Operating Instructions

Proline Promass 83

Coriolis Mass Flow Measuring System
Brief operating instructions

These brief operating instructions show you how to configure your measuring device quickly and easily:

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You can commission your measuring device quickly and easily, using the special “Quick Setup” menu. It enables you to configure important basic functions using the local display, for example display language, measured variables, units of measures, type of signal, etc.

The following adjustments can be made separately as necessary:
- Zero point adjustment
- Density adjustment

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The configuration of the transmitter can be stored on the integrated T-DAT data storage device.

Note!
For time-saving commissioning, the settings stored in the T-DAT can be transmitted:
- For equivalent measuring points (equivalent configuration)
- In the event of device/board replacement.

Note!
Always start trouble-shooting with the checklist on Page 85, if faults occur after commissioning or during operation. The routine takes you directly to the cause of the problem and the appropriate remedial measures.
QUICK SETUP “Commissioning”

Note!
More detailed information on running Quick Setup menus, especially for devices without a local display, can be found in the "Commissioning" section.

Fig. 1: "QUICK SETUP COMMISSIONING"– menu for straightforward configuration of the major device functions
Note!

- The display returns to the cell SETUP COMMISSIONING (1002) if you press the ESC key combination during parameter interrogation. The stored parameters remain valid.
- The “Commissioning” Quick Setup must be carried out before one of the Quick Setups explained below is run.
- Only units not yet configured in the current Setup are offered for selection in each cycle. The unit for mass, volume and corrected volume is derived from the corresponding flow unit.
- The “YES” option remains visible until all the units have been configured. “NO” is the only option displayed when no further units are available.
- Only the outputs not yet configured in the current Setup are offered for selection in each cycle.
- The “YES” option remains visible until all the outputs have been parameterized. “NO” is the only option displayed when no further outputs are available.
- The “automatic parameterization of the display” option contains the following basic settings/factory settings:
  YES: Main line = Mass flow; Additional line = Totalizer 1; Information line = Operating/system conditions
  NO: The existing (selected) settings remain.
- The QUICK SETUP BATCHING is only available when the optional software package BATCHING is installed.
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1  Safety instructions

1.1  Designated use

The measuring device described in these Operating Instructions is to be used only for measuring the mass flow rate of liquids and gases. At the same time, the system also measures fluid density and fluid temperature. These parameters are then used to calculate other variables such as volume flow. Fluids with widely differing properties can be measured.

Examples:
- Chocolate, condensed milk, liquid sugar
- Oils, fats
- Acids, alkalis, lacquers, paints, solvents and cleaning agents
- Pharmaceuticals, catalysts, inhibitors
- Suspensions
- Gases, liquefied gases, etc.

Resulting from incorrect use or from use other than that designated the operational safety of the measuring devices can be suspended. The manufacturer accepts no liability for damages being produced from this.

1.2  Installation, commissioning and operation

Note the following points:
- Installation, connection to the electricity supply, commissioning and maintenance of the device must be carried out by trained, qualified specialists authorised to perform such work by the facility's owner operator.
  The specialist must have read and understood these Operating Instructions and must follow the instructions they contain.
- The device must be operated by persons authorised and trained by the facility's owner-operator. Strict compliance with the instructions in the Operating Instruction is mandatory.
- Endress+Hauser will be happy to assist in clarifying the chemical resistance properties of parts wetted by special fluids, including fluids used for cleaning. However the user is responsible for the choice of fluid wetted materials as regards to their in-process resistance to corrosion. The manufacturer refuses to accept liability.
- If carrying out welding work on the piping, the welding unit may not be grounded by means of the measuring device.
- The installer must ensure that the measuring system is correctly wired in accordance with the wiring diagrams. The transmitter must be grounded, unless the power supply is galvanically isolated.
- Invariably, local regulations governing the opening and repair of electrical devices apply.

1.3  Operational safety

Note the following points:
- Measuring systems for use in hazardous environments are accompanied by separate “Ex documentation”, which is an integral part of these Operating Instructions. Strict compliance with the installation instructions and ratings as stated in this supplementary documentation is mandatory.
  The symbol on the front of this supplementary Ex documentation indicates the approval and the certification body (⃣ Europe, ⃣⃣ USA, ⃣⃣ Canada).
- The measuring device complies with the general safety requirements in accordance with EN 61010, the EMC requirements of EN 61326/A1, and NAMUR recommendation NE 21, NE 43 and NE 53.
- For measuring systems used in SIL 2 applications, the separate manual on functional safety must be observed.
The manufacturer reserves the right to modify technical data without prior notice. Your Endress+Hauser distributor will supply you with current information and updates to these Operating Instructions.

1.4 Return

The following procedures must be carried out before a flowmeter requiring repair or calibration, for example, is returned to Endress+Hauser:

- Always enclose a duly completed “Declaration of contamination” form. Only then can Endress+Hauser transport, examine and repair a returned device.
- Enclose special handling instructions if necessary, for example a safety data sheet as per EN 91/155/EEC.
- Remove all residues. Pay special attention to the grooves for seals and crevices which could contain residues. This is particularly important if the substance is hazardous to health, e.g. flammable, toxic, caustic, carcinogenic, etc.

With Promass A and Promass M the threaded process connections must first be removed from the sensor and then cleaned.

Note!
You will find a preprinted “Declaration of contamination” form at the back of this manual.

Warning!
- Do not return a measuring device if you are not absolutely certain that all traces of hazardous substances have been removed, e.g. substances which have penetrated crevices or diffused through plastic.
- Costs incurred for waste disposal and injury (burns, etc.) due to inadequate cleaning will be charged to the owner-operator.

1.5 Notes on safety conventions and icons

The devices are designed to meet state-of-the-art safety requirements, have been tested, and left the factory in a condition in which they are safe to operate. The devices comply with the applicable standards and regulations in accordance with EN 61010 “Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Procedures”. They can, however, be a source of danger if used incorrectly or for other than the designated use.

Consequently, always pay particular attention to the safety instructions indicated in these Operating Instructions by the following icons:

Warning!
“Warning” indicates an action or procedure which, if not performed correctly, can result in injury or a safety hazard. Comply strictly with the instructions and proceed with care.

Caution!
“Caution” indicates an action or procedure which, if not performed correctly, can result in incorrect operation or destruction of the device. Comply strictly with the instructions.

Note!
“Note” indicates an action or procedure which, if not performed correctly, can have an indirect effect on operation or trigger an unexpected response on the part of the device.
2 Identification

2.1 Device designation

The “Promass 80/83” flow measuring system consists of the following components:
- Promass 80 or 83 transmitter
- Promass F, Promass M, Promass E, Promass A, Promass H or Promass I sensor

Two versions are available:
- Compact version: transmitter and sensor form a single mechanical unit.
- Remote version: transmitter and sensor are installed separately.

2.1.1 Nameplate of the transmitter

Fig. 2: Nameplate specifications for the “Promass 83” transmitter (example)

1 Order code / Serial number: See the specifications on the order confirmation for the meanings of the individual letters and digits.
2 Power supply / frequency: 20...55 V AC / 16...62 V DC / 50...60 Hz
   Power consumption: 15 VA / 15 W
3 Available inputs / outputs:
   I-OUT (HART): with current output (HART)
   f-OUT: with pulse/frequency output
   RELAY: with relay output
   I-IN: with current input
   STATUS-IN: with status input (auxiliary input)
4 Reserved for information on special products
5 Ambient temperature range
6 Degree of protection
### 2.1.2 Nameplate of the sensor

![Nameplate of the sensor](image)

**Fig. 3:** Nameplate specifications for the “Promass F” sensor (example)

1. **Order code/Serial number:** See the specifications on the order confirmation for the meanings of the individual letters and digits.
2. **Calibration factor:** 2.5100; zero point: -11
3. **Nominal diameter device:** DN 25 / 1"
4. **Flange nominal diameter:** DN 25 / 1"
   - Nominal pressure: EN (DIN) PN 100 bar
5. **Material of measuring tubes:** Stainless steel 1.4539/904L
6. **TMmax:** +200 °C / +392 °F (max. fluid temperature)
7. **Pressure range of secondary containment:** max. 40 bar (600 psi)
8. **Accuracy of density measurement:** ± 0.001 g/cc
9. **Additional information (examples):**
   - With 5-point calibration
   - With 3.1 B certificate for wetted materials
10. **Reserved for information on special products**
11. **Ambient temperature range**
12. **Degree of protection**
13. **Flow direction**
14. **Reserved for additional information on device version (approvals, certificates)**
2.1.3 Nameplate for connections

See operating manual
Betriebsanleitung beachten
Observer manuel d'instruction

Ser. No.: 12345678912

1. Serial number
2. Possible configuration of current output
3. Possible configuration of relay contacts
4. Terminal assignment, cable for power supply: 85...260 V AC, 20...55 V AC, 16...62 V DC
   - Terminal No. 1: L1 for AC, L+ for DC
   - Terminal No. 2: N for AC, L- for DC
5. Signals present at inputs and outputs, possible configuration and terminal assignment (20...27), see also "Electrical values of inputs/outputs" → Page 105 ff.
6. Version of device software currently installed
7. Installed communication type, e.g.: HART, PROFIBUS PA, etc.
8. Information on current communication software (Device Revision and Device Description), e.g.: Dev. 01 / DD 01 for HART
9. Date of installation
10. Current updates to data specified in points 6 to 9

Fig. 4: Nameplate specifications for Proline transmitter (example)

2.2 Certificates and approvals

The devices are designed in accordance with good engineering practice to meet state-of-the-art safety requirements, have been tested, and left the factory in a condition in which they are safe to operate. The devices comply with the applicable standards and regulations in accordance with EN 61010 “Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Procedures” and with the EMC requirements of EN 61326/A1.

The measuring system described in these Operating Instructions thus complies with the statutory requirements of the EC Directives. Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.
2.3 Registered trademarks

KALREZ® and VITON®
Registered trademarks of E.I. Du Pont de Nemours & Co., Wilmington, USA

TRI-CLAMP®
Registered trademark of Ladish & Co., Inc., Kenosha, USA

SWAGELOK®
Registered trademark of Swagelok & Co., Solon, USA

HART®
Registered trademark of HART Communication Foundation, Austin, USA

HistoROM™, S-DAT®, T-DAT™, F-CHIP®, ToF Tool - Fieldtool® Package, Fieldcheck®, Applicator®
Registered or registration-pending trademarks of Endress+Hauser Flowtec AG, Reinach, CH
3  Installation

3.1  Incoming acceptance, transport and storage

3.1.1  Incoming acceptance

On receipt of the goods, check the following points:
- Check the packaging and the contents for damage.
- Check the shipment, make sure nothing is missing and that the scope of supply matches your order.

3.1.2  Transport

The following instructions apply to unpacking and to transporting the device to its final location:
- Transport the devices in the containers in which they are delivered.
- The covers or caps fitted to the process connections prevent mechanical damage to the sealing faces and the ingress of foreign matter to the measuring tube during transportation and storage. Consequently, do not remove these covers or caps until immediately before installation.
- Do not lift measuring devices of nominal diameters DN 40...250 by the transmitter housing or the connection housing in the case of the remote version (Fig. 5). - Use webbing slings slung round the two process connections. Do not use chains, as they could damage the housing.
- In the case of the Promass M / DN 80 sensor, use only the lifting eyes on the flanges to lift the assembly.

Warning!
Risk of injury if the measuring device slips. The center of gravity of the assembled measuring device might be higher than the points around which the slings are slung.
At all times, therefore, make sure that the device does not unexpectedly turn around its axis or slip.

Fig. 5: Instructions for transporting sensors with DN 40...250
3.1.3 **Storage**

Note the following points:

- Pack the measuring device in such a way as to protect it reliably against impact for storage (and transportation). The original packaging provides optimum protection.
- The permissible storage temperature is $-40...+80 \, ^\circ C$ (preferably $+20 \, ^\circ C$).
- Do not remove the protective covers or caps on the process connections until you are ready to install the device.
- The measuring device must be protected against direct sunlight during storage in order to avoid unacceptably high surface temperatures.

3.2 **Installation conditions**

Note the following points:

- No special measures such as supports are necessary. External forces are absorbed by the construction of the instrument, for example the secondary containment.
- The high oscillation frequency of the measuring tubes ensures that the correct operation of the measuring system is not influenced by pipe vibrations.
- No special precautions need to be taken for fittings which create turbulence (valves, elbows, T-pieces, etc.), as long as no cavitation occurs.
- For mechanical reasons and in order to protect the pipe, it is advisable to support heavy sensors.

3.2.1 **Dimensions**

All the dimensions and lengths of the sensor and transmitter are provided in the separate documentation “Technical Information”.

3.2.2 **Mounting location**

Entrained gas bubbles in the measuring tube can result in an increase in measuring errors. **Avoid** the following locations:

- Highest point of a pipeline. Risk of air accumulating.
- Directly upstream of a free pipe outlet in a vertical pipeline.

![Fig. 6: Mounting location](image-url)
The proposed configuration in the following diagram, however, permits installation in a vertical pipeline. Pipe restrictors or the use of an orifice plate with a smaller cross-section than the nominal diameter prevent the sensor from running empty during measurement.

![Diagram of installation in a vertical pipe](image)

**Fig. 7: Installation in a vertical pipe (e.g. for batching applications)**

1. Supply tank
2. Sensor
3. Orifice plate, pipe restrictions (see Table)
4. Valve
5. Batching tank

<table>
<thead>
<tr>
<th>Promass F, M, E / DN</th>
<th>Promass A / DN</th>
<th>Promass H, I / DN</th>
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<td>1) Promass F, M only</td>
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<td>1) Promass F, M only</td>
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<td>2) Promass F only</td>
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<td>2) Promass F only</td>
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<tr>
<td>1) DN 15, 25, 40 &quot;FB&quot; = Full bore versions of Promass 1</td>
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**System pressure**

It is important to ensure that cavitation does not occur, because it would influence the oscillation of the measuring tube. No special measures need to be taken for fluids which have properties similar to water under normal conditions.

