reset as follows when a primary head is replaced.
- At all events, reset the internal totalizer as described in Sect. 5.6. Note down totalizer counts beforehand.
- **Magnetic field frequency,** indicated behind the type designation on the primary head nameplate. Meaning:
  .../6 = 1/6
  .../16 = 1/16 } of power frequency
  .../32 = 1/32
  Check setting under Fct. 3.6.1 "*FIELD FREQ.*" and reset if necessary.
- **GKL value**
  Set under Fct. 3.1.5 *"GK VALUE"*.

  Do not set the GK value which is also specified on the nameplate!
- A zero check (Fct. 3.1.3) is advisable following resetting, see Sect. 7.2.
- If the new primary head has a different meter size (diameter), the new size must be additionally set in Fct. 3.1.4 and the new full-scale range for $Q_{100\%}$ in Fct. 3.1.1; in the case of F/R operation, see also Fct. 3.1.2.

8.3 Change of operating voltage and power fuse F9

Always switch off power source before commencing work!

1. Use the special wrench to remove the cover from the terminal compartment.
2. Disconnect all cables from terminals 5 / 6 / 4 / 4.1 / 4.2 / 11 / 12.
3. Use the special wrench to remove the cover from the electronic compartment.



4. Remove screws **A** and fold display board to side.
5. Remove plug **B** (2-pin, field power supply) and plug **C** (5-pin, signal cables)
6. Remove screws **D** using a screwdriver for recessed-head screws (size 2, blade length min. 200 mm [8"]), and carefully remove the complete electronics.

7.1 Replacement of power fuse F9

For location of the F9 fuse, refer to drawing of "line" circuit board in Sect. 9.1.

Connection of 230 or 240 V AC to the 240 V coil.

Voltage	Fuse F9	
	Rating	Order No.
200/220/230/240 V AC	T 0.125/250 G	5.06627
120 V AC	T 0.2/250 G	5.05678
100/110 V AC	T 0.25/250 G	5.08315

7.2. Change of operating voltage

- Transpose voltage select cable **E** on "line" circuit board, see drawing in Sect. 9.1, to obtain desired voltage.
- If necessary, change fuse F9 to suit the new voltage. For values, refer to Table under Item 7.1 (above).

8. Reassemble in reverse order.

Important: Ensure that the screw threads and the gaskets of the covers on the electronic and terminal compartments are well greased at all times.

8.4 Turning the display circuit board

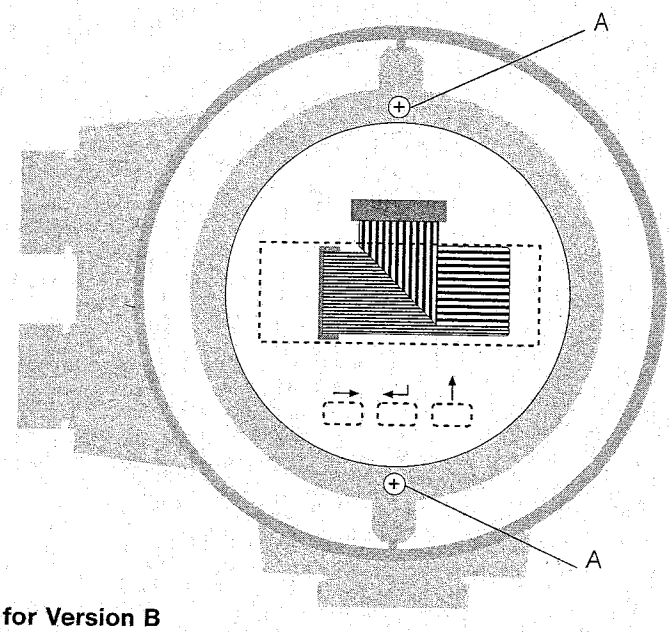
To ensure horizontal positioning of the display irrespective of the location of the IFM 1080 K, IFM 3080 K, IFM 4080 K, IFM 5080 K and K 480 S compact flowmeters, the display circuit board can be turned through ± 90° or 180°.

- **Switch off the power supply!**
- Unscrew the cover from the electronics compartment using the special wrench.
- Remove screws **A** from the display board.
- Turn display board into desired position.
  Please note Versions A – E in Sect. 8.6!
- Fold the ribbon cable as shown in the following drawings for versions **A and D** or **B** or **C and E.** Please follow directions scrupulously so as to avoid damage to electronic components and printed boards!
- For **Version B** the screws **A** must be repositioned on the display board.
- Carefully screw down the display board.

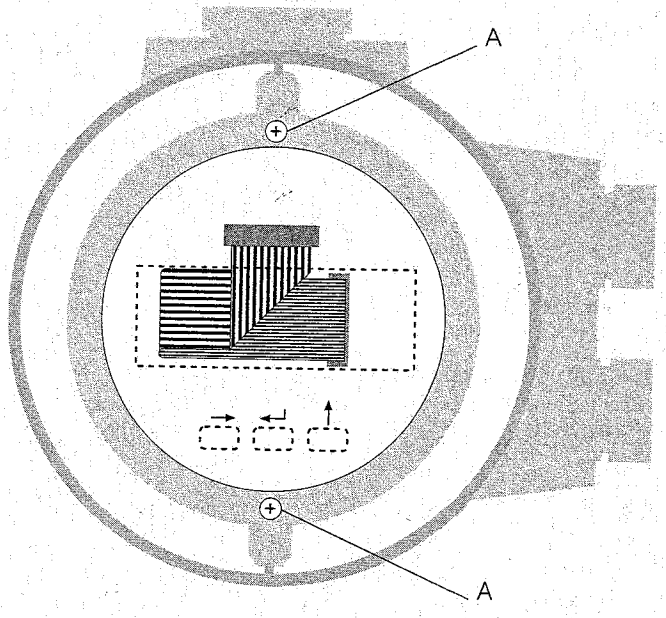
Directions for folding the ribbon cable on the display circuit board

Viewed from above through the pc board!

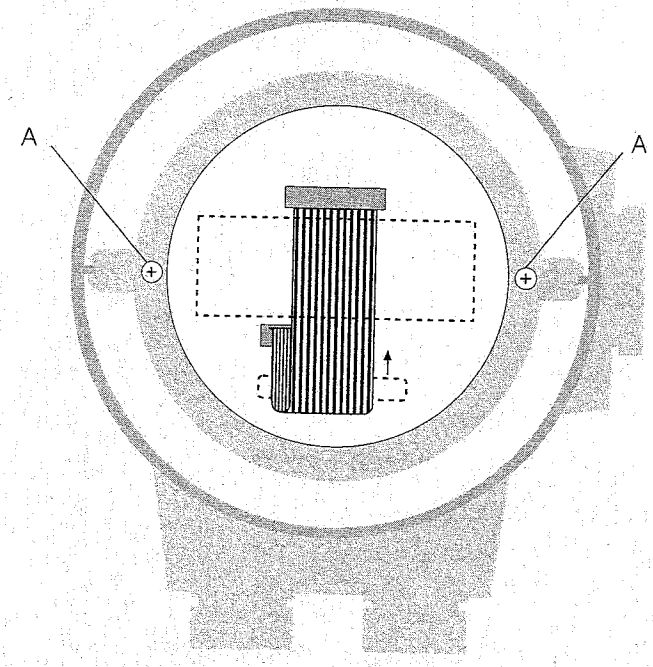
for Versions A and D
see also Sect. 8.6 (on the right)



for Versions C and E
see also Sect. 8.6 (on the right)



for Version B
see also Sect. 8.6 (on the right)



8.5 Turning the signal converter housing

To facilitate access to connecting, indicating and operating elements on compact flowmeters IFM 1080 K, IFM 3080 K, IFM 4080 K, IFM 5080 K and K 480 S installed in locations that are hard to get at, the signal converter housing can be turned through ± 90° (see Versions A to E in Sect. 8.6), but not the hazardous-duty version!

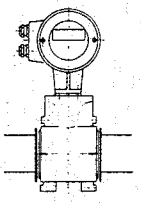
Any faults resulting from failure to follow these instructions scrupulously shall not be covered by our warranty!

- The connection wires between primary head and signal converter housing are extremely short and can break easily.
- **Switch off the power source!**
- Clamp the flowmeter firmly by the primary head housing.
- Secure converter housing against slipping and tilting.
- Remove the 2 hexagon socket screws connecting the two housings and push out the 2 plugs.
- Carefully turn the converter housing clockwise or anti-clockwise a maximum of 90°, but do not lift the housing. If the gasket should stick, do not attempt to lever it off.
- To conform to the requirements of protection category IP 67, equivalent to NEMA 6, keep connecting faces clean and tighten the 2 hexagon socket screws uniformly. Replace the plugs in the two free holes.

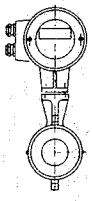
8.6 Available versions of IFM 1080 K, IFM 3080 K, IFM 4080 K, IFM 5080 K and K 480 S compact flowmeters

Compact flowmeters are supplied in 5 different versions, A – E, for various positions of the display circuit board and signal converter housing.

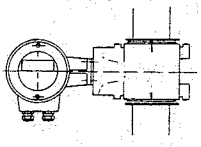
Version A



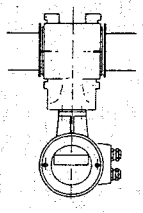
Version D



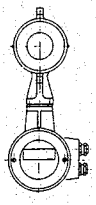
Version B



Version C

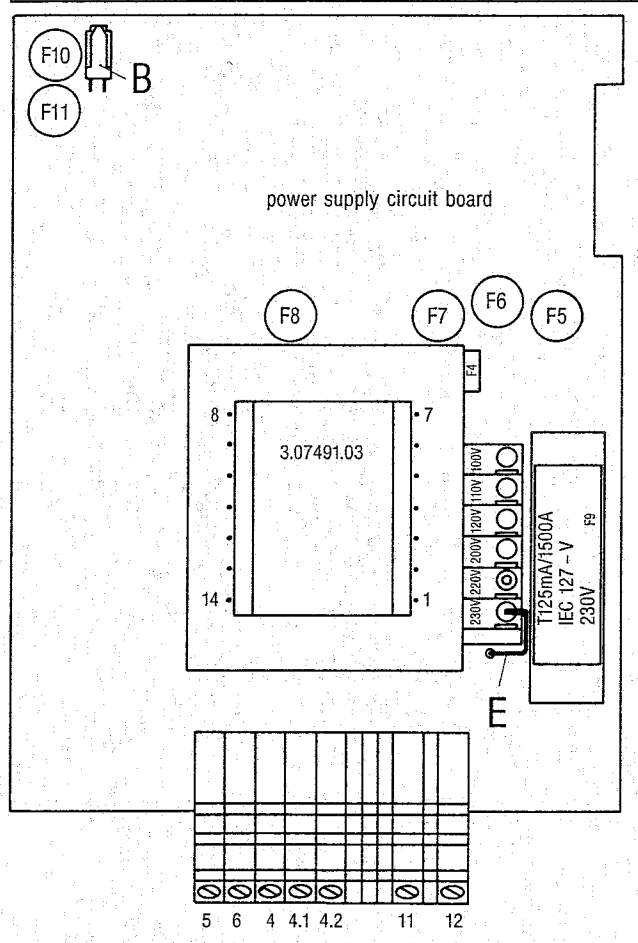


Version E

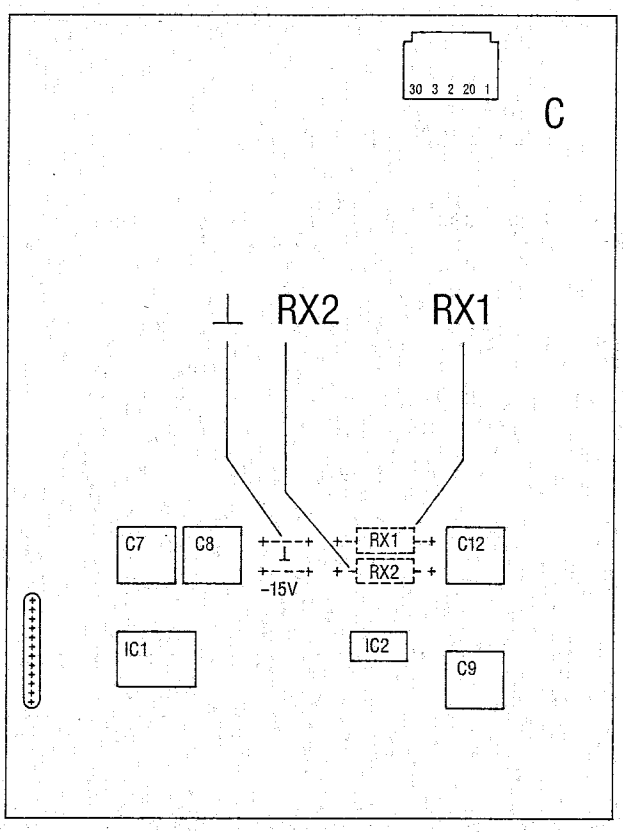


9. Connection and operating points on the circuit boards, and Part No.

9.1 Line circuit board



9.2 Input amplifier circuit board



9.3 Part No.

Electronic unit IFC 080 smart/S complete with display, magnetic sensors and smart interface for remote control with the MIC 500, installation and operating instructions IFM 1080 K / IFM 3080 K+F / IFM 4080 K+F / IFM 5080 K+F / K 480 S and self-adhesive terminal marking tag (needed only for compact units K 180 A, K 280 A, K 380 A and K 480 A with SC 80 A signal converter).

