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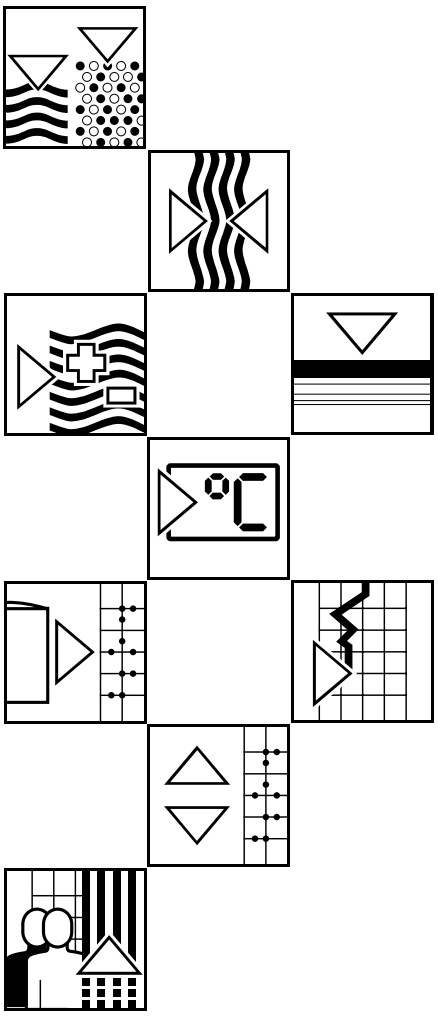
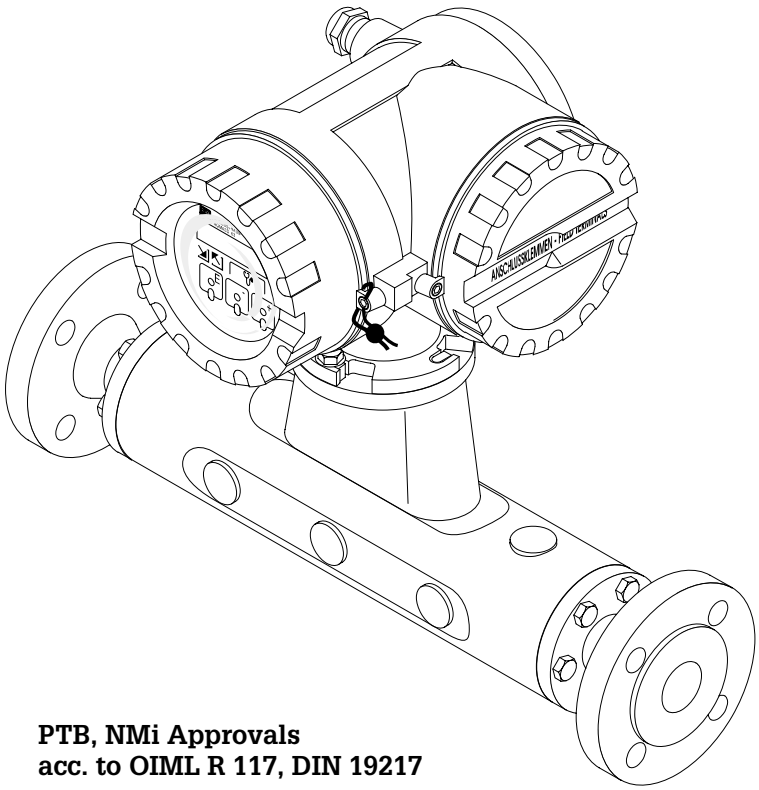
No. 50084736
CV 4.2

Valid as of software version
V 4.00.XX (amplifier)
V 3.02.XX (communications)

promass 64
Mass Flow Measuring System for Custody Transfer

Operating Manual





PTB, NMi Approvals
acc. to OIML R 117, DIN 19217

Endress+Hauser
The Power of Know How

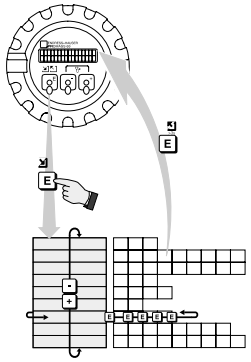
Brief Operating Instructions

With the following instructions, you may configure your measuring instrument quickly and easily for calibrated operations. Please consult the Safety Instructions on page 5.

Installation and electrical connection
Installation → s. page 11 ff.
Electrical connection → s. page 17 ff.

Commissioning → s. page 20

Operation → s. page 25 ff.



Configuration of display
- Display language → s. page 55
- Display contrast → s. page 55
- Display line (bottom) → s. page 55

Configuration of system status
- Calibration parameter → s. page 33
- Reset mode → s. page 33
  (error response)
- Process parameters → s. page 58 ff.
  e.g. measuring operations
  (uni-/bidirectional), creep, etc.

continued: next column

Engineering units → s. page 38
- Gallons/barrel → s. page 39
- Format totaliser → s. page 37

Configuration of outputs

Pulse output (for verification)
Pulse weight → s. page 45
Type of output signal → s. page 45
Phase shift → s. page 47

Current output (not for verification)
Assign output → s. page 40
Zero/f.s. values → s. page 40–43
Current span → s. page 43

Other applications
require programming of additional functions. You will find the appropriate pages and functions in the
- Index → s. page 111
- Programming matrix → s. page 27

For optimum measuring accuracy
Zero point adjustment → s. page 77
Density adjustment → s. page 52–54

Verification mode
Activate/deactivate → s. page 22

Contents

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1 Safety Instructions

1.1 Correct usage

- The Promass 64 measuring system has national approvals for the verified measurement of all liquids other than water, and for combustible gases at pressures above 100 bar. Calibration parameters mass or volume may be selected.
  The measuring system Promass 64 may used as a mass or volume counter.
  At the same time, the system also measures the density and the temperature of fluids.
- The manufacturer assumes no liability for damage caused by incorrect use of the instrument.
- Instruments which are used in the explosion hazardous area are supplied with a separate “Ex documentation”, which is an *integral part of this Operating Manual*. The instructions and connected loads provided in this supplement must absolutely be observed. An appropriate icon is shown on the front of this document according to the approval given and the test centre.

1.2 Dangers and notes

All instruments are designed to meet state-of-the-art safety requirements, have been tested, and have left the works in an operationally perfectly safe condition. The devices were developed according to EN 61010 “Protection Measures for Electronic Equipment for Measurement, Control, Regulation and Laboratory Procedures”. A hazardous situation may occur if the flowmeter is not used for the purpose it was designed for or is used incorrectly. Please carefully note the information provided in this Operating Manual indicated by the pictograms:

Warning!
A “warning” indicates actions or procedures which, if not performed correctly, may lead to personal injury or a safety hazard.
Please strictly observe the instructions supplied and proceed carefully.


Warning!

Caution!
A “caution” indicates actions or procedures which, if not performed correctly, may lead to faulty operations or the destruction of the instrument.
Please strictly observe the respective instructions.


Caution!

Note!
A “note” indicates actions or procedures which, if not performed correctly, may indirectly affect operations or lead to an unexpected instrument response.


Note!

1.3 Operational safety

- The Promass 64 measuring system fulfils all general requirements for electromagnetic compatibility (EMC) according to EN 50081 Part 1 and 2 / EN 50082 Part 1 and 2 as well as to NAMUR recommendations.
- Extensive self-monitoring of the measuring system gives complete operational safety. Any errors or power failure which may occur are immediately given at configured relay output 1.
  The appropriate error message is shown on the transmitter display. Existing errors can be automatically called up and their cause determined using the diagnosis function.
- On power failure, all data of the measuring system are safely stored in the EEPROM (no batteries required).

1.4 Personnel for installation, start-up and operation

- A calibrated Promass 64 measuring system is protected by seals on the transmitter or the sensor connection housing from manipulation of calibration parameters such as pulse weighting (see page 22). As a rule, these seals may only be broken by a representative of the appropriate approval authorities.
- Mounting, electrical installation, start-up and maintenance of the instrument may only be carried out by trained personnel authorized by the operator of the facility. Personnel must absolutely and without fail read and understand this Operating Manual before carrying out its instructions.
- The instrument may only be operated by personnel who are authorized and trained by the operator of the facility. All instructions in this Manual are to be observed without fail.
- In case of corrosive fluids, the resistance of the material of all wetted parts such as measuring pipes, gaskets, and process connections is to be verified. This also applies to fluids used to clean the Promass sensor (for wetted parts materials, see Chapter 9). The user is responsible for the correct selection of suitable wetted parts materials having suitable corrosion resistance within the process. The manufacturer is not liable! Endress+Hauser will be glad to provide information and help.
- Please observe all provisions valid for your country and pertaining to the opening and repairing of electrical devices.
- The installer has to make sure that the measuring system is correctly wired according to the wiring diagrams. The measuring system is to be grounded.

Danger of electric shock!
With the housing cover removed, protection against accidental contact is no longer present.

1.5 Repairs, dangerous chemicals

The following procedures must be carried out before a Promass 64 flowmeter is sent to Endress+Hauser for repair:

- A note must always be enclosed with the instrument, containing a description of the fault, the application, and the chemical and physical properties of the product being measured.
- Remove all residue which may be present. Pay special attention to the gasket grooves and crevices where fluid may be present. This is especially important if the fluid is dangerous to health, e.g. corrosive, poisonous, carcinogenic, radioactive, etc.
- No instrument should be returned to us without all dangerous material being removed first, e.g. in scratches or diffused through plastic.

Incomplete cleaning of the instrument may result in waste disposal or cause harm to personnel (burns, etc.). Any costs arising from this will be charged to the owner of the instrument.

1.6 Technical improvements

The manufacturer reserves the right to modify technical data without prior notice. Your local E+H Sales Office will supply you with all current information and any updates to this Operating Manual.

2 Description of the System

2.1 Application

The Promass 64 measuring system measures the mass and volume flow of liquids having widely differing characteristics:
- Chocolate, condensed milk, syrup
- Oils, fats
- Acids, alkalis
- Varnishes, paints
- Pharmaceuticals, catalytic converters, inhibitors
- Suspensions, high-pressure gases, etc.

Wherever the above-mentioned media are invoiced directly, a calibration measuring system to determine either mass or volume flow is to be used. Promass 64 meets all necessary requirements.

At the same time the system also measures the density and temperature of liquids. The advantages of this measurement process are demonstrated by its successful use in food processing, the pharmaceutical industry, the chemical and petrochemical industry, waste disposal, energy production, etc.

2.2 Measuring principle

The measuring principle is based on the controlled generation of Coriolis forces. These forces are always present when both translational (straight line) and angular (rotational) movement occur simultaneously.

$\vec{F}_C = 2 \cdot \Delta m\,(\vec{\omega} \times \vec{v})$
$\vec{F}_C$ = Coriolis force
Δm = mass of moving body
$\vec{\omega}$ = angular velocity
$\vec{v}$ = radial velocity in a rotating or oscillating system

The amplitude of the Coriolis force depends on the moving mass Δm, its velocity in the system $\vec{v}$ and therefore its mass flow.

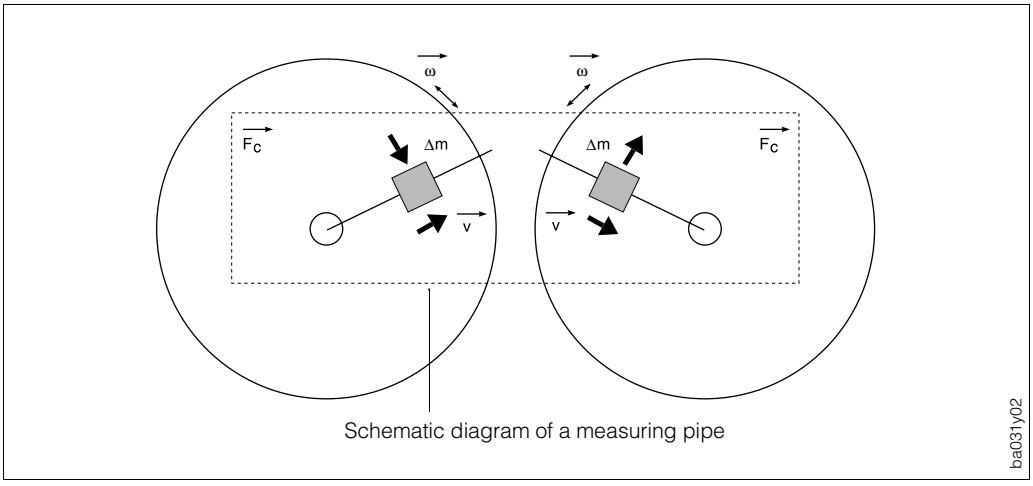


Fig. 1:
Coriolis forces in the Promass measuring pipes

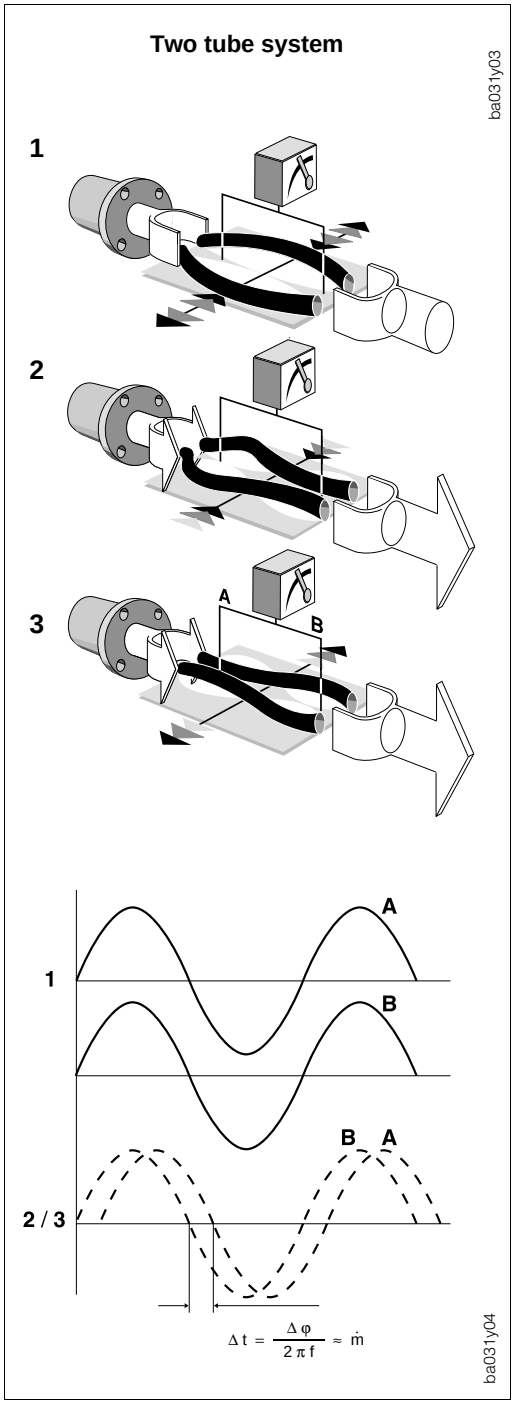


Fig. 2:
Phase shift of pipe vibration with mass flow (example for Promass M, F)

Balanced Measuring systems

Two-tube system
(*Promass M, F)*
The system balance is ensured by the two measuring tubes vibrating in antiphase.

Single tube system
(*Promass A)*
For single tube systems, other design solutions are necessary for balance than for two-tube systems. For Promass A, an internal reference mass is used for this purpose.

The Promass uses an oscillation instead of a constant angular velocity $\vec{\omega}$ and two parallel measuring pipes, with liquid flowing through them, are made to oscillate in antiphase so that they act like a tuning fork.

The Coriolis forces produced at the measuring pipes cause a phase shift in the pipe oscillation (see Fig. 2):
- When there is zero flow, i.e. with the fluid standing still, both pipes oscillate in phase (**1**).
- When there is mass flow, the pipe oscillation is decelerated at the inlet (**2**) and accelerated at the outlet (**3**).

As the mass flow rate increases, the phase difference also increases **(A–B)**. The oscillations of the measuring pipes are determined using electrodynamic sensors at the inlet and outlet.

Unlike Promass M and F, Promass A only has a single measuring pipe. However, the measuring principle and function of all sensors are identical.

The operating principle is independent of temperature, pressure, viscosity, conductivity or flow profile.

Density measurement
The measuring pipes are always made to oscillate at their resonant frequency. This excitation frequency adjusts automatically as soon as the mass, and therefore the density, of the oscillating system changes (measuring pipes and medium). The resonant frequency is thus a function of the density of the medium and enables the microprocessor to produce a density signal.

Temperature measurement
The temperature of the measuring pipes is determined and used to compensate for temperature effects. The signal produced is a function of the product temperature and can be used for external purposes.

2.3 The Promass 64 measuring system

The Promass 64 measuring system is mechanically and electronically designed for maximum flexibility with the transmitters and sensors being combined in any variation. The measuring system consists of:
- Promass 64 transmitter
- Promass A, M, M (high pressure) or F sensor

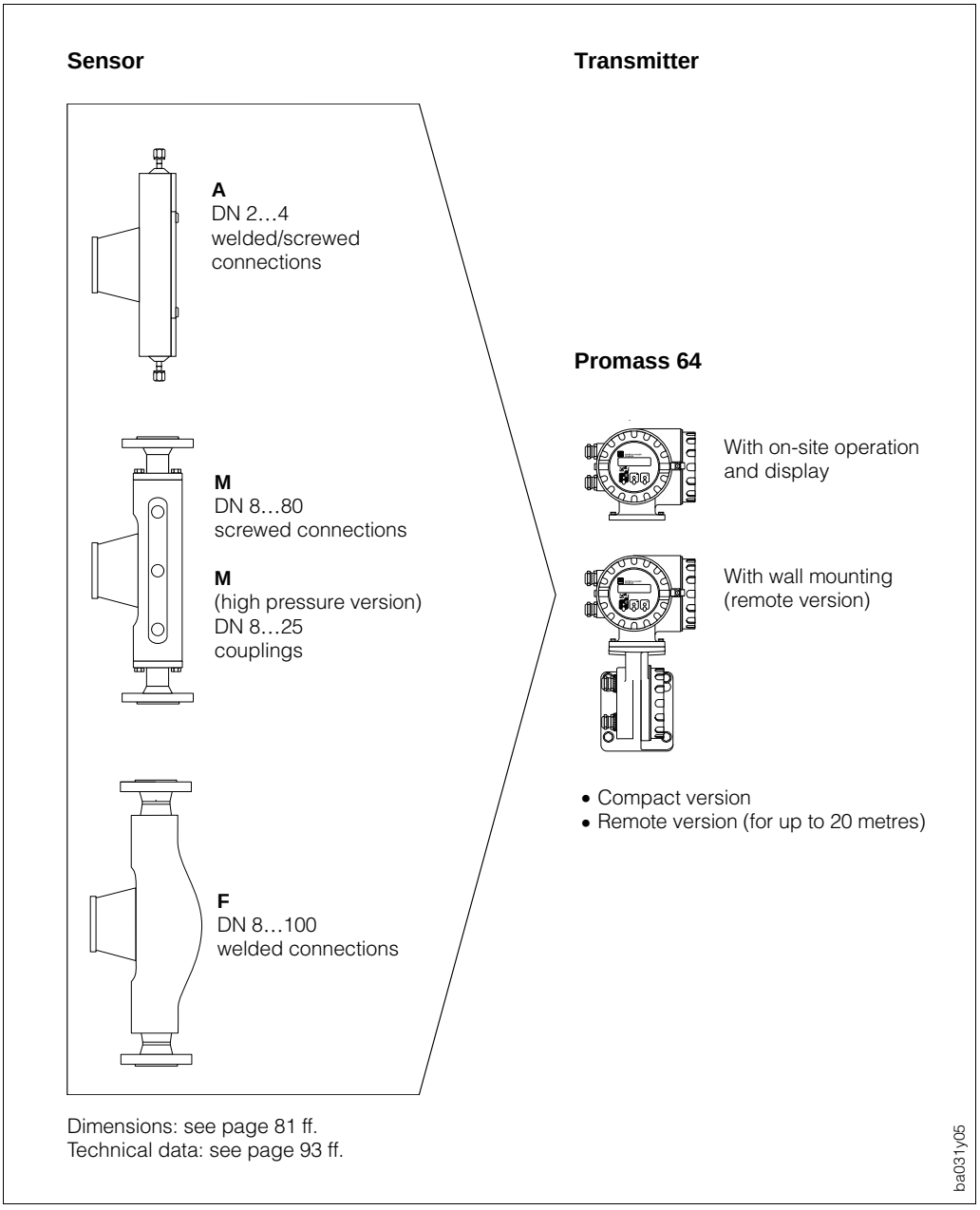


Fig. 3:
Promass 64 measuring system

Caution!
The Promass 64 measuring system is available with various approvals.
Your Endress+Hauser representative will be pleased to supply information on the approvals available at present. All Ex information and specifications are included in a separate documentation which can be sent by Endress+Hauser on request.


Caution!

3 Mounting and Installation

Warning!
- All instructions given in this section are to be observed at all times in order to ensure safe and reliable operation of the measuring system.
- Mounting regulations and technical specifications for instruments with approval for explosion hazardous areas (Ex certified) may differ from those given below. All mounting regulations and connection values in the Ex documentation must, therefore, be strictly observed.

3.1 General information

Protection IP 67 (EN 60529)
The instruments fulfil all the requirements for IP 67. After successful installation in the field or after servicing, the following points must always be observed in order to ensure protection to IP 67:

- Housing gaskets must be clean and undamaged when inserted in the gasket groove. The gaskets may need to be dried, cleaned or replaced.
- All housing screws and the housing cover must be firmly tightened.
- The cables used for connecting must have the correct outer diameter.
- The cable gland must be firmly tightened (see Fig. 4).
- The cable must loop down before entering the cable gland to ensure that no moisture can enter it (see Fig. 4).
- Any cable glands not used are to be replaced with a blind plug.
- The protective bush should not be removed from the cable gland.

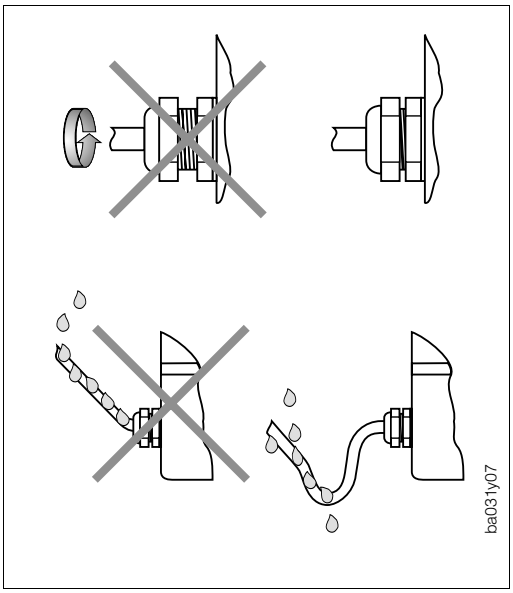


Fig. 4: Protection IP 67

Temperature ranges
- The maximum approved ambient and product temperature must be observed (see page 97).
- An all-weather cover should be used to protect the housing from direct sunlight when mounting in the open. This is especially important in warmer climates and with high ambient temperatures.

Tracing, thermal insulation
With certain products heat transfer at the sensor must be avoided. A wide range of materials can be used to assure the necessary insulation.
Heating can be provided either electrically, e.g. by heating sheets or supplied by copper pipes with heated water or steam. Heating elements for heat tracing are availble for all sensors.

Caution!
Danger of the electronics overheating! The connector between the sensor/transmitter housings of the compact version must not be insulated or heated.
Depending on the fluid temperature, certain installation positions are to be observed (see Fig. 8).

System pressure
It is important to avoid cavitation as this can affect the oscillation of the measuring pipes.
- No special measures need to be taken for products which have properties similar to those of water under normal conditions.
- With volatile liquids (hydrocarbons, solvents, liquified gas), the vapour pressure must not drop below a point where the liquid then begins to boil.
  It is also important not to release gases which are found naturally in many liquids. This can be prevented by maintaining a high enough system pressure.


Note!

Note!
The sensor is, therefore, best mounted as required:
- on the pressure side of pumps (avoiding low pressure)
- at the lowest point of a vertical pipeline

Mounting on tank wagons
When used in Class I areas, such as measurement systems on tank wagons, the transmitter should be mounted with attenuated vibration in the driver's cab.

Purge connections
The pressure vessel of the flowmeter is filled with dry nitrogen (N_2). The rinsing connections may only be opened if the pressure vessel is to be immediately filled with a dry, inert gas (corrosion protection).

3.2 Transporting to the measuring point (DN 40…100)

For transport, measuring instruments with nominal diameters of DN 40...100 may not be lifted at the transmitter housing or at the connection housing of the remote version.

Use shoulder straps for transport to the measuring points and wrap them around both process connections (see Fig. 5). Avoid using chains as this might damage the housing, e.g. scratch the coat of lacquer.


Warning!

Warning!
Danger of injury by slipping measuring instrument! The gravity centre of the entire device is higher than the two suspension points of the shoulder straps. Make sure that the device does not turn or slip due to the higher gravity centre during transport.

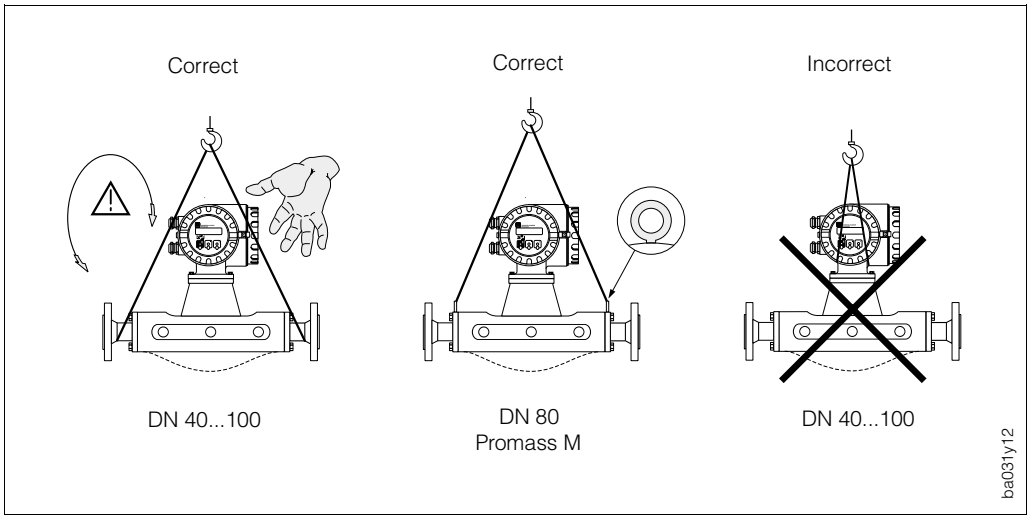


Fig. 5:
Transporting the sensor DN 40…100

3.3 Mounting

- No special fittings such as brackets are required. External forces are absorbed by the construction of the device, e.g. by the containment vessel.
- For mechanical reasons, and to protect the pipline, support is recommended for heavy sensors.
- Due to the high frequency of the measuring pipes, the Promass 64 measuring system is unaffected by plant vibration.
- When mounting, no special precautions need to be taken for turbulence-generating fittings (valves, bends, T-pieces, etc.) as long as no cavitation occurs.

The following installation instructions are to be carried out for correct operation of the measuring system:

Orientation (Promass A)

Vertical
This is best with the flow direction upwards. Entrained solids sink downward and gases rise away from the measuring pipe when the product is not flowing. This also allows the measuring pipe to be completely drained and protects it from the build-up of solids.

Horizontal
When correctly installed, the transmitter housing is either above or below the piping. This assures that no gas bubbles may collect or solids be deposited in the curved measuring pipe.

Wall and post mounting
The sensor may not be suspended in the piping, that is, without support or fixation to avoid excessive stress on the material around the process connection.

The sensor housing base plate allows table, wall, or post mounting. The post mounting requires a special mounting set:
DN 2: Order No. 50077972
DN 4: Order No. 50079218

DN	A	B
2	145	160
4	175	220

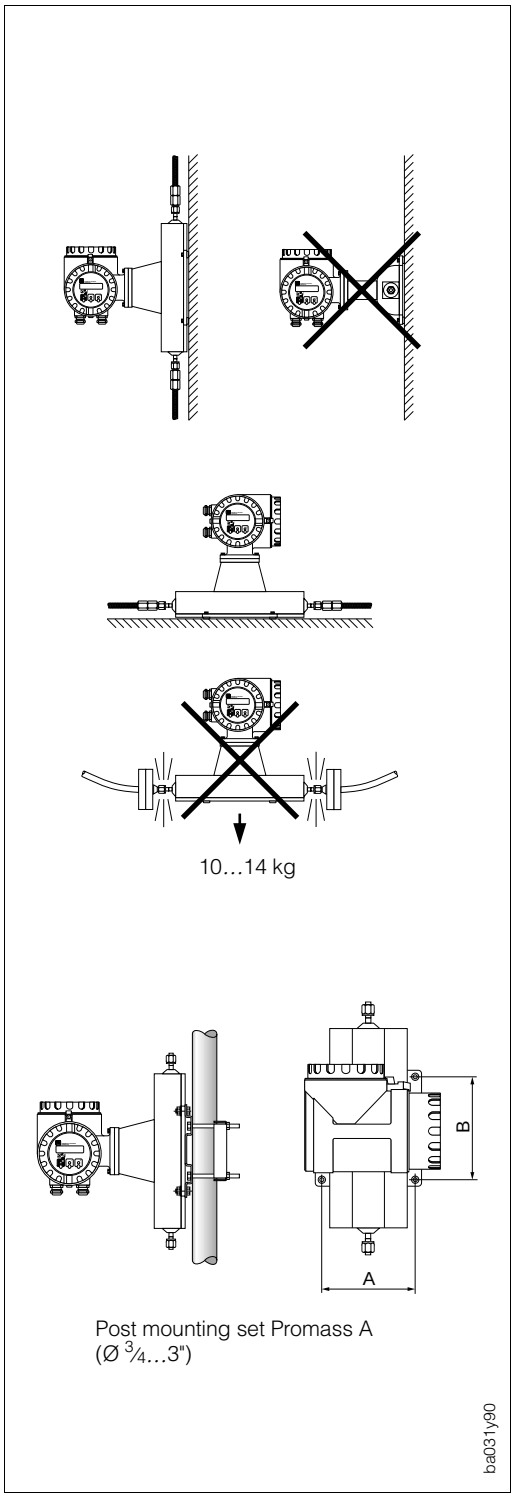


Fig. 6:
Orientation Promass A

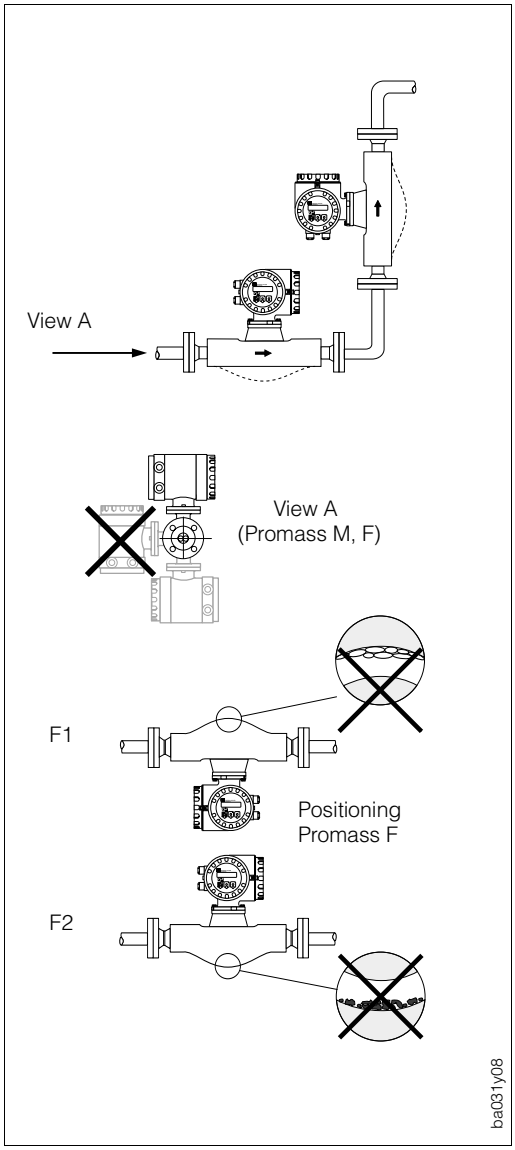


Fig. 7:
Orientation
Promass M, F

Orientation
(Promass M, F)

Vertical
This is best with the flow direction upwards. Entrained solids sink downward and gases rise away from the measuring pipes when the product is not flowing. This also allows the measuring pipes to be completely drained and protects them from the build-up of solids.