In the case of liquids with a low boiling point (hydrocarbons, solvents, liquefied gases) or in suction lines, it is important to ensure that pressure does not drop below the vapour pressure and that the liquid does not start to boil. It is also important to ensure that the gases that occur naturally in many liquids do not outgas. Such effects can be prevented when system pressure is sufficiently high.

Consequently, it is generally best to install the sensor:
- downstream from pumps (no danger of vacuum),
- at the lowest point in a vertical pipe.
3.2.3 Orientation

Make sure that the direction of the arrow on the nameplate of the sensor matches the direction of flow (direction in which the fluid flows through the pipe).

Orientation Promass A

*Vertical:*
Recommended orientation with upward direction of flow. When fluid is not flowing, entrained solids will sink down and gases will rise away from the measuring tube. The measuring tubes can be completely drained and protected against solids build-up.

*Horizontal:*
When installation is correct the transmitter housing is above or below the pipe. This arrangement means that no gas or solid deposits can accumulate in the curved measuring tube (single-tube system).
Do not install the sensor in such a way that it is suspended in the pipe, in other words without support or attachment. This is to avoid excessive strain at the process connection. The base plate of the sensor housing is designed for mounting on a tabletop, wall or post.

![Fig. 8: Vertical and horizontal orientation (Promass A)](image)
Orientation Promass F, M, E, H, I

Make sure that the direction of the arrow on the nameplate of the sensor matches the direction of flow (direction in which the fluid flows through the pipe).

Vertical:
Recommended orientation with upward direction of flow (View V). When fluid is not flowing, entrained solids will sink down and gases will rise away from the measuring tube. The measuring tubes can be completely drained and protected against solids build-up.

Horizontal (Promass F, M, E):
The measuring tubes of Promass F, M and E must be horizontal and beside each other. When installation is correct the transmitter housing is above or below the pipe (View H1/H2). Always avoid having the transmitter housing in the same horizontal plane as the pipe.

Horizontal (Promass H, I):
Promass H and Promass I can be installed in any orientation in a horizontal pipe run.

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<tbody>
<tr>
<td>Fig. V: Vertical orientation</td>
<td>✗</td>
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<td>✗</td>
<td>✗</td>
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<tr>
<td>Fig. H1: Horizontal orientation</td>
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<td>✗</td>
<td>✗ (TM = &gt;200 °C)</td>
<td>✗ (TM = &gt;200 °C)</td>
</tr>
<tr>
<td>Transmitter head up</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
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<tr>
<td>Fig. H2: Horizontal orientation</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
</tr>
<tr>
<td>Transmitter head down</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
</tr>
</tbody>
</table>

= Recommended orientation
= Orientation recommended in certain situations
= Impermissible orientation
In order to ensure that the maximum permissible ambient temperature for the transmitter
(\(-20...+60\,^\circ C\), optional \(-40...+60\,^\circ C\)) is not exceeded, we recommend the following orientations:

1. For fluids with very high temperatures (> 200 \(^\circ C\)), we recommend the horizontal orientation
   with the transmitter head pointing downwards (Fig. H2) or the vertical orientation (Fig. V).

2. For fluids with low temperatures, we recommend the horizontal orientation with the
   transmitter head pointing upwards (Fig. H1) or the vertical orientation (Fig. V).

**Special installation instructions for Promass F, E and H**

Caution!
The two measuring tubes of Promass F and Promass E and the one of Promass H are slightly curved. The position of the sensor, therefore, has to be matched to the fluid properties when the sensor is installed horizontally.

![Diagram of Promass F, E, H installed horizontally](Fig. 9: Promass F, E, H installed horizontally)


### 3.2.4 Heating

Some fluids require suitable measures to avoid loss of heat at the sensor. Heating can be electric, e.g. with heated elements, or by means of hot water or steam pipes made of copper.

Caution!

- Risk of electronics overheating! Consequently, make sure that the adapter between sensor and
  transmitter and the connection housing of the remote version always remain free of insulating
  material. Note that a certain orientation might be required, depending on the fluid
- With a fluid temperature between 200...350 \(^\circ C\), heating is not permitted for the compact version
  of the high-temperature version.

When using electrical heat tracing whose heat is regulated using phase control or by pulse packs,

it cannot be ruled out that the measured values are influenced by magnetic fields which may occur,

(i.e. at values greater than those permitted by the EC standard (Sinus 30 A/m)). In such
cases, the sensor must be magnetically screened (except for Promass M).

The secondary containment can be shielded with tin plates or electric sheets without privileged
direction (e.g. V330-35A) with the following properties:

- Relative magnetic permeability \(\mu_r \geq 300\)
- Plate thickness \(d \geq 0.35\,\text{mm}\)

- Information on permissible temperature ranges → Page 113 ff.

Special heating jackets which can be ordered as accessories from Endress+Hauser are available for
the sensors.
3.2.5 Thermal insulation

Some fluids require suitable measures to avoid loss of heat at the sensor. A wide range of materials can be used to provide the required thermal insulation.

![Diagram showing thermal insulation](image)

*Fig. 10: In the case of the Promass F high-temperature version, a maximum insulation thickness of 60 mm must be observed in the area of the electronics/neck.*

If the Promass F high-temperature version is installed horizontally (with transmitter head pointing upwards), an insulation thickness of min. 10 mm is recommended to reduce convection. The maximum insulation thickness of 60 mm must be observed.

3.2.6 Inlet and outlet runs

There are no installation requirements regarding inlet and outlet runs. If possible, install the sensor well clear of fittings such as valves, T-pieces, elbows, etc.

3.2.7 Vibrations

The high oscillation frequency of the measuring tubes ensures that the correct operation of the measuring system is not influenced by pipe vibrations. Consequently, the sensors require no special measures for attachment.

3.2.8 Limiting flow

Relevant information can be found in the “Technical Data” section under Measuring range → Page 103 ff. or Limiting flow → Page 114.
3.3 Installation instructions

3.3.1 Turning the transmitter housing

Turning the aluminium field housing

⚠️ Warning!
The turning mechanism in devices with EEx d/de or FM/CSA Cl. I Div. 1 classification is not the same as that described here. The procedure for turning these housings is described in the Ex-specific documentation.

1. Loosen the two securing screws.
2. Turn the bayonet catch as far as it will go.
3. Carefully lift the transmitter housing as far as it will go.
4. Turn the transmitter housing to the desired position (max. 2 x 90° in either direction).
5. Lower the housing into position and re-engage the bayonet catch.
6. Retighten the two securing screws.

Fig. 11: Turning the transmitter housing (aluminium field housing)

Turning the stainless steel field housing

1. Loosen the two securing screws.
2. Carefully lift the transmitter housing as far as it will go.
3. Turn the transmitter housing to the desired position (max. 2 x 90° in either direction).
4. Lower the housing into position.
5. Retighten the two securing screws.

Fig. 12: Turning the transmitter housing (stainless steel field housing)
3.3.2 Installing the wall-mount transmitter housing

There are various ways of installing the wall-mount transmitter housing:

- Mounted directly on the wall
- Installation in control panel (separate mounting set, accessories) → Page 22
- Pipe mounting (separate mounting set, accessories) → Page 22

Caution!
- Make sure that ambient temperature does not go beyond the permissible range (–20...+60 °C, optional –40...+60 °C). Install the device in a shady location. Avoid direct sunlight.
- Always install the wall-mount housing in such a way that the cable entries are pointing down.

Mounted directly on the wall

1. Drill the holes as illustrated in the diagram.
2. Remove the cover of the connection compartment (a).
3. Push the two securing screws (b) through the appropriate bores (c) in the housing.
   - Securing screws (M6): max. Ø 6.5 mm
   - Screw head: max. Ø 10.5 mm
4. Secure the transmitter housing to the wall as indicated.
5. Screw the cover of the connection compartment (a) firmly onto the housing.

![Diagram of wall-mount installation](image-url)

Fig. 13: Mounted directly on the wall
Installation in control panel

1. Prepare the opening in the panel as illustrated in the diagram.
2. Slide the housing into the opening in the panel from the front.
3. Screw the fasteners onto the wall-mount housing.
4. Screw threaded rods into holders and tighten until the housing is solidly seated on the panel wall. Afterwards, tighten the locking nuts. Additional support is not necessary.

Pipe mounting

The assembly should be performed by following the instructions in the diagram.

Caution!
If a warm pipe is used for installation, make sure that the housing temperature does not exceed the max. permitted value of +60 °C.
3.3.3 Turning the local display

1. Unscrew cover of the electronics compartment from the transmitter housing.
2. Press the side latches on the display module and remove the module from the electronics compartment cover plate.
3. Rotate the display to the desired position (max. 4 x 45° in both directions), and reset it onto the electronics compartment cover plate.
4. Screw the cover of the electronics compartment firmly back onto the transmitter housing.

![Diagram of local display turning](image)

**Fig. 16: Turning the local display (field housing)**

3.4 Post installation check

Perform the following checks after installing the measuring device in the pipe:

<table>
<thead>
<tr>
<th>Device condition and specifications</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is the device damaged (visual inspection)?</td>
<td>-</td>
</tr>
<tr>
<td>Does the device correspond to specifications at the measuring point, including process temperature and pressure, ambient temperature, measuring range, etc.?</td>
<td>→ Page 103 ff.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Installation</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Does the arrow on the sensor nameplate match the direction of flow through the pipe?</td>
<td>-</td>
</tr>
<tr>
<td>Are the measuring point number and labeling correct (visual inspection)?</td>
<td>-</td>
</tr>
<tr>
<td>Is the orientation chosen for the sensor correct, in other words suitable for sensor type, fluid properties (outgassing, with entrained solids) and fluid temperature?</td>
<td>→ Page 14 ff.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Process environment / process conditions</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is the measuring device protected against moisture and direct sunlight?</td>
<td>-</td>
</tr>
</tbody>
</table>
4  Wiring

⚠️ Warning!
When connecting Ex-certified devices, see the notes and diagrams in the Ex-specific supplement to these Operating Instructions. Please do not hesitate to contact your Endress+Hauser sales office if you have any questions.

4.1  Connecting the remote version

4.1.1  Connecting connecting cable for sensor/transmitter

⚠️ Warning!
- Risk of electric shock. Switch off the power supply before opening the device.
  Do not install or wire the device while it is connected to the power supply.
  Failure to comply with this precaution can result in irreparable damage to the electronics.
- Risk of electric shock. Connect the protective earth to the ground terminal on the housing before the power supply is applied.
- You may only connect the sensor to the transmitter with the same serial number. Communication errors can occur if this is not observed when connecting the devices.

1. Remove the connection compartment cover (a) by loosening the fixing screws on the transmitter and sensor housing.
2. Feed the connecting cable (b) through the appropriate cable runs.
3. Establish the connections between sensor and transmitter in accordance with the wiring diagram:
   - See Fig. 17
   - See wiring diagram in screw cap
4. Screw the connection compartment cover (a) back onto the sensor and transmitter housing.

Fig. 17: Connecting the remote version

a  Covers of the connection compartments (transmitter, sensor)
b  Connecting cable (signal cable)
4.1.2 Cable specification, connecting cable

The specifications of the cable connecting the transmitter and the sensor of the remote version are as follows:

- 6 x 0.38 mm² PVC cable with common shield and individually shielded cores
- Conductor resistance: ≤ 50 Ω/km
- Capacitance core/shield: ≤ 420 pF/m
- Cable length: max. 20 m
- Permanent operating temperature: max. +105 °C

Note!
The cable must be installed securely, to prevent movement.

4.2 Connecting the measuring unit

4.2.1 Transmitter connection

Warning!
- Risk of electric shock. Switch off the power supply before opening the device. Do not install or wire the device while it is connected to the power supply. Failure to comply with this precaution can result in irreparable damage to the electronics.
- Risk of electric shock. Connect the protective earth to the ground terminal on the housing before the power supply is applied (not required for galvanically isolated power supply).
- Compare the specifications on the nameplate with the local supply voltage and frequency. The national regulations governing the installation of electrical equipment also apply.

1. Unscrew the connection compartment cover (f) from the transmitter housing.
2. Feed the power supply cable (a) and the signal cable (b) through the appropriate cable entries.
3. Perform wiring:
   - Wiring diagram (aluminium housing) → Fig. 18
   - Wiring diagram (stainless steel housing) → Fig. 19
   - Wiring diagram (wall-mount housing) → Fig. 20
   - Terminal assignment → Page 27
4. Screw the cover of the connection compartment (f) back onto the transmitter housing.

