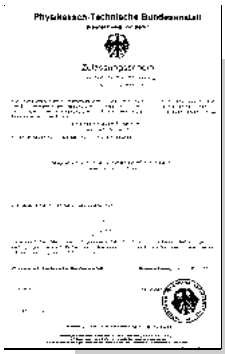
Technical
Information
TI 039D/06/en
No. 50091375

Electromagnetic Flow Measuring System *promag 31*

Cold Water Fiscal Metering



Install anywhere
- Economical flow measurement for monitoring drinking water and waste water
- IP 67 protection for compact and remote versions (optional IP 68 sensor)
- Wide size range DN 15...2000 ($^1/_2$...78")
- Flanged version with ISO meter lengths

Easy to operate
- All necessary parameters are setable using miniature switches
- Configuration can also be carried out without power
- 8-character local display for flowrate and totalizer values, optional

Operational security
- ISO 9001 manufacturer, quality assured
- PTB approval for cold water from 0...+30 °C
- Continuous operation possible at Q_{max}
- High operating integrity through self-monitoring
- Data protection with EEPROM on power failure
- Empty pipe detection
- Cenelec approval for Ex zone 1 and 2
- Electromagnetic compatibility (EMC) according to EN 50081/50082 and NAMUR

Measure precisely
- Measuring error: ±0.5% or ±0.2%
- 1000:1 operable flow range
- Excellent repeatability
- Creep suppression

Endress+Hauser

Nothing beats know-how

System Description

Fields of application
The Promag 31 measuring system possesses the PTB licence for the fiscal transfer of cold water (waste water) and at an attractive price offers accurate electromagnetic flow measurement of fresh water with a minimum conductivity of 5 µS/cm. The measuring system operates within a process temperature range of 0...30 °C and can be deployed for the following uses in the supply of drinking water:

- Internal monitoring of delivery pipe network
- Calculation of the bill from the main supply pipe
- Monitoring of the water source. For example, the amount of ground water
- Monitoring of the withdrawal and supply of different water works in a supply pipe.

Ex versions
Promag 31 is available in a number of Ex versions for use in Ex Zone 1 and 2. More information is given in the appropriate Ex documentation. Your E+H representative will be pleased to help you.

Modular design
Mechanically and electronically, the Promag 31 measuring system is constructed in a modular fashion. In this way, the meter can be optimally equipped and modified.

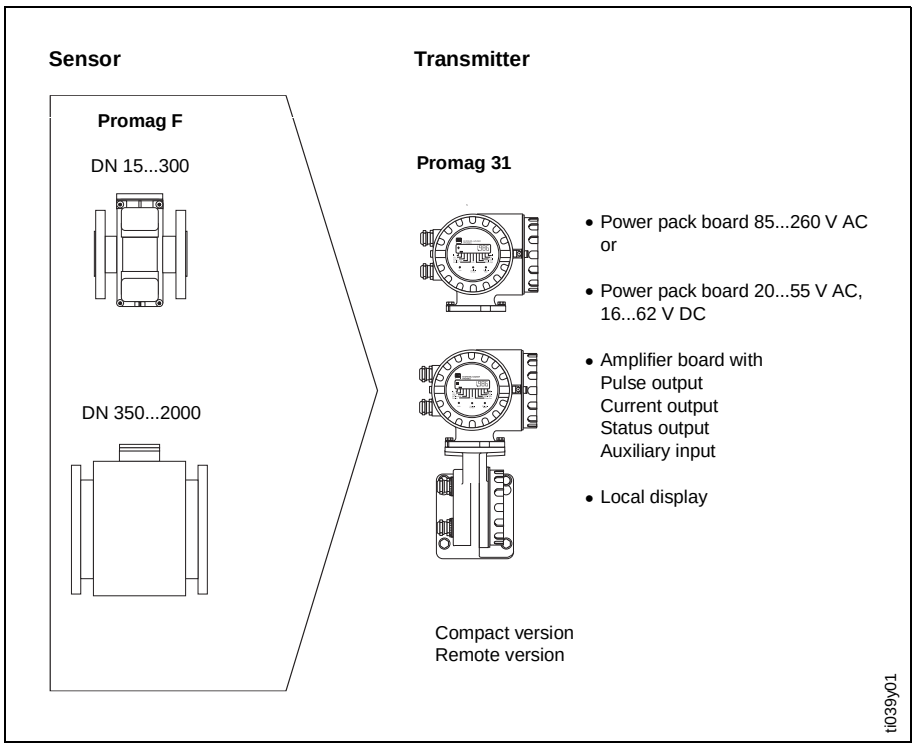
Fiscal-capability/Fiscal acceptance
In collaboration with the metrology office, Promag 31 instruments are sealed by E+H before delivery. With the remote version, the connection between sensor and transmitter is to be sealed on site.

Instruments suitable for fiscal metering, but which have not yet undergone inspection, may also be certified after the fact, although as a rule they must be removed from the pipeline.

Fiscal, electromagnetic flow meters may (in contrast to mechanical meters) be operated with $Q_{100\%} = Q_{max}$. Flowmeters with a maximum flow of >2000 m^3/h are exempt from fiscal standards. These systems may be suitable for fiscal metering but are not certifiable.

After the unit has been certified for fiscal metering it is sealed and can no longer be programmed. Therefore, pulse value and current output functions must be programmed before the approval. (Please indicate in the order, see page 11).

After calibration
The user of a fiscal Promag 31 measuring system is obliged to ensure that the prescribed standards have been adhered to.

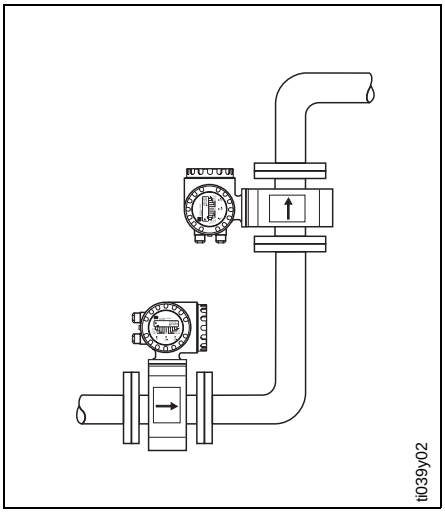


Promag 31 measuring system

(On request, Promag 31 measuring instruments are also available with customised parametrisation)

Installation

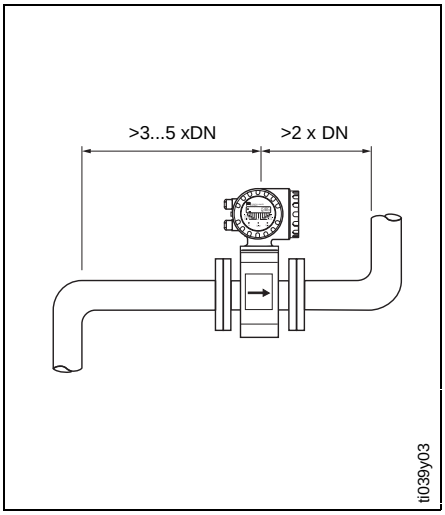
In order to measure correctly and to prevent damage, please observe the following installation instructions.



Orientation

Vertical
Optimum, with flow direction upward. At no flow, heavier entrained solids sink downward and lighter fatty contents rise away from the electrode area.