Power supply:	230 Volt AC	**Order No.**	2.07386.00
	240 Volt AC		.01
	200 Volt AC		.02
	120 Volt AC		.03
	110 Volt AC		.04
	100 Volt AC		.05
	220 Volt AC		.06
	24 Volt AC		.24
	42 Volt AC		.42
	24 Volt DC		2.07387.00
Terminal marking tag, self-adhesive			3.07496.01

Fuses		**Rating**	**Order No.**
Line power F9:	200/220/230/240 AC	T 0,125/250 G	5.06627
	120 V AC	T 0,2/250 G	5.05678
	100/110 V AC	T 0,25/250 G	5.08315
	48 V AC	T 0,5/250 G	5.07094
	42 V AC	T 0,63/250 G	5.05827
	24 V AC	T 1,25/250 G	5.06232
	24 V DC	T 1,6/250 G	5.07823
Field current:	F10 + F11	T 0,1/250	5.07561

Special wrench for housing cover Order No. 3.07421.01

Bar magnet Order No. 2.07053

Part D Technical data, measuring prinziple, block diagramm

10. Technical Data

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

Responsibility as to suitability and intended use of our instruments rests solely with the purchaser.

Full-scale range adjustable

Flowrate for Q = 100% 6 liters/hr to 12215 m³/hr or 0.02 to 53700 US G/min
corresponding to flow velocity v = 0.3 to 12 m/s or 1 to 40 ft/s (see table below)

Unit m³/hr, liters/sec or US gallons/min,
and 1 user-defined unit e.g. hectoliters per hour or US million gallons per day

Flow table for Q in m³/hr and l/hr

Meter size		Full-scale range $Q_{100\%}$		Q_F	
DN mm	inches	minimum (v = 0,3 m/s)	maximum (v = 12 m/s)	for error limit at v_F = 0.25 m/s	for error limit at v_F = 0.4 m/s
2.5	1/10	5.301 l/hr	212.1 l/hr	4.418 l/hr	7.069 l/hr
4	1/8	13.56 l/hr	542.9 l/hr	11.31 l/hr	18.10 l/hr
6	1/4	30.54 l/hr	1.221 m³/hr	25.45 l/hr	40.72 l/hr
10	3/8	84.83 l/hr	3.392 m³/hr	70.69 l/hr	113.1 l/hr
15	1/2	190.9 l/hr	7.634 m³/hr	159.0 l/hr	254.4 l/hr
20	3/4	339.3 l/hr	13.57 m³/hr	282.8 l/hr	452.5 l/hr
25	1	530.2 l/hr	21.20 m³/hr	441.8 l/hr	706.9 l/hr
32	1 1/4	868.6 l/hr	34.74 m³/hr	723.8 l/hr	1.158 m³/hr
40	1 1/2	1.358 m³/hr	54.28 m³/hr	1.131 m³/hr	1.810 m³/hr
50	2	2.121 m³/hr	84.82 m³/hr	1.767 m³/hr	2.827 m³/hr
65	2 1/2	3.584 m³/hr	143.3 m³/hr	2.987 m³/hr	4.779 m³/hr
80	3	5.429 m³/hr	217.1 m³/hr	4.524 m³/hr	7.238 m³/hr
100	4	8.483 m³/hr	339.2 m³/hr	7.069 m³/hr	11.31 m³/hr
125	5	13.26 m³/hr	530.1 m³/hr	11.04 m³/hr	17.66 m³/hr
150	6	19.09 m³/hr	763.4 m³/hr	15.83 m³/hr	25.33 m³/hr
200	8	33.93 m³/hr	1357 m³/hr	28.28 m³/hr	45.25 m³/hr
250	10	53.02 m³/hr	2120 m³/hr	44.18 m³/hr	70.69 m³/hr
300	12	76.35 m³/hr	3053 m³/hr	63.62 m³/hr	101.8 m³/hr
400	16	135.8 m³/hr	5428 m³/hr	112.1 m³/hr	179.4 m³/hr
500	20	212.1 m³/hr	8482 m³/hr	176.7 m³/hr	282.7 m³/hr
600	24	305.4 m³/hr	12215 m³/hr	254.5 m³/hr	407.2 m³/hr

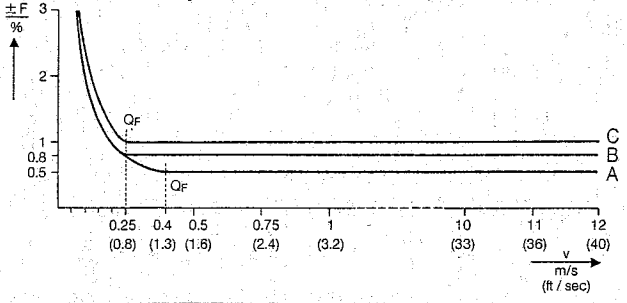
Flow table for Q in US G/min

Meter size		Full-scale range $Q_{100\%}$		Q_F	
DN mm	inches	minimum (v = 1 ft/s) in US G/min	maximum (v = 40 ft/s) in US G/min	for error limit at v = 0.8 ft/s in US G/min	for error limit at v = 1.3 ft/s in US G/min
2.5	1/10	0.02334	0.9339	0.01945	0.03112
4	1/8	0.05970	2.390	0.04980	0.07967
6	1/4	0.1345	5.376	0.1121	0.1793
10	3/8	0.3735	14.93	0.3112	0.4980
15	1/2	0.8405	33.61	0.7001	1.120
20	3/4	1.494	59.75	1.245	1.992
25	1	2.334	93.34	1.945	3.112
32	1 1/4	3.824	153.0	3.187	5.099
40	1 1/2	5.979	239.0	4.980	7.967
50	2	9.339	373.5	7.780	12.45
65	2 1/2	15.78	630.9	13.15	21.04
80	3	23.90	955.9	19.92	31.87
100	4	37.35	1493	31.12	49.80
125	5	58.38	2334	48.61	77.77
150	6	84.05	3361	69.70	111.5
200	8	149.4	5975	124.5	199.2
250	10	233.4	9334	194.5	311.2
300	12	336.2	13442	280.1	448.2
400	16	597.9	23899	493.6	789.7
500	20	933.9	37345	778.0	1245
600	24	1345	53781	1121	1793

10.2 Error limits for complete system at reference conditions

Pulse output

± F Error in % of flowrate (actual value)
Q Actual flowrate
Q_F Flow for error limit v_F = 0.25 and 0.4 m/s **or** v_F = 0.8 and 1.3 ft/s (see Flow tables)
v Flow velocity in m/s and ft/s
v_F Flow velocity in m/s and ft/s at Q_F (see Flow tables)



Reference conditions

Product	Water, 10 to 30°C/50 to 86°F
Electrical conductivity	> 300 µS/cm (µmho/cm)
Power supply (line voltage)	U_N (± 2%)
Ambient temperature	20 to 22°C/68 to 71.6°F
Warm-up time	30 minutes
Straight Inlet run	> 10 DN } DN =
Straight outlet run	> 3 DN } meter size

Curve	Primary head (System)	Meter size DN mm	Meter size inches	Error limits as % of measured value $Q \geq Q_F$	$Q < Q_F$	v_F
A	IFS 5000 IFS 4000, K 480 S (Option)	10 - 100 10 - 600	3/8 - 4 3/8 - 24	F = ± 0.5 %	$F = \pm 0.5\% \times \frac{Q_F}{Q}$	0.4 m/s or 1.3 ft/s
B	IFS 5000 IFS 4000, K 480 S (Standard) M 900	2.5 - 6 10 - 600 10 - 300	1/10 - 1/4 3/8 - 24 3/8 - 12	F = ± 0.8 %	$F = \pm 0.8\% \times \frac{Q_F}{Q}$	0.25 m/s or 0.8 ft/s
C	IFM 1080	15 - 80	1/2 - 3	F = ± 1.0 %	$F = \pm 1.0\% \times \frac{Q_F}{Q}$	0.25 m/s or 0.8 ft/s

Current output same as above error limit for pulse output **plus...**

0 to 20 mA: ± 0.05 %
4 to 20 mA: ± 0.062 %

generally: $\pm 0.05\% \times \frac{20\ mA}{I_{100\%} - I_{0\%}}$

of full-scale range in each case

10.3 IFC 080 Signal converter

Current output (term. 5/6)

Function	– all operating data adjustable – galvanically isolated (not from pulse output)
Current	
Fixed ranges	0 to 20 mA and 4 to 20 mA
Other ranges	$I_{0\%}$ for Q = 0 %: 0 – 16 mA $I_{100\%}$ for Q = 100 %: 4 – 20 mA I_{max} for Q > 100 %: 4 – 22 mA } adjustable in increments of 1 mA
Low-flow cutoff (SMU)	
Cut off "on" value	1 to 19%
Cut off "off" value	2 to 20% } of $Q_{100\%}$, adjustable in 1% increments, independent of pulse output
Forward/reverse measurements (F/R)	selectable performance, direction identified via pulse output, see under "status indication output"
Time constant	0.2 to 3600 seconds, adjustable in increments of 1 or 0.1 second
Max. load at $I_{100\%}$	$\frac{14000\ \Omega}{I_{100\%}\ [mA]}$ (e.g. 0.7 kohm at 20 mA, 2.8 kohm at 5 mA)

Pulse output

Function	– all operating data adjustable – galvanically isolated (not from current output) – digital pulse division, interpulse period non-uniform, therefore if frequency meters connected allow for minimum counting interval: gate time, totalizer $\geq \frac{1000}{P_{100\%}\ [Hz]}$, at least 0.4 seconds
Pulse rate for Q = 100%	10 to 36000000 pulses per hour 0.167 to 600000 pulses per minute 0.0028 to 10000 pulses per second (= Hz) optionally in pulses per liter, m^3 or US gallons
Active output	short-circuit-proof
Terminals 4.1/4.2	for electromechanical (EMC) or electronic (EC) totalizers
Terminals 4/4.1/4.2	for electronic (EC) totalizers
Amplitude	24 Volt (≤ 30 Volt)
Load rating	see Table "pulse width"
Passive output	
Terminals 4/4.1	open collector for connection of active electronic totalizers (EC) or switchgear
Input voltage	5 to 30 V
Load current	max. 100 mA
R_i	100 ohms