---

Fig. 18: Connecting the transmitter (aluminium field housing). Cable cross-section: max. 2.5 mm²

| a | Cable for power supply: 85...260 V AC, 20...55 V AC, 16...62 V DC
| b | Signal cable: Terminals Nos. 20-27 → Page 27
| c | Ground terminal for protective earth
| d | Ground terminal for signal cable shield
| e | Service adapter for connecting service interface FXA 193 (FieldCheck, ToF Tool – Fieldtool Package)
| f | Cover of the connection compartment
| g | Securing clamp
Fig. 19: Connecting the transmitter (stainless steel field housing); cable cross-section: max. 2.5 mm²

a  Cable for power supply: 85...260 V AC, 20...55 V AC, 16...62 V DC
   Terminal No. 1: L1 for AC, L+ for DC
   Terminal No. 2: N for AC, L- for DC
b  Signal cable: Terminals Nos. 20-27 → Page 27
c  Ground terminal for protective earth
d  Ground terminal for signal cable shield
e  Service adapter for connecting service interface FXA 193 (FieldCheck, ToF Tool - Fieldtool Package)
f  Cover of the connection compartment

Fig. 20: Connecting the transmitter (wall-mount housing); cable cross-section: max. 2.5 mm²

a  Cable for power supply: 85...260 V AC, 20...55 V AC, 16...62 V DC
   Terminal No. 1: L1 for AC, L+ for DC
   Terminal No. 2: N for AC, L- for DC
b  Signal cable: Terminals Nos. 20-27 → Page 27
c  Ground terminal for protective earth
d  Ground terminal for signal cable shield
e  Service adapter for connecting service interface FXA 193 (FieldCheck, ToF Tool - Fieldtool Package)
f  Cover of the connection compartment
## 4.2.2 Terminal assignment

### Electrical values for inputs

### Electrical values for outputs

→ Page 105

<table>
<thead>
<tr>
<th>Order variant</th>
<th>Terminal Nos. (inputs/outputs)</th>
<th>20 (+) / 21 (-)</th>
<th>22 (+) / 23 (-)</th>
<th>24 (+) / 25 (-)</th>
<th>26 (+) / 27 (-)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fixed communication boards (permanent assignment)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>83***-**********A</td>
<td>-</td>
<td>-</td>
<td>Frequency output</td>
<td>Current output HART</td>
<td></td>
</tr>
<tr>
<td>83***-**********B</td>
<td>Relay output</td>
<td>Relay output</td>
<td>Frequency output</td>
<td>Current output HART</td>
<td></td>
</tr>
<tr>
<td>83***-**********F</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>PROFIBUS-PA, Ex i</td>
<td></td>
</tr>
<tr>
<td>83***-**********G</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>FOUNDATION Fieldbus Ex i</td>
<td></td>
</tr>
<tr>
<td>83***-**********H</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>PROFIBUS-PA</td>
<td></td>
</tr>
<tr>
<td>83***-**********J</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>PROFIBUS-DP</td>
<td></td>
</tr>
<tr>
<td>83***-**********K</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>FOUNDATION Fieldbus</td>
<td></td>
</tr>
<tr>
<td>83***-**********R</td>
<td>-</td>
<td>-</td>
<td>Current output 2 Ex i, active</td>
<td>Current output 1 Ex i active, HART</td>
<td></td>
</tr>
<tr>
<td>83***-**********S</td>
<td>-</td>
<td>-</td>
<td>Frequency output Ex i, passive</td>
<td>Current output Ex i active, HART</td>
<td></td>
</tr>
<tr>
<td>83***-**********T</td>
<td>-</td>
<td>-</td>
<td>Frequency output Ex i, passive</td>
<td>Current output Ex i passive, HART</td>
<td></td>
</tr>
<tr>
<td>83***-**********U</td>
<td>-</td>
<td>-</td>
<td>Current output 2 Ex i, passive</td>
<td>Current output 1 Ex i passive, HART</td>
<td></td>
</tr>
<tr>
<td>83***-**********Q</td>
<td>-</td>
<td>-</td>
<td>Status input MODBUS RS485</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Flexible communication boards</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>83***-**********C</td>
<td>Relay output 2</td>
<td>Relay output 1</td>
<td>Frequency output</td>
<td>Current output HART</td>
<td></td>
</tr>
<tr>
<td>83***-**********D</td>
<td>Status input</td>
<td>Relay output</td>
<td>Frequency output</td>
<td>Current output HART</td>
<td></td>
</tr>
<tr>
<td>83***-**********E</td>
<td>Status input</td>
<td>Relay output</td>
<td>Current output 2</td>
<td>Current output 1 HART</td>
<td></td>
</tr>
<tr>
<td>83***-**********L</td>
<td>Status input</td>
<td>Relay output 2</td>
<td>Relay output 1</td>
<td>Current output HART</td>
<td></td>
</tr>
<tr>
<td>83***-**********M</td>
<td>Status input</td>
<td>Frequency output 2</td>
<td>Frequency output 1</td>
<td>Current output HART</td>
<td></td>
</tr>
<tr>
<td>83***-**********N</td>
<td>Current output</td>
<td>Frequency output</td>
<td>Status input MODBUS RS485</td>
<td></td>
<td></td>
</tr>
<tr>
<td>83***-**********W</td>
<td>Relay output</td>
<td>Current output 3</td>
<td>Current output 2</td>
<td>Current output 1 HART</td>
<td></td>
</tr>
<tr>
<td>83***-**********O</td>
<td>Status input</td>
<td>Current output 3</td>
<td>Current output 2</td>
<td>Current output 1 HART</td>
<td></td>
</tr>
<tr>
<td>83***-**********2</td>
<td>Relay output</td>
<td>Current output 2</td>
<td>Frequency output</td>
<td>Current output 1 HART</td>
<td></td>
</tr>
<tr>
<td>83***-**********3</td>
<td>Current input</td>
<td>Relay output</td>
<td>Current output 2</td>
<td>Current output 1 HART</td>
<td></td>
</tr>
<tr>
<td>Order variant</td>
<td>Terminal Nos. (inputs/outputs)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------------</td>
<td>------------------------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>83***-***********4</td>
<td>20 (+) / 21 (-)</td>
<td>22 (+) / 23 (-)</td>
<td>24 (+) / 25 (-)</td>
<td>26 (+) / 27 (-)</td>
<td></td>
</tr>
<tr>
<td>83***-***********5</td>
<td>Status input</td>
<td>Current input</td>
<td>Frequency output</td>
<td>Current output HART</td>
<td></td>
</tr>
<tr>
<td>83***-***********6</td>
<td>Status input</td>
<td>Current input</td>
<td>Current output 2</td>
<td>Current output HART</td>
<td></td>
</tr>
<tr>
<td>83***-***********7</td>
<td>Relay output 2</td>
<td>Relay output 1</td>
<td>Status input</td>
<td>MODBUS RS485</td>
<td></td>
</tr>
</tbody>
</table>
4.2.3 HART connection

Users have the following connection options at their disposal:
- Direct connection to transmitter by means of terminals 26(+) / 27(−)
- Connection by means of the 4...20 mA circuit

Note!
- The measuring circuit’s minimum load must be at least 250 Ω.
- The CURRENT SPAN function must be set to “4-20 mA” (individual options see device function).
- See also the documentation issued by the HART Communication Foundation, and in particular HCF LIT 20: “HART, a technical summary”.

Connection of the HART handheld communicator

See also the documentation issued by the HART Communication Foundation, and in particular HCF LIT 20: “HART, a technical summary”.

Connection of a PC with an operating software

In order to connect a PC with operating software (e.g. “ToF Tool - Fieldtool Package”), a HART modem (e.g. “Commubox FXA 191”) is needed.
4.3 Degree of protection

The devices fulfill all the requirements for IP 67.

Compliance with the following points is mandatory following installation in the field or servicing, in order to ensure that IP 67 protection is maintained:

- The housing seals must be clean and undamaged when inserted into their grooves. The seals must be dried, cleaned or replaced if necessary.
- All threaded fasteners and screw covers must be firmly tightened.
- The cables used for connection must be of the specified outside diameter. → Page 25
- Firmly tighten the cable entries.
- The cables must loop down before they enter the cable entries (“water trap”). This arrangement prevents moisture penetrating the entry. Always install the measuring device in such a way that the cable entries do not point up.
- Remove all unused cable entries and insert plugs instead.
- Do not remove the grommet from the cable entry.

Fig. 23: Installation instructions, cable entries
4.4 Post connection check

Perform the following checks after completing electrical installation of the measuring device:

<table>
<thead>
<tr>
<th>Device condition and specifications</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are cables or the device damaged (visual inspection)?</td>
<td>-</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Electrical connection</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Does the supply voltage match the specifications on the nameplate?</td>
<td>85...260 V AC (45...65 Hz) 20...55 V AC (45...65 Hz) 16...62 V DC</td>
</tr>
<tr>
<td>Do the cables comply with the specifications?</td>
<td>→ Page 25</td>
</tr>
<tr>
<td>Do the cables have adequate strain relief?</td>
<td>-</td>
</tr>
<tr>
<td>Cables correctly segregated by type? Without loops and crossovers?</td>
<td>-</td>
</tr>
<tr>
<td>Are the power supply and signal cables correctly connected?</td>
<td>See the wiring diagram inside the cover of the terminal compartment</td>
</tr>
<tr>
<td>Are all screw terminals firmly tightened?</td>
<td>-</td>
</tr>
<tr>
<td>Are all cable entries installed, firmly tightened and correctly sealed? Cables looped as “water traps”?</td>
<td>→ Page 30</td>
</tr>
<tr>
<td>Are all housing covers installed and firmly tightened?</td>
<td>-</td>
</tr>
</tbody>
</table>
5 Operation

5.1 Display and operating elements

The local display enables you to read all important parameters directly at the measuring point and configure the device using the “Quick Setup” or the function matrix.

The display consists of four lines; this is where measured values and/or status variables (direction of flow, empty pipe, bar graph, etc.) are displayed. You can change the assignment of display lines to different variables to suit your needs and preferences (→ see the “Description of Device Functions” manual).

Fig. 24: Display and operating elements

1 Liquid crystal display
   The backlit, four-line liquid crystal display shows measured values, dialogue texts, fault messages and notice messages. HOME position (operating mode) is the term given to the display during normal operation.

2 Optical sensors for “Touch Control”

3 Plus/minus keys
   - HOME position → Direct access to totalizer values and actual values of inputs/outputs
   - Enter numerical values, select parameters
   - Select different blocks, groups and function groups within the function matrix
   Press the +/- keys (\(\pm\)) simultaneously to trigger the following functions:
     - Exit the function matrix step by step → HOME position
     - Press and hold down +/- keys for longer than 3 seconds → Return directly to HOME position
     - Cancel data entry

4 Enter key
   - HOME position → Entry into the function matrix
   - Save the numerical values you input or settings you change
5.1.1 Readings displayed (operation mode)

The display area consists of three lines in all; this is where measured values are displayed, and/or status variables (direction of flow, bar graph, etc.). You can change the assignment of display lines to different variables to suit your needs and preferences (→ see the “Description of Device Functions” manual).

**Multiplex mode:**
A maximum of two different display variables can be assigned to each line. Variables multiplexed in this way alternate every 10 seconds on the display.

**Error messages:**
Display and presentation of system/process errors → Page 39

![Fig. 25: Typical display for normal operating mode (HOME position)](image)

1. Main display line: shows primary measured values, e.g. mass flow in [kg/h]
2. Additional line: shows measured variables and status variables, e.g. totalizer No. 3 in [t]
3. Information line: shows additional information on the measured variables and status variables, e.g. bargraph display of the full scale value achieved by the mass flow
4. “Info icons” field: Icons representing additional information on the measured values are shown in this field. For a full list of the icons and their meanings see
5. “Measured values” field: the current measured values appear in this field.
6. “Unit of measure” field: the units of measure and time defined for the current measured values appear in this field.

5.1.2 Additional display functions

Depending on the order options, the local display has different display functions:

**Device without batching software:**

From HOME position, use the +/- keys to open an “Info Menu” containing the following information:
- Totalizer (including overflow)
- Actual values or states of the configured inputs/outputs
- Device TAG number (user-definable)

→ Scan of individual values within the Info Menu

(Esc key) → Back to HOME position

**Device with batching software:**

On measuring instruments with installed batching software (F-Chip*) and a suitably configured display line, you can carry out filling processes directly using the local display. You will find a detailed description on → Page 36.

*F-CHIP → Page 81
5.1.3 Icons

The icons which appear in the field on the left make it easier to read and recognise measured variables, device status, and error messages.

<table>
<thead>
<tr>
<th>Icon</th>
<th>Meaning</th>
<th>Icon</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>S</td>
<td>System error</td>
<td>P</td>
<td>Process error</td>
</tr>
<tr>
<td>1</td>
<td>Fault message (with effect on outputs)</td>
<td>!</td>
<td>Notice message (without effect on outputs)</td>
</tr>
<tr>
<td>1...n</td>
<td>Current output 1...n</td>
<td>P 1...n</td>
<td>Pulse output 1...n</td>
</tr>
<tr>
<td>F 1...n</td>
<td>Frequency output</td>
<td>S 1...n</td>
<td>Status output/relay output 1...n (or status input)</td>
</tr>
<tr>
<td>Σ 1...n</td>
<td>Totalizer 1...n</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Measuring mode; PULSATING FLOW</td>
<td></td>
<td>Measuring mode; SYMMETRY (bidirectional)</td>
</tr>
<tr>
<td></td>
<td>Measuring mode; STANDARD</td>
<td></td>
<td>Counting mode, totalizer; BALANCE (forward and reverse flow)</td>
</tr>
<tr>
<td></td>
<td>Counting mode, totalizer; forward</td>
<td></td>
<td>Counting mode, totalizer; reverse</td>
</tr>
<tr>
<td></td>
<td>Status input</td>
<td></td>
<td>Volume flow</td>
</tr>
<tr>
<td></td>
<td>Target volume flow</td>
<td></td>
<td>Target corrected volume flow</td>
</tr>
<tr>
<td></td>
<td>Carrier volume flow</td>
<td></td>
<td>Carrier corrected volume flow</td>
</tr>
<tr>
<td></td>
<td>% Target volume flow</td>
<td></td>
<td>% Target corrected volume flow</td>
</tr>
<tr>
<td></td>
<td>Mass flow</td>
<td></td>
<td>Target mass flow</td>
</tr>
<tr>
<td></td>
<td>% Target mass flow</td>
<td></td>
<td>Carrier mass flow</td>
</tr>
<tr>
<td></td>
<td>% Carrier mass flow</td>
<td></td>
<td>Fluid density</td>
</tr>
<tr>
<td>Icon</td>
<td>Meaning</td>
<td>Icon</td>
<td>Meaning</td>
</tr>
<tr>
<td>------------------</td>
<td>-------------------------------------------------------------------------</td>
<td>------------------</td>
<td>--------------------------</td>
</tr>
</tbody>
</table>
| ![Icon]
| Reference density | ![Icon]
| Current input    | ![Icon]
| Batching quantity upwards | ![Icon]
| Batching quantity downwards | ![Icon]
| Batch quantity | ![Icon]
| Total batching quantity | ![Icon]
| Batch counter (x times) | ![Icon]
| Fluid temperature | ![Icon]
| Remote configuration |
| Active device operation via: |
| • HART, e.g. ToF Tool – Fieldtool Package, DXR 375 |
| • FOUNDATION Fieldbus |
| • PROFIBUS |
5.1.4 Controlling the batching processes using the local display

Filling processes can be carried out directly by means of the local display with the aid of the optional “(Batching)” software package (F-CHIP, accessories → Page 83). Therefore, the device can be fully deployed in the field as a “batch controller”.