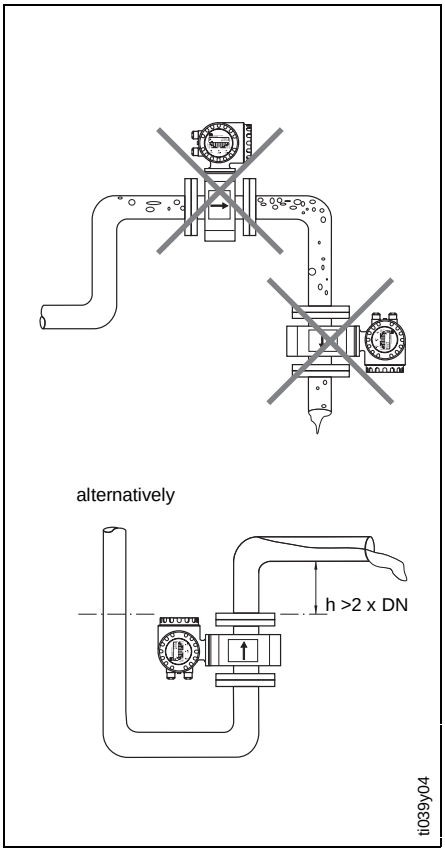
Horizontal
Electrode axis must be horizontal. This prevents short term insulation of the electrodes as a result of entrained air bubbles.



Inlet and outlet runs
The sensor should be mounted away from fittings which generate turbulence (e.g. valves, elbows,T-junctions).

Inlet lengths: >3...5 x DN
Outlet lengths: >2 x DN
DN = Pipe diameter

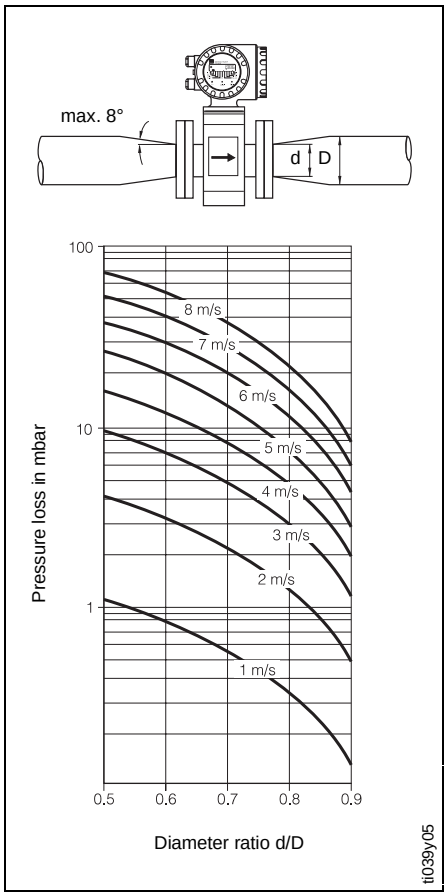
For fiscal use, the straight pipe requirements are 5 x DN upstream and 2 x DN downstream, measured from the meter flanges.



Mounting location
Correct measurement is only possible when the pipe is full. Consequently the following locations should be avoided:

- No installation at the highest point (air accumulation)
- No installation immediately before an open pipe outlet in a downward line. The alternate installation suggestion nevertheless makes such an application possible.

Installation



Adaptor pieces
The sensor can also be mounted in a pipe with a larger nominal diameter when suitable adaptors (reducers and expanders) to DIN 28545 are fitted. The resultant increase in the rate of flow increases the accuracy of measurement with slowly flowing fluids.

The adjacent nomogram can be used to determine the pressure loss caused.

Procedure:
1. Determine the ratio of the diameters d/D.
2. From the nomogram read off the pressure loss at the flow velocity and d/D ratio.

Note!
The nomogram applies to fluids with a viscosity similar to that of water.

Partly filled pipes
For inclines, a mounting similar to a drain should be adopted. Do not mount at the lowest point (risk of solids collecting). Added security is offered by Empty Pipe Detection (EPD). This option has an extra electrode in the measuring pipe.

Installation of pumps
If possible avoid mounting the sensor on the suction side of the pump (danger of vacuum!).

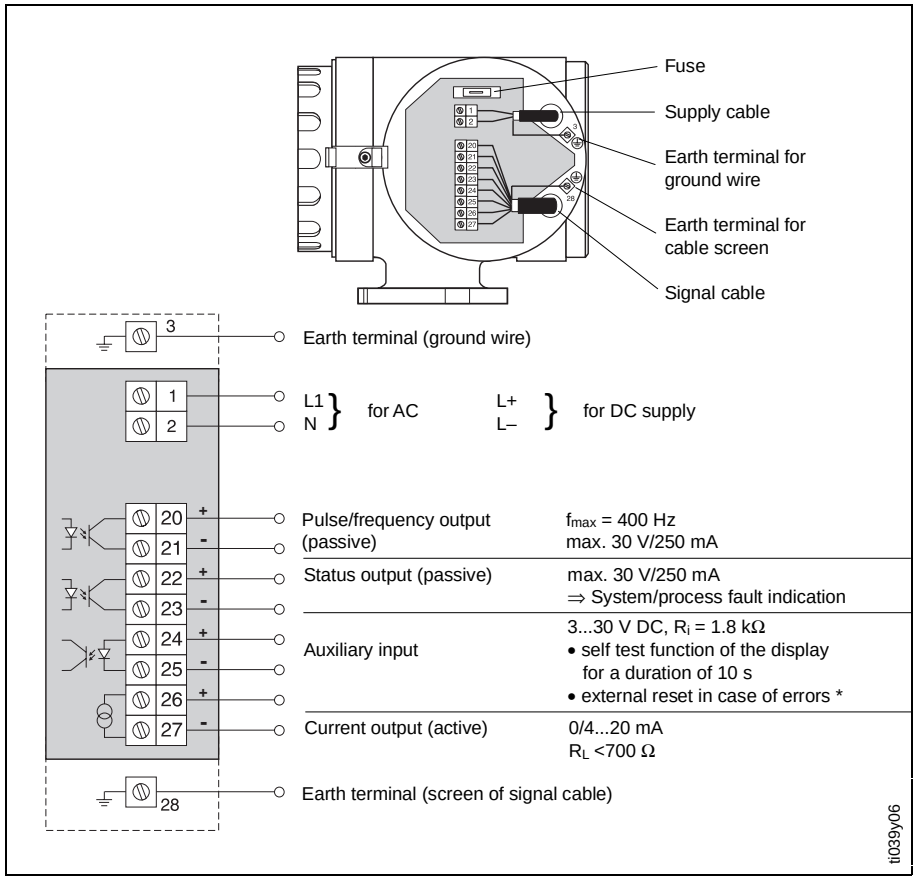
Vibration
- Fasten the piping before and after the sensor. Excessive vibration necessitates separate mounting of the sensor and transmitter
- With free runs of piping over 10 m long, we recommend mechanical supports.

Downward pipe
In a downward pipe >5 m a siphon and a vent valve should be installed after the sensor to avoid a partial vacuum.

Mounting the remote version
It is necessary when:
- Accessibility is difficult
- Space is restricted
- Extreme process and ambient temperatures prevail (s. page 14)
- Severe vibration (>2 g/2 h per day; 10...100 Hz)

Caution!
- The permissible length of cable L_{max} between the sensor and the transmitter at a distance of >10 m is governed by the conductivity of the liquid (s. page 13).
- Fix the cable run or lay it in conduit. When the conductivity of the liquid is low, cable movements can cause serious changes in capacitance and thereby falsify the measuring signal.
- Do not lay cable in the vicinity of electrical machines or switching elements.
- Pay attention to potential equalization between the transmitter and the sensor.