Pulse width	Frequency $f = P_{100\%}$ (at Q = 100%)	Load rating of active output: Load current	Load
500 ms	0.0028 Hz < f ≤ 1 Hz	≤ 150 mA	≥ 160 Ohm
200 ms	0.0028 Hz < f ≤ 2 Hz	≤ 150 mA	≥ 160 Ohm
100 ms	0.0028 Hz < f ≤ 3 Hz	≤ 150 mA	≥ 160 Ohm
100 ms	3 Hz < f ≤ 5 Hz	≤ 60 mA	≥ 400 Ohm
50 ms	0.0028 Hz < f ≤ 5 Hz	≤ 150 mA	≥ 160 Ohm
50 ms	5 Hz < f ≤ 10 Hz	≤ 60 mA	≥ 400 Ohm
30 ms	0.0028 Hz < f ≤ 6 Hz	≤ 150 mA	≥ 160 Ohm
30 ms	6 Hz < f ≤ 10 Hz	≤ 80 mA	≥ 300 Ohm
pulse width = $\frac{1}{2 \times P_{100\%}}$	10 Hz < f ≤ 10000 Hz	≤ 25 mA	≥ 1000 Ohm

Low-flow cutoff (SMU)	
cutoff "on" value	1 to 19%
cutoff "off" value	2 to 20% } of $Q_{100\%}$, adjustable in 1% increments, independent of current output
Forward/reverse measurements (F/R)	selectable performance, direction identified via current output, see under "status indication output"
Time constant	0.2 second or same as current output (see above)

Status indication output	Current output	Pulse output
Connection terminals	5 + 6	4.1 + 4.2
Voltage	24 V DC	24 V DC
Load current	I_{max} ≤ 22 mA $I_{0\%}$ ≤ 16 mA	< 25 mA
Load	≥ 1.2 kohms	> 1 kohm

Local display	3-line illuminated LCD
Display functions	actual flowrate, forward, reverse and sum totalizers (7-digit), each can be set for continuous display or in sequence with others, and output of error messages
Display units	
Actual flowrate	m^3/hr, liters/Sec or US gallons/min 1 user-defined unit (e.g. hectoliters per day or US million gallons per day) and percent of full-scale range
Totalizers	liters, m^3 or US gallons and 1 user-defined unit (e.g. hectoliters or US million gallons), min 1 year overflow time
Language of plain texts	German, English, French, others on request
Display	
1st line (top)	8-digit, 7-segment numeral and sign display, symbols for key acknowledgement
2nd line (middle)	10-character, 14-segment text display
3rd line (bottom)	4 markers ▼ to identify actual display
Power supply	
Standard	230 V AC, ± 10% (changeable to 100, 110, 120, 200, 220, 240 V AC, + 10%/– 15%), 48 to 63 Hz
Special versions	24 V AC (changeable to 21, 42, 48 V AC), ± 10%, 48 to 63 Hz 24 V DC, ± 30%
Power consumption	AC : 16 VA DC: 11 W } incl. primary head
Housing	
Material	die-cast aluminium with polyurethane finish
Environment class (to DIN 40040)	HUD (ambient temperature – 25 to + 60°C / – 13 to + 140°F), in operation and in storage, relative humidity < 80% annual mean)
Protection category (DIN 40050 / IEC 144)	
IFC 080 K (compact)	IP 67 equivalent to NEMA 6 (max. 1 m or 3.3ft underwater for max. 30 minutes)
IFC 080 F (separate)	IP 65 equivalent to NEMA 4 and 4X

10.4 Primary heads

10.4.1 IFS 5000 primary head, IFM 1080 K and IFM 5080 K compact flowmeters

Compact system	**IFM 1080 K**	**IFM 5080 K**
Primary head for separate systems	–	**IFS 5000**
Version	Sandwich (flangeless) design	Sandwich (flangeless) design
Meter size	DN 15 to 80 $^1/_2$" to 3"	DN 2.5 to 100 $^1/_{10}$" to 4"
Scope of supply	see "IFM 1080 K" Table, page 3	see "IFM 5080 K + IFS 5000" Table, page 3
Pipe flanges and **rated pressure of measuring tube** (max. operating pressure)	see "Torques" Table Sect. 1.2.3 and "Limits", Sect. 10.5	see "Torques" Table in Sect. 1.2.3 and "Limits", Sect. 10.5
Electrical conductivity	$\geq$ 5μS/cm (μmho/cm); $\geq$ 20μS/cm (μmho/cm) for demineralized cold water	$\geq$ 5μS/cm (μmho/cm); $\geq$ 20μS/cm (μmho/cm) for demineralized cold water
Process temperature	refer to Sect. 10.5 "Limits"	refer to Sect. 10.5 "Limits„
Compact system	– 10 to + 75°C or 14 to 167°F	Standard: – 60 to + 140°C **or** – 76 to + 284°F Ex version: – 60 to + 180°C **or** – 76 to + 356°F
Separate system	–	– 60 to + 180°C **or** – 76 to + 356°F
Ambient temperature for $\leq$ 60°C or $\leq$ 140°F process temperature	– 25 to + 60°C **or** – 13 to + 140°F	– 25 to + 60°C **or** – 13 to + 140°F
for > 60°C **or** > 140°F process temperature	– 25 to + 40°C **or** – 13 to + 104°F	compact system: – 25 to + 40°C **or** – 13 to + 104°F separate system: – 25 to + 60°C **or** – 13 to + 140°F
Change in process temperature		
Temperature rising	–	ΔT = 150°C or 302°F, in 10 minutes ΔT = 100°C or 212°F, for sudden change
Temperature falling	–	ΔT = 80°C or 176°F, in 10 minutes ΔT = 60°C or 140°F, for sudden change
Vacuum load	0 mbar abs. or 0 psia	0 mbar abs. or 0 psia
Insulation class of field coils		
Compact system	E, $\leq$ 75°C or $\leq$ 167°F process temperature	H, $\leq$ 140°C or $\leq$ 284°F process temperature
Separate system	–	H, $\leq$ 180°C or $\leq$ 356°F process temperature
Power supply for field coils	max. 60 V from signal converter	max. 60 V from signal converter
Electrode design	pin electrodes	fused-fitted electrodes
Protection category (DIN 40050 / IEC 144)	IP 66 equivalent to NEMA 4X	IP 67 equivalent to NEMA 6
Environment class (DIN 40040)	HUD (ambient temperature – 25 to + 60°C or – 13 to + 140°F, relative humidity < 80% annual mean)	HUD (ambient temperature – 25 to + 60°C or – 13 to + 140°F, relative humidity < 80% annual mean)

Compact system	**IFM 1080 K**	**IFM 5080 K**
Primary head for separate systems	–	**IFS 5000**
Materials		
Measuring section	polysulfone, glass fiber reinforced	fused aluminium oxide, 99.7% Al_2O_3
Electrodes	stainless steel 1.4571 or SS 316 Ti – AISI	platinum
Housing		
≤ DN 15, ≤ 1/2"	malleable cast iron (GTW 40) or grey cast iron (GG20) *	stainless steel 1.4462/Duplex
≥ DN 25, ≥ 1"	malleable cast iron (GTW 40) or grey cast iron GG 20 *	stainless steel 1.4301 or SS 304 – AISI
Terminal box (separate systems only)	–	die-cast aluminium *
Grounding rings **	stainless steel 1.4301 or SS 304 – AISI	stainless steel 1.4571 or SS 316 Ti – AISI
Gaskets **		
≤ DN 15, ≤ 1/2"	EPDM gaskets	Viton O-rings, optionally with PFA coating
≥ DN 25, ≥ 1"	EPDM gaskets	Gylon 3500 (beige) gaskets (range of application similar to that of PTFE), optionally Chemotherm (graphite) gaskets
Centering material **		
≤ DN 25, ≤ 1"	rubber sleeves	EPDM rings
≥ DN 40, ≥ 1 1/2"	rubber sleeves	rubber sleeves
Stud bolts		
Standard	steel, electrogalvanized	steel, electrogalvanized
Special version	stainless steel 1.4301 or SS 304 – AISI	stainless steel 1.4301 or SS 304 – AISI

* with polyurethane finish

** see Tables on page 3 for scope of supply

10.4.2 IFS 4000 and M 900 primary heads, IFM 4080 K and IFM 3080 K compact flowmeters

Compact system	**IFM 3080 K**	**IFM 4080 K, K 480 S**
Primary head for separate systems	**M 900**	**IFS 4000**
Versions/meter sizes with flange connections for the food industry Sanitary connection DIN 11851 Clamp connection SMS connection	DN 10–300 and $^3/_8$" to 12" (see below) Meter sizes DN 10–25 Pressure rating PN Measuring tube nom. dia. 1" to 4" on request	DN 10–600 and $^3/_8$" to 24" (see below) – – –
Rated pressure	dependent on meter size, connecting flange, liner and process temperature, see Sect. 10.5 "Limits"	dependent on meter size, connecting flange, liner and process temperature, see Sect. 10.5 "Limits"
Connecting flanges to DIN 2501 (= BS 4504) to ANSI	DN 10 to 50 and DN 80: PN 40 DN 65 and DN 100 to 150: PN 16 DN 200 to 300: PN 10 $^3/_8$" to 12" Class 150 or 300 lbs / RF	DN 10 to 50 and DN 80: PN 40 DN 65 and DN 100 to 150: PN 16 DN 200 to 600: PN 10 $^3/_8$" to 24" Class 150 lbs / RF
Electrical conductivity	≥ 5 μS/cm (μmho/cm); ≥ 20 μS/cm (μmho/cm) for demineralized cold water	≥ 5 μS/cm (μmho/cm); ≥ 20 μS/cm (μmho/cm) for demineralized cold water
Process temperature (see Sect. 10.5) Compact system Separate system	– 60 to + 140°C **or** – 76 to + 284°F – 60 to + 180°C **or** – 76 to + 356°F	– 60 to + 140°C **or** – 76 to + 284°F – 60 to + 180°C **or** – 76 to + 356°F
Ambient temperature at ≤ 60°C or ≤ 140°F process temperature at > 60°C or > 140°F process temperature Compact system Separate system	– 25 to + 60°C **or** – 13 to + 140°F – 25 to + 40°C **or** – 13 to + 104°F – 25 to + 60°C **or** – 13 to + 140°F	– 25 to + 60°C **or** – 13 to + 140°F – 25 to + 40°C **or** – 13 to + 104°F – 25 to + 60°C **or** – 13 to + 140°F
Insulation class of field coils / process temperature Standard Special version	E / ≤ 120°C **or** ≤ 248°F H / ≤ 180°C **or** ≤ 356°F	DN 10 to 300 ($^3/_8$" to 12"): H / ≤ 180°C **or** ≤ 356°F DN 350 to 600 (14" to 24"): E / ≤ 120°C **or** ≤ 248°F DN 350 to 600 (14" to 24"): H / ≤ 180°C **or** ≤ 356°F
Power supply for field coils	max. 60 V from converter	max. 60 V from converter
Electrode design Standard Special version	flat elliptical, solidly fitted, surface-polished, self-cleaning DN 50 to 300 **or** 2" to 12" field replaceable electrodes WE	DN 25 to 150 **or** 1" to 6 " replaceable when measuring tube drained DN 10 to 20 / DN 200 to 600 **or** $^3/_8$" to $^3/_4$" / 8" to 24" flat elliptical, surface-polished, self-cleaning DN 350 to 600 **or** 14" to 24" field replaceable electrodes WE
Protection category (to DIN 40050/IEC 144) Compact system Separate system	IP 67 equivalent to NEMA 6 IP 65 equivalent to NEMA 4 and 4X (option: IP 67, IP 68 equivalent to NEMA 6)	IP 67 equivalent to NEMA 6 (IP 65 equivalent to NEMA 4 and 4X with field replaceable electrodes WE) IP 67 equivalent to NEMA 6 (option: IP 68 equivalent to NEMA 6)
Environment class (DIN 40040)	HUD (ambient temperature –25 to +60°C or –13 to +140°F, relative air humidity < 80% annual mean)	HUD (ambient temperature –25 to +60°C or –13 to +140°F, relative air humidity < 80% annual mean)
Grounding rings	available as option	available as option