Procedure:

1. Configure all the required batching functions and assign the lower display info line (= BATCHING KEYS) using the “Batch” Quick Setup menu or use the function matrix. The following “softkeys” then appear on the bottom line of the local display → Fig. 26:
   - START = left display key (-)
   - PRESET = middle display key (+)
   - MATRIX = right display key (E)

2. Press the “PRESET (+)” key. Various batching process functions requiring configuration will now appear on the display:

   "PRESET" → Initial settings for the batching process

<table>
<thead>
<tr>
<th>No.</th>
<th>Function</th>
<th>Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>7200</td>
<td>BATCH SELECTOR</td>
<td>→ Selection of the batching liquid (BATCH #1...6)</td>
</tr>
<tr>
<td>7203</td>
<td>BATCH QUANTITY</td>
<td>If the “ACCESS-CUSTOMER” option was selected for the “PRESET batch quantity” prompt in the “Batching” Quick Setup, the batching quantity can be altered via the local display. If the “LOCKED” option was selected, the batching quantity can only be read and cannot be altered until the private code has been entered.</td>
</tr>
<tr>
<td>7265</td>
<td>RESET TOTAL BATCH SUM/COUNTER</td>
<td>Resets the batching quantity counter or the total batching quantity to “0”.</td>
</tr>
</tbody>
</table>

3. After exiting the PRESET menu, you can now start the batching process by pressing “START (-)”. New softkeys (STOP / HOLD or GO ON) now appear on the display. You can use these to interrupt, continue or stop the batching process at any time. → Fig. 26
   STOP (+) → Stops batching process
   HOLD (+) → Interrupts batching process (softkey changes to “GO ON”)
   GO ON (+) → Continues batching process (softkey changes to “HOLD”)

   After the batch quantity is reached, the “START” or “PRESET” softkeys reappear on the display.

   Fig. 26: Controlling batching processes using the local display (softkeys)
5.2 Brief operating instructions to the function matrix

Note!
- See the general notes → Page 38.
- Function descriptions → see the “Description of Device Functions” manual

1. HOME position → Entry into the function matrix
2. Select a block (e.g. OUTPUTS)
3. Select a group (e.g. CURRENT OUTPUT 1)
4. Select a function group (e.g. SETTINGS)
5. Select a function (e.g. TIME CONSTANT)
   Change parameter / enter numerical values:
   -> Select or enter enable code, parameters, numerical values
   -> Save your entries
6. Exit the function matrix:
   - Press and hold down Esc key (X) for longer than 3 seconds → HOME position
   - Repeatedly press Esc key (X) → Return step by step to HOME position

![Diagram of function matrix]

Fig. 27: Selecting functions and configuring parameters (function matrix)
5.2.1 General notes

The Quick Setup menu contains the default settings that are adequate for commissioning. Complex measuring operations on the other hand necessitate additional functions that you can configure as necessary and customise to suit your process parameters. The function matrix, therefore, comprises a multiplicity of additional functions which, for the sake of clarity, are arranged on a number of menu levels (blocks, groups, and function groups).

Comply with the following instructions when configuring functions:
- You select functions as described already. → Page 37
  Each cell in the function matrix is identified by a numerical or letter code on the display.
- You can switch off certain functions (OFF). If you do so, related functions in other function groups will no longer be displayed.
- Certain functions prompt you to confirm your data entries. Press $\text{P}$ to select “SURE [ YES ]” and press $\text{F}$ to confirm. This saves your setting or starts a function, as applicable.
- Return to the HOME position is automatic if no key is pressed for 5 minutes.
- Programming mode is disabled automatically if you do not press a key within 60 seconds following automatic return to the HOME position.

Caution!
A detailed All functions are described in detail, as is the function matrix itself, in the “Description of Device Functions” manual, which is a separate part of these Operating Instructions.

Note!
- The transmitter continues to measure while data entry is in progress, i.e. the current measured values are output via the signal outputs in the normal way.
- If the supply voltage fails all preset and parameterised values remain safely stored in the EEPROM.

5.2.2 Enabling the programming mode

The function matrix can be disabled. Disabling the function matrix rules out the possibility of inadvertent changes to device functions, numerical values or factory settings. A numerical code (factory setting = 83) has to be entered before settings can be changed.

If you use a code number of your choice, you exclude the possibility of unauthorised persons accessing data (→ see the “Description of Device Functions” manual).

Comply with the following instructions when entering codes:
- If programming is disabled and the $\text{P}$ operating elements are pressed in any function, a prompt for the code automatically appears on the display.
- If “0” is entered as the customer’s code, programming is always enabled.
- The Endress+Hauser service organisation can be of assistance if you mislay your personal code.

Caution!
Changing certain parameters such as all sensor characteristics, for example, influences numerous functions of the entire measuring system, particularly measuring accuracy. There is no need to change these parameters under normal circumstances and consequently, they are protected by a special code known only to the Endress+Hauser service organisation. Please contact Endress+Hauser if you have any questions.

5.2.3 Disabling the programming mode

Programming mode is disabled if you do not press an operating element within 60 seconds following automatic return to the HOME position.
You can also disable programming in the “ACCESS CODE” function by entering any number (other than the customer’s code).
5.3 Error messages

5.3.1 Type of error

Errors that occur during commissioning or measuring are displayed immediately. If two or more system or process errors occur, the error with the highest priority is the one shown on the display.

The measuring system distinguishes between two types of error:

- **System error**: This group includes all device errors, e.g. communication errors, hardware errors, etc. → Page 86
- **Process error**: This group includes all application errors, e.g. fluid not homogeneous, etc. → Page 91

![Error messages on the display (example)](image)

- **Error type**: P = process error, S = system error
- **Error message type**: $\dagger$ = Fault message, ! = Notice message
- **Error designation**: e.g. FLUID INHOM. = fluid is not homogeneous
- **Error number**: e.g. #702
- **Duration of most recent error occurrence (in hours, minutes and seconds)**

5.3.2 Error message type

Users have the option of weighting system and process errors differently, by defining them as **Fault messages** or **Notice messages**. You can define messages in this way with the aid of the function matrix (see the “Description of Device Functions” manual).

Serious system errors, e.g. module defects, are always identified and classed as “fault messages” by the measuring device.

**Notice message (!)**
- Displayed as → Exclamation mark (!), error designation (S: system error, P: process error).
- The error in question has no effect on the outputs of the measuring device.

**Fault message ($\dagger$)**
- Displayed as → Lightning flash ($\dagger$), error designation (S: system error, P: process error).
- The error in question has a direct effect on the outputs.
  - The response of the outputs (failsafe mode) can be defined by means of functions in the function matrix. → Page 94

**Note!**
- Error conditions can be output via the relay outputs
- If an error message occurs, an upper or lower signal level for the breakdown information according to NAMUR 43 can be output via the current output.
5.3.3 Confirming error messages

For the sake of plant and process safety, the measuring device can be configured in such a way that fault messages displayed ($) always have to be rectified and acknowledged locally by pressing \[\text{F}1\]. Only then do the error messages disappear from the display. This option can be switched on or off by means of the “ACKNOWLEDGE FAULT MESSAGES” function (see the “Description of Device Functions” manual).

Note!
- Fault messages ($) can also be reset and confirmed via the status input.
- Notice messages (!) do not require acknowledgement. Note, however, that they remain visible until the cause of the error has been rectified.

5.4 Communication

In addition to local operation, the measuring device can be configured and measured values can be obtained by means of the HART protocol. Digital communication takes place using the 4-20 mA current output HART. → Page 29

The HART protocol allows the transfer of measuring and device data between the HART master and the field devices for configuration and diagnostics purposes. The HART master, e.g. a handheld terminal or PC-based operating programs (such as ToF Tool – Fieldtool Package), require device description (DD) files which are used to access all the information in a HART device. Information is exclusively transferred using so-called “commands”. There are three different command groups:

- **Universal Commands**
  These are associated with the following functionalities for example: Universal commands are supported and used by all HART devices.
  - Recognizing HART devices
  - Reading digital measured values (volume flow, totalizer, etc.)

- **Common practice commands**: Common practice commands offer functions which are supported and can be executed by most but not all field devices.

- **Device-specific commands**: These commands allow access to device-specific functions which are not HART standard. Such commands access individual field device information, amongst other things, such as empty/full pipe calibration values, low flow cut off settings, etc.

Note!
The measuring device has access to all three command classes.
List of all "Universal Commands" and "Common Practice Commands": → Page 44
5.4.1 Operating options

For the complete operation of the measuring device, including device-specific commands, there are DD files available to the user to provide the following operating aids and programs:

Note!

- In the CURRENT RANGE function (current output 1), the HART protocol demands the setting “4...20 mA HART” or “4-20 mA (25 mA) HART”.
- HART write protection can be disabled or enabled by means of a jumper on the I/O board. → Page 54

HART handheld terminal DXR 375

Selecting device functions with a HART Communicator is a process involving a number of menu levels and a special HART function matrix. The HART manual in the carrying case of the HART Communicator contains more detailed information on the device.

Operating program “ToF Tool - Fieldtool Package”

Modular software package consisting of the service program “ToF Tool” for configuration and diagnosis of ToF level measuring devices (time-of-flight measurement) and evolution of pressure measuring instruments as well as the “Fieldtool” service program for the configuration and diagnosis of Proline flowmeters. The Proline flowmeters are accessed via a service interface or via the service interface FXA 193 or the HART protocol.

Contents of the “ToF Tool - Fieldtool Package”:
- Commissioning, maintenance analysis
- Configuring flowmeters
- Service functions
- Visualisation of process data
- Trouble-shooting
- Controlling the “Fieldcheck” tester/simulator

Fieldcare

FieldCare is Endress+Hauser's FDT-based plant asset management tool and allows the configuration and diagnosis of intelligent field devices. By using status information, you also have a simple but effective tool for monitoring devices. The Proline flowmeters are accessed via a service interface or via the service interface FXA 193.

Operating program “SIMATIC PDM” (Siemens)

SIMATIC PDM is a standardised, manufacturer-independent tool for the operation, configuration, maintenance and diagnosis of intelligent field devices.

Operating program “AMS” (Emerson Process Management)

AMS (Asset Management Solutions): program for operating and configuring devices
5.4.2 Current device description files

The following table illustrates the suitable device description file for the operating tool in question and then indicates where these can be obtained.

HART protocol:

<table>
<thead>
<tr>
<th>Valid for software:</th>
<th>2.00.XX</th>
<th>→ Function &quot;Device software&quot; (8100)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturer ID:</td>
<td>11\text{hex} (ENDRESS+HAUSER)</td>
<td>→ Function &quot;Manufacturer ID&quot; (6040)</td>
</tr>
<tr>
<td>Device ID:</td>
<td>51\text{hex}</td>
<td>→ Function &quot;Device ID&quot; (6041)</td>
</tr>
<tr>
<td>HART version data:</td>
<td>Device Revision 6/ DD Revision 1</td>
<td></td>
</tr>
<tr>
<td>Software release:</td>
<td>11.2004</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Operating program:</th>
<th>Sources for obtaining device descriptions:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Handheld terminal DXR 375</td>
<td>• Use update function of handheld terminal</td>
</tr>
<tr>
<td>ToF Tool – Fieldtool Package</td>
<td>• <a href="http://www.tof-fieldtool.endress.com">www.tof-fieldtool.endress.com</a> (→ Download → Software → Device driver)</td>
</tr>
<tr>
<td>Fieldcare / DTM</td>
<td>• <a href="http://www.endress.com">www.endress.com</a> (→ Download → Software → Device driver)</td>
</tr>
<tr>
<td>AMS</td>
<td>• <a href="http://www.endress.com">www.endress.com</a> (→ Download → Software → Device driver)</td>
</tr>
<tr>
<td>SIMATIC PDM</td>
<td>• <a href="http://www.endress.com">www.endress.com</a> (→ Download → Software → Device driver)</td>
</tr>
</tbody>
</table>

Operation via the service protocol

<table>
<thead>
<tr>
<th>Valid for device software:</th>
<th>2.00.XX</th>
<th>→ Function &quot;Device software&quot; (8100)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Software release:</td>
<td>11.2004</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Operating program:</th>
<th>Sources for obtaining device descriptions:</th>
</tr>
</thead>
<tbody>
<tr>
<td>ToF Tool – Fieldtool Package</td>
<td>• <a href="http://www.tof-fieldtool.endress.com">www.tof-fieldtool.endress.com</a> (→ Download → Software → Device driver)</td>
</tr>
<tr>
<td></td>
<td>• CD-ROM (Endress+Hauser order number 50097200)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tester/simulator:</th>
<th>Sources for obtaining device descriptions:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fieldcheck</td>
<td>• Update by means of ToF Tool – Fieldtool Package via Fieldflash module</td>
</tr>
</tbody>
</table>
5.4.3 Device and process variables

Device variables:
The following device variables are available using the HART protocol:

<table>
<thead>
<tr>
<th>Code (decimal)</th>
<th>Device variable</th>
<th>Code (decimal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>OFF (unassigned)</td>
<td>24</td>
</tr>
<tr>
<td>2</td>
<td>Mass flow</td>
<td>25</td>
</tr>
<tr>
<td>5</td>
<td>Volume flow</td>
<td>26</td>
</tr>
<tr>
<td>6</td>
<td>Corrected volume flow</td>
<td>27</td>
</tr>
<tr>
<td>7</td>
<td>Density</td>
<td>28</td>
</tr>
<tr>
<td>8</td>
<td>Reference density</td>
<td>29</td>
</tr>
<tr>
<td>9</td>
<td>Temperature</td>
<td>52</td>
</tr>
<tr>
<td>12</td>
<td>Target mass flow</td>
<td>53</td>
</tr>
<tr>
<td>13</td>
<td>% Target mass flow</td>
<td>58</td>
</tr>
<tr>
<td>14</td>
<td>Target volume flow</td>
<td>59</td>
</tr>
<tr>
<td>15</td>
<td>% Target volume flow</td>
<td>60</td>
</tr>
<tr>
<td>16</td>
<td>Target corrected volume flow</td>
<td>61</td>
</tr>
<tr>
<td>17</td>
<td>Carrier mass flow</td>
<td>62</td>
</tr>
<tr>
<td>18</td>
<td>% Carrier mass flow</td>
<td>63</td>
</tr>
<tr>
<td>19</td>
<td>Carrier volume flow</td>
<td>81</td>
</tr>
<tr>
<td>20</td>
<td>% carrier volume flow</td>
<td>250</td>
</tr>
<tr>
<td>21</td>
<td>Carrier corrected volume flow</td>
<td>251</td>
</tr>
<tr>
<td>22</td>
<td>% BLACK LIQUOR</td>
<td>252</td>
</tr>
<tr>
<td>23</td>
<td>°BAUME &gt;1kg/l</td>
<td></td>
</tr>
</tbody>
</table>

Process variables:

At the factory, the process variables are assigned to the following device variables:
- Primary process variable (PV) → Mass flow
- Second process variable (SV) → Totalizer 1
- Third process variable (TV) → Density
- Fourth process variable (FV) → Temperature

Note!
You can set or change the assignment of device variables to process variables using Command 51. → Page 47
### 5.4.4 Universal / Common practice HART commands

The following table contains all the universal commands supported by the device.