Electrical Connection

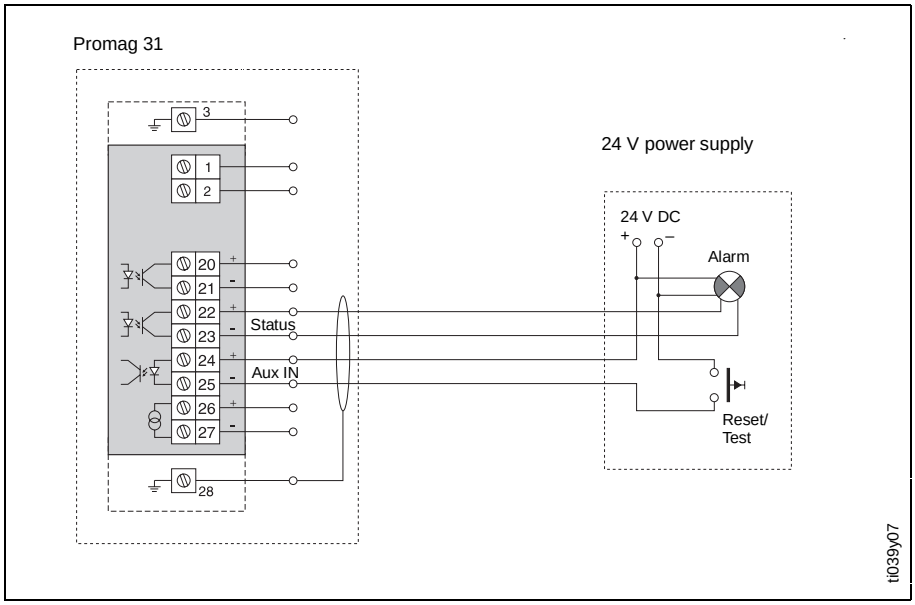


Electrical connection: power supply, inputs and outputs

* After the first operation or in case of an interruption of the power supply, the Promag 31 signals an alarm. With connection through an external reset switch according wiring variations 1 or 2, the alarm can be canceled.

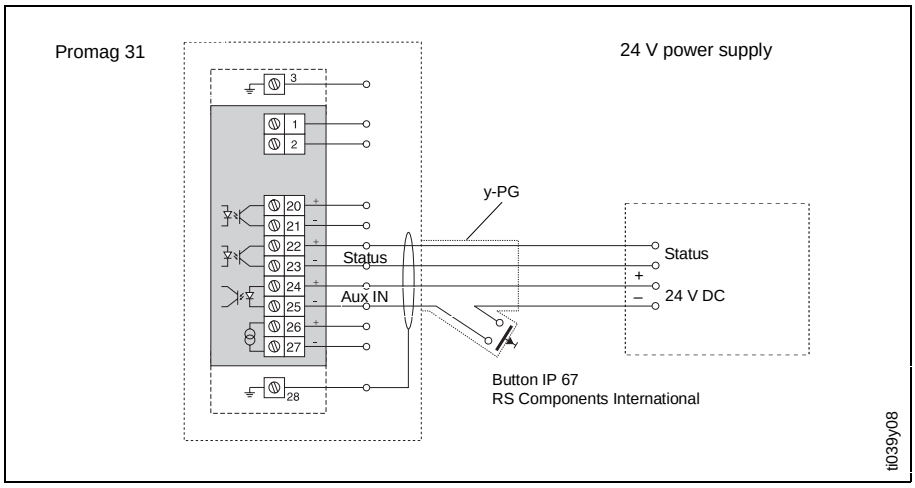
Wiring variant 1

Is chosen if the 24-V power supply is near to the Promag display. The alarm instrument is to be made available from the customer. The switch for the error reset or for the display test can be ordered through Endress+Hauser. If this wiring variant is not possible we refer to wiring variant 2.

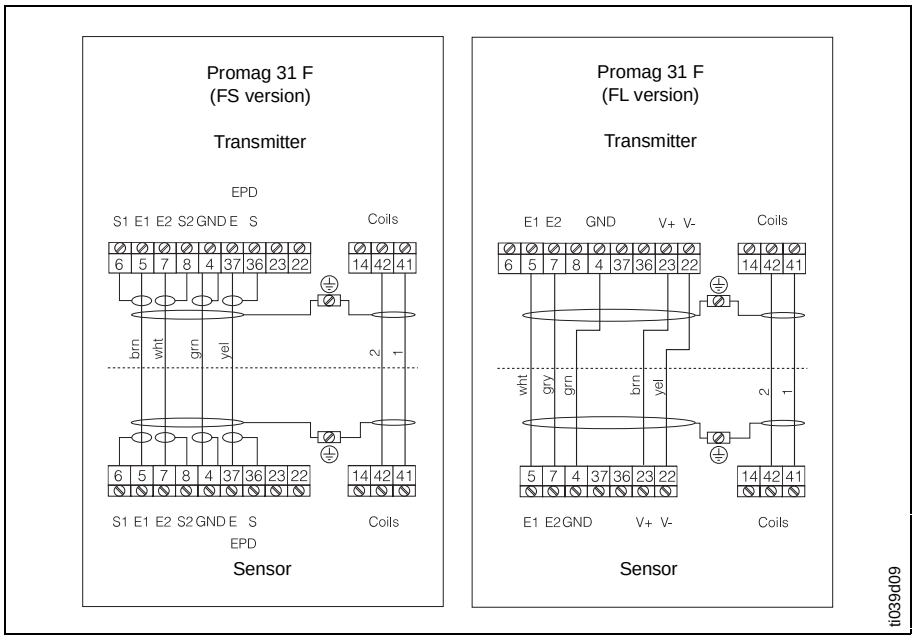


Electrical Connection

Wiring variant 2
Is to be chosen, if the 24-V power supply is not in the vicinity of the Promag display. The Y cable gland which is used for the supply can be ordered through Endress+Hauser.



Remote-mounted version (FS/FL):
Connection between sensor and transmitter



Cable Specifications

Remote version (FS)

Coil cable: 2 x 0.5 mm^2 PVC cable with common screen
Conductor resistance: ≤37 Ω/km
Capacitance: core/core, screen earthed ≤120 pF/m
Permanent operating temperature: –20...+70 °C

Signal cable: 4 x 0.38 mm^2 PVC cable with common screen and separately screened cores.
Conductor resistance: ≤50 Ω/km
Capacitance: core/screen ≤420 pF/m
Permanent operating temperature: –20...+70 °C

Remote version (FL)

Coil cable: 2 x 0.5 mm^2 PVC cable with common screen
Conductor resistance: ≤37 Ω/km
Capacitance: core/core, screen earthed ≤120 pF/m
Permanent operating temperature: –20...+70 °C

Signal cable: 5 x 0.5 mm^2 PVC cable with common screen
Conductor resistance: ≤37 Ω/km
Capacitance: core/core, screen earthed ≤120 pF/m
Permanent operating temperature: –20...+70 °C

Operation

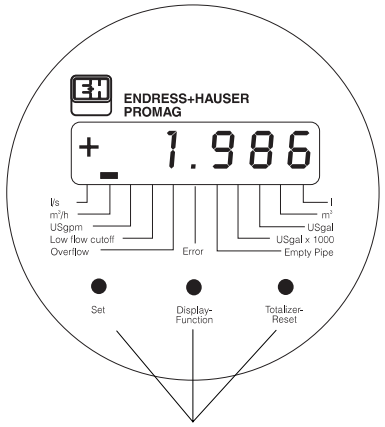
Local display

Using the Promag 31 local display, important parameters can be read off and controlled at the measuring point directly:

- Flowrate and/or totalizer value
- Technical units (SI/US units)
- Process variables (e.g. creep rate, partial pipe filling)
- Error messages

Using the three operating keys, it is also possible to select and activate various functions. A small pin is used to press the keys down.