Horizontal
The measuring pipes must lie side by side. When correctly installed, the transmitter housing is either above or below the piping (see view A).

Promass F measuring pipes are slightly curved. Therefore, the sensor position is to be adapted to the fluid properties for horizontal installation (outgassing, solids content):

F1: not suitable for outgassing products
F2: not suitable for products with solids content

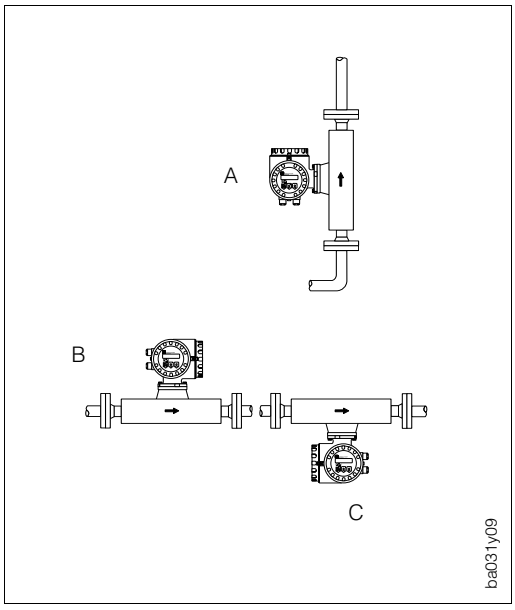


Fig. 8:
Product temperature and orientation

Product temperature/orientation
To ensure that the permitted ambient temperature range for the transmitter is not exceeded (–25…+60 °C) positioning is recommended as follows:

High temperature of product
- Vertical piping: Position A
- Horizontal piping: Position C

Low temperature of product
- Vertical piping: Position A
- Horizontal piping: Position B

Mounting location
Air or entrained gases in the measuring pipe may cause errors in measurement, and therefore the following mounting locations are to be avoided:
- Do not install at the highest point of the piping.
- Do not install directly upstream in a vertical pipeline before a free pipe output.

Correct installation is still possible in a vertical pipeline using the recommendation in the adjacent Figure. Restrictions in the piping or an orifice with a smaller cross section than the measuring instrument can prevent the sensor from running empty during measurement.

Diameter	Ø orifice/restriction
DN 2	1.5 mm
DN 4	3.0 mm
DN 8	6.0 mm
DN 15	10.0 mm
DN 25	14.0 mm
DN 40	22.0 mm
DN 50	28.0 mm
DN 80	50.0 mm
DN 100	65.0 mm

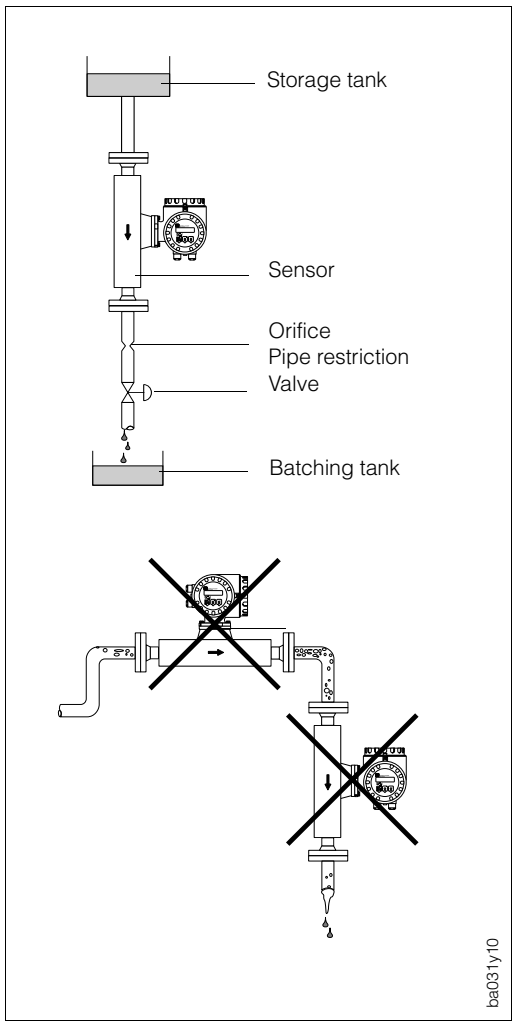
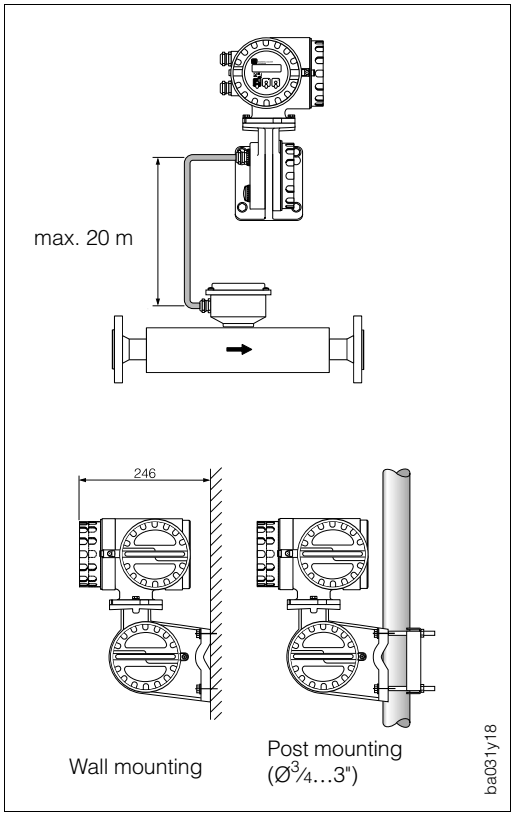


Fig. 9:
Mounting location (vertical piping)

Mounting the transmitter
A wall bracket for the transmitter housing and a 20 m ready-to-use cable to the sensor is in the scope of supply for the remote version.

Caution!
- Please pay attention to page 19: “Connecting the Remote Version”.
- Secure the cable entry or lay it in reinforced piping.
- Do not lay cables near electrical machinery or switching units.
- Thermal insulation: in case of remote versions, the connection housing of the sensor may not be insulated.
- Ensure potential compensation between sensor and transmitter (see information on page 19).

For mounting on a post a special installation set is available (Order No. 50076905).



Caution!

Fig. 10:
Mounting the transmitter (remote version)

3.4 Rotating the transmitter housing and local display

The Promass 64 transmitter and display field can be rotated in 90° steps so that the instrument can be mounted in almost any position in the piping to ensure easier handling and read-off.

Warning!

Warning!
The following procedure cannot be used for units with Ex approvals. The separate Ex documentation must, therefore, be strictly observed.

Rotating the transmitter housing

❶ Loosen the mounting screws (approx. two turns).

❷ Rotate the transmitter housing as far as the groove of the nut.

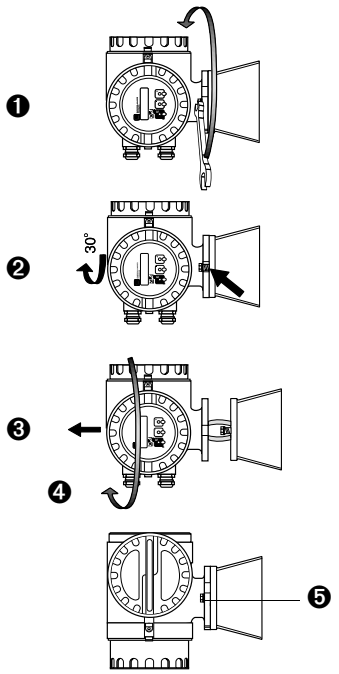
❸ Carefully pull out the transmitter housing.

Caution!

Caution!
Do not damage the connection cable between the transmitter and sensor!

❹ Rotate the transmitter housing to the position required.

❺ Push back into the latch again and tighten the two screws securely.



Rotating the local display

Warning!

Warning! Danger of electric shock.
Switch off power supply before unscrewing the transmitter housing.

❶ Loosen the safety grip (3 mm Allen key).

❷ Unscrew the cover from the electronics area.

❸ Undo both Phillips screws.

❹ Rotate the display.

❺ Tighten the Phillips screws again.

❻ Replace the cover of the electronics area on the transmitter housing.

❼ Tighten the Allen screws of the safety grip securely.

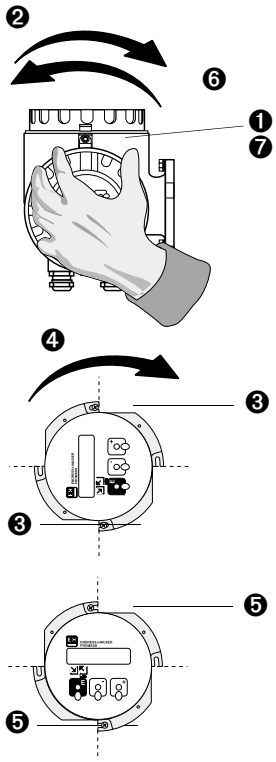


Fig. 11:
Rotating the transmitter housing and the local display

4 Electrical Connection

4.1 General information

Warning!
- The information in Section 3.1 must be observed in order to maintain protection to IP 67.
- When connecting flowmeters with Ex approval, all appropriate instructions and connections diagrams in the separate Ex documentation to this Operating Manual must be observed. For:
  CENELEC: Ex 019D/06/A2
  SEV: Ex 022D/06/C2
  FM: Ex 023D/06/A2
  CSA: Ex 024D/06/D2
- When using the remote version, only sensors and transmitters with the same serial number are to be connected together. Communication errors if this is not the case.

4.2 Connecting the transmitter

Warning!
- Danger of electric shock! Switch off the power supply before unscrewing the cover.
- Connect the ground wire to the ground terminal on the housing before turning on the power supply.
- Check that local power supply and frequency agree with the information on the nameplate. All relevant national regulations for mounting must also be observed.

❶ Loosen the screws of the safety grip (3 mm Allen key).

❷ Unscrew the cover of the terminal compartment.

❸ Push the power and signal cables through the appropriate cable glands.

❹ Wire up according to the connection diagrams (see diagram in the screw cover or Fig. 13):

The power supply is connected to Terminal 1 (L1 or L+), Terminal 2 (N or L–) and the ground terminal.
– Stranded-wire cabling: cover with an end sleeve max. 4 mm^2
– Single wire cabling: max. 6 mm^2

❺ Screw the cover of the terminal compartment securely back onto the transmitter housing.

❻ Tighten the Allen screws of the safety grip

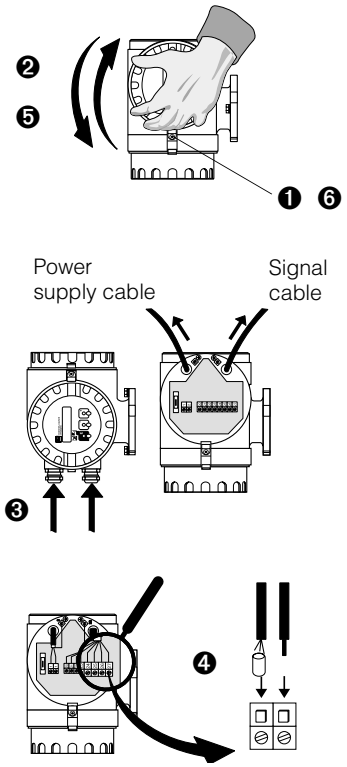
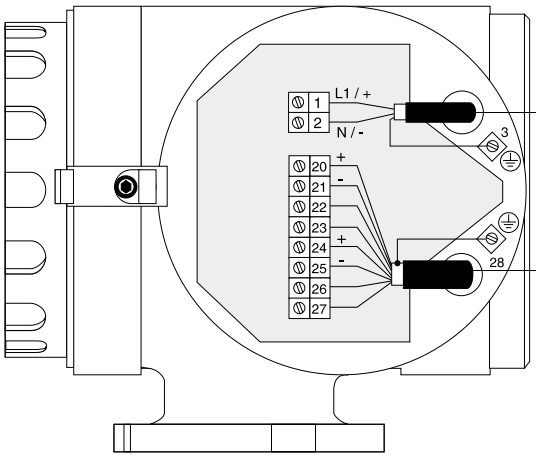


Fig. 12: Connecting the Promass 64 transmitter

Caution!
When used in Environmental Class I areas, such as measurement systems on tank wagons, the operator should ensure that the power supply is stable, e.g. by using a normal filter or separate battery power supply.



Power supply cable

Signal cable
- use screened cabling for the signal cable
- ground the signal cable screening at Terminal 28.

ba031y66

Terminal	"Ex e" board (Non-Ex - / EEx d - / EEx de - version)	"Ex i" board (intrinsically safe pulse and status output)
3	Ground connection (protective earth)	Ground connection (protective earth)
1 **2**	L1 for AC N L+ for DC power supply L–	L1 for AC N L+ for DC power supply L–
20 **21**	Current output active, 0/4…20 mA, R_L < 700 Ω	–
22 **23**	Status output relay, max. 30 V DC / 0.1 A	Status output Open Emitter, max. 30 V DC / 25 mA
24 **25**	Auxiliary input 3…30 V DC, R_i = 1.8 kΩ configurable, e.g. for resetting error messages or positive zero return	–
23 **26**	Pulse output A f_{max} = 500 Hz, active / passive active: 24 V DC, 25 mA (250 mA during 20 ms) passive: 30 V DC, 25 mA (250 mA during 20 ms)	Pulse output A Open Emitter, f_{max} = 500 Hz passive: 30 V DC, 25 mA (250 mA during 20 ms)
23 **27**	Pulse output B 90° / 180° phase shifted in relation to pulse output A, f_{max} = 500 Hz, active / passive active: 24 V DC, 25 mA (250 mA during 20 ms) passive: 30 V DC, 25 mA (250 mA during 20 ms) Terminal 23 = Common ground for pulse output A / B and status output	Pulse output B Open Emitter, f_{max} = 500 Hz 90°/ 180° phase shifted in relation to pulse output A, passive: 30 V DC, 25 mA (250 mA during 20 ms) Terminal 23 = Common supply for pulse output A / B and status output
28	Ground connection (signal cable screen)	Ground connection (signal cable screen)

Examples for connecting totalisers are found on page 46.

Fig. 13:
Electrical connection (power supply, inputs and outputs)

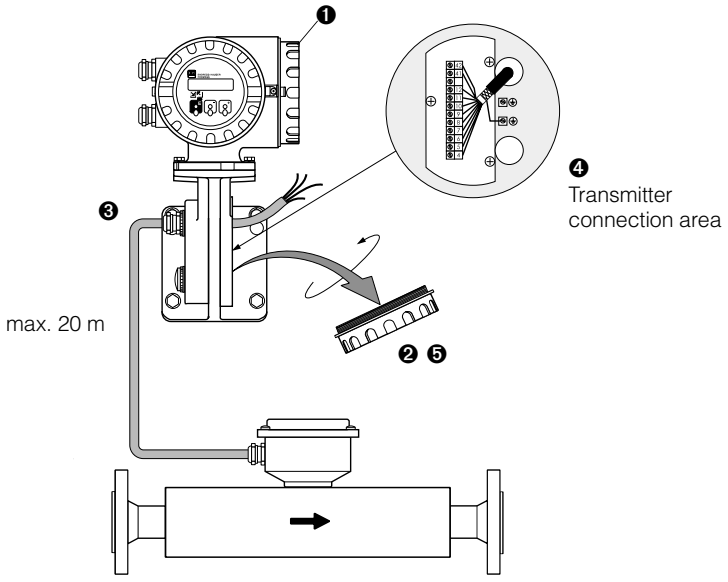
4.3 Connecting the remote version

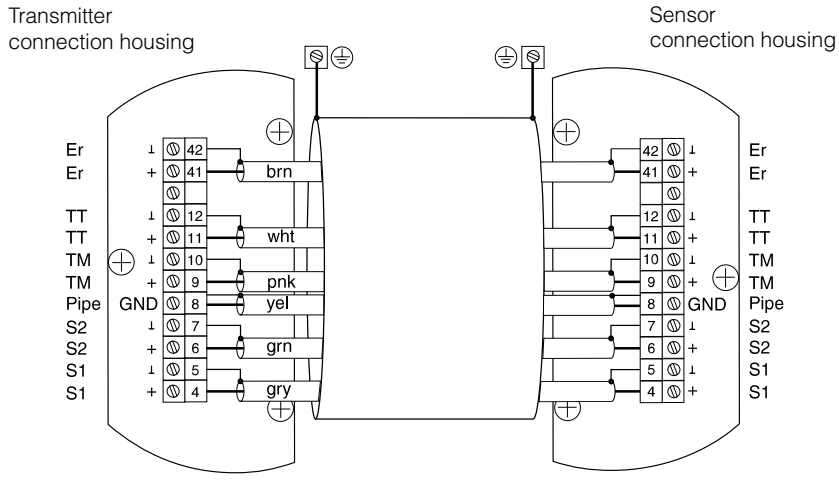
The remote version is supplied with a 20 m ready-to-use cable which is already connected to the sensor.

Warning!

Warning!
Danger of electric shock. Switch off the power supply before unscrewing the cover of the terminal compartment from the transmitter housing and the cover from the connection housing.

❶ The connection in the terminal compartment is carried out in the same way as for the compact version (see page 17).
❷ Loosen the safety grip (3 mm Allen key). Unscrew the cover of the transmitter connection area.
❸ Push the connecting cable through the appropriate cable entry.
❹ Connect the cable according to the electrical connection diagram (see Figure below or connection diagram in screw cover).
❺ Screw on the connection housing cover securely and tighten the Allen screws of the safety grip securely.





Cable specifications
brn = brown; wht = white; pnk = pink; yel = yellow; grn = green; gry = grey
6×0.38 mm^2 PVC cable with common screening and individually screened cores.
Conductor resistance: ≤ 50 Ω/km, capacitance: core/screen ≤ 420 pF/m,
continuous operation temperature: –25…+90 °C.

The cables between sensor and transmitter must always be screened and earthed at both ends. This is done at the earth terminals inside the connection housings.

Fig. 14:
Connecting the remote version

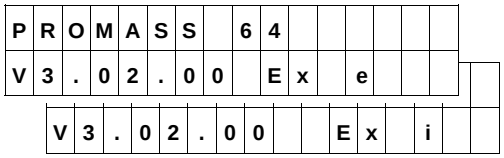
4.4 Commissioning

Before switching on the measuring system, the following *checks* should be carried out again:

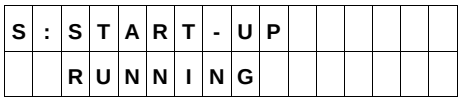
- *Installation*
  Does the directional arrow on the nameplate agree with the actual flow direction in the piping?

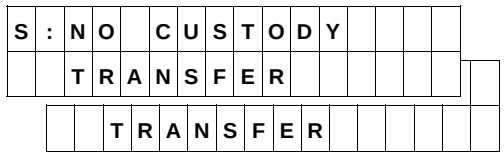
- *Electrical connection*
  Check electrical connections and terminal coding. Check that the local power supply and frequency agree with the information stated on the nameplate.

If these checks are successful, then switch on the power supply. The measuring system runs through a series of internal checks and is ready for use. During this procedure the following sequence of messages is shown on the display:

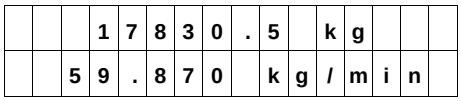


Display of the software version currently installed on the communications board (Ex e, Ex i)





Display of calibration status



After a successful start-up, normal measuring operations are started:
Top display line → totaliser no. 1
Bottom display line → freely selectable measured value (e.g. mass flow)

Note!

- If the diagnostic Function keys (⊞) have been simultaneously actuated and start-up is successful, then display messages are shown in English and with maximum contrast.
- If start-up is not successful, then an error message is shown indicating the cause.

5 Custody Transfer Measurements

The Promass 64 is a flowmeter for liquids (other than water) as well as high-pressure gases. You may select either mass or volume flow as the calibration parameter for a wide range of applications such as a
- quantity measurement of mineral oils,
- quantity measurement of alcohol,
- natural gas refuelling of vehicles, etc.

A detailed overview off all PTB and NMI approved instruments is in chapter "Technical Data" on page 100.

5.1 Suitability for calibration / approval by the standards authorities / reverification

- All Promass 64 flowmeters may be calibrated on site using reference measurements as a pre-condition to custody transfer approval. However, these instruments may only be considered officially calibrated and used for calibrated business applications upon approval by the competent standards authorities. The sealing of the measuring device safeguards this status.

Caution!
Any calculations for commercial purposes have to be based on officially verified flowmeters.

- Users of a verified Promass 64 measuring system must carry out a reverification according to all current regulations issued by the appropriate standards authorities.
- Unlike mechanical counters, officially verified mass flowmeters may be continually used at $Q_{100\%} = Q_{max}$ according to the Approval Certificate.

5.2 Features of custody transfer measurement

- The Promass 64 flowmeter is set for custody transfer measurement using two calibration switches (see page 22).
- For custody transfer, the flow may only be measured and totalised in one flow direction (forwards). Please ensure that the “MEASURING MODE” function (see page 58) has first been switched to “UNIDIRECTIONAL”.
- In the custody transfer mode, error reports occurring during measurements have to be confirmed and reset (see page 33, 34). Resetting error messages is also possible using the auxiliary input (see page 57).

Caution!
Within calibrated operations (calibration switch 1/2 → ON), all functions of the programming matrix relevant for calibration are automatically locked. Therefore, these functions may no longer be changed once the Promass 64 measuring device has been sealed.

5.3 Activating / deactivating custody transfer mode

Warning!

Warning!
Danger of electric shock! Switch off power supply before opening the flowmeter.

Activating custody transfer mode

1. Firstly configure all functions relevant for verification such as “CUSTODY TRANSFER”, “RESET FUNCTION”, “MEASURING MODE” etc., before switching off the power supply.
2. Unscrew hexagon socket head cap screw (**A**) of the safety grip (3 mm Allen key). Unscrew lid of the electronics compartment.
3. Remove local display.
4. Switch both calibration switches (**B**) to ON. The instrument is now ready for custody transfer measurement.

   Caution!
   All functions of the programming matrix relevant for custody transfer measurement are automatically locked. These functions may not be changed once the instruments are sealed.
5. Re-install local display.
6. Firmly screw lid of the electronics compartment to the transmitter housing. Firmly screw down Allen screw of the safety grip.
7. Seal measuring instrument with special sealing screw (**C, D**).
8. Switch on power supply. The display shows “S: CUSTODY TRANSFER”. This determines and stores the custody transfer status in the measuring system. For features of custody transfer measurement see page 21.

Caution!

Deactivating custody transfer mode

1. Switch off power supply.
2. Break open seal (**C**) and remove safety grip. Unscrew lid of the electronics compartment.
3. Remove local display.
4. Switch both calibration switches (**B**) to OFF.
5. Re-install local display.
6. Firmly screw lid of electronics compartment back onto the transmitter housing and firmly screw back on the hexagon socket head cap screw (**A**) of the safety grip.
7. Switch on power supply. The display now shows “S: NO CUSTODY TRANSFER”. This inactivates the custody transfer status. All functions of the programming matrix are once again freely accessible.

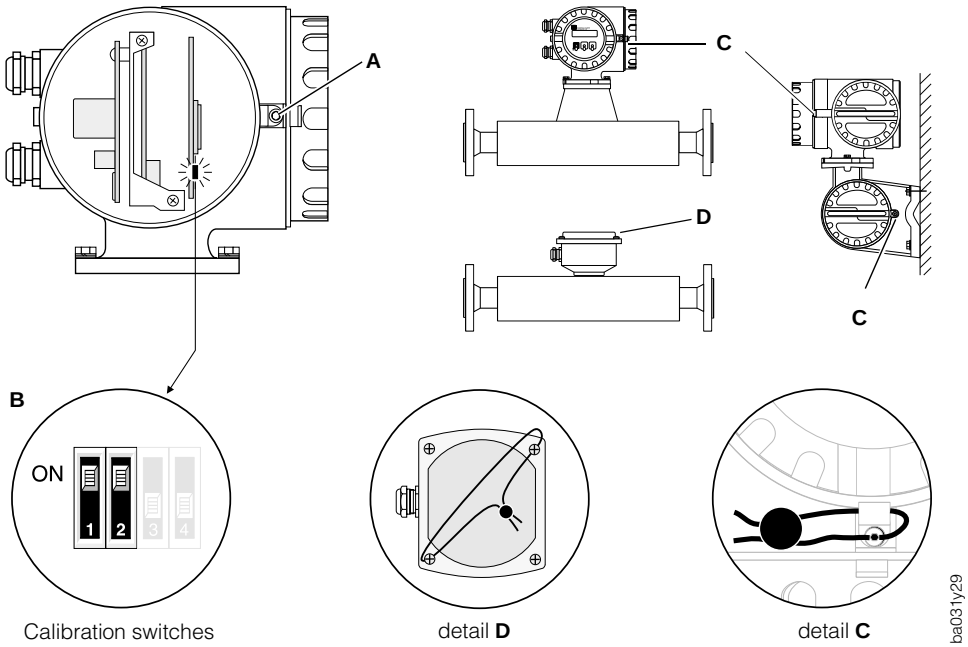


Fig. 15: Activating / deactivating the custody transfer mode

5.4 Terms and definitions

Terms of "Suitability for liquids other than water"

- Verify — Checking a measuring system to determine its variance with a "true" value and following sealing of the measuring system. Can only be done by the approval authority on site.
- Suitability for custody transfer — A measuring system or a component of the measuring system, e.g. counter or peripheral device, that is "approved for domestic custody transfer" by a (national) approval authority.
- Verified — The measuring system has been checked and sealed on site by a representative of the approval authorities. Must be arranged by the operator of the plant.
- Adjustment — On-site calibration (of zero point, density) under process conditions. They are carried out by operator of the plant.
- Calibrating — Determining and storing correction values for the individual flowmeter so that the measured value approximates as near as possible to the "real" value.
- Transmitter — Device for automatic conversion of the measured value into another parameter (pressure, temperature, density, etc.) or for permanent storage of conversion factors for the medium being measured.
- Measured error — (Also known as error limits, variance or operating error). The relative error derived from the quotients **(measured value – "real" measured value) / "real" measured value** and expressed as a percentage.
- Measuring system — Measuring installation which includes the counter, all peripheral installations and additional installations.
- Q_{min}, Q_{max} — The smallest or largest permissible flow rate for a flowmeter of a specific nominal diameter. This is stated on the nameplate in kg/min.
- Stamping points — These are areas on every component of the measuring system for preventing a change (= falsification) in determining or processing of the measured value when this cannot be done in another way. This is usually done with a leaded seal (also known as "lead sealing"). Adhesive sealing is also permitted. This may only be carried out by an authorised representative: approval authorities or for servicing purposes with a mark indicating maintenance.
- Totalizer — Device for the measurement, storage and display of verification parameters (mass, volume, density, etc.).
- Additional devices — Devices that do not directly affect measurement but are required for safety or helping to produce correct measurement results (e.g. gas display, filters, pumps, etc.).
- Peripheral devices — Devices that are directly used for processing the measured result (e.g. printers, transmitters, audit computers, preset devices, etc.).

5.5 Custody transfer

Approved measuring systems for custody transfer with liquids other than water are always verified at the place where they are to operate. The plant operator must therefore ensure that everything is done to ensure that custody transfer can be carried out at the appointed time:

- Calibrated scales or vessels with read out systems, with a loading or volume capacity corresponding to $\mathbf{Q_{max}}$ during operation of the plant for one minute. The resolution of the weigher display or read-out system must be below 0.1% of the minimum measured quantity.

- Equipment downstream from the totalizer for filling the scales or vessel with the fluid to be measured.

- Enough fluid for the measurement process.
  The amount is produced during operation of the plant.
  A rule of thumb for this is:
  3 x 1 minute at Q_{min},
  plus 3 x 1 minute at $^1/_2\ Q_{max}$,
  plus 3 x 1 minute at Q_{max},
  plus a reasonable amount in reserve.

3-step procedure for custody transfer

1) Checking the characteristics of the material:
   The measuring system is checked to ensure that all components used for custody transfer agree with the general regulations (custody transfer guidelines) as well as specific approval regulations governing the individual components (totalizers, peripheral equipment, etc.).
   The information on the nameplate(s) is also checked.

2) Checking measurements:
   In general, the plant is checked for each of three measured values (Q_{min}, $^1/_2\ Q_{max}$, and Q_{max}). None of the results may exceed the specified maximum permissible error (e.g. ± 0.5%).

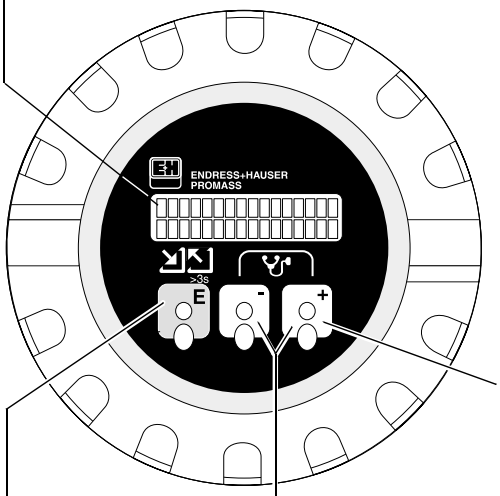
3) Stamping by the standards authorities:
   The measuring system is sealed (leaded) by the representative from the approved standards authorities at specified points (sealing diagram).

6 Operation

6.1 Display and operating elements

LC display

- Illuminated, double-spaced with 16 characters
- Simple text and numerical values are shown on it as well as error, alarm and status messages.
- During normal operation (HOME position), two freely selectable variables are shown on the display:
  Upper line → automatically assigned to totalizer no. 1
  Bottom line → free selection of measuring parameter, e.g. mass flow, density, temperature, etc.