<table>
<thead>
<tr>
<th>Command No.</th>
<th>HART command / Access type</th>
<th>Command data (numeric data in decimal form)</th>
<th>Response data (numeric data in decimal form)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Universal Commands</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>Read unique device identifier</td>
<td>none</td>
<td>Device identification delivers information on the device and the manufacturer. It cannot be changed. The response consists of a 12-byte device ID: Byte 0: fixed value 254 Byte 1: Manufacturer ID, 17 = E+H Byte 2: Device type ID, e.g., 81 = Promass 83 or 80 = Promass 80 Byte 3: Number of preambles Byte 4: Universal commands rev. no. Byte 5: Device-spec. commands rev. no. Byte 6: Software revision Byte 7: Hardware revision Byte 8: Additional device information Byte 9-11: Device identification</td>
</tr>
<tr>
<td>1</td>
<td>Read primary process variable</td>
<td>none</td>
<td>– Byte 0: HART unit code of the primary process variable – Bytes 1-4: Primary process variable Factory setting: Primary process variable = Mass flow Note! You can set the assignment of device variables to process variables using Command 51. Manufacturer-specific units are represented using the HART unit code &quot;240&quot;.</td>
</tr>
<tr>
<td>2</td>
<td>Read the primary process variable as current in mA and percentage of the set measuring range</td>
<td>none</td>
<td>– Bytes 0-3: Actual current of the primary process variable in mA – Bytes 4-7: Percentage of the set measuring range Factory setting: Primary process variable = Mass flow Note! You can set the assignment of device variables to process variables using Command 51.</td>
</tr>
<tr>
<td>3</td>
<td>Read the primary process variable as current in mA and four (preset using Command 51) dynamic process variables</td>
<td>none</td>
<td>24 bytes are sent as a response: – Bytes 0-3: Primary process variable current in mA – Byte 4: HART unit code of the primary process variable – Bytes 5-8: Primary process variable – Byte 9: HART unit code of the second process variable – Bytes 10-13: Second process variable – Byte 14: HART unit code of the third process variable – Bytes 15-18: Third process variable – Byte 19: HART unit code of the fourth process variable – Bytes 20-23: Fourth process variable Factory setting: Primary process variable = Mass flow Second process variable = Totalizer 1 Third process variable = Density Fourth process variable = Temperature Note! You can set the assignment of device variables to process variables using Command 51. Manufacturer-specific units are represented using the HART unit code &quot;240&quot;.</td>
</tr>
<tr>
<td>Command No.</td>
<td>HART command / Access type</td>
<td>Command data (numeric data in decimal form)</td>
<td>Response data (numeric data in decimal form)</td>
</tr>
<tr>
<td>-------------</td>
<td>---------------------------</td>
<td>---------------------------------------------</td>
<td>---------------------------------------------</td>
</tr>
</tbody>
</table>
| 6           | Set HART shortform address Access type = write | Byte 0: desired address (0...15)  
*Factory setting:* 0  
*Note!* With an address >0 (multidrop mode), the current output of the primary process variable is set to 4 mA. | Byte 0: active address |
| 11          | Read unique device identification using the TAG (measuring point designation) Access type = read | Bytes 0-5: TAG | Device identification delivers information on the device and the manufacturer. It cannot be changed. The response consists of a 12-byte device ID if the given TAG agrees with the one saved in the device:  
– Byte 0: fixed value 254  
– Byte 1: Manufacturer ID, 17 = E+H  
– Byte 2: Device type ID, 81 = Promass 83 or 80 = Promass 80  
– Byte 3: Number of preambles  
– Byte 4: Universal commands rev. no.  
– Byte 5: Device-spec. commands rev. no.  
– Byte 6: Software revision  
– Byte 7: Hardware revision  
– Byte 8: Additional device information  
– Byte 9-11: Device identification |
| 12          | Read user message Access type = read | none | Bytes 0-24: User message  
*Note!* You can write the user message using Command 17. |
| 13          | Read TAG, descriptor and date Access type = read | none | – Bytes 0-5: TAG  
– Bytes 6-17: Descriptor  
– Byte 18-20: Date  
*Note!* You can write the TAG, descriptor and date using Command 18. |
| 14          | Read sensor information on primary process variable | none | – Bytes 0-2: Sensor serial number  
– Byte 3: HART unit code of sensor limits and measuring range of the primary process variable  
– Bytes 4-7: Upper sensor limit  
– Bytes 8-11: Lower sensor limit  
– Bytes 12-15: Minimum span  
*Note!*  
- The data relate to the primary process variable (= Mass flow).  
- Manufacturer-specific units are represented using the HART unit code “240”. |
| 15          | Read output information of primary process variable Access type = read | none | – Byte 0: Alarm selection ID  
– Byte 1: Transfer function ID  
– Byte 2: HART unit code for the set measuring range of the primary process variable  
– Bytes 3-6: Upper range, value for 20 mA  
– Bytes 7-10: Start of measuring range, value for 4 mA  
– Bytes 11-14: Attenuation constant in [s]  
– Byte 15: Write protection ID  
– Byte 16: OEM dealer ID, 17 = E+H  
*Factory setting:*  
Primary process variable = Mass flow  
*Note!*  
- You can set the assignment of device variables to process variables using Command 51.  
- Manufacturer-specific units are represented using the HART unit code “240”. |
| 16          | Read the device production number Access type = read | none | Bytes 0-2: Production number |
### Operation Proline Promass 83

#### The following table contains all the common practice commands supported by the device.

<table>
<thead>
<tr>
<th>Command No.</th>
<th>HART command / Access type</th>
<th>Command data (numeric data in decimal form)</th>
<th>Response data (numeric data in decimal form)</th>
</tr>
</thead>
<tbody>
<tr>
<td>17</td>
<td>Write user message</td>
<td>46 Endress+Hauser</td>
<td>Displays the current user message in the device: Bytes 0-23: Current user message</td>
</tr>
<tr>
<td></td>
<td>Access = write</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Write TAG, descriptor and date</td>
<td>With this parameter, you can store an 8 character TAG, a 16 character descriptor and a date: Bytes 0-5: TAG Bytes 6-17: Descriptor Byte 18-20: Date</td>
<td>Displays the current information in the device: Bytes 0-5: TAG Bytes 6-17: Descriptor Byte 18-20: Date</td>
</tr>
<tr>
<td></td>
<td>Access = write</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Command No. 34: Write damping value for primary process variable

- **Access**: Write
- **Command data**: Bytes 0-3: Damping value of the primary process variable in seconds
- **Response data**: Displays the current damping value in the device: Bytes 0-3: Damping value in seconds

- **Factory setting**: Primary process variable = Mass flow

#### Command No. 35: Write measuring range of primary process variable

- **Access**: Write
- **Command data**: Write the desired measuring range:
  - Byte 0: HART unit code of the primary process variable
  - Bytes 1-4: Upper range, value for 20 mA
  - Bytes 5-8: Start of measuring range, value for 4 mA
- **Response data**: The currently set measuring range is displayed as a response:
  - Byte 0: HART unit code for the set measuring range of the primary process variable
  - Bytes 1-4: Upper range, value for 20 mA
  - Bytes 5-8: Start of measuring range, value for 4 mA

- **Note!**
  - You can set the assignment of device variables to process variables using Command 51.
  - If the HART unit code is not the correct one for the process variable, the device will continue with the last valid unit.

- **Manufacturer-specific units are represented using the HART unit code “240”.

#### Command No. 38: Device status reset (Configuration changed)

- **Access**: Write
- **Command data**: None
- **Response data**: None

#### Command No. 40: Simulate output current of primary process variable

- **Access**: Write
- **Command data**: Simulation of the desired output current of the primary process variable.
  - An entry value of 0 exits the simulation mode:
    - Byte 0-3: Output current in mA
- **Response data**: The momentary output current of the primary process variable is displayed as a response:
  - Byte 0-3: Output current in mA

- **Factory setting**: Primary process variable = Mass flow

- **Note!**
  - You can set the assignment of device variables to process variables with Command 51.

#### Command No. 42: Perform master reset

- **Access**: Write
- **Command data**: None
- **Response data**: None
## Command No.

HART command / Access type | Command data (numeric data in decimal form) | Response data (numeric data in decimal form)
--- | --- | ---
44 | Write unit of primary process variable | Set unit of primary process variable. Only unit which are suitable for the process variable are transferred to the device:
Byte 0: HART unit code  
*Factory setting:* Primary process variable = Mass flow  
Note!  
- If the written HART unit code is not the correct one for the process variable, the device will continue with the last valid unit.  
- If you change the unit of the primary process variable, this has no impact on the system units. | The current unit code of the primary process variable is displayed as a response:  
Byte 0: HART unit code  
Note! Manufacturer-specific units are represented using the HART unit code "240".

48 | Read additional device status | none | The device status is displayed in extended form as the response:  
Coding; see table → Page 49

50 | Read assignment of the device variables to the four process variables | none | Display of the current variable assignment of the process variables:  
- Byte 0: Device variable code to the primary process variable  
- Byte 1: Device variable code to the second process variable  
- Byte 2: Device variable code to the third process variable  
- Byte 3: Device variable code to the fourth process variable  
*Factory setting:*  
- Primary process variable: Code 1 for mass flow  
- Second process variable: Code 250 for totalizer 1  
- Third process variable: Code 7 for density  
- Fourth process variable: Code 9 for temperature  
Note! You can set the assignment of device variables to process variables with Command 51.

51 | Write assignments of the device variables to the four process variables | Setting of the device variables to the four process variables:  
- Byte 0: Device variable code to the primary process variable  
- Byte 1: Device variable code to the second process variable  
- Byte 2: Device variable code to the third process variable  
- Byte 3: Device variable code to the fourth process variable  
*Code of the supported device variables:* See data → Page 43  
*Factory setting:*  
- Primary process variable = Mass flow  
- Second process variable = Totalizer 1  
- Third process variable = Density  
- Fourth process variable = Temperature | The variable assignment of the process variables is displayed as a response:  
- Byte 0: Device variable code to the primary process variable  
- Byte 1: Device variable code to the second process variable  
- Byte 2: Device variable code to the third process variable  
- Byte 3: Device variable code to the fourth process variable

---

*Note!*
<table>
<thead>
<tr>
<th>Command No.</th>
<th>HART command / Access type</th>
<th>Command data (numeric data in decimal form)</th>
<th>Response data (numeric data in decimal form)</th>
</tr>
</thead>
<tbody>
<tr>
<td>53</td>
<td>Write device variable unit Access = write</td>
<td>This command sets the unit of the given device variables. Only those units which suit the device variable are transferred: – Byte 0: Device variable code – Byte 1: HART unit code Code of the supported device variables: See data → Page 43 Note! • If the written unit is not the correct one for the device variable, the device will continue with the last valid unit. • If you change the unit of the device variable, this has no impact on the system units.</td>
<td>The current unit of the device variables is displayed in the device as a response: – Byte 0: Device variable code – Byte 1: HART unit code Note! Manufacturer-specific units are represented using the HART unit code “240”.</td>
</tr>
<tr>
<td>59</td>
<td>Write number of preambles in response message Access = write</td>
<td>This parameter sets the number of preambles which are inserted in the response messages: Byte 0: Number of preambles [2…20]</td>
<td>As a response, the current number of the preambles is displayed in the response message: Byte 0: Number of preambles</td>
</tr>
</tbody>
</table>
5.4.5 Device status / Error messages

You can read the extended device status, in this case, current error messages, via Command “48”. The command delivers information which are partly coded in bits (see table below).

Note!
You can find a detailed explanation of the device status and error messages and their elimination on: → Page 86 ff.