Caution!
After the unit has been certified for fiscal metering it is sealed and can no longer be programmed.



3 pushbuttons (left to right)
- Enter data/Activate functions
- Select functions
- Reset totalizer

ti039y10

Setting functions

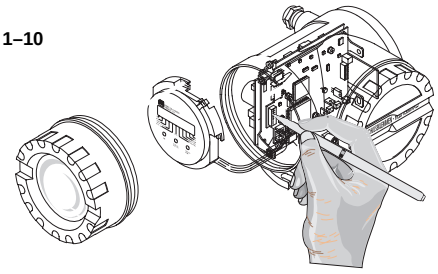
The transmitter houses miniature switches which allow the following six parameters to be set:

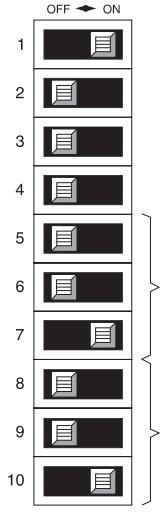
- 0...20 mA or 4...20 mA current range
- Current end value scaling (volume/time), 8 levels
- Pulse weighting in decade steps (volume/pulse), 8 levels
- Technical units
- Setting of status output (signalling system/process errors or flow direction recognition)
- Creep suppression (on/off)

The switches are accessible from the front by unscrewing the electronics cover or by removing the local display.

On request, Promag 31 measuring instruments are also available with customised configuration. This is especially important if the outputs of fiscal meters are used.

Miniature switches 1–10





ON Creep suppression ⇒ ON
OFF Creep suppression ⇒ OFF 1)
ON Status output ⇒ Flow direction 1)
OFF Status output ⇒ System/process fault indication
ON US technical units [gal] 1)
OFF SI technical units [m^3, dm^3]
ON 0...20 mA current range
OFF 4...20 mA current range

1) For *fiscal* measurement these functions are *not* available

Setting pulse weighting:
For switch settings → see Table A on page 8

Scaling the end value (flow at 20 mA):
For switch settings → see Table B on page 8

Factory settings

ti039y11

Table A

Pulse value [dm^3/pulse, m^3/pulse]

Switch

ti039y12

(f_{max} = 400 Hz at v = 10 m/s)

ON / OFF	5 6 7	5 6 7	5 6 7	5 6 7	5 6 7	5 6 7	5 6 7	5 6 7
DN								
15	0.01 dm^3	0.1 dm^3	1 dm^3	10 dm^3	100 dm^3	1 m^3	10 m3	0.004418 dm^3
25	0.1 dm^3	1 dm^3	10 dm^3	100 dm^3	1 m^3	10 m^3	100 m^3	0.012272 dm^3
32	0.1 dm^3	1 dm^3	10 dm^3	100 dm^3	1 m^3	10 m^3	100 m^3	0.020106 dm^3
40	0.1 dm^3	1 dm^3	10 dm^3	100 dm^3	1 m^3	10 m^3	100 m^3	0.031416 dm^3
50	0.1 dm^3	1 dm^3	10 dm^3	100 dm^3	1 m^3	10 m^3	100 m^3	0.049087 dm^3
65	0.1 dm^3	1 dm^3	10 dm^3	100 dm^3	1 m^3	10 m^3	100 m^3	0.082958 dm^3
80	1 dm^3	10 dm^3	100 dm^3	1 m^3	10 m^3	100 m^3	1000 m^3	0.125664 dm^3
100	1 dm^3	10 dm^3	100 dm^3	1 m^3	10 m^3	100 m^3	1000 m^3	0.196350 dm^3
125	1 dm^3	10 dm^3	100 dm^3	1 m^3	10 m^3	100 m^3	1000 m^3	0.306796 dm^3
150	1 dm^3	10 dm^3	100 dm^3	1 m^3	10 m^3	100 m^3	1000 m^3	0.441786 dm^3
200	1 dm^3	10 dm^3	100 dm^3	1 m^3	10 m^3	100 m^3	1000 m^3	0.785398 dm^3
250	10 dm^3	100 dm^3	1 dm^3	10 m^3	100 m^3	1000 m^3	10000 m^3	1.22718 dm^3
300	10 dm^3	100 dm^3	1 dm^3	10 m^3	100 m^3	1000 m^3	10000 m^3	1.76715 dm^3
350	10 dm^3	100 dm^3	1 dm^3	10 m^3	100 m^3	1000 m^3	10000 m^3	2.40582 dm^3
400	10 dm^3	100 dm^3	1 dm^3	10 m^3	100 m^3	1000 m^3	10000 m^3	3.14159 dm^3
450	10 dm^3	100 dm^3	1 dm^3	10 m^3	100 m^3	1000 m^3	10000 m^3	3.97608 dm^3
500	10 dm^3	100 dm^3	1 dm^3	10 m^3	100 m^3	1000 m^3	10000 m^3	4.90874 dm^3
600	10 dm^3	100 dm^3	1 dm^3	10 m^3	100 m^3	1000 m^3	10000 m^3	7.06858 dm^3
700	100 dm^3	1 dm^3	10 dm^3	100 m^3	1000 m^3	10000 m^3	100000 m^3	9.62113 dm^3
800	100 dm^3	1 dm^3	10 dm^3	100 m^3	1000 m^3	10000 m^3	100000 m^3	12.5664 dm^3
900	100 dm^3	1 dm^3	10 dm^3	100 m^3	1000 m^3	10000 m^3	100000 m^3	15.9043 dm^3
1000	100 dm^3	1 dm^3	10 dm^3	100 m^3	1000 m^3	10000 m^3	100000 m^3	19.6350 dm^3
1200	100 dm^3	1 dm^3	10 dm^3	100 m^3	1000 m^3	10000 m^3	100000 m^3	28.2743 dm^3
1400	100 dm^3	1 dm^3	10 dm^3	100 m^3	1000 m^3	10000 m^3	100000 m^3	38.4845 dm^3
1600	100 dm^3	1 dm^3	10 dm^3	100 m^3	1000 m^3	10000 m^3	100000 m^3	50.2655 dm^3
1800	100 dm^3	1 dm^3	10 dm^3	100 m^3	1000 m^3	10000 m^3	100000 m^3	63.6173 dm^3
2000	100 dm^3	1 dm^3	10 dm^3	100 m^3	1000 m^3	10000 m^3	100000 m^3	78.5398 dm^3

Caution!
Work with this table only when switch No. 3 is turned to “OFF” (SI units).