Compact system	**IFM 3080 K**	**IFM 4080 K, K 480 S**
Primary head for separate systems	**M 900**	**IFS 4000**
Materials		
Measuring tube	stainless steel (1.4301 or high material number) equivalent to SS 304 – AISI	stainless steel (1.4301 or higher material number) equivalent to SS 304 – AISI
Liner		
Standard: DN 10–20 or $^3/_8$ – $^3/_4$″	PTFE (Teflon)	PTFE (Teflon)
DN 25–150 or 1″ – 6″	Neoprene or PTFE (Teflon)	PFA (reinforced with stainless steel mesh)
≥ DN 200 or ≥ 8″	Neoprene or PTFE (Teflon)	Neoprene or PTFE (Teflon)
Special versions		
≥ DN 200 or ≥ 8″	Irethane, hard and soft rubber, others on request	Irethane, hard and soft rubber, others on request
Food version	PTFE (Teflon)	–
Electrodes		
Standard	Hastelloy C4	Hastelloy C4
Special versions	stainless steel 1.4571 or SS 316 Ti – AISI, Hastelloy B2, titanium, tantalum, platinum, others on request	stainless steel 1.4571 or SS 316 Ti – AISI, Hastelloy B2, titanium, tantalum, platinum, platinum/iridium, others on request
Food version	stainless steel 1.4571 or SS 316 Ti – AISI	–
Field replaceable electrodes WE	stainless steel 1.4571 or SS 316 Ti – AISI	stainless steel 1.4571 or SS 316 Ti – AISI
Housing *		
DN 10 – 40 or $^3/_8$″ – $1^1/_2$″	GTW 30	GTW 30
≥ DN 50 or ≥ 2″	sheet steel	sheet steel
Food version	optionally stainless steel 1.4571 or SS 316 Ti – AISI without enamel finish	–
Terminal box * (primary head only)		
Standard	die-cast zinc	die-cast aluminium
Food version	aluminium, without enamel finish	–
Connecting flanges *		
to DIN 2501: DN 10 – 50, DN 80	steel 1.0402 (C22) or AISI: C 1020	steel 1.0402 (C22) or AISI: C 1020
DN 65, ≥ DN 100	steel 1.0501 (RST 37.2) oe AISI: C 1035	steel 1.0501 (RST 37.2) or AISI: C 1035
to ANSI:	steel ASTM A 105 N	steel ASTM A 105 N
Grounding rings	stainless steel 1.4571 or SS 316 Ti – AISI	stainless steel 1.4571 or SS 316 Ti – AISI

* with polyurethane finish

Limits for fused aluminium oxide, PFA and PTFE

Liner	Flange standard	Nominal diameter of measuring tube and flanges	Flange pressure rating or class	S= Standard O= Option	Max. operating pressure in bar (and psig) at a product temperature of ...							
					≤ 40°C (≤ 105°F)	≤ 60°C (≤ 140°F)	≤ 70°C (≤ 158°F)	≤ 90°C (≤ 195°F)	≤ 100°C (≤ 210°F)	≤ 120°C (≤ 250°F)	≤ 140°C (≤ 285°F)	≤ 180°C (≤ 355°F)
Fused aluminium oxide	DIN 2501	DN (2.5) 15–80*	PN 40	S	40 (580)	40 (580)	40 (580)	40 (580)	40 (580)	40 (580)	40 (580)	40 (580)
		DN 100*	PN 16	S	16 (230)	16 (230)	16 (239)	16 (230)	16 (230)	16 (230)	16 (230)	16 (230)
		DN 100*	PN 25	O	25 (360)	25 (360)	25 (360)	25 (360)	25 (360)	25 (360)	25 (360)	25 (360)
	ANSI B 16.5	(1/10") 1/2"–4" *	150 lbs	S	19.6 (284)	19 (275)	18.7 (271)	18.1 (262)	17.7 (256)	17 (246)	16.2 (235)	14.7 (213)
		(1/10") 1/2"–3" *	300 lbs	O	40 (580)	40 (580)	40 (580)	40 (580)	40 (580)	40 (580)	40 (580)	40 (580)
		4" *	300 lbs	O	25 (360)	25 (360)	25 (360)	25 (360)	25 (360)	25 (360)	25 (360)	25 (360)
PFA	DIN 2501	DN 25–50, DN 80	PN 40	S	40 (580)	40 (580)	40 (580)	40 (580)	40 (580)	40 (580)	40 (580)	40 (580)
		DN 65, DN 100–150	PN 16	S	16 (230)	16 (230)	16 (230)	16 (230)	16 (230)	16 (230)	16 (230)	16 (230)
	ANSI B 16.5	1"–6"	150 lbs	S	19.6 (284)	19 (275)	18.7 (271)	18.1 (262)	17,7 (256)	17 (246)	16.2 (235)	14.7 (213)
PTFE (Teflon)	DIN 2501	DN 10–50, DN 80	PN 40	S	40 (580)	40 (580)	40 (580)	40 (580)	40 (580)	40 (580)	40 (580)	on request
		DN 65, DN 100–150	PN 16	S	16 (230)	16 (230)	16 (230)	16 (230)	16 (230)	16 (230)	16 (230)	16 (230)
		DN 200–600	PN 10	S	10 (150)	10 (150)	10 (150)	10 (150)	10 (150)	10 (150)	10 (150)	10 (150)
		DN 65, DN 100–150	PN 40	O	40 (580)	40 (580)	40 (580)	40 (580)	40 (580)	40 (580)	40 (580)	on request
		DN 200–600	PN 16	O	16 (230)	16 (230)	16 (230)	16 (230)	16 (230)	16 (230)	16 (230)	16 (230)
	ANSI B 16.5	3/8"–24"	150 lbs	S	19.6 (284)	19.0 (275)	18.7 (271)	18.1 (262)	17.7 (256)	17.0 (246)	16.2 (235)	14.7 (213)
		3/8"–24"	300 lbs	O	40 (580)	40 (580)	40 (580)	40 (580)	40 (580)	40 (580)	40 (580)	on request

* Pipe flanges, DN 2.5–100 and 1/10"–4" are flangeless design!

Limits for neoprene, irethane, hard and soft rubber

Liner	Flange standard	Nominal diameter of measuring tube and flanges	Flange pressure rating or class	S= Standard O= Option	Max. operating pressure in bar (and psig) at max. possible product temperature of ...			
					Soft rubber ≤ 40°C (≤ 105°F)	Neoprene ≤ 60°C (≤ 140°F)	Irethane ≤ 70°C (≤ 158°F)	Hard rubber ≤ 90°C (≤ 195°F)
Neoprene, irethane, hard and soft rubber	DIN 2501	DN 25–50, DN 80	PN 40	S	40 (580)	40 (580)	40 (580)	40 (580)
		DN 65, DN 100–150	PN 16	S	16 (230)	16 (230)	16 (230)	16 (230)
		DN 200–600	PN 10	S	10 (150)	10 (150)	10 (150)	10 (150)
		DN 25–600	PN 16–1500	O	** 16-64 (150-920)	** 16-100 (150-1450)	** 16-1500 (150-20000)	** 16-80 (150–1160)
	ANSI B 16.5	1"–24"	150 lbs	S	*** ≤ 19.6 (≤ 284)	*** ≤ 19.0 (≤ 275)	*** ≤ 18.7 (≤ 271)	*** ≤ 18.1 (≤ 262)
		1"–24"	300 lbs	O	*** ≤ 50.8 (≤ 737)	*** ≤ 49.2 (≤ 714)	*** ≤ 48.4 (≤ 702)	*** ≤ 46.8 (≤ 679)
		1"–24"	600 lbs	O	≤ 64 (≤ 920)	≤ 100 (≤ 1450)	≤ 100 (≤ 1450)	≤ 80 (≤ 1160)
	API 6 BX	≥ 1"	20000 psig	O	-	-	≤ 1500 (≤ 20000)	-

** dependent on flange pressure rating
*** dependent on product temperature

Limits for polysulfone

Liner	Flange standard	Nominal diameter of measuring tube and flanges *	Flange pressure rating or class	S= Standard O= Option	Max. operating pressure in bar (and psig) at a product temperature of ...										
					≤ 20°C (≤ 68°F)	≤ 25°C (≤ 77°F)	≤ 30°C (≤ 86°F)	≤ 35°C (≤ 95°F)	≤ 40°C (≤ 105°F)	≤ 50°C (≤ 122°F)	≤ 55°C (≤ 131°F)	≤ 60°C (≤ 140°F)	≤ 65°C (≤ 149°F)	≤ 70°C (≤ 158°F)	≤ 75°C (≤ 167°F)
Poly-sulfone	DIN 2501	DN 15	PN 40	S (O ****)	40 (580)	40 (580)	40 (580)	40 (580)	25 (360)	25 (360)	16 (230)	16 (230)	10 (150)	6 (90)	2.5(37)
		DN 25	PN 40	S (O ****)	40 (580)	40 (580)	40 (580)	25 (360)	25 (360)	16 (230)	16 (230)	10 (150)	10 (150)	6 (90)	2.5(37)
		DN 40	PN 40	S (O ****)	25 (360)	25 (360)	16 (230)	16 (230)	16 (230)	10 (150)	10 (150)	6 (90)	6 (90)	2.5(37)	2.5(37)
		DN 50	PN 40	S (O ****)	25 (360)	16 (230)	16 (230)	16 (230)	16 (230)	10 (150)	6 (90)	6 (90)	2.5(37)	2.5(37)	2.5(37)
		DN 80	PN 40	S	16 (230)	10 (150)	10 (150)	10 (150)	10 (150)	6 (90)	6 (90)	2.5(37)	2.5(37)	2.5(37)	-
	ANSI B 16.5	1/2"	150 lbs	S	19.7(285)	19.7(285)	19.7(285)	19.7(285)	19.6(284)	19.3(280)	16 (230)	16 (230)	10 (150)	6 (90)	2.5(37)
		1"	150 lbs	S	19.7(285)	19.7(285)	19.7(285)	19.7(285)	19.6(284)	16 (230)	16 (230)	10 (150)	10 (150)	6 (90)	2.5(37)
		1 1/2"	150 lbs	S	19.7(285)	19.7(285)	16 (230)	16 (230)	16 (230)	10 (150)	10 (150)	6 (90)	6 (90)	2.5(37)	2.5(37)
		2"	150 lbs	S	19.7(285)	16 (230)	16 (230)	16 (230)	16 (230)	10 (150)	6 (90)	6 (90)	2.5(37)	2.5(37)	2.5(37)
		3"	150 lbs	S (O ****)	16 (230)	10 (150)	10 (150)	10 (150)	10 (150)	6 (90)	6 (90)	2.5(37)	2.5(37)	2.5(37)	-

* Pipeline flanges, because of flangeless design.
**** Same operating pressure if ANSI pipe flanges 1/2" to 3", class 300 lbs are used.