3 optical operating elements "Touch control"

up: infrared transmitter diode
down: infrared receiver diode

+ / – keys

- Select function group (>GROUP SELECT.<)
- Enter figures (if keys are kept pressed, the numbers displayed will begin changing at accelerated rate)
- Select parameters/settings

Diagnostic and help function
(activate +/– operating elements simultaneously)

ENTER key

E — Access to the programming matrix

E — Leave operating matrix, return to HOME position
(activate E operating element for more than 3 seconds)

E — Access function
save entered figures and settings

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Fig. 16:
Display and operating elements

6.2 E+H programming matrix (setting functions)

❶ Access to the programming matrix

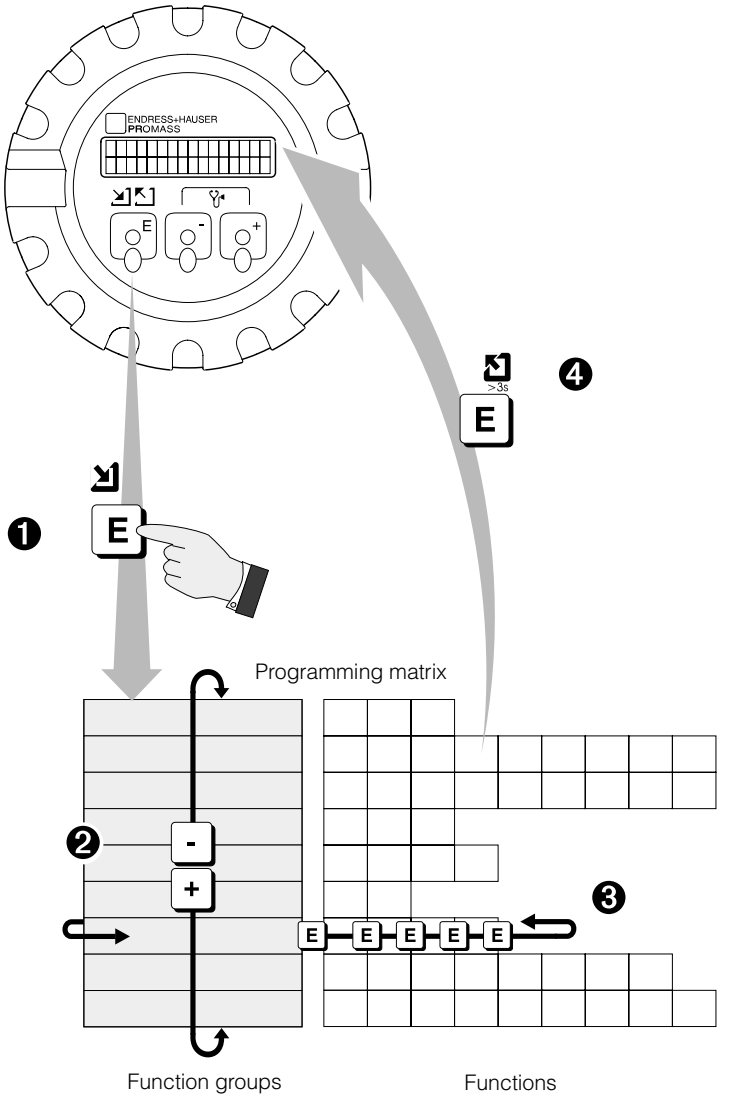
❷ Select function group (>GROUP SELECT.<)

❸ Select function (entering / setting data with ⊞; string with E)

❹ Leave programming matrix, return to HOME position from any matrix position (e.g. after programming)

Note!

Note!
Programming matrix → see page 27
Programming example → see page 29
Description of functions → see page 31 ff.



Notes!
- An automatic return to the HOME position will be made if the operating elements are not pressed for 60 seconds (only when the programming is locked).
- If the diagnostic function ⊞ is activated from the HOME position, then an automatic return to HOME position will be made if the operating elements are not pressed within 30 seconds; whether the programming is enabled or locked.

Note!

Fig. 17: Selecting functions in the E+H programming matrix

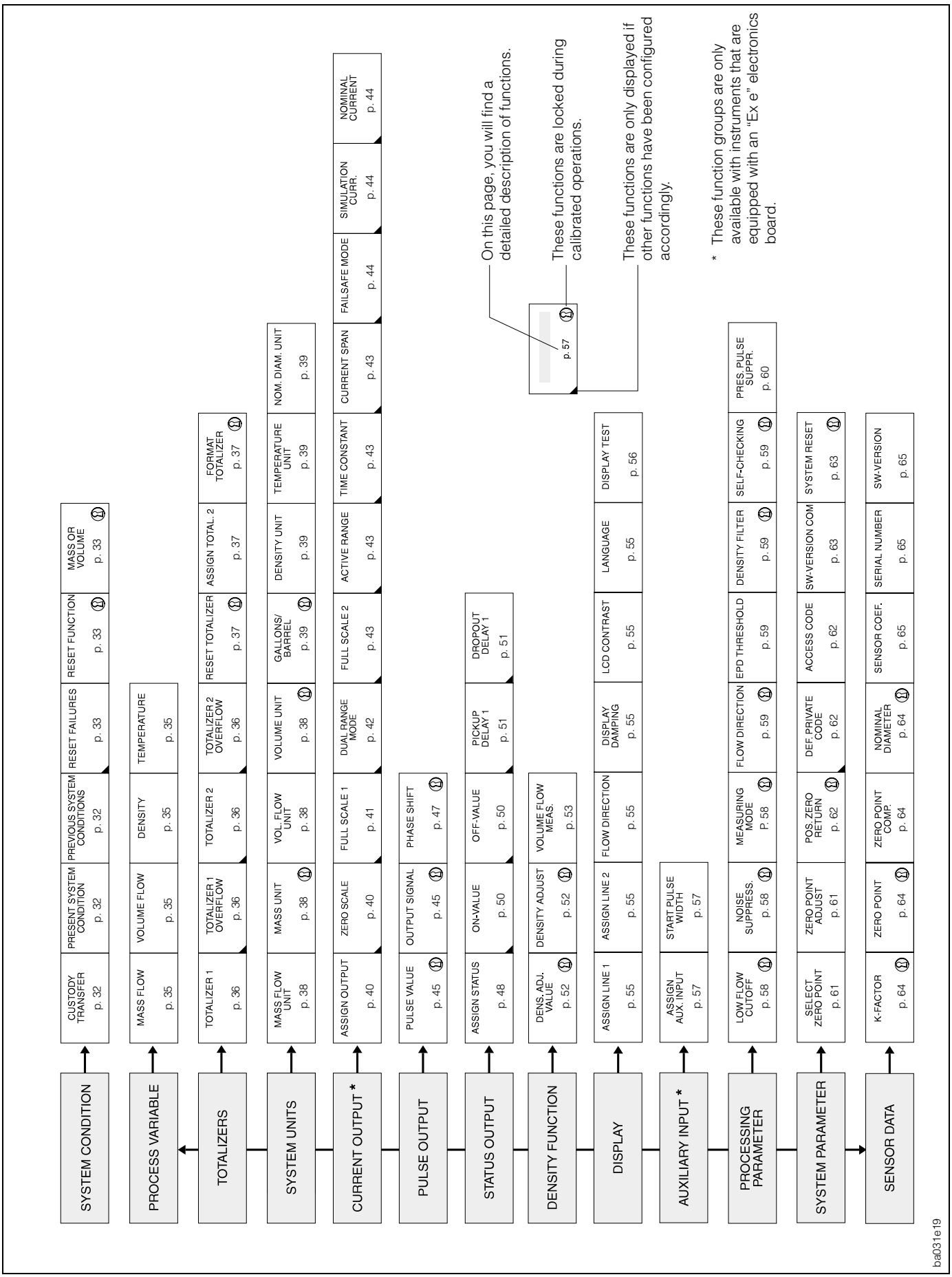


Fig. 18:
Programming matrix Promass 64

Hints for programming
For the Promass 64 measuring system there is a wide choice of functions available which the user can set individually and adapt to the conditions of the process.

Please note the following important points when programming:
- If the power supply cuts out, then all calibrated and set values are safely stored in the EEPROM (without requiring batteries).
- Functions which are not required, e.g. current output, can be set to "OFF". The appropriate functions in other function groups then no longer appear on the display.
- If, when programming, you wish to undo a setting carried out with ⊞, then select "CANCEL". This is only possible for settings which have not yet been stored by pressing [E].
- In certain functions, a prompt is given after entering data for safety reasons. Select "SURE? [YES]" with the ⊞ keys and confirm by pressing [E] again. The setting is now stored or a function, e.g. zero point calibration, is activated.
- The Promass 64 may not show values with all decimal places as this depends on the engineering unit used and the number of decimal places selected see function "FORMAT FLOW", page 55). An arrow is therefore shown between the measured value and engineering unit (e.g. 1.2 → kg/h).


Caution!

Caution!
In the verification mode, all functions and possible selections of the operating matrix relevant for verification measurement are automatically locked. Such functions may no longer be changed once the Promass measuring instruments have been sealed.
In the programming matrix (see previous page) as well as in chapter 7, such functions are marked by a key-hole symbol.

Enabling programming (entering the code number)

Normally programming is locked. Any unauthorised changes to the instrument functions, values or factory setting are therefore not possible. Only when a code has been entered (factory setting = 64) parameters can be entered or changed. The use of a personal code number which can be freely chosen prevents unauthorised personnel from gaining access to data (see page 62).


Note!

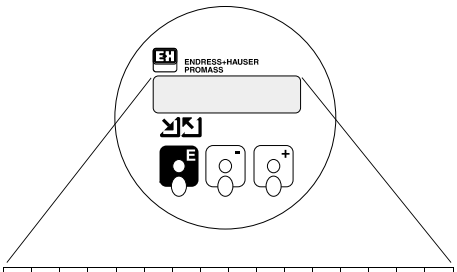
Note!
- If programming is locked and the ⊞ keys are pressed in a given function, then a prompt to enter the code automatically appears on the screen.
- With code 0 (zero) the programming is **always** enabled!
- If the personal code number is no longer available, then please contact the Endress+Hauser Service Organisation which will be pleased to help you.

Locking programming

- After returning to the HOME position, programming is again locked after 60 s if no operating element is pressed.
- If Programming can also be locked by entering any number (not the customer code number) in the function "ACCESS CODE".

6.3 Example of programming

If you want to change the current language for all display texts, e.g. from English to French, then proceed as follows:



E — Entering the E+H programming matrix.

```
PROCESS  VARIABLE
>  GROUP  SELECT.<
```

+ — Select the desired function group "DISPLAY".

```
DISPLAY
>  GROUP  SELECT.<
```

E — Select the function "LANGUAGE".

```
ENGLISH
LANGUAGE
```

+ / – — On pressing + or – the code entry is automatically prompted.

```
        0
ACCESS  CODE
```

+ / – — Enter the code number (factory setting = 64)

```
       64
ACCESS  CODE
```

E — Programming is now enabled.

```
EDITING  ENABLED
```

The programmable value flashes.

```
ENGLISH
LANGUAGE
```

+ / – — Select the desired language. The display stops flashing.

```
FRANCAIS
LANGUAGE
```

E — Save the input.

```
VALEUR  MEMORISEE
```

The display flashes and the language can be changed again.

```
FRANCAIS
LANGUAGE
```

E (≥3s) — Return to the HOME position (press the E key for more than 3 seconds).

E — Select other functions. Following the last function, there is an automatic return to >GROUP SELECT.<.

```
 RETOUR  DANS  LE
 MENU  FONCTIONS
```

7 Functions

This section lists in detail a description as well as all the information required for the individual functions of the Promass 64. Factory settings are shown in ***bold italics.*** On request, Promass 64 measuring instruments are also available with customised parameterisation. In such cases, values/settings may differ from the factory settings shown here.

Caution!
Important when programming

- Caution!
  For calibrated operations, all functions and possible selections of the operating matrix relevant for calibration are automatically locked. Such functions may no longer be changed once the Promass measuring instruments have been sealed.
  In this chapter, such functions are marked by a key-hole symbol.


Caution!

- The Promass 64 electronics are fitted with various electronics boards depending on the specifications when ordering (“Ex e” and “Ex i”). Certain functions and function groups are **not** available depending on the electronics board used (see matrix on page 27).

- Many functions and options are shown on the display only when other functions have been configured adequately.

- Functions not required, e.g. current output, can be switched “OFF”. Corresponding functions in other function groups will then not appear on the display. Functions can only be switched off if the appropriate settings in other functions have been previously reconfigured.

- If, when programming, you wish to undo a setting carried out with ⊞, then select CANCEL. This is only possible for settings which have not yet been stored by pressing [E].

- In certain functions, a prompt is given after entering data for safety reasons. Select “SURE? [YES]” with the ⊞ keys and confirm by pressing [E] again. The setting is now stored, or a function, e.g. zero point calibration, is activated.

Function group **SYSTEM CONDITION**	
CUSTODY TRANSFER	This function shows whether the measuring system is set to custody transfer mode or not (YES – NO). The setting or deletion of calibrated operations is described more in-depth on page 22!
PRESENT SYSTEM CONDITION	System/process errors as well as status messages which occur while measurement is in progress are displayed in the HOME position alternately with the actual measurement variable. Notes! • On activating the diagnosis function ⊞ there is automatically a jump to this function. The user can then call up the current system/process errors and the status messages in order of priority. • A complete listing of all possible system/process errors and status messages is found on page 70 ff. ⊞ Calling up other current errors or status messages ("+" with higher priority; "–" with lower priority). When the listing is complete the display shows the message "END OF LIST". ⊞ By pressing the diagnosis function again when a system error occurs you can also call up error descriptions. In such cases a diagnosis symbol (stethoscope) is shown on the display.
PREVIOUS SYSTEM CONDITIONS	In this function, all system/process errors and status messages that have occurred so far are listed in *chronological* order ("error history" with max. 15 entries). Notes! • A complete list of all possible system/process errors and status messages is found on page 70 ff. • If no error or status messages have occurred since the measuring system was last started up then the display shows the message "S: NO ENTRY EXISTING". • With more than 15 entries the oldest is overwritten. • Storage of this list is volatile and is lost if there is a supply failure. ⊞ Calling up other system/process errors and status messages ("+" Listing is done chronologically with the oldest, second oldest, etc. message; "–" Listing is done chronologically with the latest, second latest, etc. message). When the listing is complete the display shows the message "END OF LIST". ⊞ By activating the diagnosis function when a system error occurs you can also call up error descriptions. In such cases a diagnosis symbol (stethoscope) is shown on the display.

Note!

Note!

Function group **SYSTEM CONDITION**	
RESET FAILURES	Error messages that occur during custody transfer measurements must be reset in this function. This guarantees that error messages were noted and confirmed. On page 70 ff., you will find a list of all error messages to be reset. Notes! • This function is only available for calibrated operations. • Resetting error messages does not require a code entry. • The error can only be corrected permanently if the reason for the error, e.g. a partially filled or empty measuring pipe, is eliminated. • Should several errors occur simultaneously, they are all corrected by the "reset" function. All entries in the "CURRENT SYSTEM STATUS" function are thus simultaneously deleted. • Error messages may also be reset using the auxiliary input (see page 57) if the Promass is equipped with an Ex e electronics board. ***CANCEL*** – YES
RESET FUNCTION	Error messages that occur during custody transfer measurement must be reset and confirmed manually (see "RESET FAILURES" function). This function specifies how and when the flowmeter returns to normal operation after an error has been corrected. Please refer to the figure on page 34. ***AUTOMATIC*** Promass 64 automatically re-assumes normal measuring operations as soon as the error has been corrected. However, the appropriate error messages only disappear from the display after the message has been reset and confirmed in the "RESET FAILURES" function. RESET FAILURES Promass 64 only re-assumes normal measuring operations if the error has been corrected and the error report manually reset by using the auxiliary input or the "RESET FAILURES" function. For returning to normal operation, all error messages must, therefore, be confirmed in all cases. CANCEL
MASS OR VOLUME	In this function, you determine whether the measuring instrument is to be calibrated for mass flow or volume flow. The calibration parameter selected here is assigned to totalizer No. 1 as well as to the two pulse outputs. Caution! In custody transfer mode, all instrument functions related to calibration parameters are automatically locked. All parameters must therefore be programmed before activating the custody transfer mode (see page 22). ***MASS*** – VOLUME – CANCEL

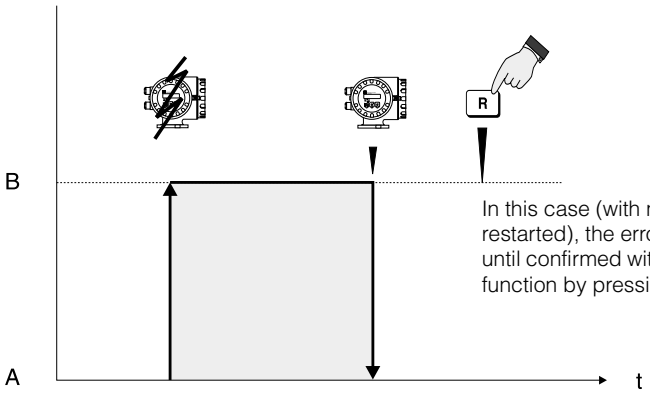
Note!

Caution!

Function group
SYSTEM CONDITION

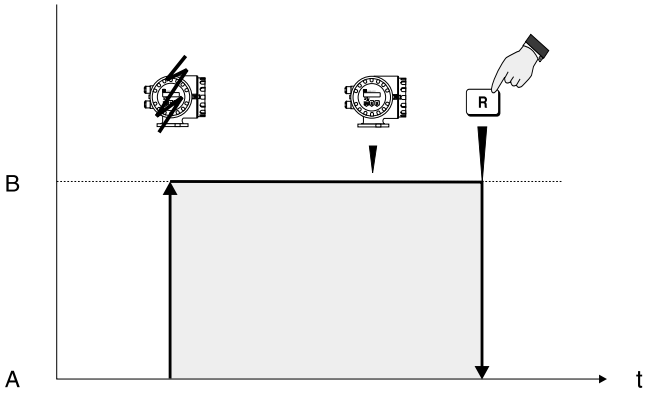
Resetting of error message during custody transfer measurement
(→ “RESET FUNCTION”, page 33)

“AUTOMATIC” setting



In this case (with normal measurement restarted), the error message is displayed until confirmed with the “ERROR RESET” function by pressing “YES”.

“RESET FAILURES” setting



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A = error-free status (normal operation)
B = error status

Error occurs

Error cleared

Error confirmed

measuring operations interrupted

To this period the following applies:
- status output open
- current output with defined failure mode (see page 44)
- totalizers stopped
- pulse output stopped
- error message displayed

Function group **PROCESS VARIABLE**	
Notes! • The engineering units of all variables shown here can be set in the Function group “SYSTEM UNITS”. • If the medium in the pipeline flows backwards, then the flow rate value is indicated by a negative sign on the display (independent of the setting in the function “MEASURING MODE”, see page 58).	
MASS FLOW	Selecting this function automatically displays the current flow rate. Display: 5-digit number with floating decimal point, incl. engineering units and arithmetic sign (e.g. 462.87 kg/h; 731.63 lb/min; etc.)
VOLUME FLOW	After selecting this function, the display automatically shows the currently measured volumetric flow rate. The volumetric flow rate is derived from the measured mass flow rate and the measured density of the medium. Display: 5-digit number with floating decimal point, incl. engineering units and arithmetic sign (e.g. 5.5445 dm^3/min; 1.4359 m^3/h; 731.63 gal/d; etc.)
DENSITY	Selecting this function automatically displays the current density of the medium or its specific gravity. Display: 5-digit number with fixed decimal point, incl. engineering units (corresponding to 0.10000…6.0000 kg/dm^3), e.g. 1.2345 kg/dm^3; 993.5 kg/dm^3; 1.0015 SG_20 °C; etc.
TEMPERATURE	Selecting this function automatically displays the current temperature of the medium. Display: max. 4-digit number with fixed decimal point, incl. engineering units and arithmetic sign (e.g. –23.40 °C; 160.0 °F; 295.4 K, etc.)


Note!

Function group **TOTALIZERS**	
TOTALIZER 1	Selecting this function automatically displays the totalised flow quantity (for calibrated operations) from when measurement began. This value is either positive or negative depending on the direction of flow. Notes! • The top display line is automatically assigned to calibratable totalizer No. 1 – for calibrated as well as non-calibrated operations. • For calibrated operations, totalizer No. 1 (incl. overflow) cannot be reset. • The symbol “>” is shown in front of the value if the number has more figures than can be shown (overflow). • For custody transfer measurement, the flow may only be measured and totalised in one flow direction (forwards). Please ensure that the “MEASURING MODE” function (see page 54) has first been switched to “UNIDIRECTIONAL”. • The totalizers always stop whenever an error occurs. Display: max. 7-digit number with fixed decimal point, incl. engineering units (e.g. 1.54 t; 14925.63 kg) Display of which measuring variable is assigned to Totalizer 1.
TOTAL. 1 OVERFLOW	The totalised mass flow is shown as a max. 7-digit number with fixed decimal point. Larger numbers (>9999999) can be read off in this function as overruns. The effective amount is calculated from the sum of the “TOTAL. 1 OVERFLOW” and the value shown in the function “TOTALIZER 1”. *Example:* Display of 2 overruns: **2 e7 kg** (= 20,000,000 kg) The value shown in the function “TOTALIZER 1” is 196,845.7 kg Total amount = 20,196,845.7 kg Notes! • This function is displayed only if overruns have occurred. • The value 0 e7 (incl. units) is shown in the HOME position if *no* overrun occurs. Display: integer to a decimal power e.g. 10 e7 kg Display of which measuring variable is assigned to Totalizer 1.
TOTALIZER 2	Function description → corresponding to Function “TOTALIZER 1”. Notes! • Totalizer No. 2 may always be reset during calibrated operations, including by way of the auxiliary input! • If necessary, totalizer No. 2 may be assigned to the bottom line of the display.
TOTAL. 2 OVERFLOW	Function description → corresponding to Function “TOTAL.1 OVERFLOW”.

Function group
TOTALIZERS

RESET TOTALIZER

The totalizers, inclusive the overflow, can be reset to zero in this function.

Notes!
- Totalizer No. 1 cannot be reset during custody transfer mode
- Totalizer No. 2 can always be reset, also via the auxiliary input (see page 57)
- If creep suppression value = 0: totalizers may always be reset
  If creep suppression value > 0: totalizers may only be reset in case of active creep suppression

Note!

CANCEL – TOTALIZER 1* – TOTALIZER 2 – TOTALIZERS 1&2*
(* cannot be selected for calibrated operations)

ASSIGN TOTAL. 2

In this function, any measuring variable required can be assigned to Totalizer 2.

Note!
The totalizer is reset to zero if the assignment in this function is changed again.

Note!

OFF – MASS – VOLUME – CANCEL

UNIDIRECTIONAL or BIDIRECTIONAL:
Display to show whether the flowmeter measures in one or in both flow directions (see Function “MEASURING MODE”, page 58).

FORMAT TOTALIZER

With this function, you may determine the number of decimal places of the totalizer display.

_.0
_***.00***
_.000

CANCEL

Function group **SYSTEM UNITS**	
MASS FLOW UNIT	In this function, select the engineering units required from those displayed for mass flow rate (mass/time). The engineering units selected here also define those for: • Zero and full scale value for current • Status output switching points (limit value for mass flow; flow direction) • Creep rate g/min – g/h – kg/s – kg/min – ***kg/h*** – t/min – t/h – t/d – lb/s – lb/min – lb/hr – ton/min – ton/hr – ton/day – CANCEL Display of current mass flow rate.
MASS UNIT	In this function, select the engineering units from those displayed for mass. The engineering units selected here also define those for: • Pulse weighting (e.g. kg/p). • Totalizer Note! If in verification mode, this function is locked if the calibration parameter was configured to “MASS”. g – ***kg*** – t – lb – ton – CANCEL
VOL. FLOW UNIT	In this function, the units required for flow rate (volume/time) can be selected from those displayed. The volumetric flow rate is derived from the measured density of the medium and the mass flow rate. The units selected here also define those for: • Zero and full scale value for current • Status output switching points (limit value for volumetric flow rate) cm^3/min – cm^3/h – dm^3/s – dm^3/min – ***dm^3/h*** – l/s – l/min – l/h – hl/min – hl/h – m^3/min – m^3/h – cc/min – cc/hr – gal/min – gal/hr – gal/day – gpm – gph – gpd – mgd – bbl/min – bbl/hr – bbl/day – CANCEL Display of actual volumetric flow rate.
VOLUME UNIT	In this function, the units required for volume are selected from those displayed. The volumetric flow rate is derived from the measured density of the medium and the mass flow rate. The engineering units selected here also define those for: • Pulse weighting (e.g. $m^3 \rightarrow m^3$/pulse) • Totalizer Note! If in verification mode, this function is locked if the calibration parameter was configured to “VOLUME”. cm^3 – ***dm^3*** – l – hl – m^3 – cc – gal – bbl – CANCEL

Note!

Note!

Function group **SYSTEM UNITS**	
GALLONS/ BARREL	In the USA and UK, the ratio of barrels (bbl) to gallons (gal) is defined according to the material used and the specific industry. Therefore the following definitions have to be selected: • US or imperial gallons • Ratio gallons/barrel Note! If in verification mode this function is locked if the calibration parameter was configured to "VOLUME". US: 31.0 gal/bbl — for beer (brewing) ***US: 31.5 gal/bbl*** — for liquids (used in normal cases) US: 42.0 gal/bbl — for oil (petrochemicals) US: 55.0 gal/bbl — for filling tanks Imp: 36.0 gal/bbl — for beer and similar liquids Imp: 42.0 gal/bbl — for oil (petrochemicals) CANCEL US: 1 gal = 3.785 l (litre) Imp: 1 gal = 4.546 l (litre)
DENSITY UNIT	In this function, select the required engineering units from those displayed for density. The units selected here also define those for: • Zero and full scale value for current • Status output switching points (limit value for density) • Density response value for Empty Pipe Detection • Density adjustment value g/cm³ – kg/dm³ – ***kg/l*** – kg/m³ – SD_4 °C – SD_15 °C – SD_20 °C – g/cc – lb/cf – lb/gal – lb/bbl – SG_59 °F – SG_60 °F – SG_68 °F – SG_4 °C – SG_15 °C – SG_20 °C – CANCEL SD = SG ("Specific Density" or "Specific Gravity") The specific gravity is the ratio between the density of the medium and the density of water (at water temperatures = 4, 15, 20 °C or 59, 60, 68 °F). Display showing current density or specific gravity.
TEMPERATURE UNIT	In this function, select the required engineering units from those displayed for temperature. The units selected here also define those for: • Zero and full scale value for current • Status output switching points (limit value for temperature) • Min./max. temperatures (sensor coefficients, see page 65) ***°C (CELSIUS)*** – K (KELVIN) – °F (FAHRENHEIT) – °R (RANKINE) – CANCEL Display showing the current medium temperature.
NOM. DIAM. UNIT	In this function, select the required engineering units from those shown for the nominal diameter of the sensor. ***mm*** – inch – CANCEL Display showing the nominal diameter of the sensor in current use.

Note!

Function group
CURRENT OUTPUT

Note!
This function group is only available if the measuring electronics of Promass 64 is equipped with the "Ex e" board.

ASSIGN OUTPUT

In this function, any variable required can be assigned to the current output.

OFF – ***MASS FLOW*** – VOLUME FLOW – DENSITY – TEMPERATURE – CANCEL

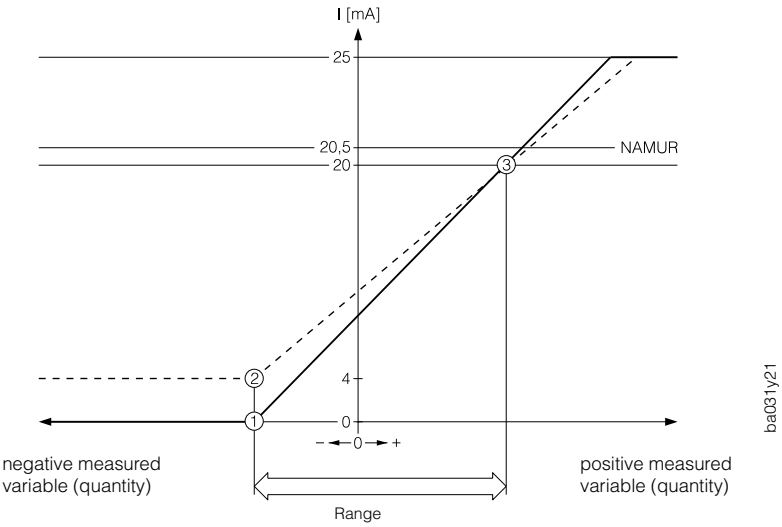
Diagnosis (for flow rate variables only):

UNIDIRECTIONAL or BIDIRECTIONAL:
Display showing if the flowmeter is measuring in one or both flow directions. With unidirectional measurement a 0/4…20 mA current signal is only produced for the positive flow direction (forward); the current stays at 0 or 4 mA for the negative direction.

ZERO SCALE

In this function, assign the 0/4 mA quiescent current to the required zero value. This value applies to both flow directions (bidirectional).

Notes!
- The zero value can be larger or smaller than the "full scale value" (see function "FULL SCALE 1", see page 41).
- The difference between the zero and full scale value should not fall below a minimum value:



Min. set value	Min. range	Max. set value
Q = –180.0 t/h**	Q = 0.5 m/s *	Q = 180 t/h **
ρ = 0.0 kg/dm³	ρ = 0.1 kg/dm³	ρ = 5.999 kg/dm³
T = –273.15 °C	T = 10 K	T = 300 °C

① Zero scale value 0…20 mA
② Zero scale value 4…20 mA
③ Full scale value 0/4…20 mA

* dependent on density
** dependent on the nominal diameter

5-digit number with floating decimal point
(e.g. 0.0000 kg/h; 245.92 kg/m³; 105.60 °C, etc.)
Factory settings: ***0.0000 kg/h*** resp. ***0.0000 kg/l*** resp. ***–50.000 °C***

Display showing which process variable is assigned to the current output.

Function group
CURRENT OUTPUT

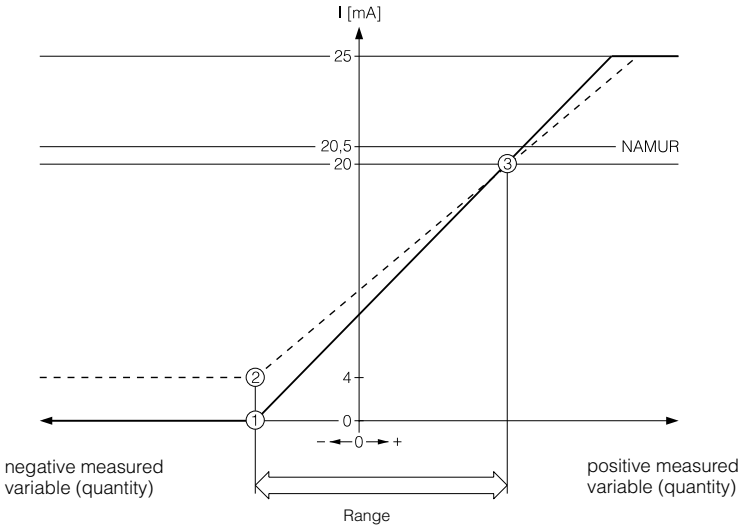
FULL SCALE 1

In this function, assign the full scale value required to the 20 mA current (= scaling the full scale value) especially for that variable selected in function "ASSIGN OUTPUT".

With flow variables the scaling is always for both flow directions (bidirectional). The direction of flow can be given at the status output when appropriately configured (not possible with custody transfer mode).

Notes!
- The full scale value can be larger or smaller than the "zero value" (see function "ZERO SCALE", page 40).
- The difference between the zero and full scale value should not fall below a minimum value:

Note!



Min. set value	Min. range	Max. set value
Q = –180.0 t/h**	Q = 0.5 m/s *	Q = 180 t/h **
ρ = 0.0 kg/dm³	ρ = 0.1 kg/dm³	ρ = 5.999 kg/dm³
T = –273.15 °C	T = 10 K	T = 300 °C

① Zero scale value 0…20 mA
② Zero scale value 4…20 mA
③ Full scale value 0/4…20 mA

* dependent on density
** dependent on the nominal diameter

5-digit number with floating decimal point (depending on the variable, e.g. 566.00 kg/min; 0.9956 kg/dm³; 105.60 °C)

Factory settings: mass flow: ***dependent*** on the nominal diameter
density: ***2.0000 kg/l***
temperature: ***200.00 °C***

Display showing which process variable is assigned to the current output.