Factory settings → shaded

Table B

Pulse value [m^3/h]

Switch

ti039y13

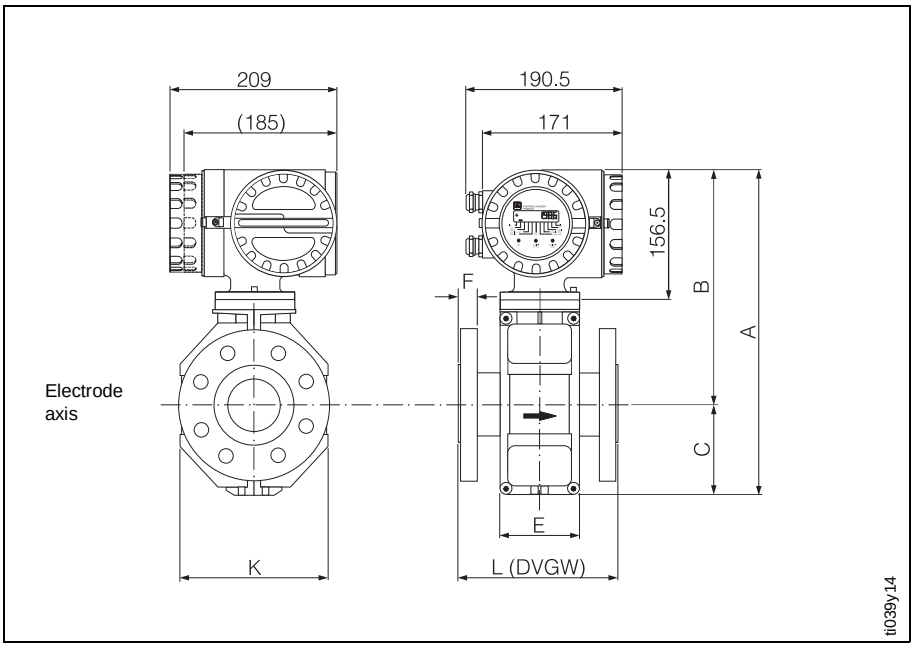
ON / OFF	8 9 10	8 9 10	8 9 10	8 9 10	8 9 10	8 9 10	8 9 10	8 9 10
DN	**0.5 m/s**	**1 m/s**	**1.5 m/s**	**2 m/s**	**2.5 m/s**	**4 m/s**	**8 m/s**	**10 m/s**
15	0.3 m^3/h	0.6 m^3/h	0.9 m^3/h	1.2 m^3/h	1.5 m^3/h	3 m^3/h	4.8 m^3/h	6 m^3/h
25	1 m^3/h	2 m^3/h	3 m^3/h	4 m^3/h	5 m^3/h	10 m^3/h	16 m^3/h	20 m^3/h
32	1.5 m^3/h	3 m^3/h	4.5 m^3/h	6 m^3/h	7.5 m^3/h	15 m^3/h	24 m^3/h	30 m^3/h
40	2 m^3/h	4 m^3/h	6 m^3/h	8 m^3/h	10 m^3/h	20 m^3/h	32 m^3/h	40 m^3/h
50	4 m^3/h	8 m^3/h	12 m^3/h	16 m^3/h	20 m^3/h	40 m^3/h	64 m^3/h	80 m^3/h
65	6 m^3/h	12 m^3/h	18 m^3/h	24 m^3/h	30 m^3/h	60 m^3/h	96 m^3/h	120 m^3/h
80	10 m^3/h	20 m^3/h	30 m^3/h	40 m^3/h	50 m^3/h	100 m^3/h	160 m^3/h	200 m^3/h
100	15 m^3/h	30 m^3/h	45 m^3/h	60 m^3/h	75 m^3/h	150 m^3/h	240 m^3/h	300 m^3/h
125	20 m^3/h	40 m^3/h	60 m^3/h	80 m^3/h	100 m^3/h	200 m^3/h	320 m^3/h	400 m^3/h
150	30 m^3/h	60 m^3/h	90 m^3/h	120 m^3/h	150 m^3/h	300 m^3/h	480 m^3/h	600 m^3/h
200	50 m^3/h	100 m^3/h	150 m^3/h	200 m^3/h	250 m^3/h	500 m^3/h	800 m^3/h	1000 m^3/h
250	100 m^3/h	200 m^3/h	300 m^3/h	400 m^3/h	500 m^3/h	1000 m^3/h	1600 m^3/h	2000 m^3/h
300	150 m^3/h	300 m^3/h	450 m^3/h	600 m^3/h	750 m^3/h	1500 m^3/h	2400 m^3/h	3000 m^3/h
350	200 m^3/h	400 m^3/h	600 m^3/h	800 m^3/h	1000 m^3/h	2000 m^3/h	3200 m^3/h	4000 m^3/h
400	200 m^3/h	400 m^3/h	600 m^3/h	800 m^3/h	1000 m^3/h	2000 m^3/h	3200 m^3/h	4000 m^3/h
450	300 m^3/h	600 m^3/h	900 m^3/h	1200 m^3/h	1500 m^3/h	3000 m^3/h	4800 m^3/h	6000 m^3/h
500	400 m^3/h	800 m^3/h	1200 m^3/h	1600 m^3/h	2000 m^3/h	4000 m^3/h	6400 m^3/h	8000 m^3/h
600	600 m^3/h	1200 m^3/h	1800 m^3/h	2400 m^3/h	3000 m^3/h	6000 m^3/h	9600 m^3/h	12000 m^3/h
700	800 m^3/h	1600 m^3/h	2400 m^3/h	3200 m^3/h	4000 m^3/h	8000 m^3/h	12800 m^3/h	16000 m^3/h
800	1000 m^3/h	2000 m^3/h	3000 m^3/h	4000 m^3/h	5000 m^3/h	10000 m^3/h	16000 m^3/h	20000 m^3/h
900	1000 m^3/h	2000 m^3/h	3000 m^3/h	4000 m^3/h	5000 m^3/h	10000 m^3/h	16000 m^3/h	20000 m^3/h
1000	1500 m^3/h	3000 m^3/h	4500 m^3/h	6000 m^3/h	7500 m^3/h	15000 m^3/h	24000 m^3/h	30000 m^3/h
1200	2000 m^3/h	4000 m^3/h	6000 m^3/h	8000 m^3/h	10000 m^3/h	20000 m^3/h	32000 m^3/h	40000 m^3/h
1400	3000 m^3/h	6000 m^3/h	9000 m^3/h	12000 m^3/h	15000 m^3/h	30000 m^3/h	48000 m^3/h	60000 m^3/h
1600	4000 m^3/h	8000 m^3/h	12000 m^3/h	16000 m^3/h	20000 m^3/h	40000 m^3/h	64000 m^3/h	80000 m^3/h
1800	5000 m^3/h	10000 m^3/h	15000 m^3/h	20000 m^3/h	25000 m^3/h	50000 m^3/h	80000 m^3/h	100000 m^3/h
2000	5000 m^3/h	10000 m^3/h	15000 m^3/h	20000 m^3/h	25000 m^3/h	50000 m^3/h	80000 m^3/h	100000 m^3/h

Caution!
Work with this table only when switch No. 3 is turned to “OFF” (SI units).