Vacuum load

Liner	Meter size		Max. operating pressure in mbar (and psia) at a product temperature of ...							
	DN mm	inches	≤ 40°C (≤ 105°F)	≤ 60°C (≤ 140°F)	≤ 70°C (≤ 158°F)	≤ 90°C (≤ 195°F)	≤ 100°C (≤ 210°F)	≤ 120°C (≤ 250°F)	≤ 140°C (≤ 285°F)	≤ 180°C (≤ 355°F)
Fused aluminium oxide	2.5 - 100	1/10 - 10	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
PFA	25 - 100	1 - 4	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	150 (2.2)	200 (2.9)
	125 - 150	5 - 6	50 (0.7)	50 (0.7)	50 (0.7)	50 (0.7)	100 (1.5)	200 (2.9)	300 (4.4)	400 (5.8)
PTFE (Teflon)	10 - 600	3/8 - 24	on request							
Neoprene	25 - 300	1 - 12	400 (5.6)	400 (5.6)	-	-	-	-	-	-
	350 - 600	14 - 24	600 (8.7)	600 (8.7)	-	-	-	-	-	-
Irethane	25 - 600	1 - 24	500 (7.3)	-	-	-	-	-	-	-
Hard rubber	25 - 300	1 - 12	250 (3.6)	400 (5.8)	400 (5.8)	400 (5.8)	-	-	-	-
	350 - 600	14 - 24	500 (7.3)	600 (8.7)	600 (8.7)	600 (8.7)	-	-	-	-
Soft rubber	25 - 300	1 - 12	500 (7.3)	-	-	-	-	-	-	-
	350 - 600	14 - 24	600 (8.7)	-	-	-	-	-	-	-
Polysulfone	15 - 80	1/2 - 3	0 (0)	0 (0)	0 (0)	-	-	-	-	-

10.6 Instrument nameplates

IFM 1080 K

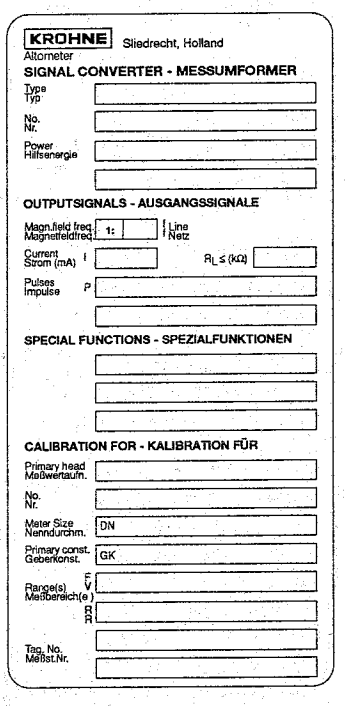
IFM 3080 K

IFM 4080 K

IFM 5080 K

K 480 S

IFC 080 F



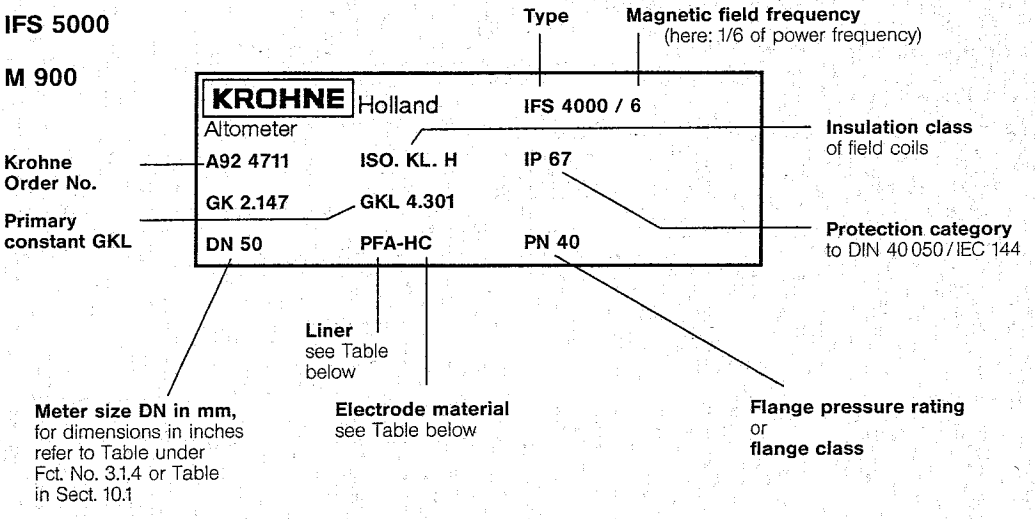
IFM 1080 K

K 480 S

IFS 4000

IFS 5000

M 900



Liner

AL	Fused aluminium oxide (99.7% Al_2O_3)
H	Hard rubber
NE	Neoprene
PFA	Teflon-PFA
PS	Polysulfone
PUI	Irethane
T	Teflon-PTFE
W	Soft rubber
ZR	Zirconium oxide

Electrode material

HB	Hastelloy B2
HC	Hastelloy C4
IN	Incoloy
M4	Monel 400
Ni	Nickel
PT	Platinum cap on stainless steel 1.4571 (SS 316 Ti)
TA	Tantalum
TI	Titanium
V4A	Stainless steel 1.4571 (SS 316 Ti)

10.7 Dimensions and weights

10.7.1 IFS 5000 and IFM 5080 K

Dimensions in mm and (inches)

Necessary flange spacing

DN 2.5 to 15, 1/10" to 1/2": Dimension a + 2 times gasket thickness
(gasket between grounding rings and pipe flanges)

DN 25 to 100, 1" to 4"
without grounding rings: Dimension a incl. gaskets between primary head and pipe flanges
with grounding rings (option): Dimension a + 10 mm or a + 0.4", incl. gaskets between grounding rings and pipe flanges

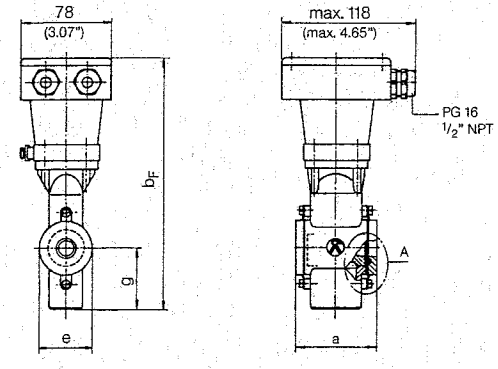
* **For compact flowmeters:** Weight as specified in Table plus approx. 2.2 kg or 4.9 lbs

** **Meter size DN 2.5 – 15 and 1/10" – 1/2":** Pipe flanges DN 15 / PN 40 or 1/2" / Class 150 lbs (300 lbs).

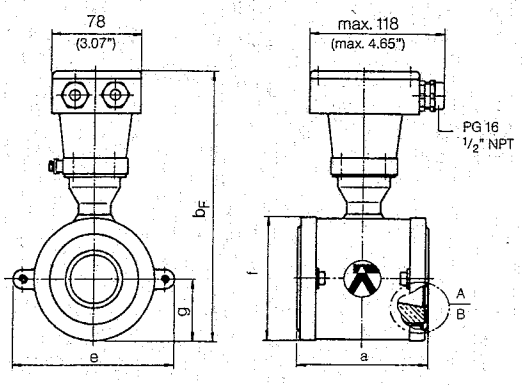
Meter size		**Dimensions** in mm (inches)									**approx.* weight**
DN mm	inches	a	b_F	b_K	c	d_1	d_2	e	f	g	in kg (lbs)
2.5 – 15 **	1/10 – 1/2 **	65 (2.56)	208 (8.19)	310 (12.20)	50 (1.97)	15 (0.58)	–	44 (1.73)	–	51 (1.99)	1.7 (3.7)
25	1	58 (2.28)	189 (7.44)	291 (11.46)	55 (2.17)	26 (1.02)	46 (1.81)	102 (4.02)	68 (2.68)	34 (1.34)	1.7 (3.7)
40	1 1/2	83 (3.27)	204 (8.03)	306 (12.05)	80 (3.15)	39 (1.54)	62 (2.44)	117 (4.61)	83 (3.27)	42 (1.63)	2.5 (5.5)
50	2	103 (4.06)	222 (8.74)	324 (12.76)	100 (3.94)	51 (2.01)	74 (2.91)	135 (5.31)	101 (3.98)	51 (1.99)	3.0 (6.6)
80	3	153 (6.02)	254 (10.00)	356 (14.02)	150 (5.91)	80 (3.15)	106 (4.17)	167 (6.57)	133 (5.24)	67 (2.62)	5.6 (12.3)
100	4	203 (7.99)	279 (10.98)	381 (15.00)	200 (7.87)	101 (3.98)	133 (5.24)	192 (7.56)	158 (6.22)	79 (3.11)	8.9 (19.6)

IFS 5000
Primary head

DN 2.5 to 15
1/10" to 1/2"

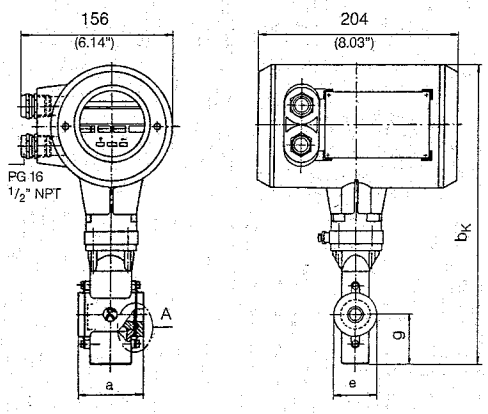


DN 25 to 100
1" to 4"

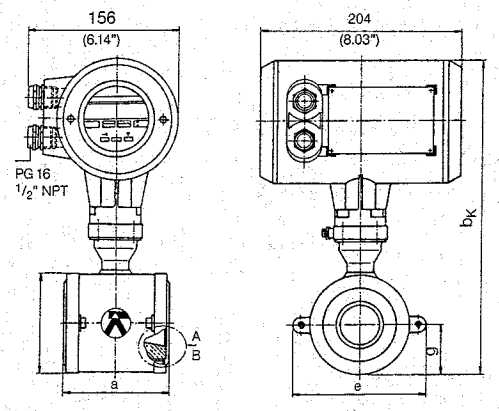


IFM 5080 K
Compact flowmeter

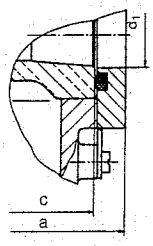
DN 2.5 to 15
1/10" to 1/2"



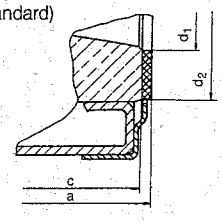
DN 25 to 100
1" to 4"



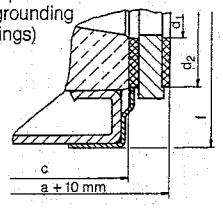
Detail A



Detail A
(standard)



Detail B
(option with grounding rings)



10.7.2 IFM 1080 K

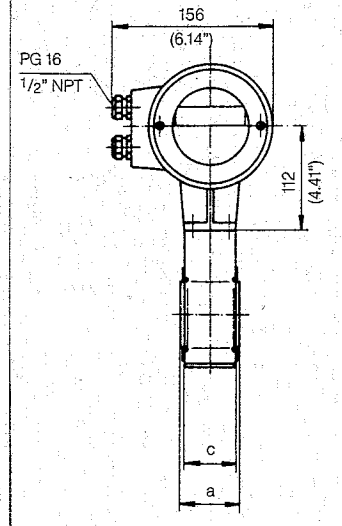
Dimensions in mm and (inches)

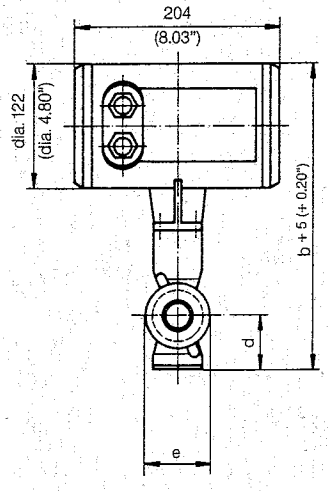
Necessary distance between pipe flanges (dimension a)
DN 15 – 80 and $^1/_2$" – 3": dimension a + 2 x thickness of gaskets between grounding ring and pipe flange