<table>
<thead>
<tr>
<th>Byte-bit</th>
<th>Error No.</th>
<th>Short error description</th>
<th>Page 85 ff.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-0</td>
<td>001</td>
<td>Serious device error</td>
<td></td>
</tr>
<tr>
<td>0-1</td>
<td>011</td>
<td>Measuring amplifier has faulty EEPROM</td>
<td></td>
</tr>
<tr>
<td>0-2</td>
<td>012</td>
<td>Error when accessing data of the measuring amplifier EEPROM</td>
<td></td>
</tr>
<tr>
<td>0-3</td>
<td>not assigned</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>0-4</td>
<td>not assigned</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>0-5</td>
<td>not assigned</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>0-6</td>
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<td>-</td>
<td></td>
</tr>
<tr>
<td>0-7</td>
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</tr>
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<td>1-0</td>
<td>not assigned</td>
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<td></td>
</tr>
<tr>
<td>1-1</td>
<td>031</td>
<td>S-DAT: defective or missing</td>
<td></td>
</tr>
<tr>
<td>1-2</td>
<td>032</td>
<td>S-DAT: Error accessing saved values</td>
<td></td>
</tr>
<tr>
<td>1-3</td>
<td>041</td>
<td>T-DAT: defective or missing</td>
<td></td>
</tr>
<tr>
<td>1-4</td>
<td>042</td>
<td>T-DAT: Error accessing saved values</td>
<td></td>
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<tr>
<td>1-5</td>
<td>051</td>
<td>I/O board and the amplifier board are not compatible.</td>
<td></td>
</tr>
<tr>
<td>1-6</td>
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</tr>
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<td>1-7</td>
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<td>3-3</td>
<td>111</td>
<td>Totalizer checksum error</td>
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<td>3-4</td>
<td>121</td>
<td>I/O board and the amplifier board (software versions) are not compatible.</td>
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<td>3-6</td>
<td>205</td>
<td>T-DAT: Data download not successful</td>
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</tr>
<tr>
<td>3-7</td>
<td>206</td>
<td>T-DAT: Data upload not successful</td>
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</tr>
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<tr>
<td>4-3</td>
<td>251</td>
<td>Internal communication fault on the amplifier board.</td>
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<tr>
<td>4-4</td>
<td>261</td>
<td>No data reception between amplifier and I/O board</td>
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</tr>
<tr>
<td>Byte-bit</td>
<td>Error No.</td>
<td>Short error description</td>
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<td>5-7</td>
<td>339</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>6-0</td>
<td>340</td>
<td>Flow buffer: The temporarily buffered flow portions (measuring mode for pulsating flow) could not be cleared or output within 60 seconds.</td>
<td></td>
</tr>
<tr>
<td>6-1</td>
<td>341</td>
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<td>343</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>6-4</td>
<td>344</td>
<td>Frequency buffer: The temporarily buffered flow portions (measuring mode for pulsating flow) could not be cleared or output within 60 seconds.</td>
<td></td>
</tr>
<tr>
<td>6-5</td>
<td>345</td>
<td>-</td>
<td></td>
</tr>
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<td>347</td>
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<td></td>
</tr>
<tr>
<td>7-0</td>
<td>348</td>
<td>Pulse buffer: The temporarily buffered flow portions (measuring mode for pulsating flow) could not be cleared or output within 60 seconds.</td>
<td></td>
</tr>
<tr>
<td>7-1</td>
<td>349</td>
<td>-</td>
<td></td>
</tr>
<tr>
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<td>350</td>
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<td>7-3</td>
<td>351</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>7-4</td>
<td>352</td>
<td>Current output: The actual value for the flow lies outside the set limits.</td>
<td></td>
</tr>
<tr>
<td>7-5</td>
<td>353</td>
<td>-</td>
<td></td>
</tr>
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<td>7-7</td>
<td>355</td>
<td>-</td>
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</tr>
<tr>
<td>8-0</td>
<td>356</td>
<td>Frequency output: The actual value for the flow lies outside the set limits.</td>
<td></td>
</tr>
<tr>
<td>8-1</td>
<td>357</td>
<td>-</td>
<td></td>
</tr>
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</tr>
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<td>8-3</td>
<td>359</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>8-4</td>
<td>360</td>
<td>Pulse output: Pulse output frequency is out of range.</td>
<td></td>
</tr>
<tr>
<td>8-5</td>
<td>361</td>
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<td></td>
</tr>
<tr>
<td>8-6</td>
<td>362</td>
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<td></td>
</tr>
<tr>
<td>8-7</td>
<td>not assigned</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>9-0</td>
<td>379</td>
<td>The measuring tube oscillation frequency is outside the permitted range.</td>
<td></td>
</tr>
<tr>
<td>9-1</td>
<td>380</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>9-2</td>
<td>381</td>
<td>The temperature sensor on the measuring tube is likely defective.</td>
<td></td>
</tr>
<tr>
<td>9-3</td>
<td>382</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>9-4</td>
<td>383</td>
<td>The temperature sensor on the carrier tube is likely defective.</td>
<td></td>
</tr>
<tr>
<td>9-5</td>
<td>384</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Byte-bit</td>
<td>Error No.</td>
<td>Short error description</td>
<td></td>
</tr>
<tr>
<td>---------</td>
<td>----------</td>
<td>-------------------------</td>
<td></td>
</tr>
<tr>
<td>9-6</td>
<td>385</td>
<td>One of the measuring tube exciter coils (inlet or outlet) is likely defective.</td>
<td></td>
</tr>
<tr>
<td>9-7</td>
<td>386</td>
<td>Amplifier error</td>
<td></td>
</tr>
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<td>387</td>
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<td></td>
</tr>
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<td>388</td>
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</tr>
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<td>10-2</td>
<td>389</td>
<td>Amplifier error</td>
<td></td>
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<td>390</td>
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<td></td>
</tr>
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</tr>
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<td>not assigned</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>11-6</td>
<td>471</td>
<td>Max. permitted batching time has been exceeded.</td>
<td></td>
</tr>
<tr>
<td>11-7</td>
<td>472</td>
<td>Underbatching: the minimum quantity was not reached. Overbatching: the maximum permitted batching quantity was exceeded.</td>
<td></td>
</tr>
<tr>
<td>12-0</td>
<td>473</td>
<td>The predefined batch quantity point was exceeded. End of filling process approaching.</td>
<td></td>
</tr>
<tr>
<td>12-1</td>
<td>474</td>
<td>Maximum flow value entered is overshot.</td>
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</tr>
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<td>12-2</td>
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</tr>
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<td>-</td>
<td></td>
</tr>
<tr>
<td>12-7</td>
<td>501</td>
<td>New amplifier software version is loaded. Currently no other commands are possible.</td>
<td></td>
</tr>
<tr>
<td>13-0</td>
<td>502</td>
<td>Upload and download of device files. Currently no other commands are possible.</td>
<td></td>
</tr>
<tr>
<td>13-1</td>
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<td></td>
</tr>
<tr>
<td>13-2</td>
<td>571</td>
<td>Batching process in progress (valves are open)</td>
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<tr>
<td>13-3</td>
<td>572</td>
<td>Batching process has been stopped (valves are closed)</td>
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</tr>
<tr>
<td>13-4</td>
<td>not assigned</td>
<td>-</td>
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</tr>
<tr>
<td>13-5</td>
<td>586</td>
<td>The fluid properties do not allow normal measuring operation.</td>
<td></td>
</tr>
<tr>
<td>13-6</td>
<td>587</td>
<td>Extreme process conditions exist. The measuring system can therefore not be started.</td>
<td></td>
</tr>
<tr>
<td>13-7</td>
<td>588</td>
<td>Overdriving of the internal analog to digital converter. A continuation of the measurement is no longer possible!</td>
<td></td>
</tr>
<tr>
<td>14-0</td>
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<td>-</td>
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</tr>
<tr>
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<td>14-3</td>
<td>601</td>
<td>Positive zero return active</td>
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<tr>
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<td></td>
</tr>
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<tr>
<td>Byte-bit</td>
<td>Error No.</td>
<td>Short error description</td>
<td></td>
</tr>
<tr>
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<td>611</td>
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</tr>
<tr>
<td>15-0</td>
<td>612</td>
<td>Simulation current output active</td>
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</tr>
<tr>
<td>15-1</td>
<td>613</td>
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<td></td>
</tr>
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<td>622</td>
<td>Simulation frequency output active</td>
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<td>15-5</td>
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<td>Simulation pulse output active</td>
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</tr>
<tr>
<td>16-2</td>
<td>634</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>16-3</td>
<td>641</td>
<td>Simulation status output active</td>
<td></td>
</tr>
<tr>
<td>16-4</td>
<td>642</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>16-5</td>
<td>643</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>16-6</td>
<td>644</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>16-7</td>
<td>651</td>
<td>Simulation relay output active</td>
<td></td>
</tr>
<tr>
<td>17-0</td>
<td>652</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>17-1</td>
<td>653</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>17-2</td>
<td>654</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>17-3</td>
<td>661</td>
<td>Simulation current input active</td>
<td></td>
</tr>
<tr>
<td>17-4</td>
<td>662</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>17-5</td>
<td>663</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>17-6</td>
<td>664</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>17-7</td>
<td>671</td>
<td>Simulation status input active</td>
<td></td>
</tr>
<tr>
<td>18-0</td>
<td>672</td>
<td>Simulation of response to error (outputs) active</td>
<td></td>
</tr>
<tr>
<td>18-1</td>
<td>673</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>18-2</td>
<td>674</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>18-3</td>
<td>691</td>
<td>Simulation of volume flow active</td>
<td></td>
</tr>
<tr>
<td>18-4</td>
<td>692</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>18-5</td>
<td>not assigned</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>18-6</td>
<td>not assigned</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>18-7</td>
<td>not assigned</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>19-0</td>
<td>700</td>
<td>The process fluid density is outside the upper or lower limit values set in the “EPD” function</td>
<td></td>
</tr>
<tr>
<td>19-1</td>
<td>701</td>
<td>The maximum current value for the measuring tube exciter coils has been reached, since certain process fluid characteristics are extreme.</td>
<td></td>
</tr>
<tr>
<td>19-2</td>
<td>702</td>
<td>Frequency control is not stable, due to inhomogeneous fluid.</td>
<td></td>
</tr>
<tr>
<td>19-3</td>
<td>703</td>
<td>NOISE LIM. CH0 Overdriving of the internal analog to digital converter. A continuation of the measurement is still possible!</td>
<td></td>
</tr>
<tr>
<td>19-4</td>
<td>704</td>
<td>NOISE LIM. CH1 Overdriving of the internal analog to digital converter. A continuation of the measurement is still possible!</td>
<td></td>
</tr>
<tr>
<td>Byte-bit</td>
<td>Error No.</td>
<td>Short error description → Page 85 ff.</td>
<td></td>
</tr>
<tr>
<td>----------</td>
<td>-----------</td>
<td>--------------------------------------</td>
<td></td>
</tr>
<tr>
<td>19-5</td>
<td>705</td>
<td>The electronics’ measuring range will be exceeded. The mass flow is too high.</td>
<td></td>
</tr>
<tr>
<td>19-6</td>
<td>not assigned</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>19-7</td>
<td>not assigned</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>20-0</td>
<td>not assigned</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>20-1</td>
<td>not assigned</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>20-2</td>
<td>not assigned</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>20-3</td>
<td>not assigned</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>20-4</td>
<td>not assigned</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>20-5</td>
<td>731</td>
<td>The zero point adjustment is not possible or has been cancelled.</td>
<td></td>
</tr>
<tr>
<td>20-6</td>
<td>not assigned</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>20-7</td>
<td>not assigned</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>22-4</td>
<td>61</td>
<td>F-Chip is faulty or not plugged into the I/O board.</td>
<td></td>
</tr>
<tr>
<td>24-5</td>
<td>363</td>
<td>Current input: The actual value for the current lies outside the set limits.</td>
<td></td>
</tr>
</tbody>
</table>
5.4.6  Switching HART write protection on and off

A jumper on the I/O board provides the means of switching HART write protection on or off.

⚠️  Warning!
Risk of electric shock. Exposed components carry dangerous voltages. Make sure that the power supply is switched off before you remove the cover of the electronics compartment.

1. Switch off power supply.
2. Remove the I/O board → Page 96
3. Switch HART write protection on or off, as applicable, by means of the jumper (→ Fig. 29).
4. Installation of the I/O board is the reverse of the removal procedure.

---

**Fig. 29:** Switching HART write protection on and off

1. Write protection OFF (default), that is: HART protocol unlocked
2. Write protection ON, that is: HART protocol locked
6 Commissioning

6.1 Function check

Make sure that all final checks have been completed before you start up your measuring point:

- Checklist for “Post installation check” → Page 23
- Checklist for “Post connection check” → Page 31

6.2 Switching on the measuring device

Once the post-connection checks have been successfully completed, it is time to switch on the supply voltage. The device is now operational.

The measuring device performs a number of power on self-tests. As this procedure progresses the following sequence of messages appears on the local display:

![Start-up message]
PROMASS 83
START-UP RUNNING

![Current software version]
PROMASS 83
DEVICE SOFTWARE V XX.XX.XX

![List of installed input/output modules]
CURRENT OUTPUT FREQUENCY OUTPUT RELAY STATUS INPUT

![Beginning of normal measuring mode]
SYSTEM OK → OPERATION

Normal measuring mode commences as soon as start-up completes.
Various measured value and/or status variables appear on the display (HOME position).

Note!
If start-up fails, an error message indicating the cause is displayed.
6.3 Application-specific commissioning

In the case of measuring devices without a local display, the individual parameters and functions must be configured via the configuration program, e.g. ToF Tool - Fieldtool Package. If the measuring device is equipped with a local display, all the important device parameters for standard operation can be configured quickly and easily by means of the “Commissioning” Quick Setup menu.

- Quick Setup “Pulsating flow”, → Page 58 ff.
- Quick Setup “Gas measurement”, → Page 65 ff.

6.3.1 Quick Setup "Commissioning"

Note!

- The display returns to the cell SETUP COMMISSIONING (1002) if you press the ESC key combination during parameter interrogation. The stored parameters remain valid.
- The “Commissioning” Quick Setup must be carried out before one of the Quick Setups explained below is run.
- Only units not yet configured in the current Setup are offered for selection in each cycle. The unit for mass, volume and corrected volume is derived from the corresponding flow unit.
- Only the outputs not yet configured in the current Setup are offered for selection in each cycle.
- The “YES” option remains visible until all the outputs have been parameterized.
  “NO” is the only option displayed when no further outputs are available.
- The “automatic parameterization of the display” option contains the following basic settings/factory settings:
  YES: Main line = Mass flow; Additional line = Totalizer 1; Information line = Operating/system conditions
  NO: The existing (selected) settings remain.
- The QUICK SETUP BATCHING is only available when the optional software package BATCHING is installed.
Fig. 30: "QUICK SETUP COMMISSIONING" - menu for straightforward configuration of the major device functions
6.3.2 Quick Setup “Pulsating Flow”

Certain types of pump such as reciprocating, peristaltic and cam-type pumps, for example, create a flow characterised by severe periodic fluctuations. Negative flows can occur with pumps of these types on account of the closing volume of the valves or valve leaks.

Note!
Before carrying out the Quick Setup “Pulsating Flow” the Quick Setup “Commissioning” has to be executed.