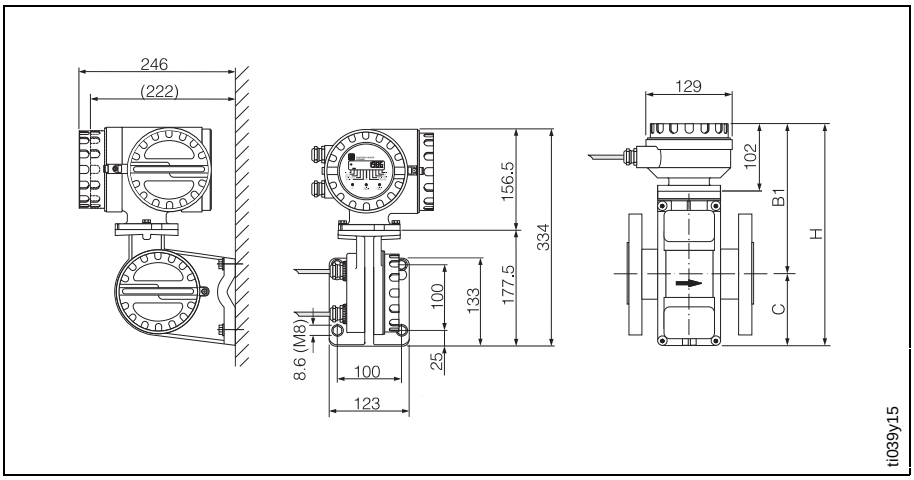
Factory settings → shaded

Dimensions

Promag 31 F
DN 15...300



Compact version



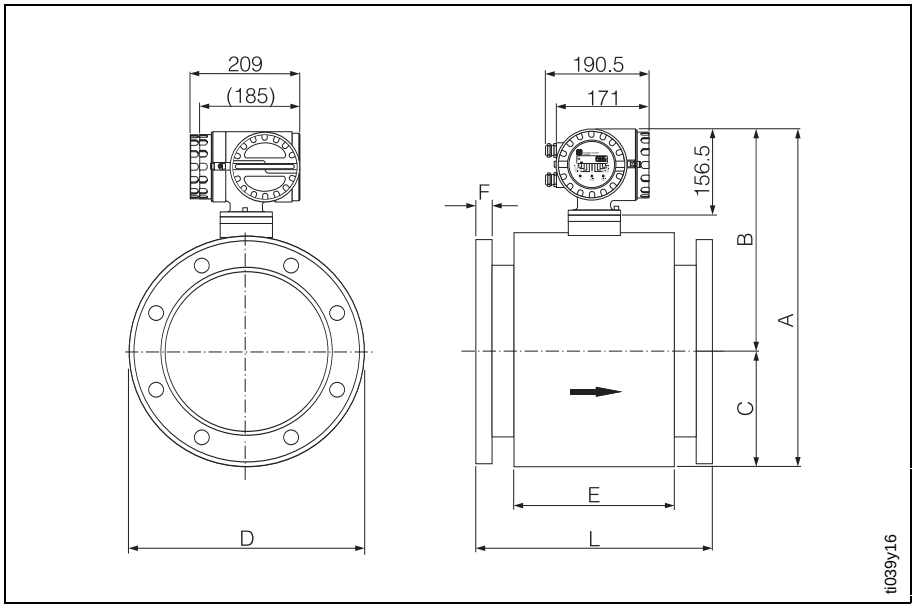
Remote version
(FS and FL version)

DN [mm]	DN [inch]	PN DIN [bar]	L[1] [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F DIN [mm]	H [mm]	B1 [mm]	Weight[2] [kg]
15	½"	40	200	340.5	256.5	84	120	94	14	286	202	6.5
25	1"	40	200	340.5	256.5	84	120	94	16	286	202	7.3
32	–	40	200	340.5	256.5	84	120	94	18	286	202	8.0
40	1½"	40	200	340.5	256.5	84	120	94	18	286	202	9.4
50	2"	40	200	340.5	256.5	84	120	94	20	286	202	10.6
65	–	16	200	390.5	281.5	109	180	94	18	336	227	12.0
80	3"	16	200	390.5	281.5	109	180	94	20	336	227	14.0
100	4"	16	250	390.5	281.5	109	180	94	22	336	227	16.0
125	–	16	250	471.5	321.5	150	260	140	24	417	267	21.5
150	6"	16	300	471.5	321.5	150	260	140	24	417	267	25.5
200	8"	10	350	526.5	346.5	180	324	156	26	472	292	35.3
250	10"	10	450	576.5	371.5	205	400	166	28	522	317	48.5
300	12"	10	500	626.5	396.5	230	460	166	28	572	342	57.5

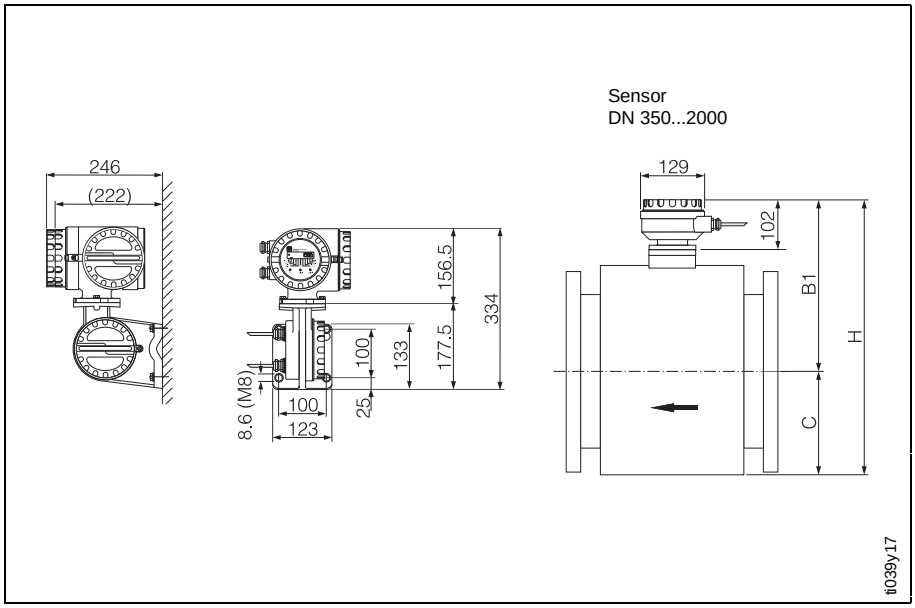
[1] The face-to-face length is independent of the pressure rating.
[2] Weights of compact version.

Dimensions

Promag 31 F
DN 350...2000



Compact version



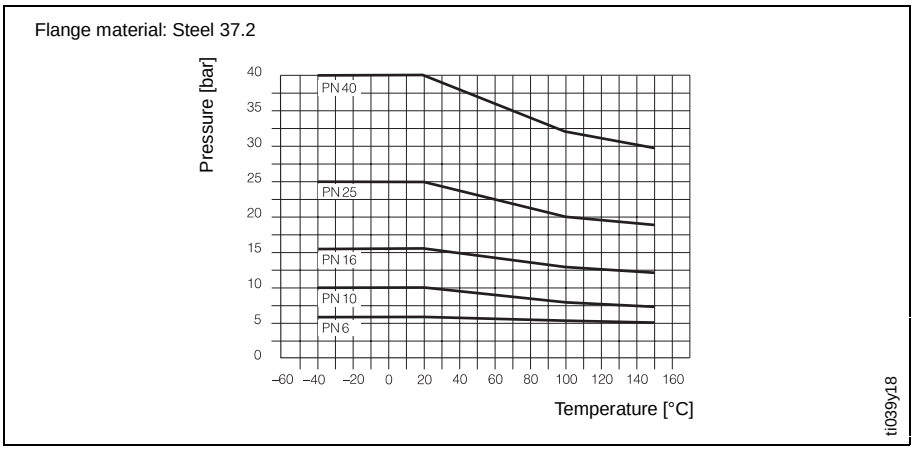
Remote version
(FS and FL version)