Function group
CURRENT OUTPUT

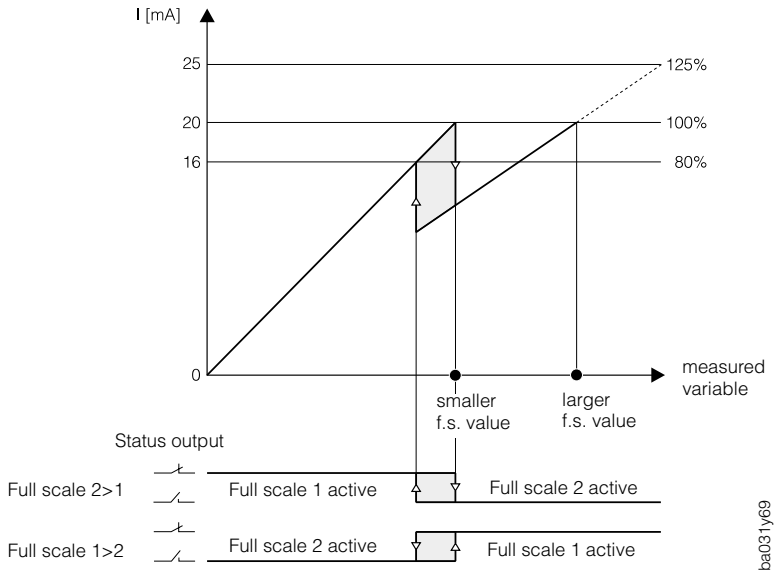
DUAL RANGE MODE

For specific applications the scaling of a second end value is useful or possibly required expecially with flow rate variables. In this function one of the two end values is selected with which the measuring system operates. The setting "AUTOMATIC" allows the measuring system to switch between two end values (see diagram below).

Applications:
- Frequent measurement of two different media with widely differing flow velocities. The operator defines an end value for each of these two media which can be activated in this function as required.
- Higher resolution of the measuring signal with very small flow velocities. The setting "AUTOMATIC" allows the Promass measuring system to switch automatically between two end values depending on the flow velocity.

Note!

Notes!
- The appropriate configuration enables the actual end value to be supplied or displayed by the status output (see following figure as well as p. 49).
- The end values can also be activated using the auxiliary input (see page 57).
- In bidirectional operation, the dual range mode acts in both the positive and negative direction of flow.



FULL SCALE 1 The measuring system operates with end value 1 only

FULL SCALE 2 The measuring system operates with end value 2 only

AUTOMATIC The measuring system operates with end value 1 and 2; automatic switching between end value 1/2 (see figure above)

AUXILIARY INPUT Selecting the end value is carried out using the auxiliary input, see page 57

CANCEL

Display showing which process variable is assigned to the current output.

Function group **CURRENT OUTPUT**	
FULL SCALE 2	For description of function: see "FULL SCALE 1", page 41. Notes! • This function is only available if "FULL SCALE 2" has been activated in the Function "DUAL RANGE MODE" (see page 42). • Full scale 2 may be larger or smaller than full scale 1.
ACTIVE RANGE	After selecting this function the actual end value is automatically displayed (***FULL SCALE 1*** – FULL SCALE 2). Note! The appropriate configuration enables the actual end value to be supplied or displayed by both relays (see figures on pages 42, 49). Display showing which process variable is assigned to the current output.
TIME CONSTANT	Selecting the time constant determines whether the current output signal reacts quickly (small time constant) to rapidly fluctuating variables e.g. flow rate or delayed (long time constant). The time constant does not influence the behaviour of the display. 3- to 5-digit number with fixed decimal point (0.01…100.00 s) Factory set value: ***1.00 s*** Display showing which process variable is assigned to the current output.
CURRENT SPAN	In this function, set the 0/4 mA quiescent current. The current for the scaled full scale value (100%) is always 20 mA. A choice can be made between the current output corresponding to NAMUR recommendations (max. 20.5 mA) or the current output with maximum 25 mA. 0–20 mA (25 mA) → maximum 25 mA 4–20 mA (25 mA) → maximum 25 mA 0–20 mA → maximum 20.5 mA (NAMUR) ***4–20 mA*** → maximum 20.5 mA (NAMUR) CANCEL Display showing which process variable is assigned to the current output.

Note!

Note!

Function group **CURRENT OUTPUT**	
FAILSAFE MODE	In cases of fault it is advisable for safety reasons that the current output assumes a previously defined status which can be set in this function. The setting chosen only affects the current output. Other outputs or the display (e.g. totalizer) are not affected. ***MIN. CURRENT*** Current signal is set to 0 mA (0…20 mA) or 2 mA (4…20 mA) on error MAX. CURRENT Current signal set to 25 mA for 0/4…20 mA (25 mA) or to 22 mA for 4…20 mA on error. HOLD VALUE Last valid measured value is held ACTUAL VALUE Normal measured value given despite error CANCEL Display showing which process variable is assigned to the current output.
SIMULATION CURR.	In this function, the output current can be simulated to correspond to 0%, 50% or 100% of the set current range. The error values 2 mA (for 4…20 mA) and 25 mA (maximum possible value) or 22 mA for NAMUR can also be simulated. *Application example:* Checking instruments connected or checking the adjustment of the internal current signal. Notes! • After activating the simulation mode, the message “S: CURRENT OUTPUT SIMUL. ACTIVE” appears on the display. • The selected simulation mode affects only the current output. The flowmeter remains fully operational for measurement, i.e. totalizer, flow display, etc. are operating normally. • Measurement value suppression interrupts any simulation being carried out and sets the output current to 0 mA or 4 mA (see function “POS. ZERO RETURN”, page 62). • Current output according to NAMUR → the 22 mA value only can be selected, not the 25 mA value. ***OFF*** – 0 mA – 10 mA – 20 mA – 22 mA – 25 mA (at 0…20 mA) 2 mA – 4 mA – 12 mA – 20 mA – 22 mA – 25 mA (at 4…20 mA) CANCEL
NOMINAL CURRENT	In this function, the current and calculated target value of the output current is shown (0.00…25.0 mA). The effective current can vary slightly due to external effects such as temperature. Display showing the current measured value for the process variable assigned to the current output.

Note!

Function group
PULSE OUTPUT

PULSE VALUE

In this function, define the freely selectable flow quantity which the output pulse is to deliver. By means of an external counter the sum of these pulses can be totalised and the total quantity determined since the start of measurement.

Note!
To determine the pulse weight, you have to make sure a pulse frequency of 500 Hz is not exceeded even at maximum flow conditions.

Note!

5-digit number with floating decimal point, incl. engineering units (e.g. 240.00 t/p; 0.6136 kg/p etc.)
Factory setting: ***dependent*** on the nominal diameter

Display showing which calibration parameter is assigned to the pulse output.

OUTPUT SIGNAL

With this function, you may configure pulse outputs, e.g. for an external totalizer system.

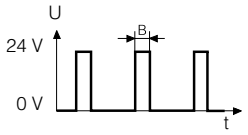
Selection by "Ex e" electronics board

PASSIVE-POSITIVE
PASSIVE-NEGATIVE
ACTIVE-POSITIVE
ACTIVE-NEGATIVE
CANCEL

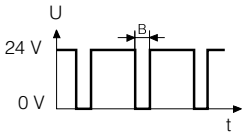
Selection by "Ex i" electronics board

PASSIVE-POSITIVE
PASSIVE-NEGATIVE
CANCEL

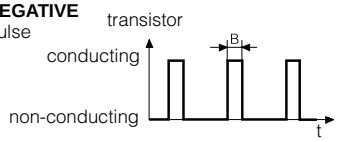
ACTIVE POSITIVE Pulse

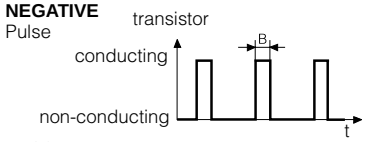


ACTIVE NEGATIVE Pulse

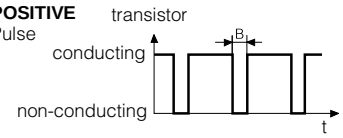


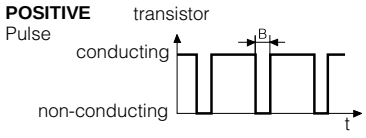
PASSIVE NEGATIVE Pulse





PASSIVE POSITIVE Pulse





B	pulse width
ACTIVE	internal power supply used (+24 V).
PASSIVE	external power supply required
POSITIVE	fall-back value at 0 V (active high).
NEGATIVE	fall-back value at 24 V (active low) or external power supply.

PASSIVE = OPEN-COLL or ACTIVE = PUSH-PULL
(for explanations see pictures below)

(Continued on next page)

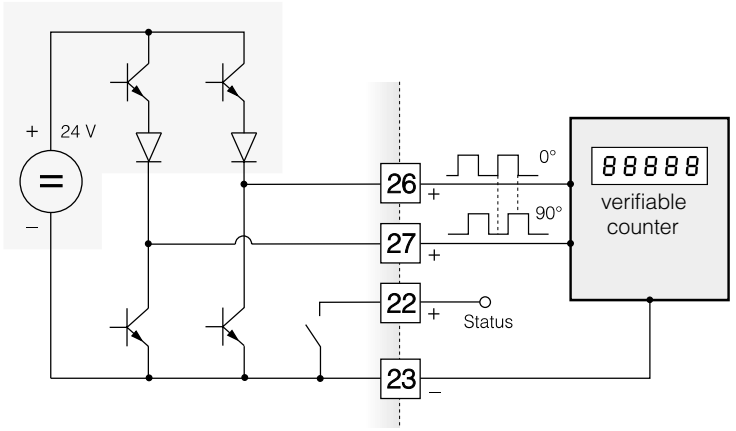
Function group
PULSE OUTPUT

OUTPUT SIGNAL
(continued)

"Ex e" electronics board

AKTIVE
PASSIVE

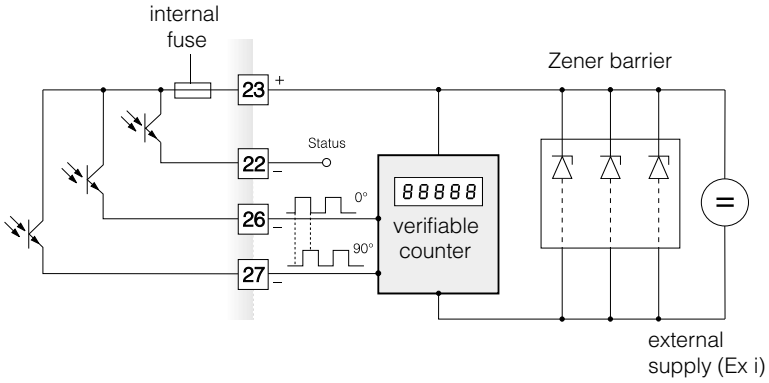
The circuit in the shaded area only applies to the “ACTIVE” mode.



Terminal 23: Common ground
Terminal 22: Status output (NO contact)
Terminal 26: Pulse output A
Terminal 27: Pulse output B
(90° or 180° phase shifted in relation to pulse output A)

"Ex i" electronics board

PASSIVE



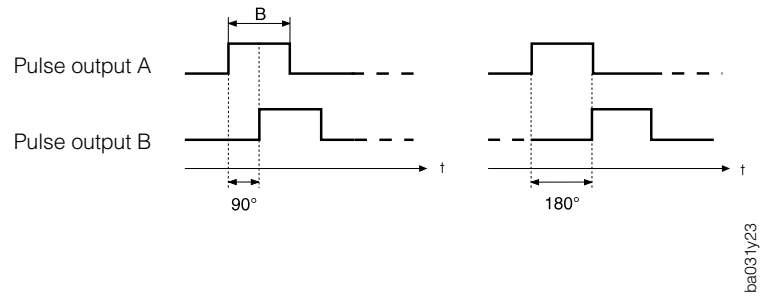
Terminal 23: Common supply
Terminal 22: Status output (Open Emitter)
Terminal 26: Pulse output A (Open Emitter)
Terminal 27: Pulse output B (Open Emitter)
(90° or 180° phase shifted in relation to pulse output A)

Function group
PULSE OUTPUT

PHASE SHIFT

With this function, you may determine the phase shift of the double pulse outputs (signals).

+ / – ***90°*** – 180° – CANCEL



Note!
The pulse width (B) *cannot* configured; it adjusts according to the flow rate.
Minimum pulse width: 1 ms
Maximum pulse width: 10 ms

Note!


Caution!

Function group
STATUS OUTPUT

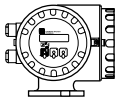
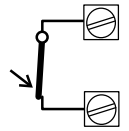
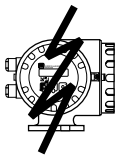
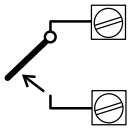
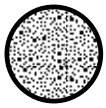
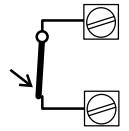
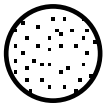
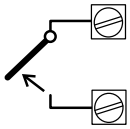
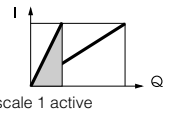
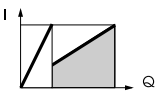
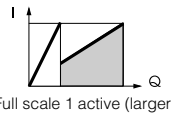
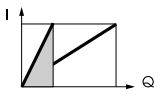
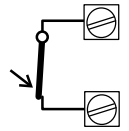
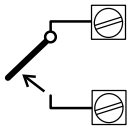
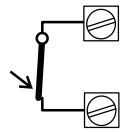
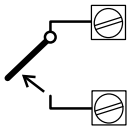
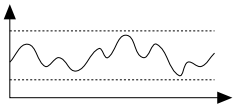
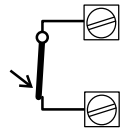
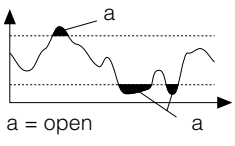
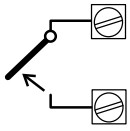
ASSIGN STATUS

Various functions can be assigned to the status output.
The switching response of the relay contact is shown in Fig. 19 (see next pages).

Caution!
In the verification mode, the status output is automatically configured to "FAILURE". The other functions are only available for non-verification measurements.

FAILURE	Error message (see page 70)
EMPTY PIPE DET.	Empty Pipe Detection → falling below a defined density response value, e.g. with empty measuring pipes (see also function "EPD THRESHOLD", page 59)
DUAL RANGE MODE	Registering active End value 1 or 2 (see page 42)
FLOW DIRECTION	Flow direction message (see page 50). On unidirectional measurement Relay 1 also switches in the negative flow direction.
LIMIT MASS FLOW LIMIT VOL. FLOW LIMIT DENSITY LIMIT TEMPERAT.	Registering if preset limit value is outside range. (see page 50)
CANCEL	

With selection "EPD"
Display showing which value is assigned in the function "EPD THRESHOLD" (see page 59). The setting 0.0000 indicates that Empty Pipe Detection is switched off.

Functions Status Output	**Status**	**Switching response** Relay (Ex e); Open Emitter (Ex i)
FAILURE (calibrated operation → error)	System OK 	closed 
	Failure (system error) Supply failure 	open 
EMPTY PIPE DET. *	Measuring pipe filled 	closed 
	Empty measuring pipe (e.g. when falling below the density response value) 	open 
DUAL RANGE MODE * *(with "Ex e" board only)*	Full scale value 1 < 2  Full scale 1 active Full scale 2 active (larger span)  Full scale value 1 > 2  Full scale 1 active (larger span) Full scale 2 active 	closed 
		open 
FLOW DIRECTION *	forward 	closed 
	reverse 	open 
LIMIT MASS FLOW * **LIMIT VOL. FLOW *** **LIMIT DENSITY *** **LIMIT TEMPERAT. ***	Limit value not outside range limits 	closed 
	Limit value outside range limits 	open 

***** This function is only available for non-calibrated response!

Fig. 19:
Status output (functions and switching response)

Note!

Function group
STATUS OUTPUT

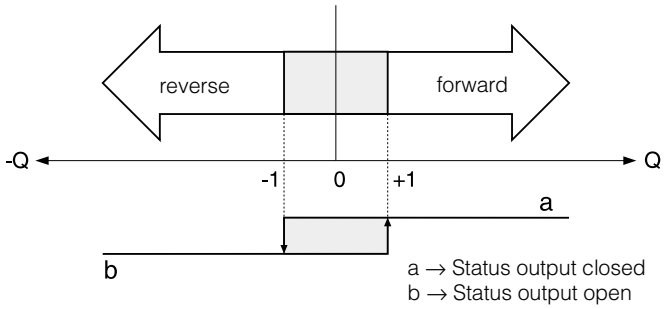
ON-VALUE

If you have correctly configured the status output for “LIMIT…” or “FLOW DIRECTION”, you may determine the necessary switching points in these functions. If the respective measured value reaches these preset values, the status output will switch as shown in the figures below.

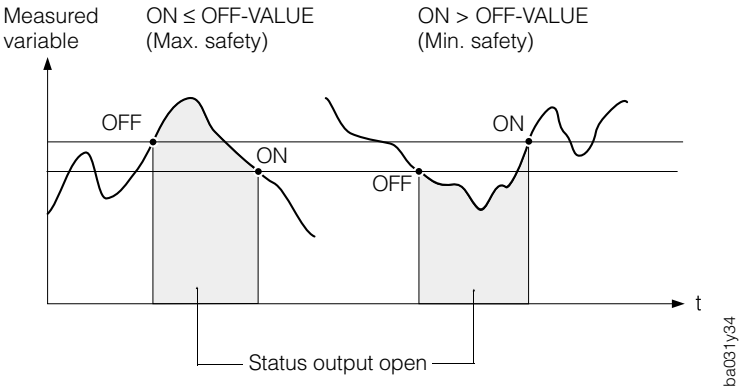
OFF-VALUE

Note!
The value for the switch-on point can be larger or smaller than for the switch-off point.

Status output → “FLOW DIRECTION”
The value entered in this function also defines the switch-on point for the positive and negative flow direction. If the switching point entered is for example = 1 kg/s, then the status output opens at –1 kg/s and closes again at +1 kg/s. If a direct switchover is required (no hysteresis), then set the switching point to the value = 0. If creep suppression is activated (see page 58), then it is recommended that the hysteresis is set to a value larger or the same as the low flow cutoff.



Status output → “LIMIT” (mass / volumetric flow rate, density, temperature)
The status output switches over as soon as the current variable moves outside the limits of a specific switching point.
Applications: monitoring flow, density, temperature and thus also the product quality; monitoring process conditions (process control).



Density/flow variables: 5-digit number with floating or fixed decimal point, incl. engineering units (e.g. 0.0037 t/min; 900.00 kg/m^3, etc.)
Temperature: max. 4-digit number with fixed decimal point, incl. engineering units and arithmetic sign (e.g. –22.50 °C)

Display showing which function is assigned to Relay 1.

Function group **STATUS OUTPUT**	
PICKUP DELAY	Note! This function is only available in the function “ASSIGNMENT STATUS” of the function group “STATUS OUTPUT” and also when one of the following parameters has been selected: • LIMIT MASS FLOW • LIMIT VOL. FLOW • LIMIT DENSITY • LIMIT TEMPERAT. In this function, a delay time (0...100 s) for a relay can be set. The delay time is first activated on reaching a preset limit value. The relay then only switches when this time has elapsed. Energising of the relay is delayed when a pickup operating time delay is used (i.e. the signal status changes from 0 to 1). Range: 0...100 seconds (in one second steps) Factory setting: ***0 s***
DROPOUT DELAY	Note! This function is only available in the function “ASSIGNMENT STATUS” of the function group “STATUS OUTPUT” and also when one of the following parameters has been selected: • LIMIT MASS FLOW • LIMIT VOL. FLOW • LIMIT DENSITY • LIMIT TEMPERAT. In this function, a delay time (0...100 s) for a relay can be set. The delay time is first activated on reaching a preset limit value. The relay then only switches when this time has elapsed. De-energising of the relay is delayed when a drop-out time delay is used (i.e. the signal status changes from 1 to 0). Range: 0...100 seconds (in one second steps) Factory setting: ***0 s***

Function group **DENSITY FUNCTION**	
DENS. ADJ. VALUE	In this function, enter the "target density" (= density adjust value) of the particular medium for which you want to carry out a field density adjustment. Implementation and procedure of this field adjustment is described in detail in the following function "DENSITY ADJUST". Notes! • If in verification mode this function is locked if the calibration parameter was configured to "VOLUME". • With two-point density adjustment, a target density value is to be given in this function for each of the two media. The two target density values must differ from each other by at least 0.2 kg/dm^3. • The value given here is only stored in a volatile memory. If the power supply is interrupted then the target value is set to the value 0.0000. 5-digit number with floating decimal point, incl. engineering units (corresponding to 0.1…5.9999 kg/l) MANUAL DENSITY CALIBRATION
DENSITY ADJUST	With this function a density adjustment can be carried out on site. The density adjustment values will thus be recalculated and stored. This ensures that the values dependent on density calculations are as accurate as possible. Note! This function is locked in calibrated operations if the calibration parameter is configured to VOLUME. Two types of adjustment are to be distinguished: **1-point density adjustment** (with *one* medium) This type of density adjustment is necessary under the following conditions: • The sensor does not measure the density accurately which the operator expects from laboratory trials. • The characteristics of the medium are outside the measuring points set at the factory or reference conditions under which the flowmeter has been calibrated. • The plant is used solely for measuring a medium whose density is to be determined very accurately under constant conditions. **2-point density adjustment** (with *two* media) This type of adjustment is always to be carried out if the measuring pipes have been mechanically altered by, e.g. • material build-up • abrasion • corrosion In such cases, the resonant frequency of the measuring pipes has been affected by these factors and is no longer compatible with the calibration data set at the factory. The 2-point density adjustment allows for these mechanical changes and recalculates new revised data. ***CANCEL*** – SAMPLE FLUID 1 – SAMPLE FLUID 2 – DENSITY ADJUST Display of actual target density value (see Function "DENS. ADJ. VALUE") (continued on next page)

Function group
DENSITY FUNCTION

DENSITY ADJUST

Carrying out density adjustment

Caution!


Caution!

- Density adjustment on site always demands that the operator accurately knows the density of the medium, for example, from laboratory trials.
- Density adjustment changes the density calibration values entered at the factory or by the service engineer.

1-point density adjustment (see Figure on page 54)

1. Fill the sensor with medium. Ensure that the measuring pipes are completely filled and that the medium is free of gas bubbles.
2. Wait until the temperature between the medium and the measuring pipe is constant (time taken → depends on the temperature and the medium).
3. Enter the target value of your medium in the function "DENS. ADJ. VALUE" with ± (see page 49) and store this value with E.
4. Select the setting "SAMPLE FLUID 1" in this function with ± and press E. The message "SAMPLE FLUID 1 RUNNING" is shown on the display for approx. 10 seconds. During this time, Promass 64 measures a new density-specific resonance frequency for the measuring pipes and the medium.

   Note!
   Repeat the procedure if an error message is displayed.
   Check the plant and process conditions if necessary.


Note!

5. Select the setting "DENSITY ADJUST" in this function with ± and press E. The prompt is displayed: Select "SURE [YES]" with ± and confirm with E. The density adjustment values are now calculated and then stored in the Promass measuring system.

2-point density adjustment (see Figure on page 54)

Note!
This type of density adjustment is only possible if both target density values are different from each other by at least 0.2 kg/l, otherwise the message "DENSITY ADJUST FAILURE" is shown on the display during adjustment.


Note!

1. Fill the sensor with the medium. Ensure that the measuring pipes are completely filled and that the medium is free of gas bubbles.
2. Wait until the temperature between the medium and the measuring pipe is constant (→ depends on the temperature and the medium).
3. Enter the target value of your medium in the function "DENS. ADJ. VALUE" ± (see page 49) and store this value E.
4. Select the setting "SAMPLE FLUID **1**" in this function with ± and press E. The message "SAMPLE FLUID 1 RUNNING" is shown on the display for approx. 10 seconds. During this time, Promass 64 measures a new density-specific resonance frequency for the measuring pipes.

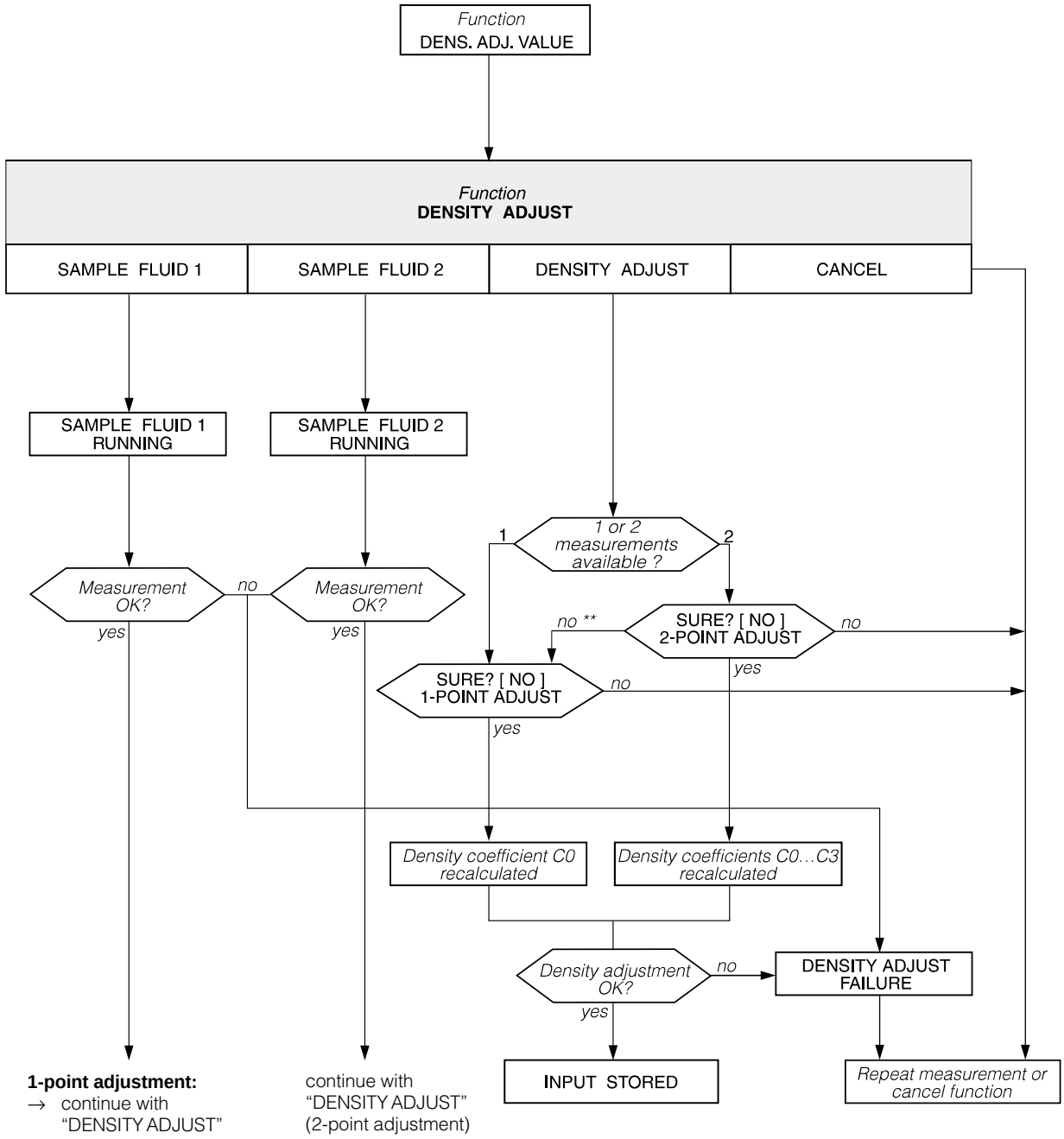
   Note!
   Repeat the procedure if an error message is displayed.
   Check the plant and process conditions if necessary.


Note!

5. Repeat step 1 to 4 for a *second* medium. Select the setting "SAMPLE FLUID **2**" for your second medium.
6. Select the setting "DENSITY ADJUST" in this function with ± and press E. The prompt is displayed: Select "SURE [YES]" with ± and confirm with E. The density adjustment values are now calculated and then stored in the Promass measuring system.

VOLUME FLOW MEAS.

This function shows that the volume measurement is always at disposal. In other functions you may, therefore, activate the respective settings (e.g. calibration parameter → VOLUME).



1-point adjustment:
→ continue with "DENSITY ADJUST"

or

2-point adjustment:
→ enter density adjustment value for medium 2
→ continue with "SAMPLE FLUID 2"

continue with "DENSITY ADJUST" (2-point adjustment)

** For the 1-point adjustment the measuring value of fluid 1 is used.

ba031e77

Fig. 20:
Carrying out density adjustment (flow diagram)
1-point and 2-point density adjustment

Function group **DISPLAY**	
ASSIGN LINE 1	For Promass 64, the top display line is always assigned to totalizer No. 1. Display: TOTALIZER 1
ASSIGN LINE 2	With this function the variable is defined which should be displayed on the *lower* display line during normal operation ("HOME" position). OFF – ***MASS FLOW*** – VOLUME FLOW – DENSITY – TEMPERATURE – TOTAL. 1 OVERFLOW – TOTALIZER 2 – CANCEL
DISPLAY DAMPING	Selecting a time constant determines whether the display reacts quickly (small time constant) or slowly (large time constant) to widely changing flow variables. Notes! • Damping is inactivated when set to "zero". • The time constant does not affect the response of the current output. Max. 2-digit number: 0…99 seconds Factory setting: ***1 s***
FORMAT FLOW	The maximum number of significant decimal places for all measured values and flow rate parameters are specified. Note! • The settings carried out here affect the display only and do not alter in any way the accuracy of calculations within the system. • The decimal places calculated by the Promass are dependent on the settings selected and engineering unit used. They are, however, not always shown. In such cases an arrow is shown on the display between the measured value and engineering unit (e.g. 1.2 → kg/h), i.e. the measuring system is using more decimal places when calculating than can be shown. xxxxx. – xxxx.x – xxx.xx – xx.xxx – ***x.xxxx*** – CANCEL
LCD CONTRAST	The display contrast can be optimally adjusted to match prevailing operating conditions on site (ambient temperature). Caution! At minus temperatures (<0 °C) the visibility of the LCD is no longer assured. The display contrast is at a maximum if the ± keys are simultaneously pressed when starting up the flowmeter. **IIIIIIIIIII**..... Any change in contrast is immediately seen with the adjustable bar graph.
LANGUAGE	In this function the appropriate language is selected in which all text, parameters and operating messages are to be displayed. Note! English is selected if the ± keys are simultaneously pressed when starting up the flowmeter. ENGLISH – DEUTSCH – FRANCAIS – ESPANOL – ITALIANO NEDERLANDS – DANSK – NORSK – SVENSKA – SUOMI – BAHASA INDONESIA – JAPANESE (in original alphabet) – CANCEL


Note!


Note!


Caution!


Note!

Function group **DISPLAY**	
DISPLAY TEST	With this function, you may verify whether the display or its segments are operative. This test may be executed without entering a code (to release the programming). The following displays are visible during the test: 1. ▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮ (both display lines) 2. 8888888888888888 (both display lines) 3. ---------- (both display lines empty) 4. 0000000000000000 (both display lines)  ***CANCEL*** – START

Function group
AUXILIARY INPUT

Note!
This function group is only available if the measuring electronics of Promass 64 are equipped with an "Ex e" board.


Note!

ASSIGN AUX. INPUT

Here, various functions can be assigned to the auxiliary input. The functions of the auxiliary input are started or activated by applying an external voltage.

OFF – RESET TOTAL. 2 – RESET FUNCTION – DUAL RANGE MODE – POS. ZERO RETURN – CANCEL

Pulsed mode

Assignment	*Pulse at auxiliary input*	*Function*
RESET TOTAL. 2	Pulse between 3…30 V DC, at least for the duration of the start pulse width which has been set.	Totalizer No. 2 reset.
RESET FUNCTION	Pulse between 3…30 V DC, at least for the duration of the start pulse width which has been set.	Error message is confirmed and reset.