Dimension a incl. grounding rings and gaskets between primary head and grounding rings

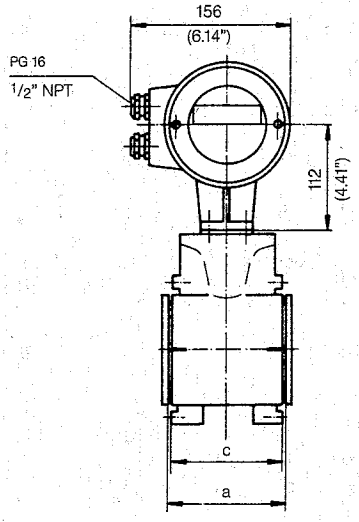
Meter size		**Dimensions** in mm (inches)					**Approx. weight**
DN mm	inches	a	b	c	d	e	in kg (lbs)
15	$^1/_2$	65 (2.56)	310 (12.20)	52 (2.05)	67 (2.64)	47 (1.85)	4.2 (9.3)
25	1	65 (2.56)	320 (12.60)	52 (2.05)	62 (2.44)	66 (2.60)	4.5 (9.9)
40	1 $^1/_2$	89 (3.50)	335 (13.19)	76 (2.99)	70 (2.76)	82 (3.23)	5.0 (11.0)
50	2	112 (4.41)	354 (13.94)	98 (3.86)	70 (2.76)	102 (4.02)	5.9 (13.0)
80	3	162 (6.38)	370 (14.57)	148 (5.83)	81 (3.19)	131 (5.16)	7.3 (16.1)

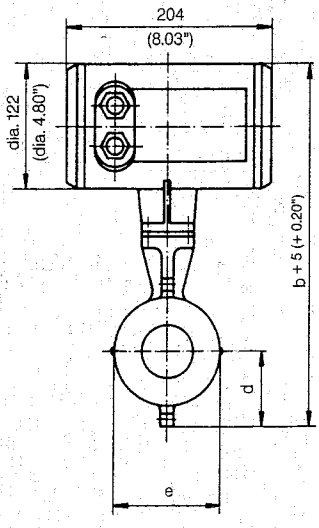
DN 15 – 40
$^1/_2$" – 1 $^1/_2$"





DN 50 and DN 80
2" and 3"





10.7.3 IFS 4000, IFM 4080 K and K 480 S

Flanged connections
... DIN 2501 (=BS 4504) / DN 10–300 / PN 40, 16 oder 10: see Table
... ANSI B 16.5 / 3/8"–12" / Class 150 lbs / RF: see Table

Dimensions in mm (inches)

Dimension a without flange gaskets: Not supplied with flowmeter, to be provided by customer.

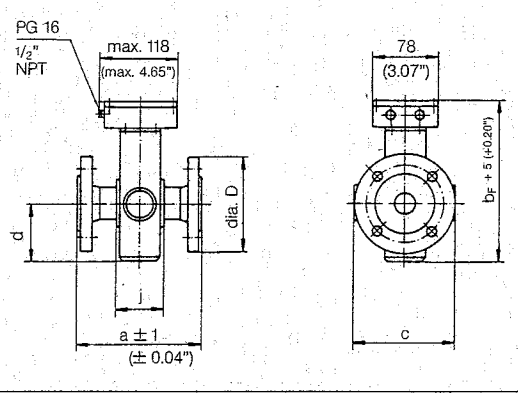
*** For compact flowmeters:** Weight as specified in Table plus approx. 2.2 kg or 4.9 lbs

**** Meter size 3/8":** Flanged connection 1/2"

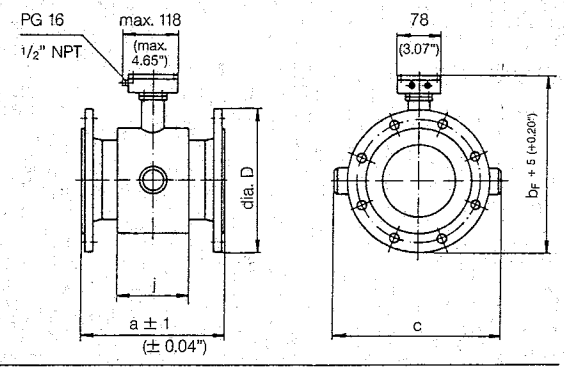
Meter size to ...			**Dimensions** in mm (inches)								**Approx. * weight**
DIN		**ANSI**									
DN mm	PN	Inches	a	b_F	b_K	c	d	j	dia. D_{DIN}	dia. D_{ANSI}	in kg (lbs)
10	40	3/8**	150 (5.91)	231 (9.09)	333 (13.11)	121 (4.76)	61 (2.40)	58 (2.28)	90 (3.54)	88.9 (3.50)	4 (8.8)
15	40	1/2	150 (5.91)	231 (9.09)	333 (13.11)	121 (4.76)	61 (2.40)	58 (2.28)	95 (3.74)	88.9 (3.50)	4 (8.8)
20	40	3/4	150 (5.91)	231 (9.09)	333 (13.11)	121 (4.76)	61 (2.40)	58 (2.28)	105 (4.13)	98.6 (3.89)	6 (13)
25	40	1	150 (5.91)	231 (9.09)	333 (13.11)	121 (4.76)	61 (2.40)	58 (2.28)	115 (4.53)	108.0 (4.25)	6 (13)
32	40	–	150 (5.91)	247 (9.72)	349 (13.74)	139 (5.47)	70 (2.76)	73 (2.87)	140 (5.51)	–	7 (15)
40	40	1 1/2	150 (5.91)	252 (9.92)	354 (13.94)	150 (5.91)	75 (2.95)	73 (2.87)	150 (5.91)	127.0 (5.00)	7 (15)
50	40	2	200 (7.87)	290 (11.42)	392 (15.43)	181 (7.13)	–	99 (3.90)	165 (6.50)	152.4 (6.00)	8 (18)
65	16	–	200 (7.87)	300 (11.81)	402 (15.83)	181 (7.13)	–	99 (3.90)	185 (7.28)	–	12 (27)
80	40	3	200 (7.87)	307 (12.09)	409 (16.10)	195 (7.68)	–	99 (3.90)	200 (7.87)	190.5 (7.50)	12 (27)
100	16	4	250 (9.84)	358 (14.09)	460 (18.11)	257 (10.12)	–	131 (5.16)	220 (8.66)	228.6 (9.00)	14 (31)
125	16	–	250 (9.84)	369 (14.53)	471 (18.54)	257 (10.12)	–	131 (5.16)	250 (9.84)	–	19 (42)
150	16	6	300 (11.81)	399 (15.71)	501 (19.72)	281 (11.06)	–	143 (5.63)	285 (11.22)	279.4 (11.00)	22 (49)
200	10	8	350 (13.78)	457 (17.99)	559 (22.01)	342 (13.46)	–	177 (6.97)	340 (13.39)	342.9 (13.50)	35 (77)
250	10	10	400 (15.75)	509 (20.04)	611 (24.06)	383 (15.08)	–	205 (8.07)	395 (15.55)	406.4 (16.00)	49 (108)
300	10	12	500 (19.69)	572 (22.52)	674 (26.54)	433 (17.05)	–	235 (9.25)	445 (17.52)	482.6 (19.00)	61 (134)

IFS 4000 Primary head

DN 10 – 40
3/8" – 1 1/2"

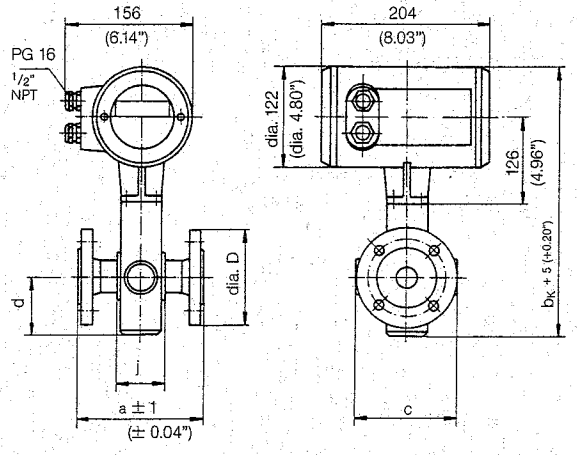


DN 50 – 300
2" – 12"

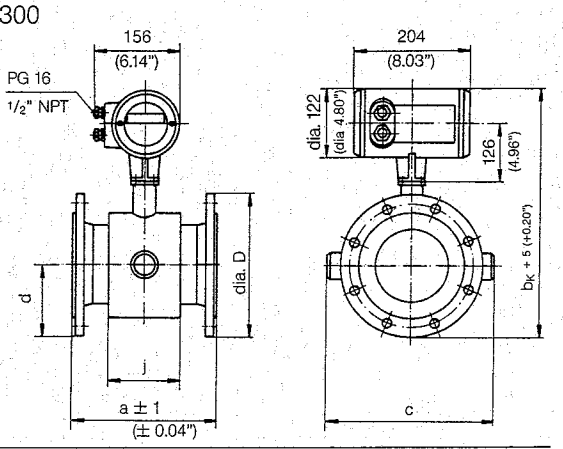


IFM 4080K and K 480 S Compact flowmeters

DN 10 – 40
3/8" – 1 1/2"



DN 50 – 300
2" – 12"



Flanged connections

.. DIN 2501 (=BS 4504) / DN 350–2000 / PN 10 or 6:	see Table
.. DIN 2501 (=BS 4504) / DN 350–2000 / PN 25:	see Table, dimension a_{DIN} + 200 mm or + 7.87"
.. ANSI B 16.5 / 14" – 40" / Class 150 lbs / RF:	see Table
.. ANSI B 16.5 / 14" – 40" / Class ≥ 300 lbs / RF:	Dimensions supplied on request
.. AWWA / ≥ 24" / Class B or D / FF:	Dimensions supplied on request

Dimensions in mm (inches)

Dimension a without flanged gaskets: Not supplied with flowmeter, to be provided by customer

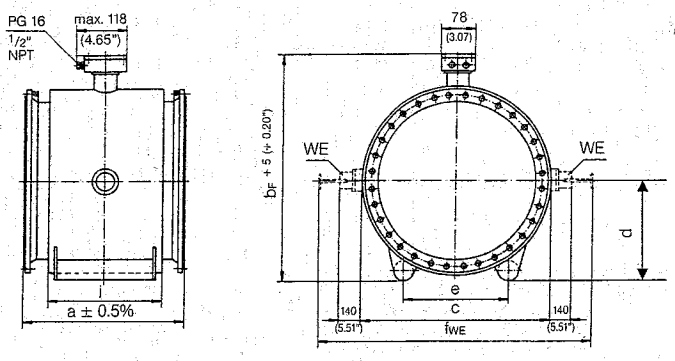
Irethane liner, thickness > 12 mm/> 10.5": Size of flange greater than size of measuring tube, see Tables below.