![Flow characteristics of various types of pump](image)

Fig. 31: Flow characteristics of various types of pump

A With severely pulsating flow
B With low pulsating flow
1 1-cylinder cam pump
2 2-cylinder cam pump
3 Magnetic pump
4 Peristaltic pump, flexible connecting hose
5 Multi-cylinder reciprocating pump

Severely pulsating flow

Once several device functions have been configured in the “Pulsating flow” Quick Setup menu, flow fluctuations of this nature can be compensated over the entire flow range and pulsating fluid flows measured correctly. You will find detailed instructions on how to use this Quick Setup menu on the following pages.

Note!
It is always advisable to work through the “Pulsating flow” Quick Setup menu if there is any uncertainty about the exact flow characteristic.

Slightly pulsating flow

If flow fluctuations are no more than minor, as is the case, for example with gear-type, three-cylinder or multi-cylinder pumps, it is not absolutely necessary to work through the Quick Setup menu.

In cases of this nature, however, it is advisable to adapt the functions listed below in the function matrix (see the “Description of Device Functions” manual) to suit local process conditions in order to ensure a stable, unvarying output signal:

- Measuring system damping: “FLOW DAMPING“ function → Increase the value
- Current output damping: TIME CONSTANT function → increase the value
Performing the “Pulsating flow” Quick Setup

This Quick Setup menu guides you systematically through the setup procedure for all the device functions that have to be parameterised and configured for measuring pulsating flows. Note that this has no effect on values configured beforehand, such as measuring range, current range or full scale value.

**Fig. 32:** Quick Setup for measuring severely pulsating flows.

Recommended settings are found on the following page.
### “Pulsating Flow” Quick Setup menu

<table>
<thead>
<tr>
<th>Function No.</th>
<th>Function name</th>
<th>Selection with ( % )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1003</td>
<td>QS PULSATING FLOW</td>
<td>YES</td>
</tr>
</tbody>
</table>

After is pressed by way of confirmation, the Quick Setup menu calls up all the subsequent functions in succession.

#### Basic configuration

<table>
<thead>
<tr>
<th>Function No.</th>
<th>Function name</th>
<th>Selection with ( % )</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>DISPLAY DAMPING</td>
<td>1 s</td>
</tr>
<tr>
<td>3002</td>
<td>TOTALIZER MODE (DAA)</td>
<td>BALANCE (Totalizer 1)</td>
</tr>
<tr>
<td>3002</td>
<td>TOTALIZER MODE (DAB)</td>
<td>BALANCE (Totalizer 2)</td>
</tr>
<tr>
<td>3002</td>
<td>TOTALIZER MODE (DAC)</td>
<td>BALANCE (Totalizer 3)</td>
</tr>
</tbody>
</table>

#### Signal type for “CURRENT OUTPUT 1...n”

<table>
<thead>
<tr>
<th>Function No.</th>
<th>Function name</th>
<th>Selection with ( % )</th>
</tr>
</thead>
<tbody>
<tr>
<td>4004</td>
<td>MEASURING MODE</td>
<td>PULSATING FLOW</td>
</tr>
<tr>
<td>4005</td>
<td>TIME CONSTANT</td>
<td>1 s</td>
</tr>
</tbody>
</table>

#### Signal type for “FREQ./PULSE OUTPUT 1...n” (for FREQUENCY operating mode)

<table>
<thead>
<tr>
<th>Function No.</th>
<th>Function name</th>
<th>Selection with ( % )</th>
</tr>
</thead>
<tbody>
<tr>
<td>4206</td>
<td>MEASURING MODE</td>
<td>PULSATING FLOW</td>
</tr>
<tr>
<td>4208</td>
<td>TIME CONSTANT</td>
<td>0 s</td>
</tr>
</tbody>
</table>

#### Signal type for “FREQ./PULSE OUTPUT 1...n” (for PULSE operating mode)

<table>
<thead>
<tr>
<th>Function No.</th>
<th>Function name</th>
<th>Selection with ( % )</th>
</tr>
</thead>
<tbody>
<tr>
<td>4225</td>
<td>MEASURING MODE</td>
<td>PULSATING FLOW</td>
</tr>
</tbody>
</table>

#### Other settings

<table>
<thead>
<tr>
<th>Function No.</th>
<th>Function name</th>
<th>Selection with ( % )</th>
</tr>
</thead>
<tbody>
<tr>
<td>8005</td>
<td>ALARM DELAY</td>
<td>0 s</td>
</tr>
<tr>
<td>6400</td>
<td>ASSIGN LOW FLOW CUTOFF</td>
<td>MASS FLOW</td>
</tr>
</tbody>
</table>
| 6402         | ON-VALUE LOW FLOW CUTOFF       | Setting depends on diameter:  
  DN 1 = 0.02 [kg/h] resp. [l/h]  
  DN 2 = 0.10 [kg/h] resp. [l/h]  
  DN 4 = 0.45 [kg/h] resp. [l/h]  
  DN 8 = 2.0 [kg/h] resp. [l/h]  
  DN 15 = 6.5 [kg/h] resp. [l/h]  
  DN 15* = 18 [kg/h] resp. [l/h]  
  DN 25 = 18 [kg/h] resp. [l/h]  
  DN 25* = 45 [kg/h] resp. [l/h]  
  DN 40 = 45 [kg/h] resp. [l/h]  
  DN 40* = 70 [kg/h] resp. [l/h]  
  DN 50 = 70 [kg/h] resp. [l/h]  
  DN 80 = 180 [kg/h] resp. [l/h]  
  DN 100 = 350 [kg/h] resp. [l/h]  
  DN 150 = 650 [kg/h] resp. [l/h]  
  DN 250 = 1800 [kg/h] resp. [l/h]  
  * DN 15, 25, 40 “FB” = Full bore versions of Promass I |
| 6403         | OFF-VALUE LOW FLOW CUTOFF      | 50%                   |
| 6404         | PRESSURE SHOCK SUPPRESSION     | 0 s                   |

Back to the HOME position:

→ Press and hold down Esc key for longer than three seconds or
→ Repeatedly press and release Esc key → Exit the function matrix step by step
6.3.3 Quick Setup “Batching”

This Quick Setup menu guides you systematically through the setup procedure for all the device functions that have to be parameterised and configured for batching operation. These basic settings allow simple (one step) batching processes.

Additional settings, e.g. for the calculation of after runs or for multi-stage batching procedures, must be made via the function matrix itself (see the “Description of Device Functions” manual).

**Caution!**
The “Batching” Quick Setup sets certain device parameters for discontinuous measurement operation.

If the measuring instrument is used for continuous flow measurement at a later time, we recommend at you rerun the “Commissioning” and/or “Pulsating Flow” Quick Setup.

**Note!**
- Before carrying out the Quick Setup “Batching” the Quick Setup “Commissioning” has to be executed. → Page 4
- This function is only available when the additional “batching” software is installed in the measuring device (order option). You can order this software from E+H as an accessory at a later date. → Page 83
- You can find detailed information on the batching functions in the separate “Description of Device Functions” manual.
- You can also directly control filling process using the local display. During Quick Setup, an appropriate dialogue appears concerning the automatic display configuration. Acknowledge this by clicking “YES”.

This assigns special batching functions (START, PRESET, MATRIX) to the bottom line of the display. These can be directly executed on-site using the three operating keys (O / S / F).

Therefore, the measuring device can be fully deployed in the field as a “batch controller”. → Page 36
Fig. 33: Quick Setup “Batching”

Recommended settings are found on the following page.
"Batching" Quick Setup menu

<table>
<thead>
<tr>
<th>Function No.</th>
<th>Function name</th>
<th>Setting to be selected (↓)</th>
<th>Setting to be selected (↑)</th>
<th>to next function with (↓)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1005</td>
<td>QUICK SETUP BATCHING / DOSING</td>
<td>YES</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

After ↓ is pressed by way of confirmation, the Quick Setup menu calls up all the subsequent functions in succession.

Note!
Functions with a grey background are configured automatically (by the measuring system itself)

<table>
<thead>
<tr>
<th>Function No.</th>
<th>Function name</th>
<th>Setting to be selected (↓)</th>
<th>Setting to be selected (↑)</th>
<th>to next function with (↓)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6400</td>
<td>ASSIGN LOW FLOW CUTOFF</td>
<td>MASS FLOW</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6402</td>
<td>ON-VALUE LOW FLOW CUTOFF</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6403</td>
<td>OFF-VALUE LOW FLOW CUTOFF</td>
<td>50%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6603</td>
<td>FLOW DAMPING</td>
<td>0 seconds</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6404</td>
<td>PRESSURE SHOCK SUPPRESSION</td>
<td>0 seconds</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7200</td>
<td>BATCH SELECTOR</td>
<td>BATCH #1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7201</td>
<td>BATCH NAME</td>
<td>BATCH #1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7202</td>
<td>ASSIGN BATCH VARIABLE</td>
<td>MASS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7203</td>
<td>BATCH QUANTITY</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7204</td>
<td>FIXED CORRECTION QUANTITY</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7205</td>
<td>CORRECTION MODE</td>
<td>OFF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7208</td>
<td>BATCH STAGES</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7209</td>
<td>INPUT FORMAT</td>
<td>VALUE INPUT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4700</td>
<td>ASSIGN RELAY</td>
<td>BATCH VALVE 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4780</td>
<td>TERMINAL NUMBER</td>
<td>Output (display only)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7220</td>
<td>OPEN VALVE 1</td>
<td>0% or 0 [unit]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7240</td>
<td>MAXIMUM BATCH TIME</td>
<td>0 seconds (= switched off)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7241</td>
<td>MINIMUM BATCH QUANTITY</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7242</td>
<td>MAXIMUM BATCH QUANTITY</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2200</td>
<td>ASSIGN (main line)</td>
<td>BATCH NAME</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2220</td>
<td>ASSIGN (Multiplex main line)</td>
<td>OFF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2400</td>
<td>ASSIGN (additional line)</td>
<td>BATCH DOWNWARDS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2420</td>
<td>ASSIGN (Multiplex additional line)</td>
<td>OFF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2600</td>
<td>ASSIGN (information line)</td>
<td>BATCHING KEYS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2620</td>
<td>ASSIGN (Multiplex information line)</td>
<td>OFF</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Back to the HOME position:
→ Press and hold down Esc key ↓ for longer than three seconds or
→ Repeatedly press and release Esc key ↓ → Exit the function matrix step by step
<table>
<thead>
<tr>
<th>Nominal diameter [mm]</th>
<th>Low flow cutoff / factory settings (v \sim 0.04 m/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SI units [kg/h]</td>
</tr>
<tr>
<td>1</td>
<td>0.08</td>
</tr>
<tr>
<td>2</td>
<td>0.40</td>
</tr>
<tr>
<td>4</td>
<td>1.80</td>
</tr>
<tr>
<td>8</td>
<td>8.00</td>
</tr>
<tr>
<td>15</td>
<td>26.00</td>
</tr>
<tr>
<td>15 *</td>
<td>72.00</td>
</tr>
<tr>
<td>25</td>
<td>72.00</td>
</tr>
<tr>
<td>25 *</td>
<td>180.00</td>
</tr>
<tr>
<td>40</td>
<td>180.00</td>
</tr>
<tr>
<td>40 *</td>
<td>300.00</td>
</tr>
<tr>
<td>50</td>
<td>300.00</td>
</tr>
<tr>
<td>80</td>
<td>720.00</td>
</tr>
<tr>
<td>100</td>
<td>1200.00</td>
</tr>
<tr>
<td>150</td>
<td>2600.00</td>
</tr>
<tr>
<td>250</td>
<td>7200.00</td>
</tr>
</tbody>
</table>

* DN 15, 25, 40 "FB" = Full bore versions of Promass I
6.3.4 Quick Setup “Gas Measurement”

The measuring device is not only suitable for measuring liquid flow. Direct mass measurement based on the Coriolis principle is also possible for measuring the flow rate of gases.

Note!
- Before carrying out the Quick Setup “Gas measurement” the Quick Setup “Commissioning” has to be executed. → Page 4
- Only mass and Corrected volume flow can be measured and output with the gas measurement mode. Note that direct density and/or volume measurement is not possible!
- The flow ranges and measuring accuracy that apply to gas measurement are not the same as those for liquids.
- If corrected volume flow (e.g. in Nm³/h) is to be measured and output instead of the mass flow (e.g. in kg/h), change the setting for the CORRECTED VOLUME CALCULATION function to “FIXED REFERENCE DENSITY” in the “Commissioning” Quick Setup menu.

Corrected volume flow can be assigned as follows:
- to a display line
- to the current output
- to the pulse/frequency output

Performing the “Gas Measurement” Quick Setup

This Quick Setup menu guides you systematically through the setup procedure for all the device functions that have to be parameterised and configured for gas measurement.

Fig. 34: “Gas Measurement” Quick Setup

Recommended settings are found on the following page.
**Gas Measurement** Quick Setup menu

<table>
<thead>
<tr>
<th>Function No.</th>
<th>Function name</th>
<th>Setting to be selected (YES)</th>
<th>(to next function with F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1004</td>
<td>QS GAS MEASUREMENT</td>
<td>YES</td>
<td>After F is pressed by way of confirmation, the Quick Setup menu calls up all the subsequent functions in succession.</td>
</tr>
</tbody>
</table>

6400 ASSIGN LOW FLOW CUTOFF

- On account of the low mass flow involved when gas flows are measured, it is advisable not use a low flow cutoff.
- Setting: OFF

6402 ON-VALUE LOW FLOW CUT OFF

- If the ASSIGNMENT LOW FLOW CUTOFF function was not set to "OFF", the following applies:
- Setting: 0.0000 [unit]
- User input: Flow rates for gas measurements are low, so the value for the switch-on point (= low flow cutoff) must be correspondingly low.

6403 OFF-VALUE LOW FLOW CUTOFF

- If the ASSIGNMENT LOW FLOW CUTOFF function was not set to "OFF", the following applies:
- Setting: 50%
- User input: Enter the switch-off point as a positive hysteresis in %, referenced to the switch-on point.

Back to the HOME position:
- Press and hold down Esc key for longer than three seconds or
- Repeatedly press and release Esc key → Exit the function matrix step by step

Note!
Quick Setup automatically deactivates the function EMPTY PIPE DETECTION (6420) so that the instrument can measure flow at low gas pressures.
6.3.5 Data back-up with “T-DAT SAVE/LOAD”

The "T-DAT SAVE/LOAD" function can be used to store all the settings and parameters of the device to the T-Dat data storage device.