Level mode

Assignment	*Pulse at auxiliary input*	*Function*
DUAL RANGE MODE	No voltage	Current output operates with FULL SCALE 1
	Voltage between 3…30 V DC	Current output operates with FULL SCALE 2

This parameter is only available if the current output is available and the function "DUAL RANGE MODE" is set to "AUXILIARY INPUT".
As long as the auxiliary input is set to "DUAL RANGE MODE", neither the current output can be switched off nor its dual range changed.

POS. ZERO RETURN	No voltage	Flowmeter operates normally
	Voltage between 3…30 V DC	All outputs are reset to "ZERO" (corresponds to no flow)

see also function group "SYSTEM PARAMETERS", page 62.

START PULSE WIDTH

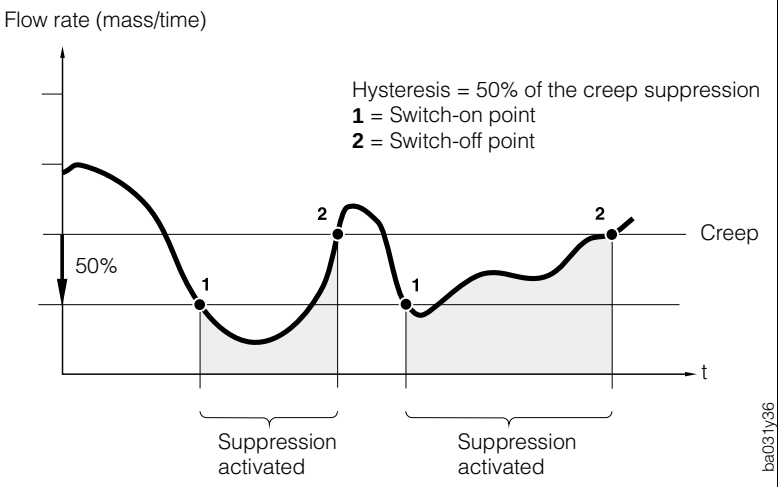
Certain functions of the auxiliary input are only started via a pulsed voltage.
In this function, you enter the minimum pulse width to be reached by the input pulse for that the appropriate function is activated.

Max. 3-digit number, incl. engineering units (20…100 ms)
Factory setting: ***20 ms***

Function group
PROCESSING PARAMETER

LOW FLOW CUTOFF

In this function, the required switching point for creep suppression can be entered. The creep suppression prevents the flow rate being registered in the lowest measuring range (e.g. a variable column of liquid at standstill). When creep suppression is active, the sign of the flow appears optically inverted on the display.



5-digit number with floating decimal point (e.g. 25.000 kg/min)
Factory setting: ***dependent*** on the nominal diameter

HYSTERESIS = 50%
Creep suppression operates with a negative hysteresis of 50% (see above figure).

NOISE SUPPRESS.

Using the interference blanking (= software filter) the sensitivity of the flow measurement signal can be reduced with respect to transient flows and interference peaks; e.g. with media containing solids or gas bubbles.

0.00 – 2.00 seconds

0.00 seconds = OFF
2.00 seconds = high damping

MEASURING MODE

The Promass 64 measuring system generally measures flow in both directions. This function enables you to switch the signal outputs (incl. totalizer) to “uni-” or “bidirectional” mode as required:
- Unidirectional: signal output in the positive direction only (forward). Flows in the negative direction (reverse) are not included or totalised.
- Bidirectional: signal output in both directions (forward and reverse).

UNIDIRECTIONAL – BIDIRECTIONAL – CANCEL

Function group **PROCESSING PARAMETER**	
FLOW DIRECTION	In special cases it is possible that the arrow marked on the sensor nameplate does not agree with the actual direction of flow of the medium. You have the option in this function to change the arithmetic sign of the flow variable. ***FORWARD*** – REVERSE – CANCEL
EPD THRESHOLD	EPD = Empty Pipe Detection: With empty measuring pipes the density of the medium falls below a specified value (= response or threshold value) which can be specified in this function. Notes! • When the preset response value is reached or exceeded the display shows the error message “A: EMPTY PIPE”. The flow is then set to the value 0.0000 and the density to the EPD threshold value. Promass 64 will interprete this report as an “error” which has to be reset in the custody transfer mode (see page 34). • Switching on and off the EPD operates at a time constant of 1 second. • Empty Pipe Detection is switched off if the EPD threshold value is set to the value 0.0000. Caution! Select a correspondingly low EPD response value so that the difference to the effective density of the medium is sufficiently large enough. This ensures that totally empty measuring pipes and not partially filled ones are detected. 5-digit number with fixed decimal point, incl. engineering units (corr. to 0.0000…5.9999 kg/l) Factory setting: ***0.2000 kg/l*** [unit] Caution! Due to the low gas densities found in CNG applications, the Empty Pipe Detection function is to be switched off. The EPD response value is therefore to be set to “0.0000”.
DENSITY FILTER	The density filter allows the sensitivity of the density measuring signal to be lowered with respect to variations in the density of the medium, e.g. with heterogeneous liquids. Note! If in verification mode this function is locked if the calibration parameter was configured to “VOLUME”. OFF – LOW – ***MEDIUM*** – HIGH – CANCEL
SELF-CHECKING	Better reproducibility for short batch cycles (< 60 s) and transient wide variations in flow can be guaranteed by activating the function “SMARTPLUS”. Note! Select “CYCLIC” for batching times > 60 s and for continuous measuring mode. ***CYCLIC*** – SMARTPLUS – CANCEL

Note!

Caution!

Caution!

Note!

Note!

Function group
PROCESSING PARAMETER

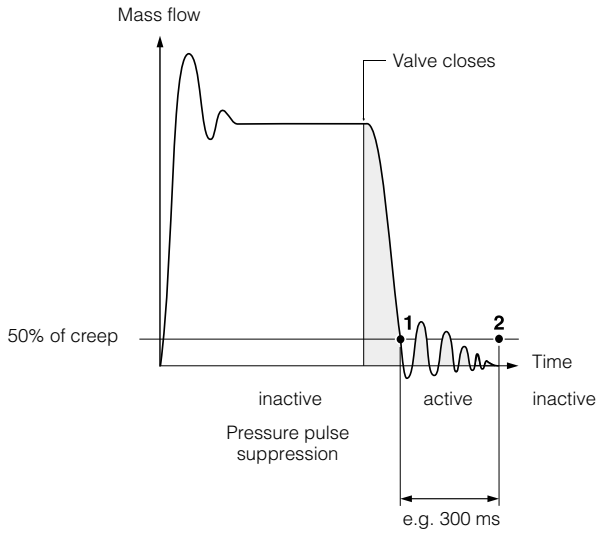
PRES. PULSE SUPPR.

When closing a valve, there may be a sudden but strong rush of liquid in the piping which is then detected by the measuring system. The pulses will be counted, especially those from filling cycles, and produce an incorrect result in the totalizer. Because of this, the Promass 64 has a function for pressure pulse suppression (= transient signal suppression) which can eliminate interference coming from the plant.
The time interval of the active pressure pulse suppression is defined in this function:

Switch-on point
Pressure pulse suppression is activated after the flow velocity falls below 50% of the creepage value.

The following applies during the pressure pulse suppression:
- Current output → is set to 0 mA or 4 mA
- Pulse output → at the fall back value
- Display flow → = 0
- Display totalizer → both totalizers (TOTALIZER 1 and 2) remain at the last applicable value.
- Temperature/density values → continue to be shown

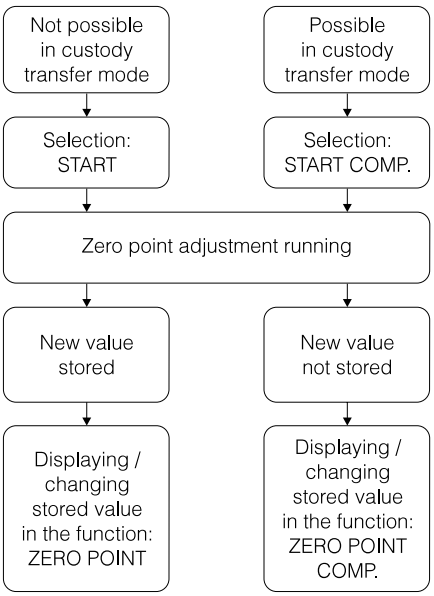
Switch-off point
The pressure pulse suppression is again deactivated after the set time interval.



Max. 4-digit number, incl. units (0.00...10.00 seconds)
Factory setting: ***0.00 s*** (= switched off)

Note!
When using the pressure pulse suppresion, the low flow cut off must be set to a value > 0.

Note!

Function group **SYSTEM PARAMETER**	
SELECT ZERO POINT	This function displays zero point 1 continually used by the measuring system.
ZERO POINT ADJUST	This function enables a static zero point calibration to be automatically carried out. The new zero point determined by the measuring system is adopted by the function “ZERO POINT”. Notes! • Before carrying out the adjustment please refer to page 77 ff. where a detailed description of the static zero point calibration is given. • In the verification mode this function is locked and a zero point adjustment is no longer possible. • Programming is locked during zero point adjustment. The display shows “S: ZERO ADJUST RUNNING”. • If the zero point adjustment is not possible, e.g. with a flow velocity >0.1 m/s, or has been cancelled, then the alarm message “A: ZERO ADJUST NOT POSSIBLE” is shown on the display. • In contrast to the selection "START", you can start the zero point adjustment via "STARTCOMP." without entering (storage) the new determined zero point. The "present" zero point is displayed in the function group "Sensor Data", funcion "Zero Point Comp." and can be compared with the storaged zero point (function "Zero Point"). ***CANCEL*** – START – STARTCOMP. Display showing the current zero point value used by the measuring system. The different possibilities and conditions for a zero point adjustment when selecting START and STARTCOMP.: 

Note!

Function group **SYSTEM PARAMETER**	
POS. ZERO RETURN	This function enables signals to be set from the current and pulse/frequency output to the fallback value, e.g. for interrupting the measurement for cleaning the piping. • Current output: set to 0 mA or 4 mA • Pulse output: at the fallback value • Display: flow = 0 both totalizers remain at the last applicable value. Temperature and density values are still shown. Notes! • This function has top priority above all other functions of the instrument. Simulations are cancelled for example. This function is only available via the auxiliary input. • After measurand suppression is activated, the display shows the message "S: POS. ZERO-RET. ACTIVE". • During measurand suppression the status output is closed. Any error messages occurring (fault, alarm) can then only be called up using the diagnosis function or in the function "PRESENT SYSTEM CONDITION". These do not, however, affect the outputs. ***OFF*** – ON ALL SIGNALS SET TO ZERO (for description: see above)
DEF. PRIVATE CODE	This function enables a personal code number to be selected with which programming can be enabled. Notes! • Programming is **always** enabled with the code number 0. • When programming is locked this function is not available and access to the personal code number by third parties is not possible. • The code number can only be altered when programming has been enabled. max. 4-digit number (0…9999) Factor set value: ***64***
ACCESS CODE	All data of the Promass 64 measuring system are protected against unauthorised access. Only by first entering a code number in this function programming is enabled and the settings of the instrument can then be altered. If in any function the operating element is pressed, then the measuring system jumps automatically into this function and the display shows the prompt to enter the code number (if programming is locked): → Enter code number 64 (factory setting) or → Enter personal code number (see function "DEF. PRIVATE CODE"above) max. 4-digit number (0…9999) Factory setting: ***64*** Notes! • After jumping to the HOME position programming is again locked after 60 seconds if no operating element is pressed during this time. Programming can also be locked by entering any number (not the customer code number) in this function. • If you can no longer find your personal code number, then the Endress+Hauser Service Organisation will be pleased to help you.

Note!

Note!

Note!

Function group **SYSTEM PARAMETER**	
SW-VERSION COM	In this function, the current software is shown which is installed on the electronics board. The numbers of the software version have the following meaning: V 3 . 02 . 00 Ex e / Ex i Type of installed electronics board. Number changes if minor alterations are made to the new software. This also applies to special version software. Number changes if the new software contains additional functions. Number changes if basic alterations have to be made to the software, e.g. owing to technical modifications to the instrument.
SYSTEM RESET 	With this function the Promass 64 can be restarted **without** the power supply being switched off and on again.  ***CANCEL*** – RESTART SYSTEM Note! With a “restart” all error entries in the function “PREVIOUS SYSTEM CONDITIONS” are deleted.


Note!


Caution!

Function group **SENSOR DATA**	
K-FACTOR	In this function, the current calibration factor of the sensor is shown. Display: max. 5-digit number with fixed decimal point (0.1000…5.9999) Factory setting: ***dependent*** on the sensor (nominal diameter) and its calibration. Caution! The calibration factor may only be changed under certain conditions. It is urgently recommended that the appropriate E+H Service Office is first contacted.
ZERO POINT	In this function, the zero point correction currently used by the sensor can be called up and/or changed. • Static zero point adjustment: This value is calculated by the measuring system automatically and adopted by this function. • Dynamic zero point adjustment: This value is determined by the user and must be entered manually in this function. Static and dynamic zero point adjustment are described in detail on page 77 ff. max. 5-digit number (–10000…+10000) Factory setting: ***dependent*** on the sensor (nominal diameter) and its calibration. Correction factor 100 = 1% of Q_{ref} with v = 1 m/s (ρ = 1 kg/l) Correction factor 100 = 0.5% of Q_{ref} with v = 2 m/s (ρ = 1 kg/l) etc. ZERO POINT 1 Display showing the active zero point
ZERO POINT COMP.	After carrying out a zero point adjustment without storing (by selected START COMP. in the function group SYSTEM PARAMETER, see page 61) the actual zero point is shown in this field. Display: max. 5-digit number (–10000…+10000)
NOMINAL DIAMETER	In this function, the actual nominal diameter of the sensor is shown. Display: e.g. 25 mm; 2 inch; etc.

Function group **SENSOR DATA**	
SENSOR COEF.	In this function, other calibration data and information on the sensor can be called up. Changes to the calibration values shown in this function can only be carried out by an E+H Service technician. This also applies to resetting calibration values originally done in the factory. Caution! A density adjustment on site (see page 52) can alter the calibration values C0, C1, C2 and C3. Options Display: CANCEL — By selecting "CANCEL" and confirming with E you jump to the next function. DENSITY COEF. C 0 DENSITY COEF. C 1 DENSITY COEF. C 2 DENSITY COEF. C 3 TEMP. COEF. Km TEMP. COEF. Kt MIN. TEMPERATURE (lowest temperature of medium measured) MAX. TEMPERATURE (highest temperature of medium measured) E For each of these calibration coefficients you can call up the particular value by pressing E. You jump back to the options by pressing E.
SERIAL NUMBER	In this function the serial number of the sensor is shown. Display: max. 6-digit number (100000…999999)
SOFTWARE VERSION	In this function, the current software is shown which is installed on the amplifier board. The numbers of the software version have the following meaning: V 4 . 00 . 00 A M F A M F: Type of Promass sensor. Number changes if minor alterations are made to the new software. This also applies to special version software. Number changes if the new software contains additional functions. Number changes if basic alterations have to be made to the software, e.g. owing to technical modifications to the instrument.


Caution!

8 Diagnosis and Trouble-shooting

8.1 Response of the measuring system on fault or alarm

Error indications which occur during operation are indicated in the HOME position alternately with the measured values. The Promass 64 measuring system has two types of error:

Type of error	Response of the instrument
Fault (system error, failure) Errors due to failure of the instrument	➤ An appropriate error message is shown on the display. ➤ Status output → open, if configured for FAILURE (see page 49). ➤ Pulse outputs and totalizers inactive. ➤ Current output responds according to set failsafe mode (see page 44).
Alarm (process error) Error due to process conditions	➤ An appropriate alarm message is shown on the display. ➤ Response of status output → according to configuration (see page 49).

Notes!
- A list of all error messages is given in Section 8.3.
- Error messages during verification measurement must be confirmed and reset. Please also read the instructions on pages 33 and 34.
- During verification mode, the two alarm messages “A: EMPTY PIPE” as well as “A: FLOW TOO HIGH” are treated as error messages.
- To protect the pulse outputs from cable breakage, the Promass 64 electronics can be configured by E+H Service to give a quiescent current of approx. 4 mA.


Note!

Caution!
Please note the following points on active suppression of measured value (positive zero return) or active simulation:


Caution!

Measurand suppression
- This function has top priority above all other instrument functions. Simulations are cancelled for example.
- After measurand suppression is activated, the display shows the message “S: POS. ZERO-RET. ACTIVE”.
- During measurand suppression the status output is closed. Any error messages occurring (fault, alarm) can then only be called up using the diagnosis function or in the function “PRESENT SYSTEM CONDITION”. These do not, however, affect the outputs.

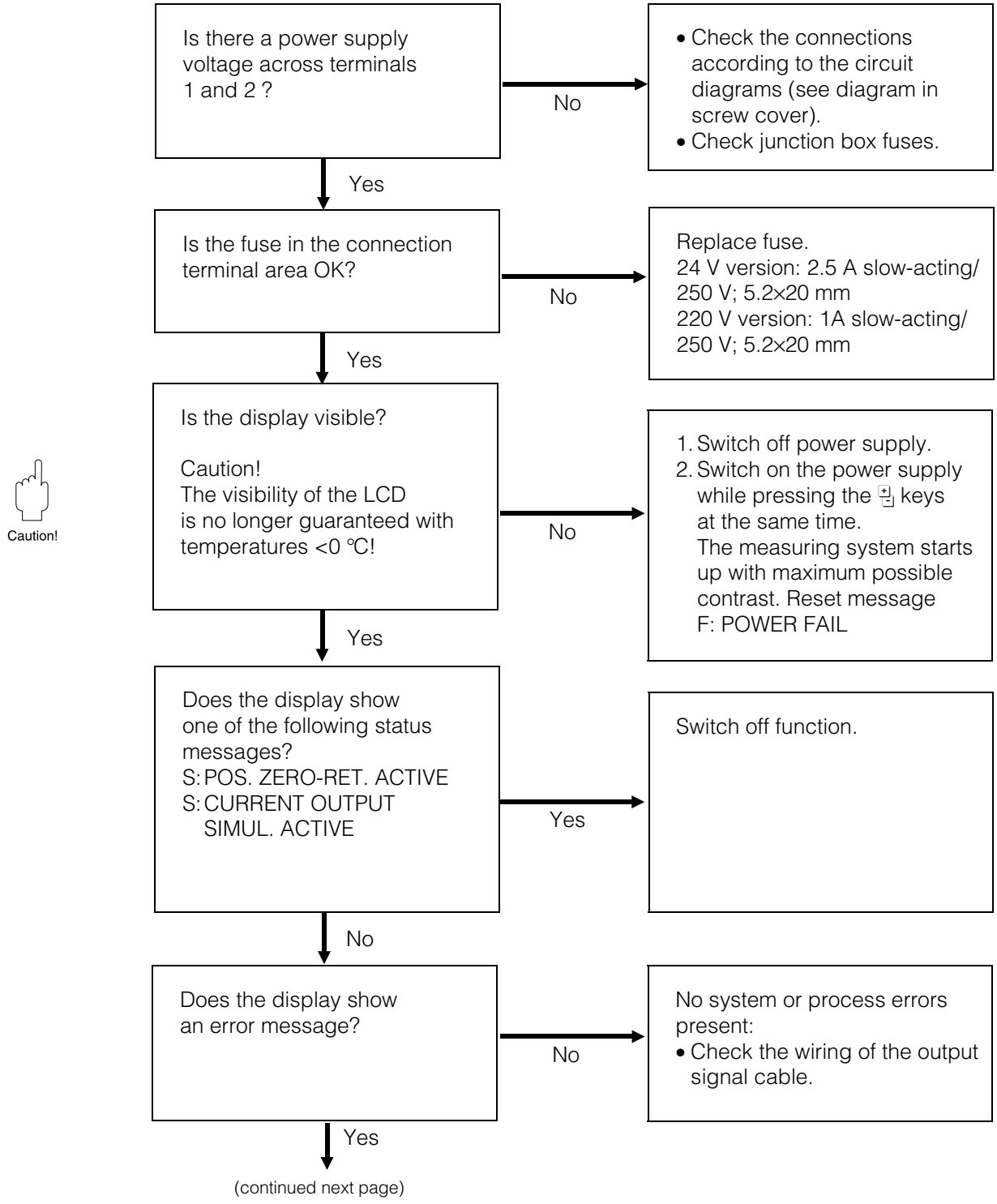
Simulation
- This function has the second highest priority. Specific status messages can still only be called up and shown using the diagnosis function.
- Normal output of system errors if the status output is configured for “FAILURE”.

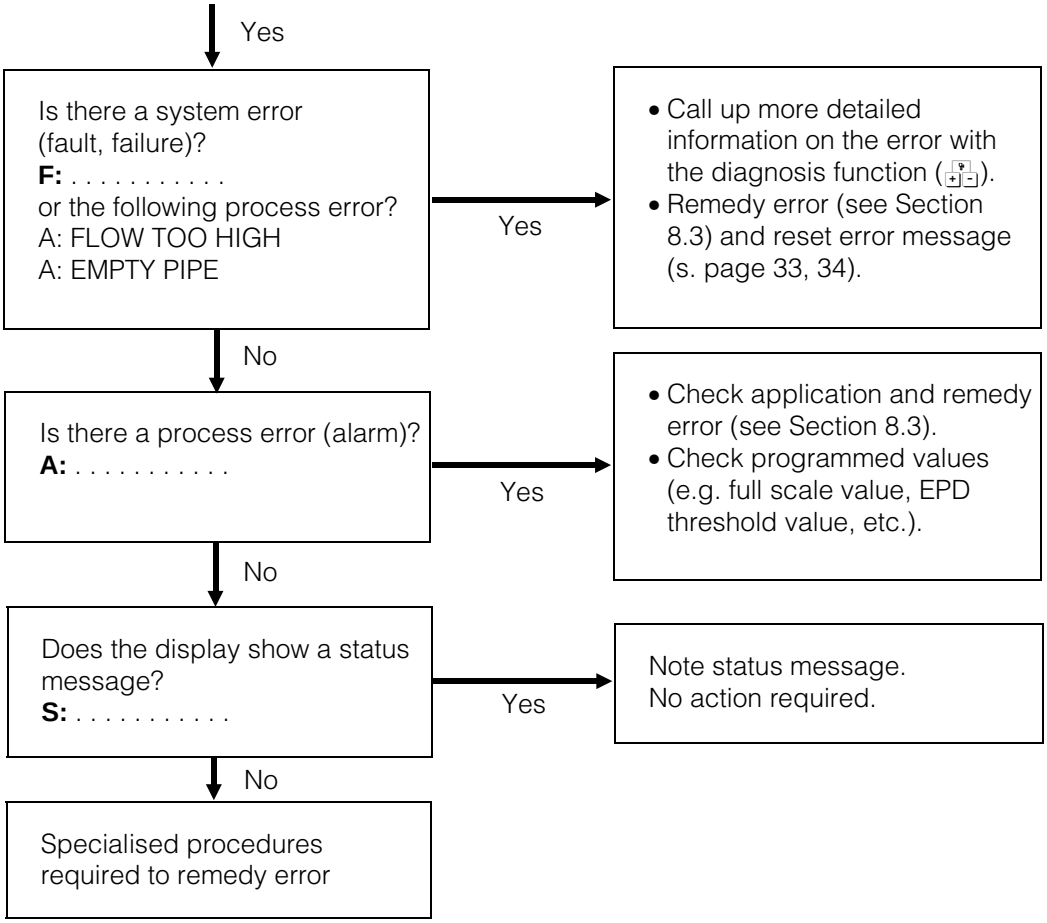
8.2 Diagnosis flow chart and trouble-shooting

All instruments undergo various stages of quality control during production. However, should an error or fault occur during set-up or operation, then refer to the flow chart below to identify possible causes.

Caution!

- Error messages that occur during custody transfer measurements must be confirmed and reset. Please read the explanations on pages 33 and 34. You will find a list of all error messages on pages 70 ff.
- With the diagnosis function ⊞, the causes of system errors may be called up (see next page).
- Some errors can only be corrected after breaking the seals and then deactivating the verification mode.





Diagnosis function for calling up error messages (example)

1. An error message is shown in the HOME position alternating with measured values (if measurement value suppression or simulation are not active).

F	:		S	Y	S	T	E	M		E	R	R	O	R	
			A	M	P	L	I	F	I	E	R				

(Example)

2. Activate diagnosis function (press ⊞ keys simultaneously). The instrument jumps automatically to the function "PRESENT SYSTEM CONDITION" in which all actual errors and status messages are listed (see also p. 32).

   If a system error has occurred additional information on errors can be called up by pressing the diagnosis function keys again ⊞ (see following pages). A stethoscope symbol and plain text is also shown on the display.

	:		L	O	W		V	O	L	T	A	G	E		
			D	E	T	E	C	T	E	D					

(Example)

3. Calling up other actual errors and status messages with lower priority (if present).

4. Jump to the HOME position.

8.3 Error and status messages

Error messages F:	Cause (Call up using ⊞)	Remedy
F: POWER FAIL **	**: NO DIAGNOSIS** Power supply was interrupted. This error message is only displayed in the verification mode.	Reset error message (see page 34)
F: SYSTEM ERROR AMPLIFIER	**: LOW VOLTAGE DETECTED** * The amplifier is detecting a power voltage which is too low (power pack or amplifier defective).	1. Check power supply voltage. 2. Replace electronics module.
	: DAT FAILURE * Error on access to data in DAT (calibration values of the sensor).	1. Check to see if the DAT is plugged in. 2. Replace electronics module. 3. Order and replace a new DAT using the serial number and order code.
	: EEPROM FAILURE * Error on access to EEPROM data (calibration values of the amplifier).	1. Check to see if the DAT is plugged in. 2. Replace electronics module. 3. Order and replace a new DAT using the serial number and order code.
	: RAM FAILURE * Error on access to working memory (RAM) of the processor.	1. Replace electronics module.
	: TEMP. CIRCUIT FAILURE ** Temperature switching of the amplifier defective.	1. Replace electronics module.
	: ASIC FAILURE ** The ASIC on the amplifier board is defective.	1. Replace electronics module.

Error messages Promass 64:

** Error message cannot be reset. To delete error, it is necessary to either switch power supply off and then on, or to contact the E+H Service engineer to open the measuring instrument.*

*** Error message must be confirmed and reset in verification mode.*

Error messages F:	Cause (Call up using ⊞)	Remedy
	: TEMP. SENSOR MEAS. TUBES ** The temperature sensor of the measuring pipes is defective.	1. Check connection No. 5 (see page 76). 2. For remote version, check terminal 9 and 10 on the sensor and transmitter.
	: TEMP. SENSOR CARRIER TUBE ** The temperature sensor of the secondary containment is defective.	1. Check connection No. 5 (see page 76). 2. For remote version, check terminal 9 and 10 on the sensor and transmitter.
F: TUBES NOT OSCILLATING **	**: NO DIAGNOSIS** Instrument error or applicational problem.	1. Mount the instrument on the pressure side of the pump. 2. Using a valve, choke the piping downstream from the instrument and thus increase pressure in the instrument. 3. Install an orifice plate downstream from the instrument. 4. Provide suitable equipment for increasing pressure in the system. Refer also to notes on trouble-shooting.
F: PICK-UP FAILURE **	**: NO DIAGNOSIS** The sensor coil is defective.	1. Check connection No. 7 (see page 76). 2. For remote version, check terminal 4, 5, 6 and 7 on the sensor and transmitter. Refer also to notes on trouble-shooting.
F: SYSTEM ERROR POWER SUPPLY	**: LOW VOLTAGE DETECTED** * The power pack is supplying a power voltage which is too low.	1. Check power supply voltage. 2. Replace electronics module.

Error messages Promass 64:

** Error message cannot be reset. To delete error, it is necessary to either switch power supply off and then on, or to contact the E+H Service engineer to open the measuring instrument.*

*** Error message must be confirmed and reset in verification mode.*

Error messages F:	Cause (Call up using ⊞)	Remedy
F: NO AMPLIFIER RESPONSE **	**: NO DIAGNOSIS** Data transfer between amplifier and communications module not possible.	1. Check connection No. 5 (see page 76). If one of the previous messages is still shown, then replace the electronics module. 2. If an error message is still shown, then replace the electronics module. Refer also to notes on trouble-shooting.
F: VALUE NOT ACCEPTED *	**: NO DIAGNOSIS** An internally stored value cannot be read by the communications module.	1. Restart the measuring system (switch the power supply off and then on). 2. Replace electronics module.
F: RESET AMPLIFIER **	**: NO DIAGNOSIS** COM module function no longer assured, e.g. by measuring pipes not vibrating for any length of time.	Reset error message (see page 34)
F: SYSTEM ERROR COM-MODULE *	**: EEPROM FAILURE *** Error on access to EEPROM data (process and calibration data of communications module).	1. Replace electronics module.
	: RAM FAILURE * Error on access to the working memory (RAM).	1. Replace electronics module.
	: ROM FAILURE * Error on access to the programme memory (ROM).	1. Replace electronics module.
	: LOW VOLTAGE DETECTED * DC/DC converter on the communications module is supplying a power voltage which is too low.	1. Replace electronics module.

Error messages Promass 64:

** Error message cannot be reset. To delete error, it is necessary to either switch power supply off and then on, or to contact the E+H Service engineer to open the measuring instrument.*

*** Error message must be confirmed and reset in verification mode.*

Error messages F:	Cause (Call up using ⊞)	Remedy
F: SYSTEM ERROR COM-MODULE *	**: VOLTAGE REFERENCE *** Reference voltage of the communications module outside tolerance, i.e. correct functioning of the current output is no longer guaranteed.	1. Replace electronics module.
	: EEPROM HW DATA ERROR * The EEPROM of the communications module is empty or a part of the data is overwritten. Default values from the ROM are written in. The measuring system can still operate on a makeshift basis using these values.	1. Replace electronics module.
	: EEPROM PARA. DATA ERR * A part of the EEPROM data of the communications module is damaged or has been overwritten. Default values from the ROM are written in. The measuring system can still operate on a makeshift basis using these values.	1. Replace electronics module.
	: EEPROM TOT. DATA ERROR * A part of the EEPROM data of the communications module (totalizer block) is damaged or has been overwritten. The default value 0 is entered in the totalizer.	1. Recalibrate the instrument. 2. Switch the instrument off and then on.
	: EEPROM DEFAULT VALUES * The EEPROM of the communications module is empty. The default values stored in the ROM are entered.	1. Check to see if the DAT is plugged in. 2. Replace electronics module. 3. Order and replace a new DAT using the serial number and order code.
F: RESET COM-MODULE *	**: NO DIAGNOSIS *** COM module function no longer guaranteed, e.g. due to oscillations of the supply voltage.	Reset error message (see page 34)

Alarm and Status messages Promass 64

** Error message cannot be reset. To delete error, it is necessary to either switch power supply off and then on, or to contact the E+H Service engineer to open the measuring instrument.*

*** Alarm message must be confirmed and reset in verification mode.*

Alarm messages **A: . . . .** **Status messages** **S: ....**	**Cause**	**Remedy**
A: DAT CONTAINS DEFAULT DATA	Empty DAT on the amplifier board. The instrument is operating with default values (factory-set).	1. Check to see if the DAT is plugged in. 2. Replace electronics module. 3. Order and replace a new DAT using the serial number and order code.
A: EXCIT. CURRENT LIMIT	The max. excitation current for the excitation coil has been attained with specified medium characteristics at limit values (e.g. gas or solids content). The instrument is continuing to operate correctly.	1. Mount the instrument on the pressure side of the pump. 2. Using a valve, choke the piping downstream from the instrument and thus increase pressure in the instrument. 3. Install an orifice plate downstream from the instrument. 4. Provide suitable equipment for increasing pressure in the system.
A: SLUG FLOW CONDITIONS	The medium is heterogeneous (gas/solids content). The current needed to excite the measuring pipes therefore varies significantly.	1. Mount the instrument on the pressure side of the pump. 2. Using a valve, choke the piping downstream from the instrument and thus increase pressure in the instrument. 3. Install an orifice plate downstream from the instrument. 4. Provide suitable equipment for increasing pressure in the system.
A: EMPTY PIPE **	Applicational problem: air in the measuring pipes, density too low (see page 59, Empty Pipe Detection).	1. Fill the measuring pipe and ensure that no gas bubbles are in the medium. 2. Set the EPD at the response value so that it is larger than the density of the medium.