*** For compact flowmeters:** Weight as specified in Table plus approx. 2.2 kg or 4.9 lbs

Meter size to ...			**Dimensions** in mm (inches)								**Approx. * weight**
DIN		**ANSI**									
DN mm	PN	inches	a_{DIN}	a_{ANSI}	b_F	b_K	c	d	e	j	in kg (lbs)
350	10	14	500 (19.69)	700 (27.56)	753 (29.65)	853 (33.66)	570 (22.44)	329 (12.95)	332 (13.07)	305 (12.01)	145 (320) *
400	10	16	600 (23.62)	800 (31.50)	802 (31.57)	904 (35.59)	620 (24.41)	353 (13.90)	349 (13.74)	385 (15.16)	180 (400) *
500	10	20	600 (23.62)	800 (31.50)	903 (35.55)	1005 (39.57)	720 (28.35)	404 (15.91)	371 (14.61)	385 (15.16)	240 (530) *
600	10	24	600 (23.62)	800 (31.50)	1005 (39.57)	1107 (43.58)	822 (32.36)	455 (17.91)	493 (19.41)	385 (15.16)	330 (730) *

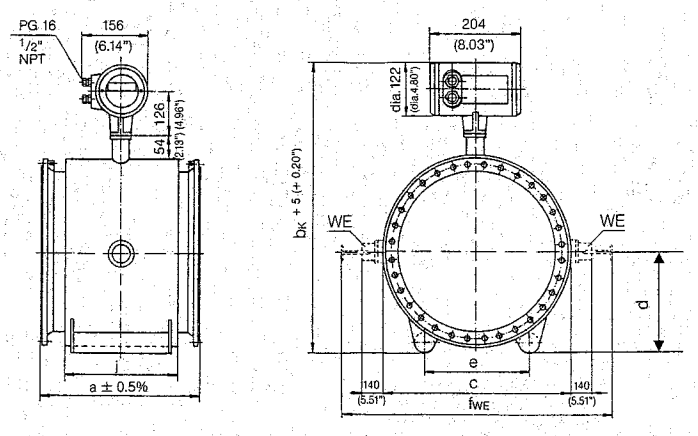
IFS 4000 Primary head

DN 350 – 2000
14" – 40"



IFM 4080K and K 480 S Compact flowmeters

DN 350 – 600
14" – 24"



Flange size for irethane liner, thickness > 12 mm/> 0.5"

Nominal size DN in mm (DIN 2501)

Measuring tube	Flanges
DN 350	DN 400
DN 400, 450	DN 500
DN 500, 550	DN 600
DN 600, 650	DN 700
DN 700, 750	DN 800
DN 800, 850	DN 900
DN 900, 950	DN 1000
DN 1000	DN 1200

Nominal size in inches (ANSI B 16.5)

Measuring tube	Flanges
14"	16"
16", 18"	20"
20", 22"	24"
24", 26"	28"
28", 30"	32"
32", 34"	36"
36", 38"	40"
40"	48"

WE = Field replaceable electrodes

f_{WE} = Dimension c + 900 mm or C + 35.50" (minimum dimension)

10.7.4 M 900 and IFM 3080 K

Flanged connections
... DIN 2501 (=BS 4504) / DN 10–300 / PN 40, 16 or 10: see Table
... ANSI B 16.5 / 3/8"–12" / Class 150 lbs / RF: see Table
... ANSI B 16.5 / 3/8"–12" / Class ≥ 300 lbs / RF: dimensions on request

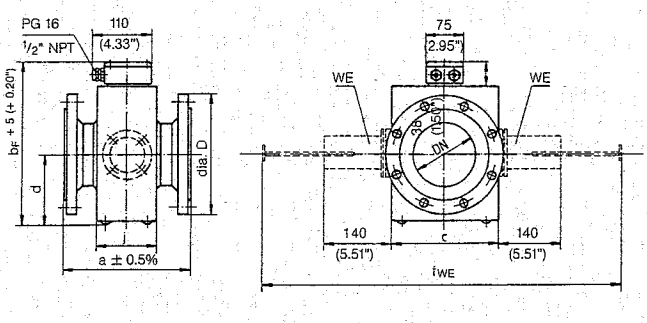
Dimensions in mm and (inches)

Dimension a without flange gaskets: Not supplied with flowmeter, to be provided by customer.
*** For compact flowmeters:** Weight as specified in Table plus approx. 2.2 kg or 4.9 lbs
**** Meter size 3/8":** Flanged connection 1/2"

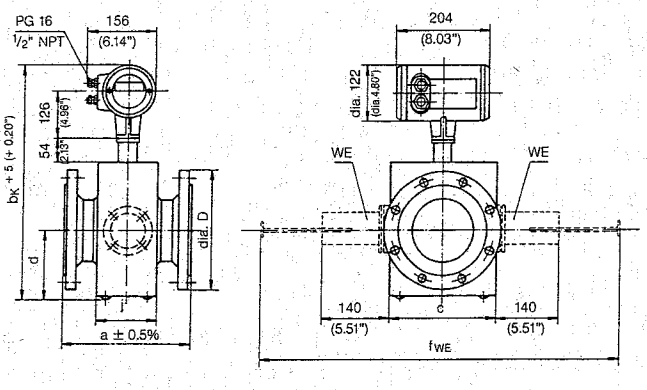
WE = Field replaceable electrodes, optional for meter sizes DN 50 – 300 and 2" – 12"
f_{WE} = Dimension c + 900 mm or c + 35,50" (minimum dimension)

Meter size to ...			**Dimensions** in mm (inches)								**Approx.* weight**
DIN		**ANSI**									
DN mm	PN	inches	a	b_F	b_K	c	d	j	dia. D_{DIN}	dia. D_{ANSI}	in kg (lbs)
10	40	3/8**	200 (7.87)	169 (6.65)	358 (14.09)	92 (3.62)	66 (2.60)	70 (2.76)	90 (3.54)	88.9 (3.50)	10 (22)
15	40	1/2	200 (7.87)	169 (6.65)	358 (14.09)	92 (3.62)	66 (2.60)	70 (2.76)	95 (3.74)	88.9 (3.50)	10 (22)
20	40	3/4	200 (7.87)	169 (6.65)	358 (14.09)	92 (3.62)	66 (2.60)	70 (2.76)	105 (4.13)	98.6 (3.89)	10 (22)
25	40	1	200 (7.87)	191 (7.52)	380 (14.96)	96 (3.78)	77 (3.03)	94 (3.70)	115 (4.53)	108.0 (4.25)	11 (24)
32	40	1 1/4	200 (7.87)	191 (7.52)	380 (14.96)	96 (3.78)	77 (3.03)	94 (3.70)	140 (5.51)	117.3 (4.62)	11 (24)
40	40	1 1/2	200 (7.87)	236 (9.29)	425 (16.73)	184 (7.24)	99 (3.90)	94 (3.70)	150 (5.91)	127.0 (5.00)	13 (29)
50	40	2	200 (7.87)	236 (9.29)	425 (16.73)	184 (7.24)	99 (3.90)	94 (3.70)	165 (6.50)	152.4 (6.00)	14 (31)
65	16	2 1/2	200 (7.87)	256 (10.08)	445 (17.25)	184 (7.24)	109 (4.29)	94 (3.70)	185 (7.28)	177.8 (7.00)	15 (33)
80	40	3	200 (7.87)	256 (10.08)	445 (17.25)	184 (7.24)	109 (4.29)	94 (3.70)	200 (7.87)	190.5 (7.50)	17 (37)
100	16	4	250 (9.84)	316 (12.44)	505 (19.88)	234 (9.21)	139 (5.47)	125 (4.92)	220 (8.66)	228.6 (9.00)	28 (62)
125	16	5	250 (9.84)	316 (12.44)	505 (19.88)	234 (9.21)	139 (5.47)	125 (4.92)	250 (9.84)	254.0 (10.00)	35 (77)
150	16	6	300 (11.81)	336 (13.23)	525 (20.67)	266 (10.47)	149 (5.87)	172 (6.77)	285 (11.22)	279.4 (11.00)	45 (99)
200	10	8	350 (13.78)	396 (15.59)	585 (23.03)	354 (13.94)	179 (7.05)	210 (8.27)	340 (13.39)	342.9 (13.50)	56 (123)
250	10	10	400 (15.75)	456 (17.95)	645 (25.39)	434 (17.09)	209 (8.23)	244 (9.61)	395 (15.55)	406.4 (16.00)	75 (165)
300	10	12	500 (19.69)	532 (20.94)	721 (28.39)	490 (19.29)	247(9.72)	280 (11.02)	445 (17.52)	482.6 (19.00)	110 (243)

M 900
Primary head
DN 10 – 300
3/8" – 12"



IFM 3080 K
Compact flowmeter
DN 10 – 300
3/8" – 12"



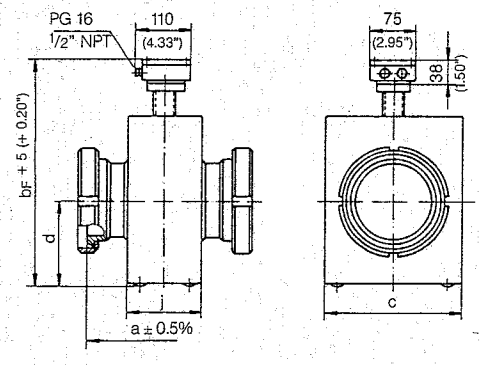
M 900 and IFM 3080 K with sanitary connection to DIN 11851

Dimensions in mm and (inches)

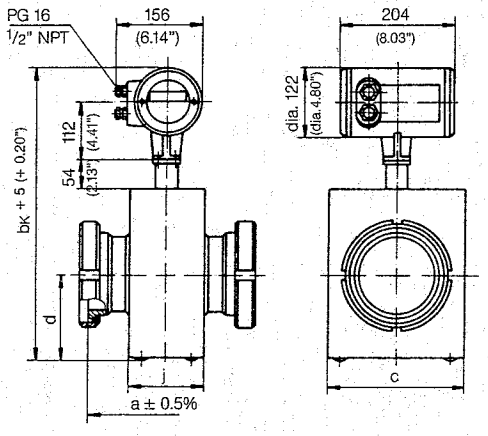
*** For compact flowmeters:** Dimension b + 127 mm or + 5.00"
**** For stainless steel housing:** Dimension c + 14 mm or + 0.55"

Meter size	**Dimensions** in mm (inches)				
DN mm	a	b*	c**	d	j
10 and 20	200 (7.87)	223 (8.78)	92 (3.62)	66 (2.60)	70 (2.76)
25 and 32	200 (7.87)	245 (9.65)	96 (3.78)	77 (3.03)	94 (3.70)
40 and 50	200 (7.87)	290 (11.42)	184 (7.24)	99 (3.90)	94 (3.70)
65 and 80	200 (7.87)	310 (12.20)	184 (7.24)	109 (4.29)	94 (3.70)
100 and 125	250 (9.84)	370 (14.57)	234 (9.21)	139 (5.47)	125 (4.92)

M 900 primary head
with sanitary connection to DIN 11851
DN 10 – 125 / PN 10



IFM 3080 K compact flowmeter
with sanitary connection to DIN 11851
DN 10 – 125 / PN 10



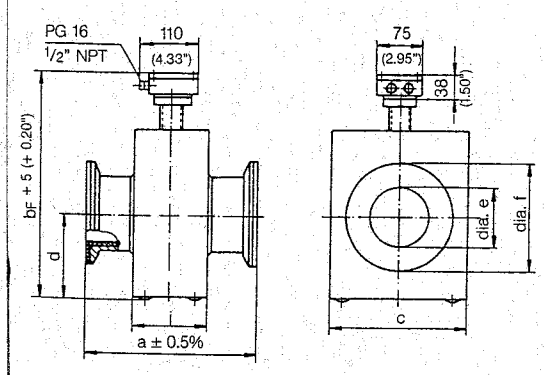
M 900 and IFM 3080 K with clamp connection

Dimensions in mm and (inches)

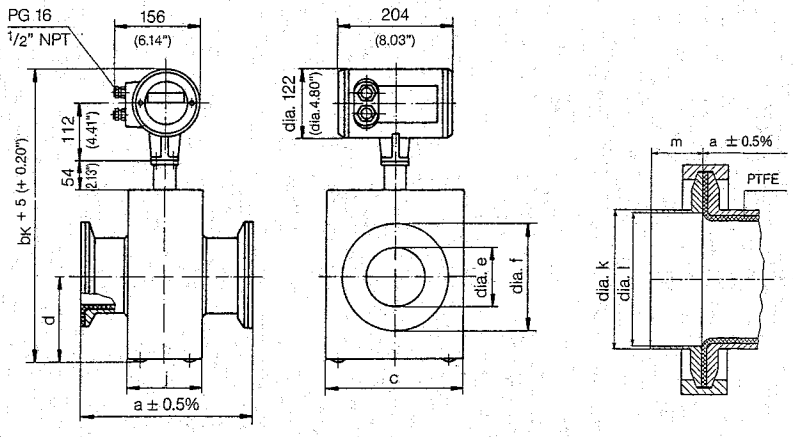
*** For compact flowmeters:** Dimension b + 127 mm or + 5.00"
**** For stainless steel housing:** Dimension c + 14 mm or + 0.55"