DN [mm]	DN [inch]	PN DIN [bar]	L[1] [mm]	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F DIN [mm]	H [mm]	B1 [mm]	Weight[2] PN10/ANSI [kg]
350	14"	10	550	783	456	282	564	276	26	683.5	401.5	110
400	16"	10	600	790	482	308	616	276	26	735.5	427.5	130
450	18"	–	650	840	507	333	666	292	–	785.5	452.5	240
500	20"	10	650	891	532.5	358.5	717	292	28	836.5	478	170
600	24"	10	780	995	584.5	410.5	821	402	28	940.5	530	230
700	28"	10	910	1198	686	512	1024	589	30	1143.5	631.5	350
750	30"	–	975	1198	686	512	1024	626	–	1143.5	631.5	450
800	32"	10	1040	1241	707.5	533.5	1067	647	32	1186.5	653	450
900	36"	10	1170	1394	784	610	1220	785	34	1339.5	729.5	600
1000	40"	10	1300	1546	860	686	1372	862	34	1491.5	805.5	720
1050	42"	–	1365	1598	886	712	1424	912	–	1543.5	831.5	1050
1200	48"	6	1560	1796	985	811	1622	992	28	1741.5	930.5	1200
1350	54"	–	1755	1998	1086	912	1824	1252	–	1943.5	1031.5	2150
1400	–	6	1820	2148	1161	987	1974	1252	32	2093.5	1106.5	1800
1500	60"	–	1950	2196	1185	1011	2022	1392	–	2141.5	1130.5	2600
1600	–	6	2080	2286	1230	1056	2112	1482	34	2231.5	1175.5	2500
1650	66"	–	2145	2360	1267	1093	2186	1482	–	2305.5	1212.5	3700
1800	72"	6	2340	2550	1362	1188	2376	1632	36	2495.5	1307.5	3300
2000	78"	6	2600	2650	1412	1238	2476	1732	38	2595.5	1357.5	4100

[1] Thickness of the flange face includes seal face.
[2] Weight of compact version DIN PN 10. If there is no DIN version, take ANSI or AWWA weight.

Pressure Limitations

Promag F (DIN 2413 and 2505)



Nominal Diameter and Metrological Classes

Selection of the metrological class
Please indicate the following data in all requests and orders:

1. *Nominal flow rate (Qn)* for class A or B. This information is shown on the nameplate and must be given in the order text.

   Notes:
   – Class A instruments: without indication of Q_n the default value is given at the factory (see table below).
   – Class B instruments: without indication of Q_n the order can not be handled.
   – Q_n must lie between the corresponding $Q_{n\ (min)}$ and $Q_{n\ (max)}$ valid for class A or B.

2. For scaling the current output, the full scale value Q_{max} and if required the pulse value must be given, and will then be set at the factory.

   Note:
   The full scale value Q_{max} and the value Q_n are two different values. For example, the full scale value Q_{max} can be higher than the defined Q_n. In extreme cases, it is double the value of $Q_{n\ (max)}$ and lies at 10 m/s.

Diameter selection
As a rule, the pipeline diameter determines the sensor nominal diameter.
A necessary increase in velocity can be achieved through a reduction of the sensor diameter.
The table below summarizes the minimum and maximum end values (incl. factory setting) which can be set by miniature switches in Promag 31 (see page 7 and 8).

DN [mm]	$Q_{n\ (min)}$ Class A [m^3/h]	$Q_{n\ (min)}$ Class B [m^3/h]	$Q_{n\ (max)}$ [m^3/h]	$Q_{n\ (default)}$ only by Class A [m^3/h]
15	0.8	1.6	3.0	1.2
25	2.2	4.4	8.8	3.5
32	3.6	7.2	14.0	6.0
40	5.6	11.3	22.6	10.0
50	9.0	15.0	35.0	15.0
65	15.0	20.0	60.0	25.0
80	15.0	30.0	90.0	35.0
100	18.0	46.0	140.0	55.0
125	28.0	73.0	220.0	90.0
150	40.0	105.0	320.0	130.0
200	70.0	190.0	550.0	230.0
250	110.0	290.0	880.0	350.0
300	160.0	420.0	1250	500.0
350	215.0	570.0	1700	700.0
400	280.0	750.0	2200	900.0
500	440.0	1170	3500	1400
600	640.0	1700	5000	2000

Technical Data

Application	
Instrument name	Flow measuring system “Promag 31” for cold water / waste water fiscal metering.
Instrument function	Flow measurement of liquids in closed piping.
Function and system design	
Measuring principle	Electromagnetic flow measurement according to Faraday's law (Generation of a voltage by induction in a magnetic field).
Measuring system	Instrument family “Promag 31” consisting of: • Transmitter: Promag 31 • Sensor Promag F (DN 15...2000) Two versions are available: • Compact version (Sensor and transmitter are one unit) • Remote version (FS or FL version, see page 13)
Input variables	
Measured variables	Flow velocity (proportional to induced voltage. Measured by two electrodes in the measuring pipe)
Measuring range (for current output)	Measuring range electronics: v = 0...12.5 m/s Minimum full scale value: 0.4 m/s Maximum full scale value: 10 m/s
Operable flow range	Up to 1000:1. Flow velocities from under 0.05 m/s to over 10 m/s can be measured with the specified accuracy.
Auxiliary input	U = 3...30 V DC, Ri = 1.8 kΩ, galvanically separated. Adjustable for measured value suppression or external totaliser reset (if instrument fitted with display)
Output variables	
Output signal	• *Current output:* 0/4...20 mA adjustable, galvanically separated. Time constant: automatically assigned full-scale value can be set Temperature coefficient: 0.01% o.r./°C, additional error: 0.3% o.r. • *Pulse output:* Open Collector, 0...400 Hz, U_{max} = 30 V, I_{max} = 250 mA, galvanically separated, pulse value adjustable, pulse/pause ratio appr. 1:1, pulse width max. 2 s. • *Status output:* Open Collector, U_{max} = 30 V, I_{max} = 250 mA; Adjustable for: System and process error messages, flow direction recognition.
Signal on alarm	*Status output:* Configurable for alarm. The status output operates in the quiescent current mode, i.e. with no alarm condition, the output is closed (transistor conducting). As long as the alarm is not cleared, the following applies: *Current output:* Current is set to a defined value 0...20 mA → 0 mA 4...20 mA → 2 mA *Pulse output:* No pulse output
Load	R_L < 700 Ω (current output)
Creep suppression	In fiscal metering applications, the “creep suppression” function is always active. v ≤ 0.02 m/s → Suppression active (current output is set to quiescent value of 0/4 mA during this time) v ≥ 0.04 m/s → Suppression not active (v = flow velocity)

Accuracy

Reference conditions

According to DIN 19200 and VDI/VDE 2641:
Medium temperature: +28 °C ±2K
Ambient temperature: +22 °C ±2K
Heating-up time: 30 minutes

Installation conditions:
Inlet length > 10 x DN
Outlet length > 5 x DN
Sensor and transmitter are earthed.
The sensor is mounted centrally in the pipe.

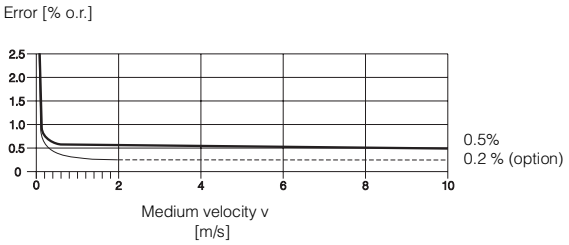
Measured error

Pulse output:
±0.5% o.r. ±0.01% o.f.s. (o.f.s. = of full-scale; full-scale = 10 m/s)

±0.2% o.r. ±0.05% of Q_k (optional)
Q_k = desired reference flow rate for calibration (v = 2...10 m/s). Please quote Q_k when ordering.

Current output: plus typ. ±10 µA

Within the specified range, fluctuation of the supply voltage has no effect.