Error messages Promass 64:

** Error message cannot be reset. To delete error, it is necessary to either switch power supply off and then on, or to contact the E+H Service engineer to open the measuring instrument.*

*** Error message must be confirmed and reset in verification mode.*

Alarm messages **A: . . . .** **Status messages** **S: ....**	**Cause**	**Remedy**
A: FLOW TOO HIGH **	Velocity of liquid in measuring pipe >12.5 m/s. Measuring range of transmitter electronics is exceeded.	Lower the flow rate
A: CURRENT OUTP. OVERFLOW	The actual measured value is outside the range preset by the scaled zero and full-scale values.	Change the scaled zero or full scale values (see pages 40 - 43) or else change the value of the measured variable.
A: ZERO ADJUST NOT POSSIBLE	The static zero point calibration is not possible or has been cancelled.	Check to see if flow velocity = 0 m/s (see page 77).
S: POS. ZERO-RET. ACTIVE	Measured value suppression is activated. This message has highest priority for the Promass 64.	Switch off low flow cutoff (see page 62).
S: CURRENT OUTPUT SIMUL. ACTIVE	Current simulation is activated.	Switch off current output simulation (see page 44).
S: ZERO ADJUST RUNNING	Static zero point calibration is running.	Not required
S: 1 CUST. SWITCH DEFECTIVE	Calibration switch defective Caution! The calibration status last installed (YES or NO) is upheld, that is, emergency operations *are* assured.	By E+H Service

Alarm and Status messages Promass 64

** Error message cannot be reset. To delete error, it is necessary to either switch power supply off and then on, or to contact the E+H Service engineer to open the measuring instrument.*

*** Alarm message must be confirmed and reset in verification mode.*

8.4 Replacing the transmitter electronics

Warning!

Warning!
- Danger of electric shock! Switch off the power supply before unscrewing the cover of the electronics area of the transmitter housing.
- The local power supply voltage and frequency must agree with the technical data of the power supply boards used.
- The regulations given in the separate Ex documentation are to be observed when using Ex instruments.
- In case of verified Promass 64 flowmeters the electronics compartment can only be opened upon breaking the calibration seal by the competent people, e.g. the representative of the respective standardisation authority.

❶ Loosen the screws of the safety grip (3 mm Allen key).

❷ Unscrew the cover of the electronics area of the transmitter housing.

❸ Remove the local display (if present):
a) Loosen the mounting screws of the display module.
b) Unplug the ribbon cable of the display module from the communications board.

❹ Unplug the 2-pole plug of the power supply cable (by pressing down the catch) from the power supply board.

❺ Remove cable board of the screened signal cable (incl. the DAT module connected) from the amplifier board.

❻ Loosen the two Phillips screws of the board support plate. Carefully remove the support plate approx. 4–5 cm out of the transmitter housing.

❼ Remove the excitation current cable plug from the power supply board.

❽ Remove the ribbon cable plug (connection cable to the terminal area) from the communications board.

❾ The entire transmitter electronics, together with the board support plate, can now be completely removed from the housing.

Caution!

Caution! The Promass M and F electronics are not identical with those of Promass A.

❿ Replace the old transmitter electronics with new transmitter electronics.
Reassemble in reverse sequence.

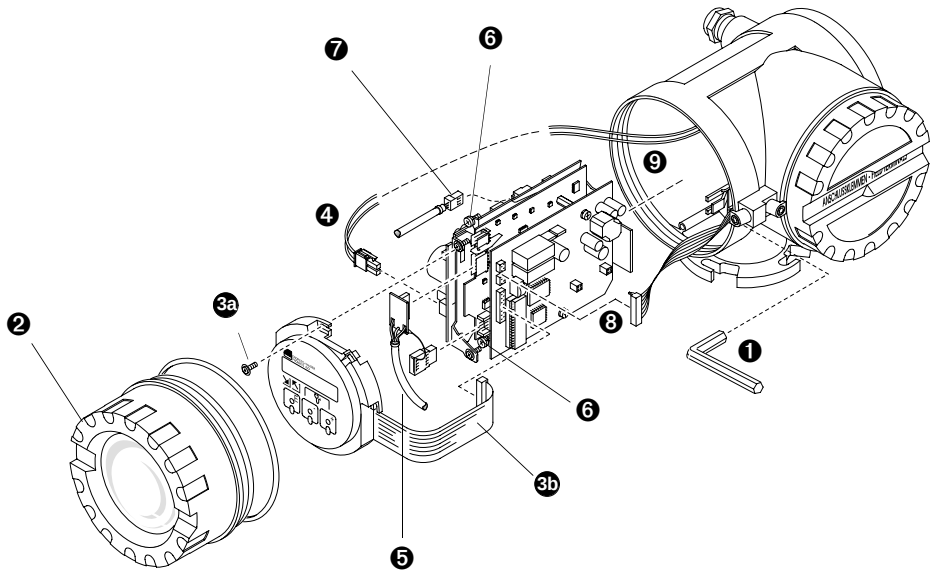


Fig. 21:
Replacing the Promass 64 transmitter electronics

8.5 Zero point adjustment

All Promass 64 transmitters are calibrated using the most up-to-date technology available with the zero point calibrated stated on the nameplate.
Calibration is carried out according to the reference conditions (see page 94).
Using other liquids or process conditions, a new zero point adjustment must be carried out in order to achieve the specified measuring accuracy.

Caution!
In verification mode the "ZERO POINT ADJUST" function is locked. A zero point adjustment must, therefore, be carried out before activating the verification mode. This is done in two ways (see following explanations).

Static zero point adjustment → page 78

- For media **without** gas or solids content.
- Adjustment is carried out without the fluid moving in the piping.

Caution!
Static zero point adjustment carried out with heterogeneous media can lead to measuring errors during operation.

Static zero point adjustment is carried out using completely filled measuring pipes and at "no-flow" with e.g. shut-off valves both upstream and downstream of the sensor (or by using existing shut-off and sliding valves, etc.).

Normal operation
- Open valves A and B

*Zero point adjustment **with** pumping*
- Open valve A
- Close valve B

*Zero point adjustment **without** pumping*
- Close valve A
- Open valve B

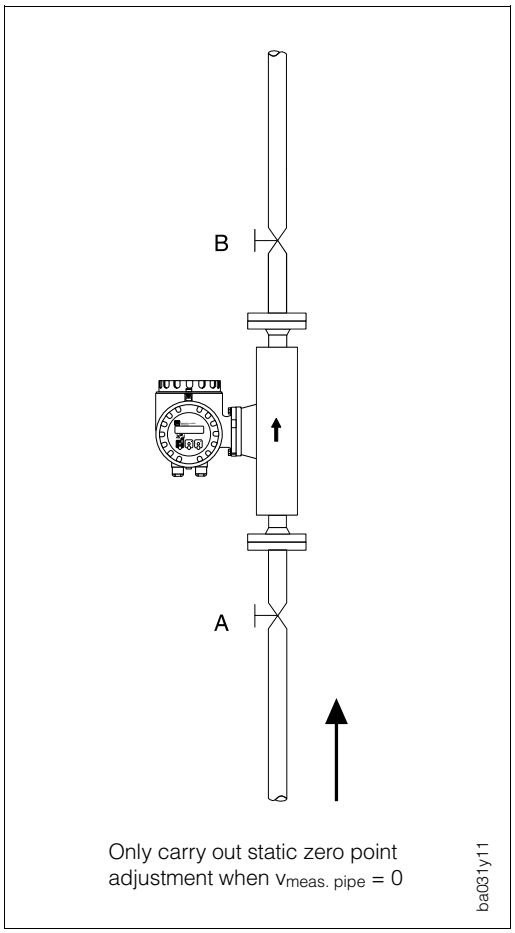
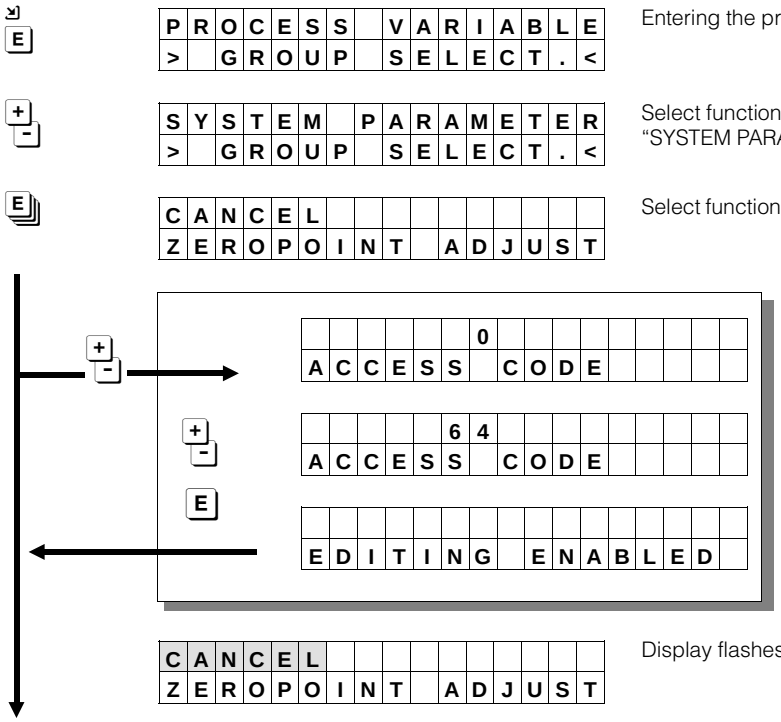


Fig. 22:
Static zero point adjustment and shut-off valves

Dynamic zero point adjustment → page 79
- For heterogeneous media **with** gas or solids content.
- With dynamic zero point adjustment, the actual specific mass flow found by test weighing is compared with that shown on the flowmeter. This enables a new zero point to be calculated.
- This type of adjustment is necessary because each time the medium is stopped a different zero point is determined due to the different position of the gas bubbles or particulate solids in the measuring pipe.

Static zero point adjustment

1. Run the plant for as long as necessary until it is operating normally.
2. Stop the flow.
3. Check the shut-off valves (for leaks). Also check the operating pressure.
4. Carry out the adjustment as follows:



Dynamic zero point adjustment

1. Run the plant for as long as is necessary until it is operating normally.
2. Check that any measuring errors present do not originally come from the plant itself.
3. Determine the measuring error using a check weighing, for example:

   - Fill a container and determine the weight when full using weight scales (Δm_{target}).
   - Note the mass flow rate during the filling procedure (m_{actual}), e.g. in kg/h.
   - Note the mass shown by the Promass measuring system (Δm_{actual}).
   - Calculate the measuring error F as follows:

$$F\,[\%] = \frac{\Delta\, m_{actual} - \Delta\, m_{target}}{\Delta\, m_{target}} \cdot 100\%$$

   - In the function ZERO POINT read off from the display the actual zero point value used ($PIPO_{old}$). Calculate the new zero point $PIPO_{new}$:

$$PIPO_{new} = PIPO_{old} + \left(F\% \cdot 100 \cdot \frac{m_{actual}}{m_{ref}}\right)$$

m_{ref} = reference flow as function of nominal diameter (DN); corresponding to v =1 m/s at ρ = 1 kg/dm^3 (see table)

DN	m_{ref}
2	11.3 kg/h
4	45.2 kg/h
8	181 kg/h
15	636 kg/h
25	1767 kg/h
40	4524 kg/h
50	7069 kg/h
80	18096 kg/h
100	28274 kg/h

Example

Nominal diameter: DN 25
Measuring error: –1.3%
m_{actual}: 2300 kg/h (mass flow rate)
$PIPO_{old}$: +283
$PIPO_{new}$: $+283 + \left(-1.3\% \cdot 100 \cdot \frac{2300\ kg/h}{1767\ kg/h}\right) = +283 + (-169) = +114$

Note the arithmetic sign of the measuring error F (%) and $PIPO_{old}$!

4. In the function ZERO POINT of the E+H matrix, enter the value for $PIPO_{new}$ using the on-site display. Use the same procedure as the example given on page 29.

8.6 Replacing the fuse

Warning!
- Danger of electric shock! Switch off the power supply before unscrewing the cover of the terminal compartment from the transmitter housing.
- For flowmeters with Ex approvals the guidelines in the separate Ex documentation must be strictly followed.

Exclusively use the following types of fuses,

- Non Ex version:
  24 V power supply: 2.5 A slow-acting / 250 V; 5.2 × 20 mm
  220 V power supply:1.0 A slow-acting / 250 V; 5.2 × 20 mm

- Ex version:
  24 V power supply: 2.0 A fuse slow blow / breaking capacity 1500 A
  220 V power supply:1.0 A fuse slow blow / breaking capacity 1500 A

9 Dimensions

Note!
Information on dimensions and weights of Ex instruments may differ from that shown.
Please refer to the seperate Ex documentation.

Note!

9.1 Dimensions Promass 64 A

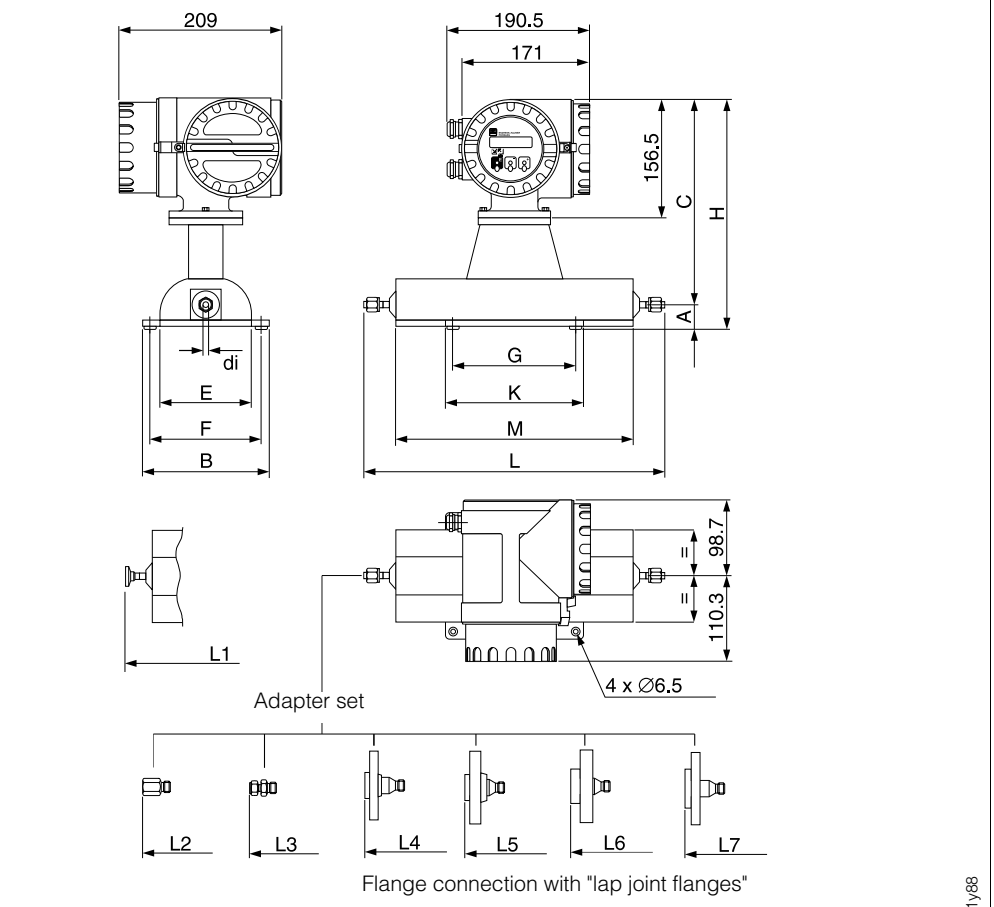


Fig. 23:
Dimensions Promass 64 A
Compact version

Process connection	**L** 4-VCO-4-fittings	**L1** ½" Tri-Clamp	**L2** ¼" NPT-F	**L3** SWAGELOK DN 2: ⅛" or ¼" DN 4: ¼"	**L4** **L5** ½"-flange (ANSI)		**L6** **L7** DN 15-flange (DIN, JIS)	
					Cl 150	Cl 300	PN 40	10K
DN 2	372	378	443	441.6	475	475	475	475
DN 4	497	503	568	571.6	600	600	600	600

Diameter DIN / ANSI		**di**	**A**	**B**	**C**	**E**	**F**	**G**	**H**	**K**	**M**	**Weight** [kg]
DN 2	1/12"	1.8	32	165	269.5	120	145	160	301.5	180	310	11
DN 2*	1/12"	1.4	32	165	269.5	120	145	160	301.5	180	310	11
DN 4	⅛"	3.5	32	195	279.5	150	175	220	311.5	240	435	15
DN 4*	⅛"	3.0	32	195	279.5	150	175	220	311.5	240	435	15

All dimensions in [mm]; * High pressure version

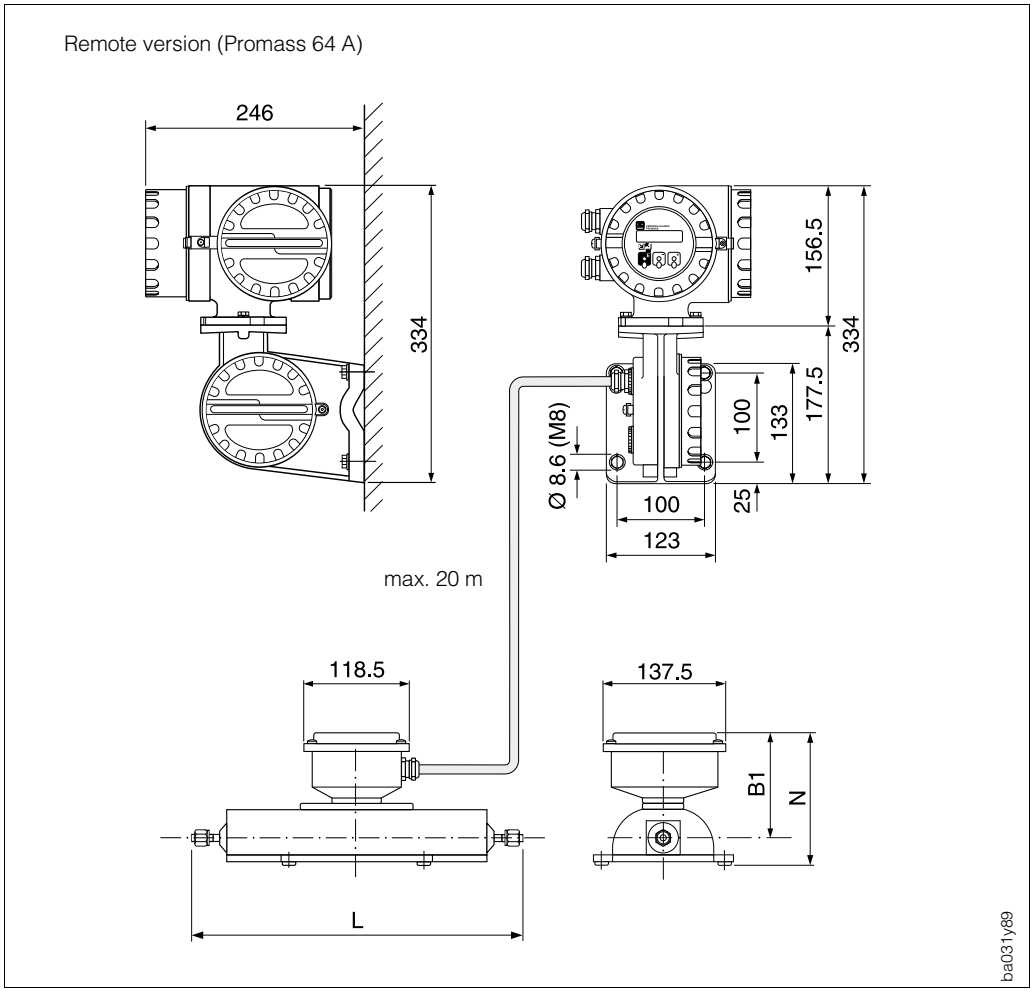


Fig. 24:
Dimensions Promass 64 A
Remote Version

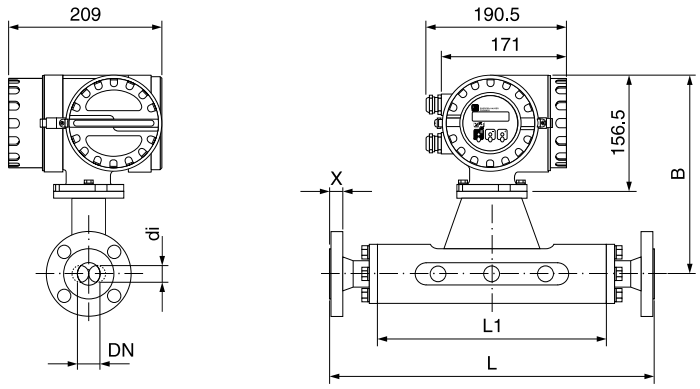
Diameter DIN	Diameter ANSI	B1 [mm]	N [mm]	L
DN 2 DN 4	1/12" 1/8"	122 132	154 164	Dimensions dependent on the process connection (see previous page)

Wetted parts materials

Measuring tube:	SS 1.4539 (904L), Alloy C-22 2.4602 (N 06022)
4-VCO-4-fittings	SS 1.4539 (904L), Alloy C-22 2.4602 (N 06022)
½" Tri-Clamp	SS 1.4539 (904L)
Adapter sets: ⅛" or ¼" SWAGELOK	SS 1.4401 (316)
¼" NPT-F	SS 1.4539 (904L), Alloy C-22 2.4602 (N 06022)
Flange: DIN, ANSI, JIS	SS 1.4539 (904L), Alloy C-22 2.4602 (N 06022), lap joint flanges (not wetted) in SS 1.4404 (316L)
Gasket (O-ring):	Viton (–15...+200 °C), EPDM (–40...+160 °C), Silicone (–60...+200 °C), Kalrez (–30...+210 °C)

9.2 Dimensions Promass 64 M

Compact version



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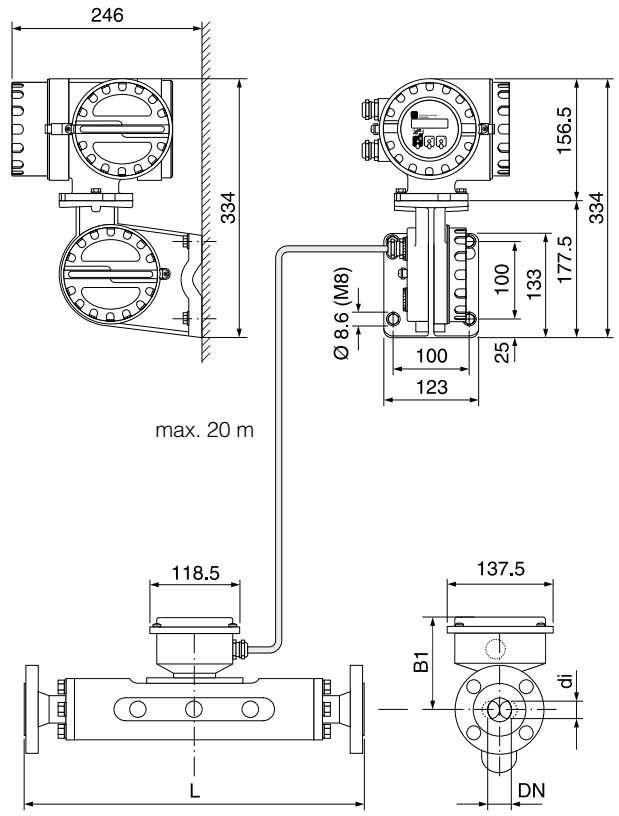
Remote version



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Diameter DIN	Diameter ANSI	L	x	L1 [mm]	B [mm]	B1 [mm]	di [mm]	Weight [kg]
DN 8	3/8"			256	262.5	113.0	5.53	11
DN 15	1/2"	Dimensions		286	264.5	114.5	8.55	12
DN 25	1"	dependent on		310	268.5	119.0	11.38	15
DN 40	1 1/2"	process		410	279.5	130.0	17.07	24
DN 50	2"	connections		544	289.5	140.0	25.60	41
DN 80	3"	(see page 87 ff.)		644	305.5	156.0	38.46	67
DN 100*	4" *			–	305.5	156.0	38.46	71

DN 8: with DN 15 flanges as standart;
* DN 100/4" : nominal diameter DN 80/3" with DN 100/4" flanges;
All weight stated are those for the compact version

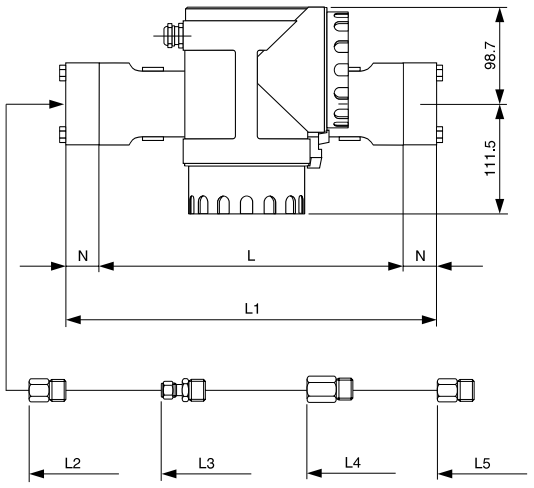
Fig. 25:
Dimensions Promass 64 M

9.3 Dimensions Promass 64 M (High pressure version)

Wetted parts materials

Measuring pipes:	titanium Grade 9
Connector:	SS 1.4404 (316L)
Fittings:	SS 1.4401 (316)
Gasket:	O-ring in Viton (–15...+200 °C), Silicone (–60...+200 °C)

Couplings and connectors optimized for CNG (Compressed Natural Gas) applications.



	N	L without connector	L1 with connector	L2 G 3/8"	L3 VCO with 1/2" SWAGELOK	L4 1/2" NPT	L5 3/8" NPT
DN 8	24	256	304	355.8	366.4	370	355.8
DN 15	24	286	334	385.8	396.4	400	385.8
DN 25	34	310	378	429.8	440.4	444	429.8

Dimensions of measuring pipes and transmitter housing: see page 83

Fig. 26:
Process connections
Promass M (high pressure)

9.4 Dimensions Promass 64 M (without process connections)

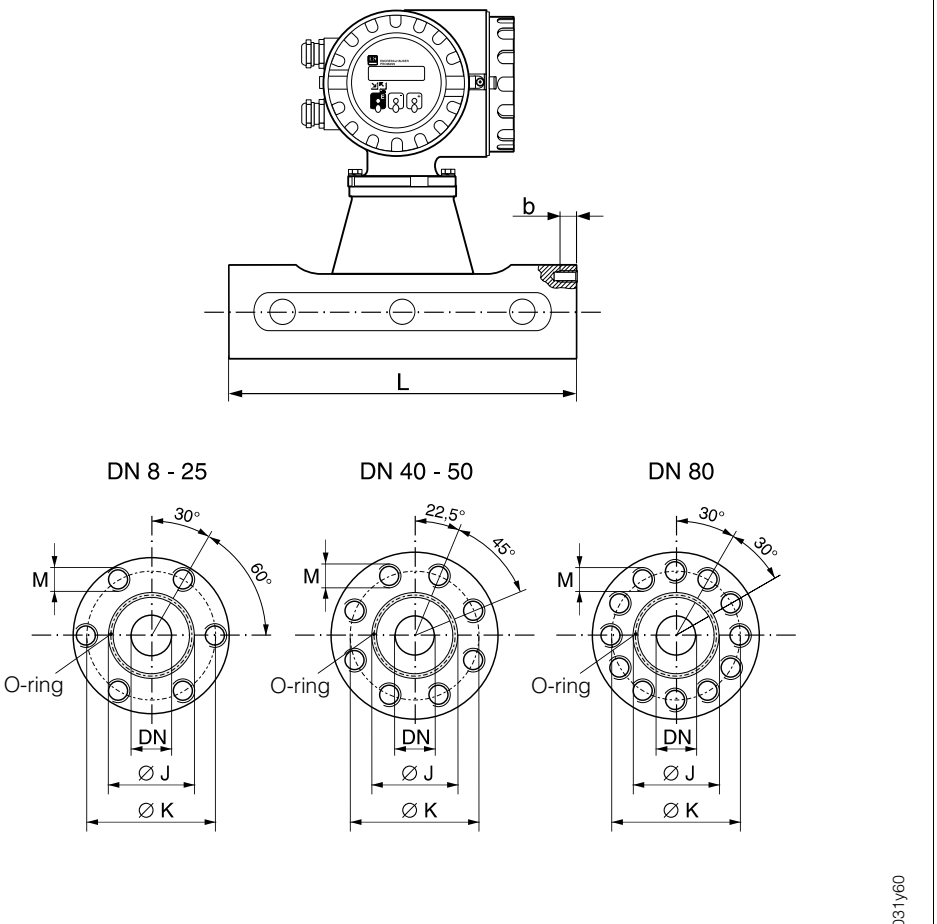


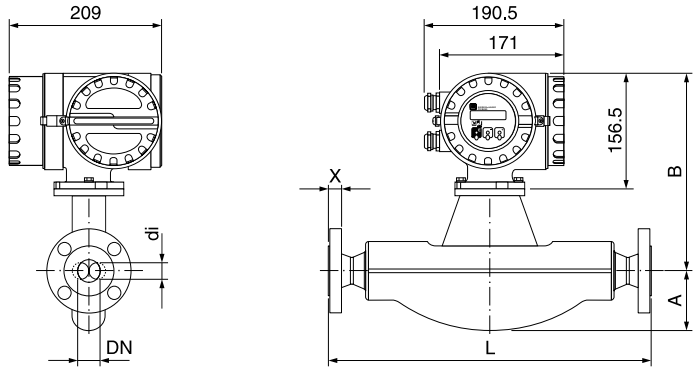
Fig. 27:
Dimensions Promass 64 M without process connections

Diameter DN		Dimensions			Coupling		Minimum screw depth	Torque	Lubricated thread	O-ring	
DIN	ANSI	Ø L [mm]	Ø J [mm]	Ø K [mm]	Screws M	Depth b [mm]	[mm]	[Nm]	yes / no	Diam. [mm]	Inside-Ø [mm]
8	3/8"	256	27	54	6 x M 8	12	10	30.0	no	2.62	21.89
8*	3/8"	256	27	54	6 x M 8	12	10	19.3	yes	2.62	21.86
15	1/2"	286	35	56	6 x M 8	12	10	30.0	no	2.62	29.82
15*	1/2"	286	35	56	6 x M 8	12	10	19.3	yes	2.62	29.82
25	1"	310	40	62	6 x M 8	12	10	30.0	no	2.62	34.60
25*	1"	310	40	62	6 x M 8	12	10	19.3	yes	2.62	34.60
40	1 1/2"	410	53	80	8 x M 10	15	13	60.0	no	2.62	47.30
50	2"	544	73	94	8 x M 10	15	13	60.0	yes	2.62	67.95
80	3"	644	102	128	12 x M 12	18	15	100.0	yes	3.53	94.84