Meter size	**Dimension** in mm (inches)									
inches	a	b*	c**	d	dia. e	dia. f	j	dia. k	dia. l	m
1	200 (7.87)	245 (9.65)	96 (3.78)	77 (3.03)	18.5 (0.71)	49.6 (1.95)	94 (3.70)	25.5 (1.00)	22.1 (0.87)	25.4 (1.00)
1 1/2	200 (7.87)	245 (9.65)	96 (3.78)	77 (3.03)	28.5 (1.12)	49.6 (1.95)	94 (3.70)	38.2 (1.50)	34.8 (1.37)	25.4 (1.00)
2	200 (7.87)	290 (11.42)	184 (7.24)	99 (3.90)	44.5 (1.73)	76.6 (3.02)	94 (3.70)	51.0 (2.01)	47.5 (1.87)	25.0 (0.98)
3	200 (7.87)	310 (12.20)	184 (7.24)	109 (4.29)	64.5 (2.52)	117.7 (4.63)	94 (3.70)	76.3 (3.00)	72.9 (2.87)	25.4 (1.00)
4	250 (9.84)	370 (14.57)	234 (9.21)	139 (5.47)	93.8 (3.66)	117.7 (4.63)	125 (4.92)	108.9 (4.25)	97.6 (3.84)	24.3 (0.96)

M 900 primary head
with clamp connection
1" – 4"



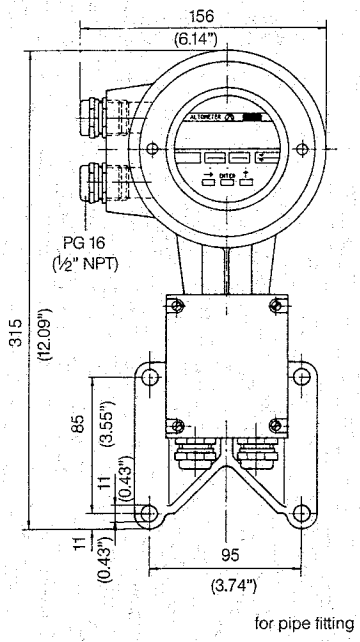
IFM 3080 K compact flowmeter
with clamp connection
1" – 4"

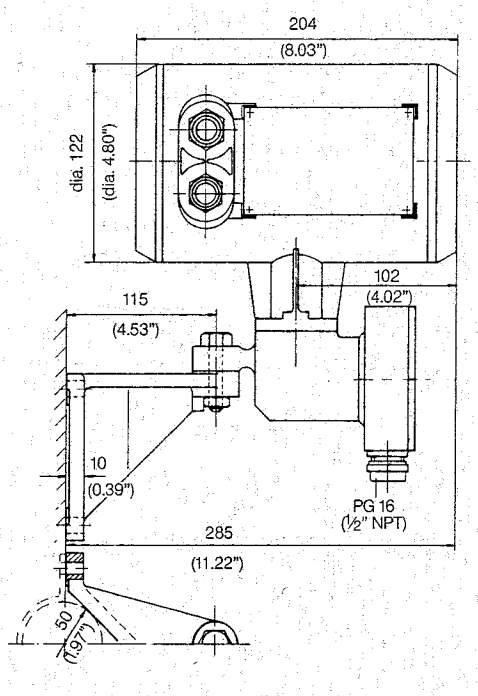


10.7.5 IFC 080 F signal converter with wall mounting and ZD connection box

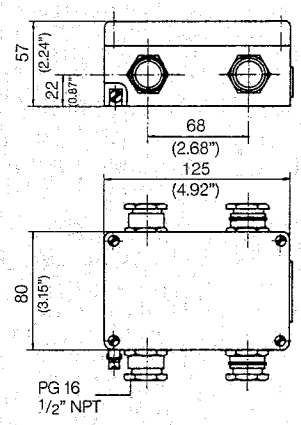
Dimensions and weights
dimensions in mm and (inches)

IFC 080 F Signal converter
Weight approx. 4.2 kg/9.3 lbs





ZD Intermediate connection box
Weight approx. 0.5 kg/1.1 lbs



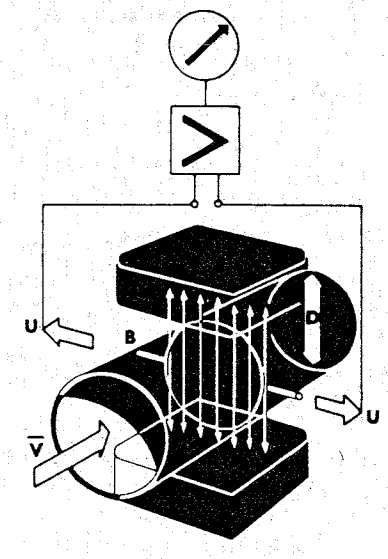
11. Measuring principle and function of the system

The flowmeter is designed for electrically conductive fluids.

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

$U = K \times B \times \bar{v} \times D$

where:
U = induced voltage
K = an instrument constant
B = magnetic field strength
$\bar{v}$ = mean velocity
D = pipe diameter



Thus the induced voltage is proportional to the mean flow velocity, when the field strength is constant.

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

This method of measurement offers the following advantages:

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

The magnetic field of the primary head is generated by a square wave current fed from signal converter to the field coils.

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

12. Block diagram and description of the signal converter

The SC 80 AS(F) consists of five functional groups.

Functional group 1 contains an input amplifier, and a high-resolution analog/digital converter (ADC) that is controlled and monitored by microprocessor μP 01.

Functional group 2 generates a pulsed, electronically controlled direct current for the primary head coils. This group is galvanically isolated from all other groups.

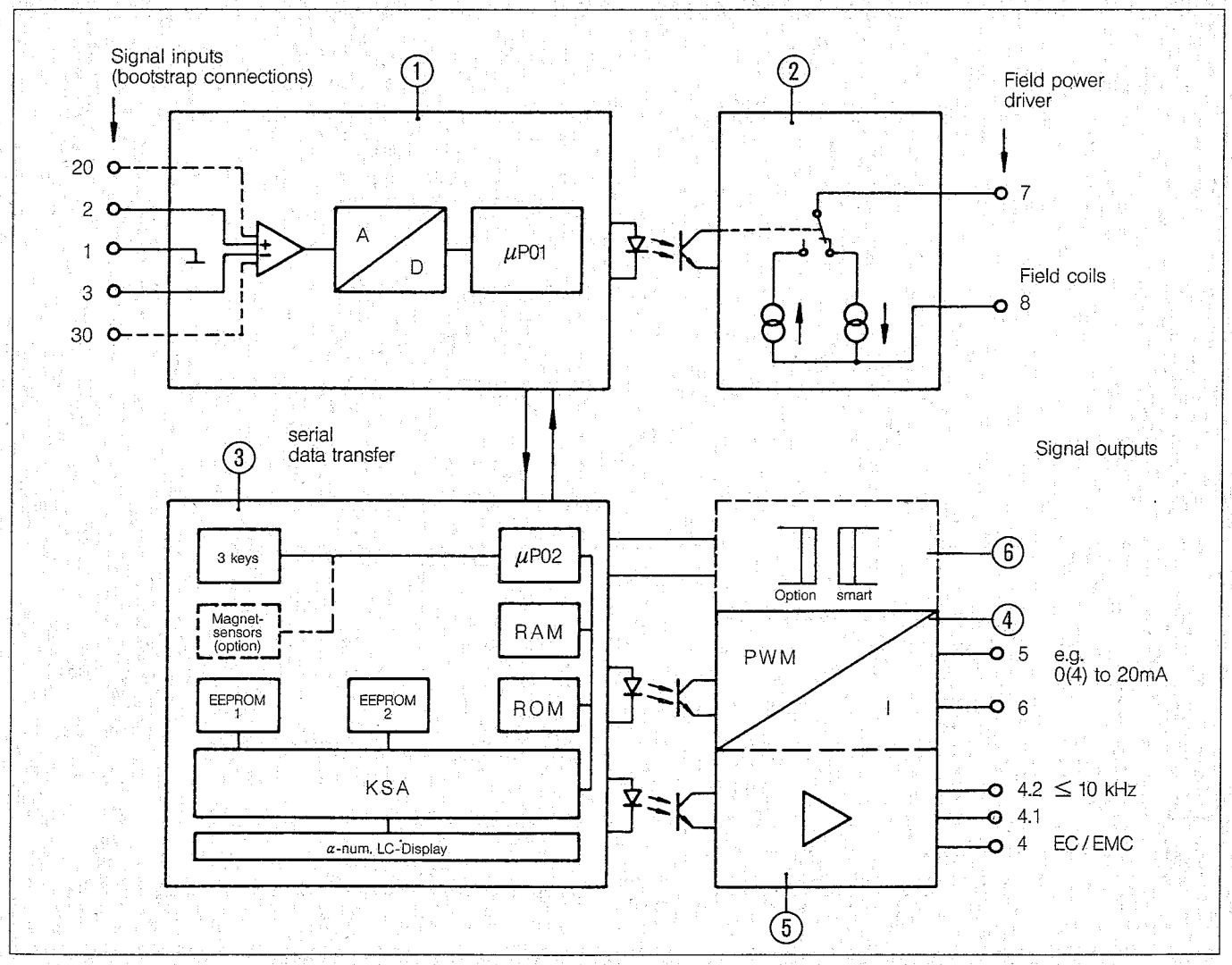
In **functional group 3** the digitalized data supplied by μP 01 are evaluated by microprocessor μP 02 in acordance with the functions, operating and primary head data set by way of the 3 keys. Microprocessor μP 02 controls with the aid of the Krohne-developed LSI circuit (KSA) the outputs that are galvanically isolated by optocouplers (functional groups 4 and 5). The last measured value and other information are forwarded via this circuit to the alphanumeric LCD for indication.

The KSA module is also used to feed last counts to the EEPROM. In the event of a power failure, last counts are saved in EEPROM 2. In the same way as operating and functional data are permanently stored in EEPROM 1, both are retained for 10 years without auxiliary power.

Functional group 4 converts an output signal into a proportional current. This group is galvanically isolated from the other groups but not from functional group 5.

Functional group 5 consists of power drivers to allow control of electronic (EC) and electromechanical (EMC) totalizers. This group is galvanically isolated from the other groups but not from functional group 4.

Functional group 6 (option) consists of an FBA modem which allows bidirectional data transmission between the signal converter and the MIC 500 hand-held communicator. This group is electrically isolated from functional group 4 (current output) and functional group 3 by a transformer.



Part E Index

If you need to return flowmeters for testing or repair to Krohne

Your ALTOFLUX electromagnetic flowmeter

- has been carefully manufactured and tested by a company with ISO 9001 certification
- and volumetrically calibrated in one of the world's most accurate test rigs.

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

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

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

If the flowmeter has been operated with toxic, caustic, flammable or water-endangering liquids, you are kindly requested

- to check and ensure, if necessary by rinsing or neutralizing, that all cavities in the flowmeter are free from such dangerous substances.
  (Directions on how you can find out whether the 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 cannot service your flowmeter unless accompanied by such a certificate.

SPECIMEN certificate

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

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

Tel. No.: .....

The enclosed electromagnetic flowmeter

ALTOFLUX, 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:

KROHNE

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