Repeatability

±0.1% o.r. ±0.005% o.f.s.
(o.r. = of range; o.f.s. = of full scale)

Operating conditions

Installation conditions

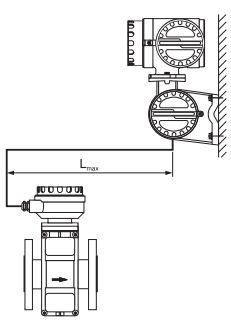
Installation instructions

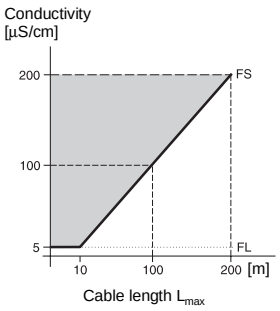
Orientation: vertical or horizontal.
Restrictions on installation and other recommendations:
see pages 3–4.

Inlet and outlet sections

Inlet lengths: > 3...5 x DN (for fiscal user: 5 x DN)
Outlet lengths: > 2 x DN (for fiscal user: 2 x DN)
(DN = Nominal diameter)

Connection cable length (remote version)





- *FS version:*
  Cable length 0... 10 m → min. conductivity ≥5 µS/cm
  Cable length 10...200 m → min. conductivity = f (L_{max})
- *FL version:*
  Cable length 0...200 m → min. conductivity ≥5 µS/cm
- *Instruments equiped with empty pipe detection (EPD):*
  Cable length = max. 10 m

Operating conditions (continued)

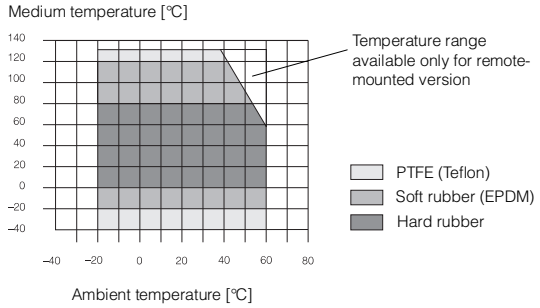
Ambient conditions

Ambient temperature

–25...+60 °C (Transmitter Promag 31)
–25...+60 °C (Sensor Promag F)
0...+30 °C (for cold water fiscal metering)

When installed outdoors, specially in countries with high ambient temperatures please provide a weatherproof hood as protection against direct solar radiation.

At high medium and ambient temperatures it is necessary to mount the Promag F sensor and Promag 31 transmitter separately. Risk of the electronics becoming over-heated (see following Fig.).



Storage temperature	–40...+80 °C
Degree of protection (EN 60529)	Transmitter: IP 67; NEMA 4X Sensor Promag F: IP 67 (option IP 68); NEMA 4X (option NEMA 6P)
Shock resistance *Vibrational resistance*	According to EN 61010 and IEC 68-2-6 Acceleration up to 2 g/2 h per day; 10...100 Hz (complete measuring system)
Electromagnetic compatibility	According to EN 50081 Part 1 and 2 / EN 50082 Part 1 and 2 as well as the NAMUR recommendations

Process conditions

Process temperature

Process temperature range depends on the sensor lining: (see Fig. above)

Promag F: –40...+130 °C (PTFE, DN 15...600)
–20...+120 °C (soft rubber, DN 25...2000)
0...+ 80 °C (hard rubber, DN 65...2000)

Nominal pressure

Sensor Promag F:

DIN PN 6 (DN 1200...2000)
PN 10 (DN 200...1000)
PN 16 (DN 65...150)
PN 40 (DN 15...50)
PN 16/25 (DN 200...300)
PN 40 (DN 65...100), option

(Pressure limitations: see page 11)

Fluid conductivity

- Min. conductivity: ≥5 µS/cm
- For remote version the minimum conductivity depends on the cable length between sensor and transmitter → see "Connection cable length"

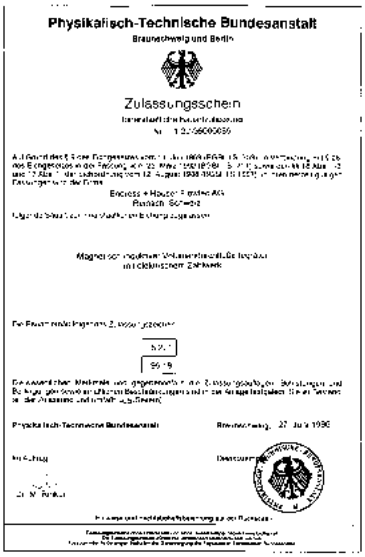
Pressure loss

No pressure loss, if sensor and piping have the same nominal diameter.

For adapter piece (DIN 28545) pressure loss, see page 4

Mechanical construction	
Design / dimensions	see pages 9, 10
Weights	see pages 9, 10
Materials	*Transmitter housing:* Powder-coated die-cast aluminium *Flange material:* Promag F DIN → stainless steel 1.4571; St. 37.2 *Electrode material:* Promag F 1.4435; Platinum/Rhodium 80/20; Titanium; Hastelloy C-22; Tantalum *Housing material sensor:* Promag F (DN 15...300) powder-coated die-cast aluminium (DN 350...2000) coated steel
Process connections	Flange (Promag F) DN 15... 300: DIN DN 350...2000: DIN
Electrical connections	Wiring diagram: see pages 5, 6 Cable glands (In-/outputs; remote version): PG 13.5 cable glands (5…15 mm) or NPT 1/2", M20 x 1.5 (8…15 mm), G 1/2" threads for cable glands Galvanic isolation: All circuits for inputs, outputs, power supply, and sensor are galvanically isolated from each other. Cable specifications: see page 6
User interface	
Operation / Display	• 10 miniature switches for selecting device functions • 3 keys on local display for more functions • jumper for configuring the auxiliary input • LC display, with 8 characters and display segments for status information (see also page 7)
Power supply	
Supply voltage, Frequency	Transmitter: 85...230 V AC + 10% (45...65 Hz) 20... 55 V DC, 16...62 V DC Sensor: is supplied by the transmitter
Power consumption	AC: <15 VA (incl. sensor) DC: <15 W (incl. sensor)
Power supply failure	Bridges min. 1 power cycle (22 ms). • EEPROM saves measuring system data on power failure (no batteries required). • DAT = exchangeable data storage module which stores all sensor data such as calibration data, nominal diameter, sensor version, etc. When replacing the transmitter or its electronics, the old DAT module is simply inserted into the new transmitter. When the system is restarted, the measuring point then operates using the variables stored in the DAT.
Certificates and approvals	
	Information on presently available Ex versions (e.g. CENELEC, SEV, FM, CSA) can be supplied by your E+H Sales Centre on request. All explosion protection data are given in separate documentation available on request.

Technical Data

Certificates and approvals (continued)	
Degrees of protection *Ex approvals*	• Transmitter: Promag 31 (compact and remote version): CENELEC: EEx d/de; Ex zone 2 VDE 0165 • Sensor: Promag F CENELEC: EEx d/de; Ex zone 2 VDE 0165
Fiscal capability	 Physikalisch-Technische Bundesanstalt Braunschweig und Berlin Zulassungsschein
CE mark	By attaching the CE-mark, Endress+Hauser confirms that the Promag 31 measurement system has been successfully tested and fulfils all legal requirements of the relevant EC directives.
Order information	
Supplementary documentation	• Operating Manual Promag 31 (BA028D/06/d) • All explosion protection data are given in separate documentation available on request.
Other standards and guidelines	
EN 60529 Degree of protection EN 61010 Protection Measures for Electronic Equipment for Measurement, Control, Regulation and Laboratory Procedures EN 50081 Part 1 and 2 (interference emission) EN 50082 Part 1 and 2 (interference immunity) NAMUR Association of Standards for Control and Regulation in the Chemical Industry.	

Subject to modification

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