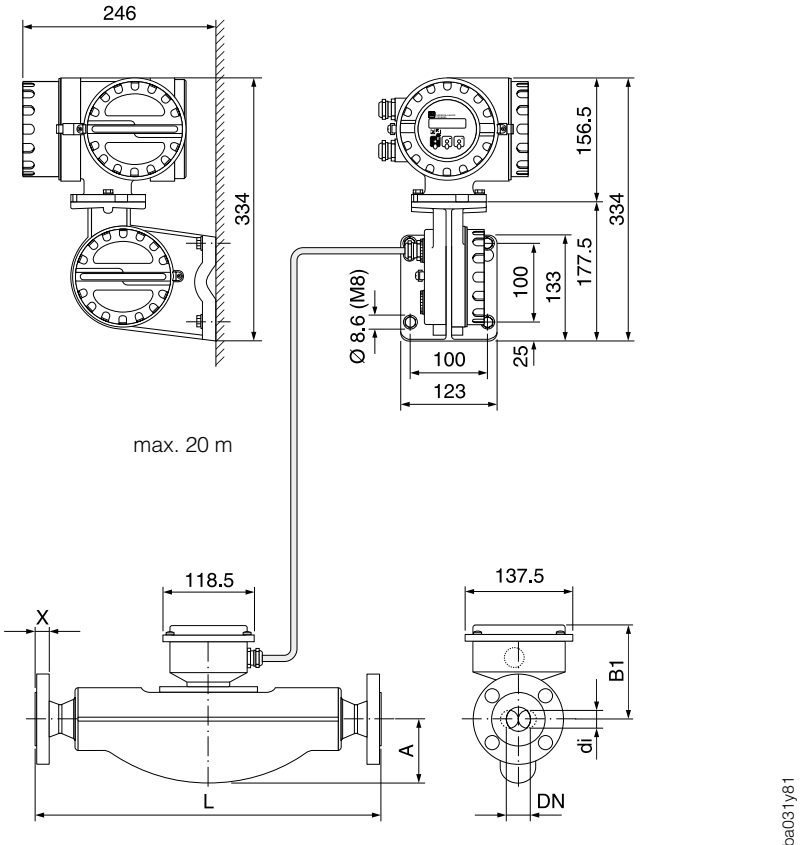
Permissable threads: A4 – 80;
* High pressure version;
Lubricant: Molykote P 37

9.5 Dimensions Promass 64 F

Compact version



Remote version



Diameter DIN	Diameter ANSI	L	x	A [mm]	B [mm]	B1 [mm]	di [mm]	Weight [kg]
DN 8	3/8"	Dimensions dependent on process connections (see page 87 ff.)		75	262.5	113.0	5.53	11
DN 15	1/2"			75	262.5	113.0	8.30	12
DN 25	1"			75	262.5	113.0	12.00	14
DN 40	1 1/2"			105	267.5	118.0	17.60	19
DN 50	2"			141	279.5	130.0	26.00	30
DN 80	3"			200	301.0	151.5	40.50	55
DN 100 *	4"			200	301.0	151.1	40.50	61
DN 100	4"			247	320.0	163.0	51.20	96
DN 150 **	6"			247	320.0	163.0	51.20	108

DN 8: with DN 15 flanges as standart;
All weight stated are those for the compact version;
* DN 100: nominal diameter DN 80 with DN 100 flanges;
** DN 150: nominal diameter DN 100 with DN 150 flanges

Fig. 28:
Dimensions Promass 64 M

9.6 Dimensions: process connections Promass 64 M, F

DIN 2501 process connections

Promass M

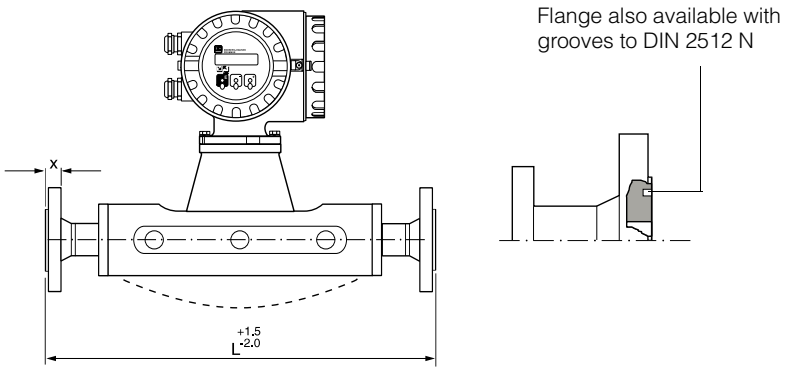
Flange material:	SS 1.4404 (316L), titanium Gr. 2
Gasket material:	O-ring in Viton (–15...+200 °C), Kalrez (–30...+210 °C), Silicone (–60...+200 °C), EPDM (–40...+160 °C), FEP-coated (–60...+200 °C)

Promass F

Flange material:	(DN 8...100) SS 1.4404 (316L), (DN 8...80) Alloy C-22 2.4602 (N 06022)
Welded process connection:	no internal gaskets

Surface finish of the flanges

For PN 16, PN 40: DIN 2526 Form C, R_a 6.3...12.5 µm
For PN 64, PN 100: DIN 2526 Form E, R_a 1.6...3.2 µm



Diameter	PN 16		PN 40		PN 64		PN 100	
	L [mm]	x [mm]	L [mm]	x [mm]	L [mm]	x [mm]	L [mm]	x [mm]
DN 8 *	–	–	370	16	400	20	400	20
DN 15 *	–	–	404	16	420	20	420	20
DN 25	–	–	440	18	470	24	470	24
DN 40	–	–	550	18	590	26	590	26
DN 50	–	–	715	20	724	26	740	28
DN 80	–	–	840	24	875	28	885	32
DN 100 **	874	20	874	24	–	–	–	–
DN 100	1128	20	1128	24	1128	30	1128	36
DN 150 ***	1168	22	1168	28	–	–	–	–

DN 8: with DN 15 flanges as standart; DN 100 only for Promass F available;
* DN 8, DN 15: also available with DN 25, PN 40 flanges (L = 440 mm, x = 18 mm);
** DN 100: nominal diameter DN 80 with DN 100 flanges;
** DN 150: nominal diameter DN 100 with DN 150 flanges

Fig. 29:
Dimensions
DIN process connections

ANSI B16.5 process connections

Promass M

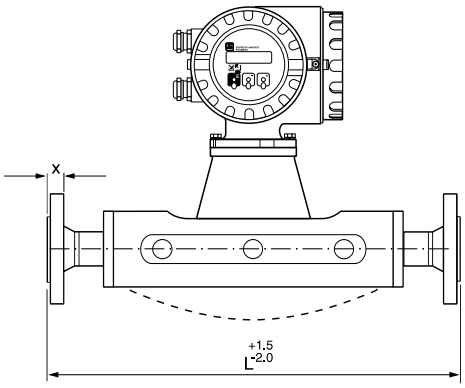
Flange material:	SS 1.4404 (316L), titanium Gr. 2
Gasket material:	O-ring in Viton (–15...+200 °C), Kalrez (–30...+210 °C), Silicone (–60...+200 °C), EPDM (–40...+160 °C), FEP-coated (–60...+200 °C)

Promass F

Flange material:	(DN 8...100) SS 1.4404 (316L), (DN 8...80) Alloy C-22 2.4602 (N 06022)
Welded process connection:	no internal gaskets

Surface finish of the flanges

For Class 150, 300, 600: R_a 3.2...6.3 µm



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Diameter		Cl 150		Cl 300		Cl 600	
ANSI	DIN	L [mm]	x [mm]	L [mm]	x [mm]	L [mm]	x [mm]
3/8"	DN 8	370	11.2	370	14.2	400	20.6
1/2"	DN 15	404	11.2	404	14.2	420	20.6
1"	DN 25	440	14.2	440	17.5	490	23.9
1 1/2"	DN 40	550	17.5	550	20.6	600	28.7
2"	DN 50	715	19.1	715	22.3	742	31.8
3"	DN 80	840	23.9	840	28.4	900	38.2
4" *	DN 100	874	23.9	894	31.7	–	–
4"	DN 100	1128	23.9	1128	31.7	1158	48.4
6" **	DN 150	1168	25.4	–	–	–	–

3/8" with 1/2" flanges as standard; 4" / DN 100 only for Promass F available;
* 4" / DN 100: nominal diameter 3" / DN 80 with 4" / DN 100 flanges;
** 6" / DN 150: nominal diameter 4" / DN 100 with 6" / DN 150 flanges

Fig. 30:
Dimensions
ANSI process connections

JIS B2238 process connections

Promass M

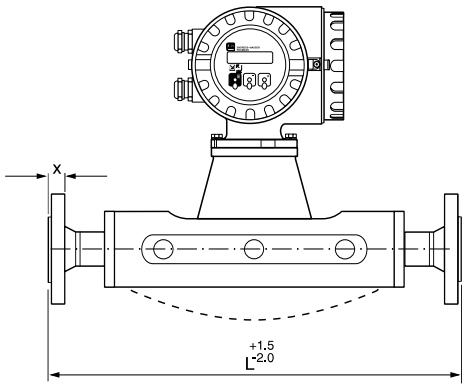
Flange material:	SS 1.4404 (316L), titanium Gr. 2
Gasket material:	O-ring in Viton (–15...+200 °C), Kalrez (–30...+210 °C), Silicone (–60...+200 °C), EPDM (–40...+160 °C), FEP-coated (–60...+200 °C)

Promass F

Flange material:	(DN 8...100) SS 1.4404 (316L), (DN 8...80) Alloy C-22 2.4602 (N 06022)
Welded process connection:	no internal gaskets

Surface finish of the flanges

For 10K, 20K, 40K, 63K: R_a 3.2...6.3 µm



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Dia-meter	10K		20K		40K		63K	
	L [mm]	x [mm]	L [mm]	x [mm]	L [mm]	x [mm]	L mm]	x [mm]
DN 8	–	–	370	14	400	20	420	23
DN 15	–	–	404	14	425	20	440	23
DN 25	–	–	440	16	485	22	494	27
DN 40	–	–	550	18	600	24	620	32
DN 50	715	16	715	18	760	26	775	34
DN 80	832	18	832	22	890	32	915	40
DN 100 *	864	18	–	–	–	–	–	–
DN 100	1128	18	1128	24	1168	36	1168	44
DN 150 **	1168	22	–	–	–	–	–	–

DN 8: with DN 15 flanges as standard; DN 100 only for Promass F available;
* DN 100: nominal diameter DN 80 with DN 100 flanges;
** DN 150: nominal diameter DN 100 with DN 150 flanges

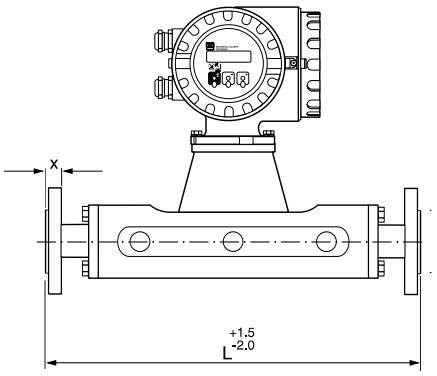
Fig. 31:
Dimensions
JIS process connections

PVDF process connections (DIN 2501 / ANSI B16.5 / JIS B2238)

This process connection is only available for **Promass M**.

Flange material: PVDF

Gasket matirial: O-ring in Viton (–15...+200 °C),
Kalrez (–30...+210 °C),
Silicone (–60...+200 °C),
EPDM (–40...+160 °C)



Diameter		PN 16 / Cl 150 / 10K	
DIN	ANSI	L [mm]	x [mm]
DN 8	3/8"	370	16
DN 15	1/2"	404	16
DN 25	1"	440	18
DN 40	1 1/2"	550	21
DN 50	2"	715	22

DN 8 resp. 3/8" with DN 15 resp. 1/2" flanges as standard

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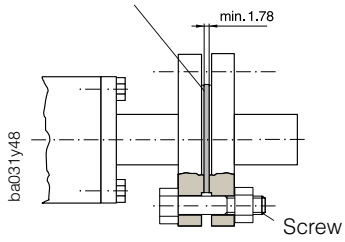
Screw tightening torques (PVDF process connections)

Diameter		PN 16		Cl 150		10K	
DIN	ANSI	[Nm]	Screw	[Nm]	Screw	[Nm]	Screw
DN 8	3/8"	4.8	4 x M 12	3.4	4 x UNC 1/2	5.9	4 x M 12
DN 15	1/2"	4.8	4 x M 12	3.4	4 x UNC 1/2	5.9	4 x M 12
DN 25	1"	11.2	4 x M 12	7.3	4 x UNC 1/2	14.1	4 x M 16
DN 40	1 1/2"	25.7	4 x M 16	15.7	4 x UNC 1/2	22.7	4 x M 16
DN 50	2"	35.8	4 x M 16	30.7	4 x UNC 5/8	32.6	4 x M 16

Hardness of gasket:
Shore A ≤ 75



Caution!
- When using PVDF process connections:
  – use only gaskets as specified above
  – use only the specified tightening torques
- For large diameters with heavy dead weights: sensor must be supported

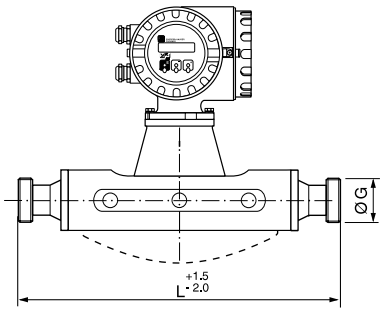

Caution!

Fig. 32: Dimensions and tightening torques PVDF process connections

Sanitary process connections
Hygienic coupling (DIN 11851 / SMS 1145)

Promass M (connections with internal gaskets)
Coupling: SS 1.4404 (316L)
Gasket: Silicone (–60...+200 °C) or
EPDM (–40...+160 °C) flat gasket,
FDA licensed gasket materials

Promass F (completely welded version)
Coupling: SS 1.4404 (316L)
Welded process connection: no internal gaskets



Dia-meter	L [mm]	Ø G DIN 11851	Ø G SMS 1145
DN 8	367	Rd 34 x 1/8"	Rd 40 x 1/6"
DN 15	398	Rd 34 x 1/8"	Rd 40 x 1/6"
DN 25	434	Rd 52 x 1/6"	Rd 40 x 1/6"
DN 40	560	Rd 65 x 1/6"	Rd 60 x 1/6"
DN 50	720	Rd 78 x 1/6"	Rd 70 x 1/6"
DN 80 M	815	Rd 110 x 1/4"	–
DN 80 M	792	–	Rd 98 x 1/6"
DN 80 F	900	Rd 110 x 1/4"	Rd 98 x 1/6"
DN 100 *	1128	Rd 130 x 1/4"	Rd 132 x 1/6"

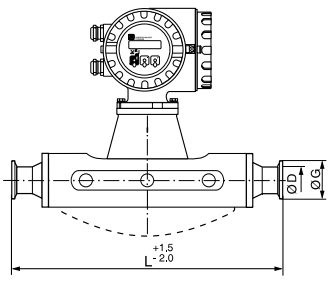
DN 8 with DN 15 connection as standard;
* DN 100 only for Promass F available;
3A-version with $R_a \leq 0.8$ µm available

ba031y50

Fig. 33: Dimensions Hygienic coupling DIN 11851 / SMS 1145

Tri-Clamp
Promass M (connections with internal gaskets)
Tri-Clamp: SS 1.4404 (316L)
Gasket: Silicone (–60...+200 °C) or
EPDM (–40...+160 °C) flat gasket,
FDA licensed gasket materials

Promass F (completely welded version)
Tri-Clamp: SS 1.4404 (316L)
Welded process connection: no internal gaskets



Diameter DIN	Diameter ANSI	Clamp	L [mm]	Ø G [mm]	Ø D [mm]
DN 8	3/8"	1/2"	367	25.0	9.5
DN 8	3/8"	1"	367	50.4	22.1
DN 15	1/2"	1/2"	398	25.0	9.5
DN 15	1/2"	1"	398	50.4	22.1
DN 25	1"	1"	434	50.4	22.1
DN 40	1 1/2"	1 1/2"	560	50.4	34.8
DN 50	2"	2"	720	63.9	47.5
DN 80 M	3"	3"	801	90.9	72.9
DN 80 F	3"	3"	900	90.9	72.9
DN 100 *	4"	4"	1128	118.9	97.4

3/8" and 1/2" with 1"-connection as standard;
* DN 100 only for Promass F available;
3A-version with $R_a \leq 0.8$ µm available

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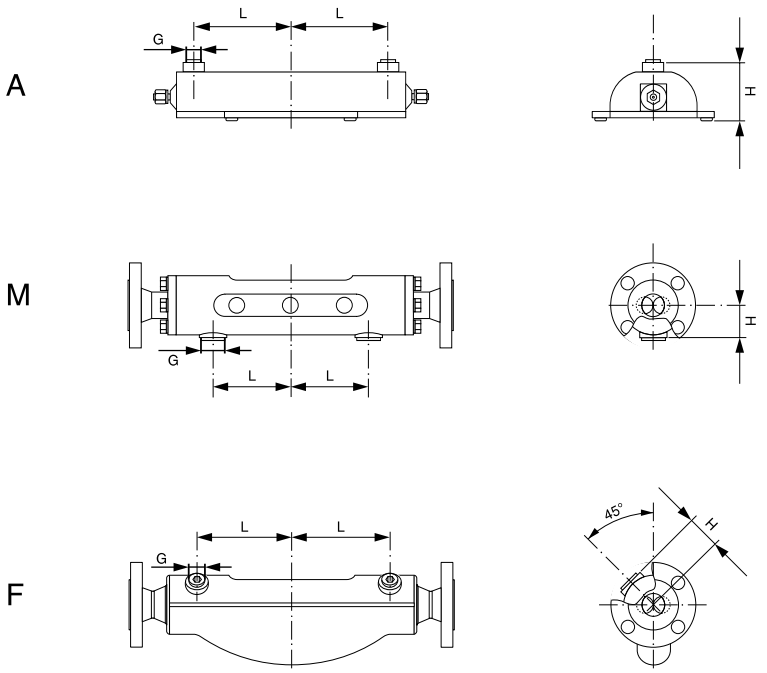
Pressure limitations due fluid temperature
The material load limits is exclusively determind by the material properties of the Tri-Clamp used.
This clamp is not included in the shipment.

Fig. 34: Dimensions Tri-Clamp

9.7 Dimensions of purge connections (pressure vessel monitoring)

Promass



Diameter		Promass A		Promass M		Promass F		Con-nection
DN	ANSI	L	H	L	H	L	H	G
DN 2	1/12"	130.0	87.0	–	–	–	–	1/2" NPT
DN 4	1/8"	192.5	97.1	–	–	–	–	1/2" NPT
DN 8	3/8"	–	–	85	44.0	108	47	1/2" NPT
DN 15	1/2"	–	–	100	46.5	110	47	1/2" NPT
DN 25	1"	–	–	110	50.0	130	47	1/2" NPT
DN 40	1 1/2"	–	–	155	59.0	155	52	1/2" NPT
DN 50	2"	–	–	210	67.5	226	64	1/2" NPT
DN 80	3"	–	–	210	81.5	280	86	1/2" NPT
DN 100	4"	–	–	–	–	342	100	1/2" NPT

Fig. 35: Dimensions of purge connections (pressure vessel monitoring)

10 Technical Data

Application

Instrument name	Flowmeter “Promass 64” for custody transfer operations
Instrument function	Mass and volumetric totalisation of liquids other than water (with custody transfer) and burnable gases for a pressure range > 100 bar in closed piping.

Function and system design

Measuring principle	Mass flow measurement according to the Coriolis measuring principle (see page 7 ff.)
Measuring system	Instrument family “Promass 64” consisting of: • Transmitter: Promass 64 • Sensor: Promass A (DN 2, 4), standard and high pressure version Promass F (DN 8, 15, 25, 40, 50, 80, 100) Promass M (DN 8, 15, 25, 40, 50, 80) Promass M high pressure (DN 8, 15, 25) Two versions are available: • Compact version • Remote version (max. 20 m)

Input variables

Measured variables	• Mass flow rate (is proportional to the phase difference of two sensors in the measuring pipe which detect differences in its oscillation, see page 7) • Medium density (is proportional to the resonance frequency of the measuring pipes) • Medium temperature (is measured with temperature sensors)
Measuring range (Q_{min} / Q_{max}) in custody transfer	Mass meter for liquids

Sensor type	Diameter DN	Mass flow (relate to 1.0 kg/dm³)		smallest measuring quantity
	[mm]	Q_{min} [kg/min]	Q_{max} [kg/min]	[kg]
A	2	0.1	2	0.05
A	4	0.4	8	0.20
F, M	8	1.5	30	0.50
F, M	15	5.0	100	2.00
F, M	25	15.0	300	5.00
F, M	40	35.0	700	20.00
F, M	50	50.0	1000	50.00
F, M	80	150.0	3000	150.00
F	100	200.0	4500	200.00

Mass meter for compressed natural gas applications (CNG)

Sensor type	Diameter DN	Mass flow Q_{min}	Mass flow Q_{max}	smallest measuring quantity	max. pressure
	[mm]	[kg/min]	[kg/min]	[kg]	[bar]
M / M*	8	0.1	10	0.2	250 / 350*
M / M*	15	0.3	40	0.5	250 / 350*
M / M*	25	1.0	100	2.0	250 / 350*

* Promass M (high pressure version)

Volumetric meter for liquids (also LPG)

Sensor type	Diameter DN	Volume flow (relate to 1.0 kg/dm³)		smallest measuring quantity
	[mm]	Q_{min} [l/min]	Q_{max} [l/min]	[l]
A	2	0.1	2	0.05
A	4	0.4	8	0.20
F	8	1.5	30	0.50
F	15	5.0	100	2.00
F	25	15.0	300	5.00
F	40	35.0	700	20.00
F	50	50.0	1000	50.00
F, M	80	150.0	3000	150.00
F	100	200.0	4500	200.00

Input variables (continued)	
Operable flow range	20:1 with verified flowmeters.
Auxiliary input (with "Ex e" board only)	U = 3…30 V DC, R_i = 1.8 kΩ, pulsed or level mode, configurable for reset totalizer 2, error reset, positive zero return or full scale switching.
Output variables	
Output signal	***With "Ex e" electronics board*** • *Status output* Relay, max. 30 V DC/0.1 A. Configurable for error message, empty pipe detection, full scale switching, flow direction, limit value. The output is automatically set to "error message" for custody transfer. • *Current output* 0/4…20 mA, also acc. to NAMUR recommendations; R_L < 700 Ω; freely assignable to different measured values (see page 40), time constant freely selectable (0.01…100.00 s), full scale value selectable, temperature coefficient typ. 0.005% o.f.s./°C o.f.s. = of full scale • *Pulse output A* active/passive, f_{max} = 500 Hz, R_L > 100 Ω active: 24 V DC, 25 mA (250 mA during 20 ms) passive: 30 V DC, 250 mA (250 mA during 20 ms) standard variables, pulse value and output signal type selectable • *Pulse output B* 90° or 180° phase shifted to pulse output A, f_{max} = 500 Hz, active/passive, R_L > 100 Ω, active: 24 V DC, 25 mA (250 mA during 20 ms) passive: 30 V DC, 25 mA (250 mA during 20 ms)
	With "Ex i" electronics board • *Status output* Open Emitter, max. 30 V DC / 25 mA, configurable (see page 49) • *Pulse output A* Open Emitter, passive, 30 V DC, 25 mA, f_{max} = 500 Hz, R_L > 100 Ω; standard variables, pulse value and output signal type selectable • *Pulse output B* Open Emitter, 90° or 180° phase shifted to pulse output A, passive: 30 V DC, 25 mA, f_{max} = 500 Hz, R_L > 100 Ω
Signal on alarm	The following applies until the fault has been cleared (see also page 34): • *Current output:* failure mode selectable • *Pulse outputs:* no pulse output signals; both totalizers inactive • *Status output*: the output is open on error (automatically configured to "ERROR" in custody transfer)
Load	R_L < 700 Ω (current output)
Creep suppression	Switch points for low flow selectable. Hysteresis = 50% of the chosen value (further information: see page 58).

Accuracy

Reference conditions

Error limits based on ISO / DIS 11631:
- 20…30 °C; 2…4 bar
- Calibration facilities based on national standards
- Zero point calibrated under operating conditions
- Field density calibration carried out (or special density calibration)

Measured error

- *Mass flow:*
  Promass A, M, F ± 0.10% ± [(zero stability / flow rate) x 100]% of rate
- *Volume flow:*
  Promass A, M ± 0.25% ± [(zero stability / flow rate) x 100]% of rate
  Promass F ± 0.15% ± [(zero stability / flow rate) x 100]% of rate

  zero stability → see table below


Note!

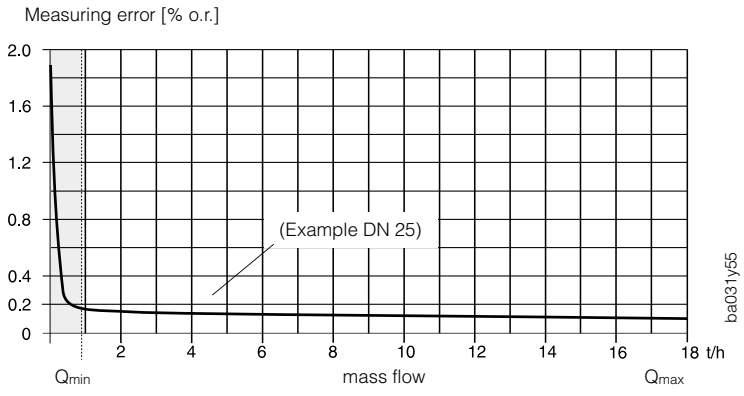
Note!
Additional inaccuracy of the current output: ± 5 µA (typical)

Diameter [mm]	Full scale [t/h] resp. [m³/h]	Zero stability Promass A, M, F [kg/h] resp. [l/h]
DN 2	0.100	0.0050
DN 4	0.450	0.0225
DN 8	2.0	0.1000
DN 15	6.5	0.3250
DN 25	18.0	0.90
DN 40	45.0	2.25
DN 50	70.0	3.50
DN 80	180.0	9.00
DN 100	350.0	14.00

Example for calculating the measuring error:

Promass F → ± 0.10% ± [(zero stability / flow rate) x 100]% of rate
DN 25; Flow rate = 3.6 t/h = 3600 kg/h

$$\text{Measuring error} \rightarrow \pm 0.10\% \pm \frac{0.9\ \text{kg/h}}{3600\ \text{kg/h}} \cdot 100\% = \pm 0.125\%$$




Caution!

Caution!
Q_{min} and Q_{max} are specified for custody transfer measurement (see page 93)

Accuracy (contninued)

Measured error (continued)

- *Density (Liquid):*
  Standard calibration:
  Promass A, M ± 0.020 g/cc (1 g/cc = 1 kg/l)
  Promass F ± 0.010 g/cc

  Special density calibration (optional)
  (calibration range: 0.8…1.8 g/cc; 5…80 °C):
  Promass A, M ± 0.002 g/cc
  Promass F ± 0.001 g/cc

  Field-density calibration:
  Promass A, M ± 0.0010 g/cc
  Promass F ± 0.0005 g/cc

- *Temperature:*
  Promass A, M, F ± 0.5 °C ± 0.005 · T (T = medium temp. in °C)

Repeatability

- *Mass flow:*
  Promass A, M, F ± 0.05% ± [$^1/_2$ x (zero stability / flow rate) x 100]% of rate

- *Volume flow:*
  Promass A, M ± 0.10% ± [$^1/_2$ x (zero stability / flow rate) x 100]% of rate
  Promass F ± 0.05% ± [$^1/_2$ x (zero stability / flow rate) x 100]% of rate

  zero stability → see Table on page 95

Example for calculating the repeatability:
Promass F
F → ± 0.05% ± [$^1/_2$ x (zero stability / flow rate) x 100]% of rate
DN 25; Flow rate = 3.6 t/h = 3600 kg/h

Repeatability → $\pm 0.05\% \pm {}^1/_2 \cdot \frac{0.9\ \text{kg/h}}{3600\ \text{kg/h}} \cdot 100\% = \pm 0.0625\%$

- *Density (Liquid):*
  Promass A, M ± 0.00050 g/cc (1 g/cc = 1 kg/l)
  Promass F ± 0.00025 g/cc

- Temperature:
  Promass A, M, F ± 0.25 °C ± 0.0025 · T (T = medium temp. in °C)

Process effects

- *Process temperature effect:*
  The below value represents the zero point error due to changing process temperature away from temperature at which a zero point adjustment was carried out: Promass A, M, F typical = ± 0,0002% of full scale / °C

- *Process pressure effect:*
  The below defined values represent the effect on accuracy of mass flow due to changing process pressure away from calibration pressure (values in % of rate / bar).

DN [mm]	Promass A flow rate %o .r.*/ bar	Promass M flow rate % o.r.*/ bar	Promass M** flow rate % o.r.*/ bar	Promass F flow rate % o.r.*/ bar
DN 2	none	—	—	—
DN 4	none	—	—	—
DN 8	—	0.009	0.006	none
DN 15	—	0.008	0.005	none
DN 25	—	0.009	0.003	none
DN 40	—	0.005	—	–0.003
DN 50	—	none	—	–0.008
DN 80	—	none	—	–0.009
DN 100	—	—	—	–0.012

* o.r. = of rate;
** Promass M (High pressure version)

Operating conditions	
Installation conditions	
Installation instructions	Orientation: vertical or horizontal Restrictions on installation and other recommendations: see chapter 3.
Inlet and outlet sections	Installation site is independent of inlet and outlet sections.
Connection cable length	Remote version: max. 20 m (further information see page 15)
Ambient conditions	
Ambient temperature	–25…+60 °C Promass 64 transmitter –25…+60 °C Promass A, F, M, M (high pressure) sensors • Depending on the product temperature, certain installation positions are to be observed to ensure that the permitted ambient temperature range for the transmitter is not exceeded (see page 14). • An all-weather cover should be used to protect the housing from direct sunlight when mounting in the open. This is especially important in warmer climates and with high ambient temperatures.
Storage temperature	–40…+80 °C
Environmental class	B, C, I acc. to OIML R117, DIN 19217 B = For a fixed instrument installed in a building. C = For a fixed instrument installed outdoors. I = For a mobile instrument, especially that which is mounted on a truck.
Degree of protection (EN 60529)	Transmitter: IP 67; NEMA 4X Sensors: IP 67; NEMA 4X (Promass A, F, M, M high pressure)
Shock resistance	According to IEC 68-2-31
Vibrational resistance	Up to 2 g, 10…150 Hz according to IEC 68-2-6
Electromagnetic compatibility (EMC)	Acc. to EN 50081 Part 1 and 2 / EN 50082 Part 1 and 2 as well as to NAMUR recommendations
Medium conditions	
Medium temperature	• *Sensor* Promass A –50…+200 °C Promass F –50…+200 °C Promass M –50…+150 °C Promass M (high pressure) –50…+150 °C • *Gaskets* Viton –15…+200 °C EPDM –40…+160 °C Silicone –60…+200 °C Kalrez –30…+210 °C FEP coated –60…+200 °C

Operating conditions (continued)	
Nominal pressure	• *Promass A* Fittings: max. 160 bar (standard version), max. 400 bar (high pressure version) Flanges: DIN PN 40 / ANSI Cl 150, Cl 300 / JIS 10K Containment vessel: 25 bar resp. 375 psi • *Promass F* Flanges: DIN PN 16…100 / ANSI Cl 150, Cl 300, Cl 600 / JIS 10K, 20K, 40K, 63K Containment vessel: DN 8...80: 25 bar resp. 375 psi DN 100: 16 bar resp. 250 psi DN 8...50: optional 40 bar resp. 600 psi • *Promass M* Flanges: DIN PN 40…100 / ANSI Cl 150, Cl 300, Cl 600 / JIS 10K, 20K, 40K, 63K Containment vessel: 40 bar (optional 100 bar) resp. 600 psi (optional 1500 psi) • *Promass M (high pressure)* Measuring pipes, connector, fittings: max. 350 bar Containment vessel: 100 bar resp. 1500 psi
Pressure loss	Dependent on nominal diameter and sensor type (see page 102)
Mechanical construction	
Design, dimensions	See pages 81–92
Weights	See pages 81, 83, 86
Materials	• *Transmitter housing* Powder-coated die-cast aluminium • *Sensor housing / containment vessel* Promass A, F: Surfaces resistant to acids and alkalis, SS 1.4301 (304) Promass M: Surfaces resistant to acids and alkalis, DN 8…50: chemically nickel-plated steel DN 80: SS 1.4313 Promass M: (high pressure) Surfaces resistant to acids and alkalis, chemically nickel-plated steel • *Sensor connection housing (remote version)* SS 1.4301 (304) • *Process connections:* see pages 82, 87 ff. • *Measuring pipes* Promass A SS 1.4539 (904L), Alloy C-22 2.4602 (N 06022) Promass M Titanium Grade 2 (DN 80), Titanium Grade 9 (DN 8…50) Promass M (high pressure) Titanium Grade 9 (DN 8...25) Promass F (DN 8...100) SS 1.4539 (904L) (DN 8...80) Alloy C-22 2.4602 (N 06022) • *Gaskets:* see pages 82, 87 ff.

Mechanical construction (continued)	
Process connections	• *Promass A* — *Welded process connections:* 4-VCO-4 fittings, ½" Tri-Clamp *Screw-on process connections:* Flanges (DIN 2501, ANSI B16.5, JIS B2238), NPT-F and SWAGELOK fittings • *Promass F* — *Welded process connections:* Flanges (DIN 2501, ANSI B16.5, JIS B2238), *Sanitary connections:* Tri-Clamp, Hygienic coupling DIN 11851 / SMS 1145 • *Promass M* — *Screw-on process connections:* Flanges (DIN 2501, ANSI B16.5, JIS B2238), *Sanitary connections:* Tri-Clamp, Hygienic coupling DIN 11851 / SMS 1145 • *Promass M (high pressure)* — *Screw-on process connections:* G ⅜", ½" NPT, ⅜" NPT fittings and ½" SWAGELOK coupling, connector with 7/8 14UNF internal thread
Electrical connection	• *Wiring diagram:* see Section 4 • *Cable glands (in-/outputs; remote version):* PG 13.5 cable glands (5…15 mm) or ½" NPT, M 20 × 1.5 (8…15 mm), G ½" threads for cable glands • *Cable specifications (remote version):* see page 19
User interface	
Operation	• 2 switches for custody transfer mode (electronics compartment has to be opened) • On-site operation with 3 operating elements for setting all instrument functions in the E+H programming matrix (see page 26)
Display	LC-display, illuminated, double-spaced with 16 characters each
Communication	none

Power supply

Supply voltage, Frequency

- *Transmitter:*
  85...260 V AC (50...60 Hz)
  20... 55 V AC, 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

Ex 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.

Verification of accuracy

NMi and PTB approval for measuring the mass and volumetric flow of liquids other than water and of pressurised gases.

Flowmeter certified to OIML R105 / R117, DIN 19217.

		PTB approval			
		for liquids other than water for			for high pressure (CNG) application
Promass	DN	Mass meter	Volume meter	Density meter	Mass meter
A	2...4	YES	YES	YES	NO
F	8...100	YES	YES	YES	NO
M	8...50	YES	NO	NO	NO
M	80	YES	YES	YES	NO
M* (high press.)	8...25	NO	NO	NO	YES
M*	8...25	NO	NO	NO	YES

* for CNG-applications

		NMi approval	
		for liquids other than water for	
Promass	DN	Mass meter	Volume meter
A	2...4	YES	YES
F	8...100	YES	YES
M	8...80	YES	YES
M* (high press.)	8...25	NO	NO
M*	8...25	NO	NO

* for CNG-applications

Certificates and approvals	
CE mark	By attaching the CE mark, Endress+Hauser confirms that the Promass 64 measurement system has been successfully tested and fulfils all legal requirements of the relevant EC directives.
Order information	
Accessories	• Post mounting set for Promass A: DN 2: Order No. 50077972 DN 4: Order No. 50079218 • Post mounting set for remote transmitter housing: Order No. 50076905
Supplementary documentation	Technical Information Promass 64 (TI 038D/06/en) System Information Promass (SI 014D/06/en)

Other standards and guidelines

EN 60529	Degree of protection by housing (IP code)
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

Pressure loss

The pressure drop is dependent on the characteristics of fluid and its flow rate. The following formulae can be used for liquids to approximately calculate the pressure loss:

Δp pressure loss [mbar]
υ kinem. viscosity [m^2/s]
$\dot{m}$ mass flow rate [kg/s]
ρ fluid density [kg/m^3]
d internal diameter of of measuring tubes [m]
K... constants dependent on the nominal diameter (DN)

	Promass A	**Promass M, M (high pressure), F**
Reynolds No.	$Re = \frac{4 \cdot \dot{m}}{\pi \cdot d \cdot \upsilon \cdot \rho}$	$Re = \frac{2 \cdot \dot{m}}{\pi \cdot d \cdot \upsilon \cdot \rho}$
$Re \geq 2300$	$\Delta p = K \cdot \upsilon^{0.25} \cdot \dot{m}^{1.75} \cdot \rho^{-0.75}$	$\Delta p = K \cdot \upsilon^{0.25} \cdot \dot{m}^{1.85} \cdot \rho^{-0.86}$
$Re < 2300$	$\Delta p = K1 \cdot \upsilon \cdot \dot{m}$	$\Delta p = K1 \cdot \upsilon \cdot \dot{m} + \frac{K2 \cdot \upsilon^{0.25} \cdot \dot{m}^2}{\rho}$

	Diameter	d [m]	K	K1	K2
Promass A	DN 2	$1.80 \cdot 10^{-3}$	$1.6 \cdot 10^{10}$	$2.4 \cdot 10^{10}$	–
	DN 4	$3.50 \cdot 10^{-3}$	$9.4 \cdot 10^{8}$	$2.3 \cdot 10^{9}$	–
Promass A (high pressure)	DN 2	$1.40 \cdot 10^{-3}$	$5.4 \cdot 10^{10}$	$6.6 \cdot 10^{10}$	–
	DN 4	$3.00 \cdot 10^{-3}$	$2.0 \cdot 10^{9}$	$4.3 \cdot 10^{9}$	–
Promass M	DN 8	$5.53 \cdot 10^{-3}$	$5.2 \cdot 10^{7}$	$8.6 \cdot 10^{7}$	$1.7 \cdot 10^{7}$
	DN 15	$8.55 \cdot 10^{-3}$	$5.3 \cdot 10^{6}$	$1.7 \cdot 10^{7}$	$9.7 \cdot 10^{5}$
	DN 25	$11.38 \cdot 10^{-3}$	$1.7 \cdot 10^{6}$	$5.8 \cdot 10^{6}$	$4.1 \cdot 10^{5}$
	DN 40	$17.07 \cdot 10^{-3}$	$3.2 \cdot 10^{5}$	$1.2 \cdot 10^{6}$	$1.2 \cdot 10^{5}$
	DN 50	$25.60 \cdot 10^{-3}$	$6.4 \cdot 10^{4}$	$4.5 \cdot 10^{5}$	$1.3 \cdot 10^{4}$
	DN 80	$38.46 \cdot 10^{-3}$	$1.4 \cdot 10^{4}$	$8.2 \cdot 10^{4}$	$3.7 \cdot 10^{3}$
Promass M (high pressure)	DN 8	$4.93 \cdot 10^{-3}$	$6.06 \cdot 10^{7}$	$1.42 \cdot 10^{8}$	$2.80 \cdot 10^{7}$
	DN 15	$7.75 \cdot 10^{-3}$	$8.00 \cdot 10^{6}$	$2.54 \cdot 10^{7}$	$1.45 \cdot 10^{6}$
	DN 25	$1.02 \cdot 10^{-2}$	$2.70 \cdot 10^{6}$	$8.95 \cdot 10^{6}$	$6.33 \cdot 10^{5}$
Promass F	DN 8	$5.35 \cdot 10^{-3}$	$5.70 \cdot 10^{7}$	$9.60 \cdot 10^{7}$	$1.90 \cdot 10^{7}$
	DN 15	$8.30 \cdot 10^{-3}$	$5.80 \cdot 10^{6}$	$1.90 \cdot 10^{7}$	$10.60 \cdot 10^{5}$
	DN 25	$12.00 \cdot 10^{-3}$	$1.90 \cdot 10^{6}$	$6.40 \cdot 10^{6}$	$4.50 \cdot 10^{5}$
	DN 40	$17.60 \cdot 10^{-3}$	$3.50 \cdot 10^{5}$	$1.30 \cdot 10^{6}$	$1.30 \cdot 10^{5}$
	DN 50	$26.00 \cdot 10^{-3}$	$7.00 \cdot 10^{4}$	$5.00 \cdot 10^{5}$	$1.40 \cdot 10^{4}$
	DN 80	$40.50 \cdot 10^{-3}$	$1.10 \cdot 10^{4}$	$7.71 \cdot 10^{4}$	$1.42 \cdot 10^{4}$
	DN 100	$51.20 \cdot 10^{-3}$	$3.54 \cdot 10^{3}$	$3.54 \cdot 10^{4}$	$5.40 \cdot 10^{3}$

Pressure loss data **inclusive** interface measuring tube(s) / piping.

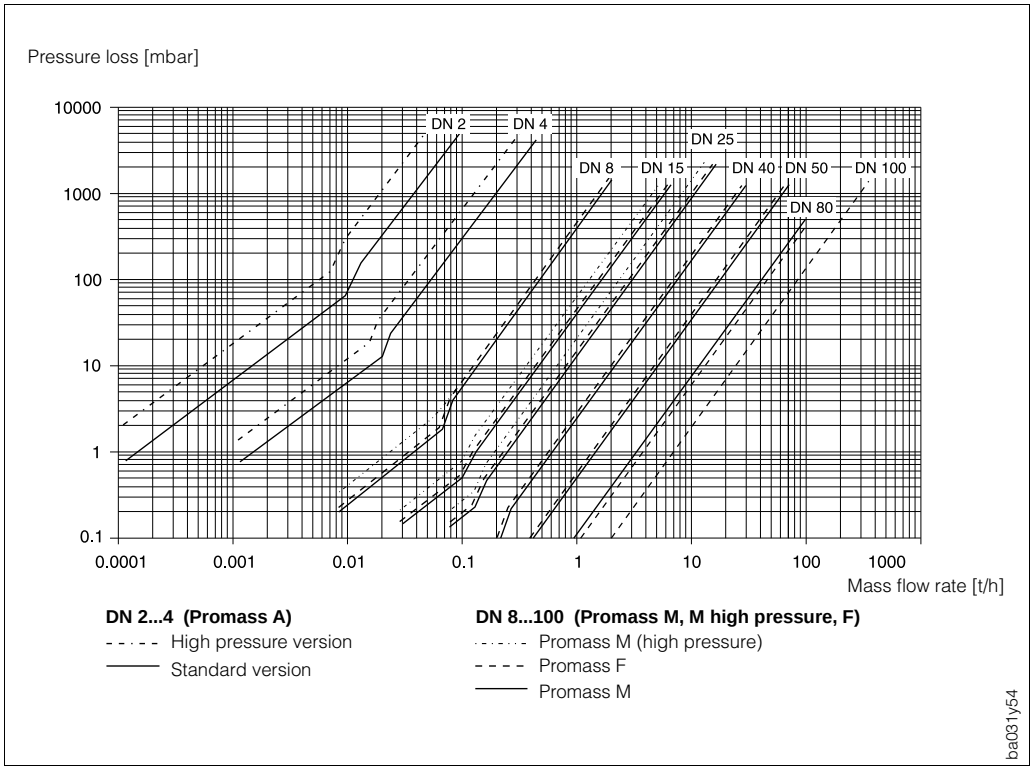


Fig. 36: Pressure loss for water

11 Functions at a Glance

SYSTEM CONDITION	
CUSTODY TRANSFER (p. 32)	This function shows whether the measuring system is set to custody transfer. YES – NO The setting and deletion of calibration operations is described more in-depth on page 22.
PRESENT SYSTEM CONDITIONS (p. 32)	Display (listed in priority) F... = Error message (System Error) A... = Alarm message (Processor Error) S... = Status message
PREVIOUS SYSTEM CONDITIONS (p. 32)	Display (listed in chronological) F... = Error message (System Error) A... = Alarm message (Processor Error) S... = Status message
RESET FAILURES (p. 33)	***CANCEL*** – YES Error messages that occur during custody transfer can be reset in this function. This function is only available for calibrated operation.
RESET FUNCTION (p. 33) 	***AUTOMATIC*** – RESET FAILURES – CANCEL This function specifies how and when the flowmeter returns to normal operation after an error has been corrected. Your setting:.....
MASS OR VOLUME (p. 33) 	***MASS*** – VOLUME – CANCEL In this function, you determine whether the measuring instrument is to be calibrated for mass flow or volume flow. Caution! In custody transfer mode, all instrument functions related to calibration parameters are automatically locked. All parameters must therefore be programmed before activating the custody transfer mode (see page 22). Your setting:.....

PROCESS VARIABLE	
The engineering units of all variables shown here can be set in the Function group "SYSTEM UNITS". If the medium in the pipeline flows backwards, then the flow rate value is indicated by a negative sign on the display (independent of the setting in the Function "MEASURING MODE", see page 58).	
MASS FLOW (p. 35)	Display: 5-digit number with floating decimal point, incl. engineering units and arithmetic sign. (e.g. 462.87 kg/h; 731.63 lb/min; etc.)
VOLUME FLOW (p. 35)	Display: 5-digit number with floating decimal point, incl. engineering units and arithmetic sign. (e.g. 5.5445 dm^3/min; 1.4359 m^3/h; 731.63 gal/d; etc.)
DENSITY (p. 35)	Display: 5-digit number fixed decimal point, incl. engineering units (corresponding to 0.10000...6.0000 kg/dm^3). e.g. 1.2345 kg/dm^3; 993.5 kg/m^3; 1.0015 SG_20 °C; etc.
TEMPERAT. (p. 35)	Display: 4-digit number fixed decimal point, incl. engineering units and arithmetic sign. (e.g. –23.4 °C; 160.0 °F; 295.4 K; etc.)

TOTALIZER	
TOTALIZER 1 (p. 36)	Selecting this function automatically displays the totalised flow quantity (for calibrated operations) from when measurement began. This value is either positive or negative depending on the direction of flow. Display: max. 7-digit number with fixed decimal point, incl. engineering units (e.g. 1.54 t; 14925.63 kg) Display of which measuring variable is assigned to Totalizer 1.
TOTAL. 1 OVERFLOW (p. 36)	Display: Integer to a decimal power, incl. engineering units and arithmetic sign, e.g. 10 e7 kg Display of which measuring variable is assigned to Totalizer 1.
TOTALIZER 2 (p. 36)	Function description → corresponding to Function "TOTALIZER 1".
TOTAL. 2 OVERFLOW (p. 36)	Function description → corresponding to Function "TOTAL. 1 OVERFLOW".
RESET TOTALIZER (p. 37)	***CANCEL*** – TOTALIZER 1 * – TOTALIZER 2 – TOTALIZER 1&2 * (* cannot be selected for calibrated operation) Your setting:.....
ASSIGN TOTAL. 2 (p. 37)	***OFF*** – MASS – VOLUME – CANCEL Any measuring variable required can be assigned to Totalizer 2. Your setting:.....
FORMAT TOTALIZER (p. 37)	_.0 – _***.00*** – _.000 – CANCEL Number of decimal places of the totalizer display. Your setting:.....

SYSTEM UNITS	
MASS FLOW UNIT (p. 38)	g/min – g/h – kg/s – kg/min – ***kg/h*** – t/min – t/h – t/d – lb/s – lb/min – lb/hr – ton/min – ton/hr – ton/d – CANCEL Your setting:.....
MASS UNIT (p. 38)	g – ***kg*** – t – lb – ton – CANCEL Your setting:.....
VOL. FLOW UNIT (p. 38)	cm^3/min – cm^3/h – dm^3/s – dm^3/min – ***dm^3/h*** – l/s – l/min – l/h – hl/min – hl/h – m^3/min – m^3/h – cc/min – cc/hr – gal/min – gal/hr – gal/day – gpm – gph – gpd – mgd – bbl/min – bbl/hr – bbl/day – CANCEL Your setting:.....
VOLUME UNIT (p. 38)	cm^3 – ***dm^3*** – l – hl – m^3 – cc – gal – bbl – CANCEL Your setting:.....
GALLONS/ BARREL (p. 39)	US: 31.0 gal/bbl ***US: 31.5 gal/bbl*** US: 42.0 gal/bbl US: 55.0 gal/bbl Imp: 36.0 gal/bbl Imp: 42.0 gal/bbl CANCEL Your setting:.....
DENSITY UNIT (p. 39)	g/cm^3 – kg/dm^3 – ***kg/l*** – kg/m^3 – SD_4 °C – SD_15 °C – SD_20 °C – g/cc – lb/cf – lb/gal – lb/bbl – SG_59 °F – SG_60 °F – SG_68 °F – SG_4 °C – SG_15 °C – SG_20 °C – CANCEL Your setting:.....
TEMPERAT. UNIT (p. 39)	***°C (CELSIUS)*** – K (KELVIN) – °F (FAHRENHEIT) – °R (RANKINE) – CANCEL Your setting:.....
NOM. DIAM. UNIT (p. 39)	***mm*** – inch – CANCEL Your setting:.....

CURRENT OUTPUT	
This Function group is only available if the measuring electronics of Promass 64 is equipped with the "Ex e"-board.	
ASSIGN OUTPUT (p. 40)	OFF – ***MASS FLOW*** – VOLUME FLOW – DENSITY – TEMPERATURE – CANCEL Your setting:.....
ZERO SCALE (p. 40)	5-digit number with floating decimal point (e.g. 0.0000 kg/h; 245.92 kg/m^3; 105.60 °C) Factory settings: Mass flow : ***0.0000 kg/h*** Density : ***0.0000 kg/l*** Temperature: –***50.000 °C*** Your setting:.....
FULL SCALE 1 (p. 41)	5-digit number with floating decimal point, depending on the variable, (e.g. 566.00 kg/min; 0.9956 kg/dm^3; 105.60 °C; etc.) Factory setting: Mass flow : ***dependent*** on the nom. dia. Density : ***2.0000 kg/l*** Temperature: ***200.00 °C*** Your setting:.....
DUAL RANGE MODE (p. 42)	***FULL SCALE 1*** – FULL SCALE 2 – AUTOMATIC – AUXILIARY INPUT – CANCEL Your setting:.....
FULL SCALE 2 (p. 43)	Function description → corresponding to Function "FULL SCALE 1". Your setting:.....
ACTIVE RANGE (p. 43)	Display: ***FULL SCALE 1*** – FULL SCALE 2
TIME CONSTANT (p. 43)	3- to 5-digit number with fixed decimal point (0.01...100.00 s) Factory setting: ***1.00 s*** Your setting:.....
CURRENT SPAN (p. 43)	0–20 mA (25 mA) – 4–20 mA (25 mA) – 0–20 mA – ***4–20 mA*** – CANCEL Your setting:.....

CURRENT OUTPUT	
FAISAFE MODE (p. 44)	***MIN. CURRENT*** Current signal is set to 0 mA (0...20 mA) resp. 2 mA (4...20 mA) on error. MAX. CURRENT Current signal is set to 25 mA for 0/4...20 mA (25 mA) resp. to 22 mA for 4...20 mA on error. HOLD VALUE Last valid measured value is held ACTUAL VALUE Normal measured value given despite error CANCEL Your setting:.....
SIMULATION CURR. (p. 44)	***OFF*** – 0 mA – 10 mA – 20 mA – 22 mA – 25 mA (at 0...20 mA) – 2 mA – 4 mA – 12 mA – 20 mA – 22 mA – 25 mA (at 4...20 mA) – CANCEL Your setting:.....
NOMINAL CURRENT (p. 44)	Display: 3-digit number with floating decimal point (0.00...25.0 mA) Your setting:.....

PULSE OUTPUT	
PULSE VALUE (p. 45)	5-digit number with floating decimal point, incl. engineering units (e.g. 240.00 t/p; 0.6136 kg/p; etc.) Factory setting: ***dependent*** on the nominal diameter Your setting:.....
OUTPUT SIGNAL (p. 45)	Selection by "Ex e"-electronics board: PASSIVE-POSITIVE – PASSIVE-NEGATIVE– ***ACTIVE-POSITIVE*** – ACTIVE-NEGATIVE – CANCEL Selection by "Ex i"-electronics board: ***PASSIVE-POSITIV***E – PASSIVE-NEGATIVE – CANCEL Your setting:.....
PHASE SHIFT (p. 47)	***90°*** – 180° – CANCEL Your setting:.....

STATUS OUTPUT	
ASSIGN STATUS (p. 48)	***FAILURE*** – EMPTY PIPE DET. – DUAL RANGE MODE – FLOW DIRECTION – LIMIT MASS FLOW – LIMIT VOLUME FLOW – LIMIT DENSITY – LIMIT TEMPERAT. – CANCEL Your setting:.....
ON-VALUE (p. 50)	Density-/flow-variables: 5-digit number with floating or fixed decimal point, incl. engineering units, (e.g. 0.0037 t/min; 900.00 kg/m^3; etc.) Temperature: max. 4-digit number with fixed decimal point, incl. engineering units and arithmetic sign (e.g. –22.50 °C) Your setting:.....
OFF-VALUE (p. 50)	Density-/flow-variables: 5-digit number with floating or fixed decimal point, incl. engineering units, (e.g. 0.0037 t/min; 900.00 kg/m^3; etc.) Temperature: max. 4-digit number with fixed decimal point, incl. engineering units and arithmetic sign (e.g. –22.50 °C) Your setting:.....
PICKUP DELAY (p. 51)	***0***...100 seconds (in second steps) Your setting:.....
DROPOUT DELAY (p. 51)	***0***...100 seconds (in second steps) Your setting:.....

DENSITY FUNCTION	
DENS. ADJ. VALUE (p. 52) 	5-digit number with floating decimal points, incl. engineering units (corresponding to 0.1...5.9999 kg/l) Factory setting: ***0.0000 kg/l*** Your setting:.....
DENSITY ADJUST (p. 52) 	***CANCEL*** – SAMPLE FLUID 1 – SAMPLE FLUID 2 – DENSITY ADJUST Your setting:.....
VOLUME FLOW MEAS. (p. 53)	This function shows that the volume measurement is always at disposal. In other functions you may, therefore, activate the respective settings (e.g. calibration parameter → VOLUME).

DISPLAY	
ASSIGN LINE 1 (p. 55)	Display: Totalizer 1
ASSIGN LINE 2 (p. 55)	OFF – ***MASS FLOW*** – VOLUME FLOW – DENSITY – TEMPERATURE – TOTAL. 1 OVERFLOW – TOTALIZER 2 – CANCEL Your setting:.....
DISPLAY DAMPING (p. 55)	max. 2-digit number: 0...99 seconds Factory setting: ***1 s*** Your setting:.....
FORMAT FLOW (p. 55)	xxxxx. – xxxx.x – xxx.xx – xx.xxx – ***x.xxxx*** – CANCEL Your setting:.....
LCD CONTRAST (p. 55)	**IIIIIIIIIII**..... Any change in the contrast is immediately seen with the adjustable bar graph.
LANGUAGE (p. 55)	ENGLISH – DEUTSCH – FRANCAIS – ESPANOL – ITALIANO – NEDERLAND – DANSK – NORSK – SVENSKA – SUOMI – BAHASA INDONESIA – JAPANESE (in orginal alphabet) – CANCEL Your setting:.....
DISPLAY TEST (p. 56)	With this function, you may verify whether the display or its segments are operative. This test may be executed without entering a code (to release the programming). The following displays are visible during the test: 1. ▮▮▮▮▮▮▮ (both display lines) 2. 8888888 (both display lines) 3. ---------- (both display lines empty) 4. 0000000 (both display lines) ***CANCEL*** – START

AUXILIARY INPUT	
This Function group is only available if the measuring electronics of Promass 64 is equipped with the "Ex e"-board.	
ASSIGN AUX. INPUT (p. 57)	***OFF*** – RESET TOTAL. 2 – RESET FUNCTION – DUAL RANGE MODE – POS. ZERO RETURN – CANCEL Your setting:.....
START PULSE WIDTH (p. 57)	max. 3-digit number, incl. engineering units (20...100 ms) Factory setting: ***20 ms*** Your setting:.....

PROCESSING PARAMETER	
LOW FLOW CUTOFF (p. 58)	5-digit number with floating decimal point (e.g. 25.000 kg/min) Factory setting: ***dependent*** on the nominal diameter Your setting:.....
NOISE SUPPRESS. (p. 58)	***0.00***...2.00 seconds 0.00 s = OFF 2.00 s = high damping Factory setting: ***0,00*** s Your setting:.....
MEASURING MODE (p. 58)	***UNIDIRECTIONAL*** – BIDIRECTIONAL – CANCEL Your setting:.....
FLOW DIRECTION (p. 59)	***FORWARD*** – REVERSE – CANCEL Your setting:.....
EPD THRESHOLD (p. 59)	5-digit number with fixed decimal point, incl. engineering unit (corresponding to 0.0000...5.9999 kg/l) Factory setting: ***0.0000*** [unit] Your setting:.....
DENSITY FILTER (p. 59)	OFF – LOW – ***MEDIUM*** – HIGH – CANCEL Your setting:.....
SELF-CHECKING (p. 59)	***CYCLIC*** – SMARTPLUS – CANCEL Your setting:.....
PRES. PULSE SUPPR. (p. 60)	max. 3-digit number, incl. engineering unit (0...1000 ms) Factory setting: ***0 ms*** Your setting:.....

SYSTEM PARAMETER	
SELECT ZERO POINT (p. 61)	Display: Zero point 1 continually used by the measuring system
ZERO POINT ADJUST (p. 61)	***CANCEL*** – START
POS. ZERO RETURN (p. 62) 	***OFF*** – ON Your setting:.....
DEF. PRIVATE CODE (p. 62)	max. 4-digit number (0...9999) Factory setting: ***64*** Your setting:.....
ACCESS CODE (p. 62)	max. 4-digit number (0...9999) Factory setting: ***64*** Your setting:.....
SW-VERSION COM (p. 63)	Display: V 3 . 02. 00 Ex e resp. V 3 . 02. 00 Ex i
SYSTEM RESET (p. 63) 	***CANCEL*** – RESTART SYSTEM

SENSOR DATA	
K-FACTOR (p. 64) 	Display: max. 5-digit number with fixed decimal point (0.1000...5.9999) Factory setting: ***dependent*** on the sensor (nominal diameter) and its calibration Your setting:.....
ZERO POINT (p. 64) 	max. 5-digit number (–10000...+10000) Factory setting: ***dependent*** on the sensor (nominal diameter) and its calibration Correction factor 100 = 1% of Q_{ref} with v = 1 m/s (ρ = 1 kg/l) Correction factor 100 = 0.5% of Q_{ref} with v = 2 m/s (ρ = 1 kg/l) Your setting:.....
ZERO POINT COMP. (p. 64)	Display: max. 5-digit number (–10000…+10000)
NOMINAL DIAMETER (p. 64) 	Display: e.g. 25 mm; 2 inch; etc.
SENSOR COEFF. (p. 65)	CANCEL – DENSITY COEFF. C 0 * – DENSITY COEFF. C 1 * – DENSITY COEFF. C 2 * – DENSITY COEFF. C 3 * – TEMP. COEFF. Km – TEMP. COEFF. Kt – MIN. TEMPERATURE – MAX. TEMPERATURE * A density adjustment on site can alter the calibration values. Your setting:.....
SERIAL NUMBER (p. 65)	Display: max. 6-digit number (100000...999999)
SOFTWARE VERSION (p. 65)	Display: e.g. V 4 . 00 . 00 A

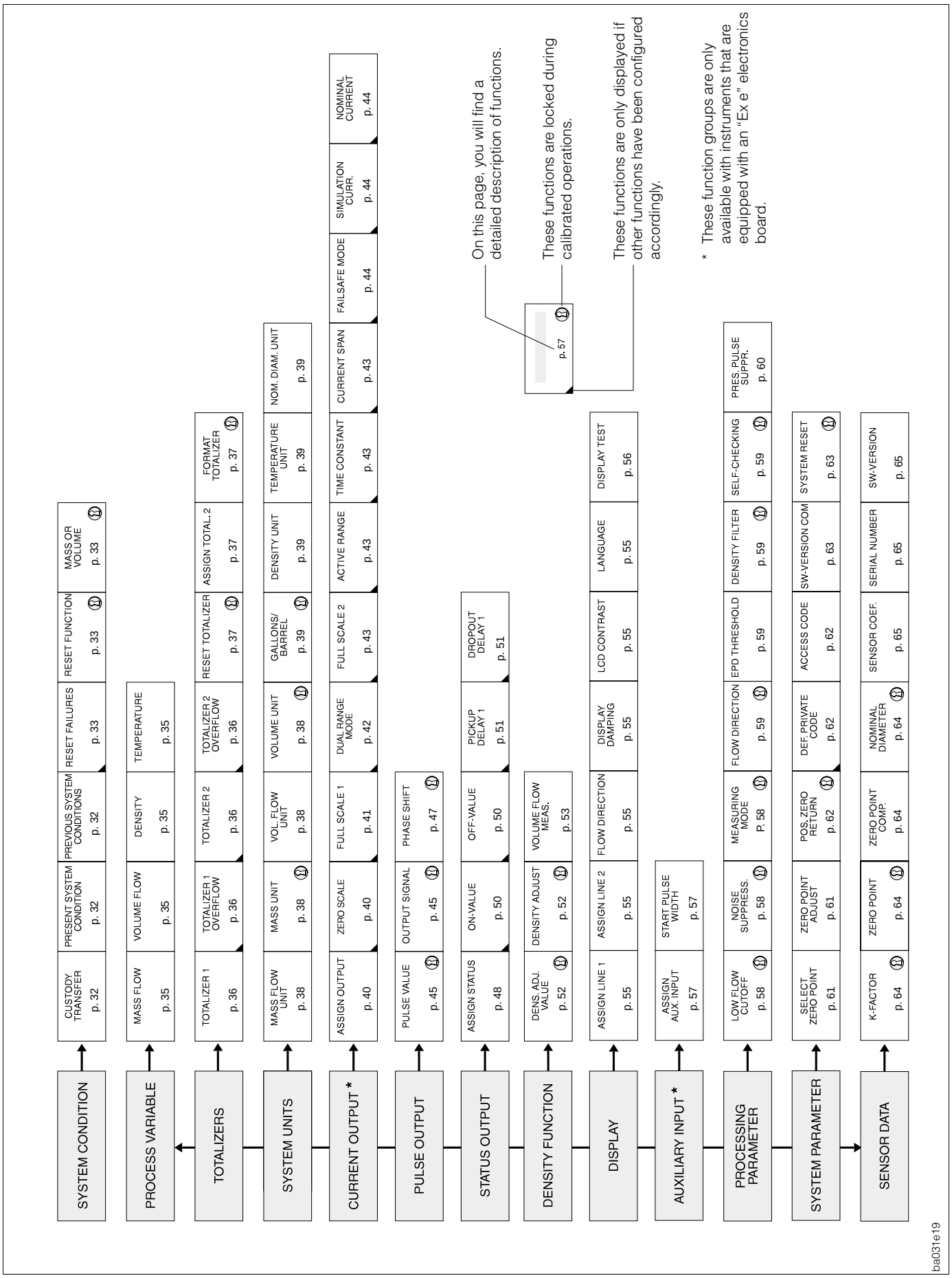


Fig. 37:
Programming matrix Promass 64

Index

U

V

W

Z

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