Options

LOAD
Data on the T-DAT data storage device are copied to the device memory (EEPROM). This overwrites any settings and parameters of the device.

SAVE
Settings and parameters are copied from the device memory (EEPROM) to the T-DAT.

CANCEL
Cancels the option selection and returns you to the higher selection level.

Application examples

- After commissioning, the current measuring point parameters can be saved to the T-DAT as a backup.
- If the transmitter is replaced for some reason, the data from the T-DAT can be loaded into the new transmitter -(EEPROM).

Note!
- If the target device has an older software version, the message "TRANSM. SW-DAT" is displayed during start-up. Then only the "SAVE" function is available.
- LOAD
  This function is only possible if the target device has the same software version as, or a more recent software version than, the source device.
- SAVE
  This function is always available.
6.4 Configuration

6.4.1 Current output: active/passive

The current outputs are configured as “active” or “passive” by means of various jumpers on the I/O board or the current submodule.

⚠️ Warning!
Risk of electric shock.Exposed components carry dangerous voltages. Make sure that the power supply is switched off before you remove the cover of the electronics compartment.

1. Switch off power supply
2. Remove the I/O board → Page 95 ff.
3. Set the jumpers → Fig. 36
   🚨 Caution!  
   - Risk of destroying the measuring device. Set the jumpers exactly as shown in the diagram. Incorrectly set jumpers can cause overcurrents that would destroy either the measuring device or external devices connected to it.
   - Note that the position of the current submodule on the I/O board can vary, depending on the version ordered, and that the terminal assignment in the connection compartment of the transmitter varies accordingly. → Page 27
4. Installation of the I/O board is the reverse of the removal procedure.

Fig. 36: Configuring current outputs with the aid of jumpers (I/O board)

1 Current output 1 with HART
1.1 Active current output (default)
1.2 Passive current output
2 Current output 2 (optional, plug-in module)
2.1 Active current output (default)
2.2 Passive current output
6.4.2 Current input: active/passive

The current outputs are configured as “active” or “passive” by means of various jumpers on the current input submodule.

⚠️ Warning!
Risk of electric shock. Exposed components carry dangerous voltages. Make sure that the power supply is switched off before you remove the cover of the electronics compartment.

1. Switch off power supply
2. Remove the I/O board → Page 96 ff.
3. Set the jumpers → Fig. 37
   🔥 Caution!
   - Risk of destroying the measuring device. Set the jumpers exactly as shown in the diagram. Incorrectly set jumpers can cause overcurrents that would destroy either the measuring device or external devices connected to it.
   - Note that the position of the current submodule on the I/O board can vary, depending on the version ordered, and that the terminal assignment in the connection compartment of the transmitter varies accordingly. → Page 27
4. Installation of the I/O board is the reverse of the removal procedure.

---

**Fig. 37**: Configuring current inputs with the aid of jumpers (I/O board)

Current input 1 (optional, plug-in module)

1. Active current input (default)
2. Passive current input
6.4.3 Relay contacts: Normally closed/Normally open

The relay contact can be configured as normally open (NO or make) or normally closed (NC or break) contacts by means of two jumpers on the I/O board or on the pluggable submodule. This configuration can be called up at any time with the “ACTUAL STATUS RELAY” function (No. 4740).

⚠️ Warning!
Risk of electric shock. Exposed components carry dangerous voltages. Make sure that the power supply is switched off before you remove the cover of the electronics compartment.

1. Switch off power supply
2. Remove the I/O board → Page 96 ff.
3. Set the jumpers → Fig. 38

⚠️ Caution!
– If you change the setting you must always change the positions of both jumpers!
– Note precisely the specified positions of the jumpers.
– Note that the position of the relay submodule on the I/O board can vary, depending on the version ordered, and that the terminal assignment in the connection compartment of the transmitter varies accordingly. → Page 27

4. Installation of the I/O board is the reverse of the removal procedure.

![Fig. 38: Configuring relay contacts (NC / NO) on the convertible I/O board (submodule).](image1)

1 Configured as NO contact (default, relay 1)
2 Configured as NC contact (default, relay 2, if installed)

![Fig. 39: Configuring relay contacts (NC / NO) on the non-convertible I/O board. A = relay 1; B = relay 2.](image2)

1 Configured as NO contact (default, relay 1)
2 Configured as NC contact (default, relay 2)
### 6.4.4 Concentration measurement

The measuring device determines three primary variables simultaneously:
- Mass flow
- Fluid density
- Fluid temperature

As standard, these measured variables allow other process variables to be calculated, such as volume flow, reference density (density at reference temperature) and corrected volume flow.

The optional software package “Concentration measurement” (F-Chip, accessories →) offers a multitude of additional density functions. Additional evaluation methods are available in this way, especially for special density calculations in all types of applications: → Page 83
- Calculating percentage contents, mass and volume flow in two-phase media (carrier fluid and target fluid)
- Converting density of the fluid into special density units (°Brix, °Baumé, °API, etc.).

#### Concentration measurement with fixed calculation function

By means of the “DENSITY FUNCTION (7000)” function, you can select various density functions which use a fixed specified calculation mode for calculating concentration:

<table>
<thead>
<tr>
<th>Density function</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>%-MASS</td>
<td>By using the functions for two-phase-media, it is possible to calculate the percentage mass or volume contents of the carrier fluid or the target fluid. The basic equations (without temperature compensation) are:</td>
</tr>
<tr>
<td></td>
<td>Masse [%] = ( \frac{D_2 \cdot (\rho - D_1)}{\rho \cdot (D_2 - D_1)} \cdot 100% )</td>
</tr>
<tr>
<td></td>
<td>Volumen [%] = ( \frac{(\rho - D_1)}{(D_2 - D_1)} \cdot 100% )</td>
</tr>
<tr>
<td></td>
<td>D1 = density of carrier fluid (transporting liquid, e.g. water)</td>
</tr>
<tr>
<td></td>
<td>D2 = density of target fluid (material transported, e.g. lime powder or a second liquefied material to be measured)</td>
</tr>
<tr>
<td></td>
<td>( \rho ) = measured overall density</td>
</tr>
<tr>
<td>°BRIX</td>
<td>Density unit used for the Food &amp; Beverage industry which deals with the saccharose content of aqueous solutions, e.g. for measuring solutions containing sugar such as fruit juice, etc. The following ICUMSA table for Brix units is the basis for calculations within the device.</td>
</tr>
<tr>
<td>°BAUME</td>
<td>This density unit or scale is mainly used for acidic solutions, e.g. ferric chloride solutions. Two Baumé scales are used in practice:</td>
</tr>
<tr>
<td></td>
<td>– BAUME &gt; 1 kg/l: for solutions heavier than water</td>
</tr>
<tr>
<td></td>
<td>– BAUME &lt; 1 kg/l: for solutions lighter than water</td>
</tr>
<tr>
<td>°BALLING</td>
<td>Both units are a commonly used basis for calculating the fluid density in the brewery industry. A liquid with a value of 1° BALLING (Plato) has the same density as a water/cane sugar solution consisting of 1 kg cane sugar dissolved in 99 kg of water. 1° Balling (Plato) is thus 1% of the liquid weight.</td>
</tr>
<tr>
<td>°PLATO</td>
<td></td>
</tr>
<tr>
<td>%-BLACK LIQUOR</td>
<td>The units of concentration used in the paper industry for black liquor in % by mass. The formula used for the calculation is the same as for %-MASS.</td>
</tr>
<tr>
<td>°API</td>
<td>°API (= American Petroleum Institute) Density units specifically used in North America for liquefied oil products.</td>
</tr>
</tbody>
</table>
Fig. 40: Selecting and configuring different density functions in the function matrix
Concentration measurement with flexible calculation function

Under certain application conditions, it may not be possible to use density functions with a fixed calculation function (% mass, °Brix, etc). However, user-specific or application-specific concentration calculations can be used with the “FLEXIBLE” setting in the function “DENSITY FUNCTION (7000)”.

The following types of calculation can be selected in function “MODE (7021)”:  
- % MASS 3D  
- % VOLUME 3D  
- % MASS 2D  
- % VOLUME 2D  
- OTHER 3D  
- OTHER 2D

### Brixgrade (density of hydrous saccharose solution in kg/m³)

<table>
<thead>
<tr>
<th>°Brix</th>
<th>10°C</th>
<th>20°C</th>
<th>30°C</th>
<th>40°C</th>
<th>50°C</th>
<th>60°C</th>
<th>70°C</th>
<th>80°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>999.70</td>
<td>998.20</td>
<td>995.64</td>
<td>992.21</td>
<td>988.03</td>
<td>983.19</td>
<td>977.76</td>
<td>971.78</td>
</tr>
<tr>
<td>5</td>
<td>1019.56</td>
<td>1017.79</td>
<td>1015.03</td>
<td>1011.44</td>
<td>1007.14</td>
<td>1002.20</td>
<td>996.70</td>
<td>989.65</td>
</tr>
<tr>
<td>10</td>
<td>1040.15</td>
<td>1038.10</td>
<td>1035.13</td>
<td>1031.38</td>
<td>1026.96</td>
<td>1021.93</td>
<td>1016.34</td>
<td>1010.23</td>
</tr>
<tr>
<td>15</td>
<td>1061.48</td>
<td>1059.15</td>
<td>1055.97</td>
<td>1052.08</td>
<td>1047.51</td>
<td>1042.39</td>
<td>1036.72</td>
<td>1030.55</td>
</tr>
<tr>
<td>20</td>
<td>1083.58</td>
<td>1080.97</td>
<td>1077.58</td>
<td>1073.50</td>
<td>1068.83</td>
<td>1063.60</td>
<td>1057.85</td>
<td>1051.63</td>
</tr>
<tr>
<td>25</td>
<td>1106.47</td>
<td>1103.59</td>
<td>1099.98</td>
<td>1095.74</td>
<td>1090.94</td>
<td>1085.61</td>
<td>1079.78</td>
<td>1073.50</td>
</tr>
<tr>
<td>30</td>
<td>1130.19</td>
<td>1127.03</td>
<td>1123.20</td>
<td>1118.80</td>
<td>1113.86</td>
<td>1108.44</td>
<td>1102.54</td>
<td>1096.21</td>
</tr>
<tr>
<td>35</td>
<td>1154.76</td>
<td>1151.33</td>
<td>1147.58</td>
<td>1142.71</td>
<td>1137.65</td>
<td>1132.13</td>
<td>1126.16</td>
<td>1119.79</td>
</tr>
<tr>
<td>40</td>
<td>1180.22</td>
<td>1176.51</td>
<td>1172.25</td>
<td>1167.52</td>
<td>1162.33</td>
<td>1156.71</td>
<td>1150.68</td>
<td>1144.27</td>
</tr>
<tr>
<td>45</td>
<td>1206.58</td>
<td>1202.61</td>
<td>1198.15</td>
<td>1193.25</td>
<td>1187.94</td>
<td>1182.23</td>
<td>1176.14</td>
<td>1169.70</td>
</tr>
<tr>
<td>50</td>
<td>1233.87</td>
<td>1229.64</td>
<td>1224.98</td>
<td>1219.93</td>
<td>1214.50</td>
<td>1208.70</td>
<td>1202.56</td>
<td>1196.11</td>
</tr>
<tr>
<td>55</td>
<td>1262.11</td>
<td>1257.64</td>
<td>1252.79</td>
<td>1247.59</td>
<td>1242.05</td>
<td>1236.18</td>
<td>1229.98</td>
<td>1223.53</td>
</tr>
<tr>
<td>60</td>
<td>1291.31</td>
<td>1286.61</td>
<td>1281.59</td>
<td>1276.25</td>
<td>1270.61</td>
<td>1264.67</td>
<td>1258.45</td>
<td>1251.88</td>
</tr>
<tr>
<td>65</td>
<td>1321.46</td>
<td>1316.56</td>
<td>1311.38</td>
<td>1305.93</td>
<td>1300.21</td>
<td>1294.21</td>
<td>1287.96</td>
<td>1281.52</td>
</tr>
<tr>
<td>70</td>
<td>1352.55</td>
<td>1347.49</td>
<td>1342.18</td>
<td>1336.63</td>
<td>1330.84</td>
<td>1324.80</td>
<td>1318.55</td>
<td>1312.13</td>
</tr>
<tr>
<td>75</td>
<td>1384.58</td>
<td>1379.38</td>
<td>1373.88</td>
<td>1368.36</td>
<td>1362.52</td>
<td>1356.46</td>
<td>1350.21</td>
<td>1343.83</td>
</tr>
<tr>
<td>80</td>
<td>1417.50</td>
<td>1412.20</td>
<td>1406.70</td>
<td>1401.10</td>
<td>1395.20</td>
<td>1389.20</td>
<td>1383.00</td>
<td>1376.60</td>
</tr>
<tr>
<td>85</td>
<td>1451.30</td>
<td>1445.90</td>
<td>1440.80</td>
<td>1434.80</td>
<td>1429.00</td>
<td>1422.90</td>
<td>1416.80</td>
<td>1410.50</td>
</tr>
</tbody>
</table>

Source: A. & L. Emmerich, Technical University of Brunswick; officially recommended by ICUMSA, 20th session 1990
Calculation type “% MASS 3D” or “% VOLUME 3D”

For this type of calculation, the relationship between the three variables - concentration, density and temperature must be known (3-dimensional), e.g. by a table. In this way, the concentration can be calculated from the measured density and temperature values by means of the following formula (the coefficients A0, A1, etc. have to be determined either by the user or by the ToF Tool – Fieldtool Package or Fieldcare program):

\[
K = A0 + A1 \cdot \rho + A2 \cdot \rho^2 + A3 \cdot \rho^3 + A4 \cdot \rho^4 + B1 \cdot T + B2 \cdot T^2 + B3 \cdot T^3
\]

\[K\] Concentration
\[\rho\] Currently measured density
A0 Value from function (COEFFICIENT A0 (7032))
A1 Value from function (COEFFICIENT A1 (7033))
A2 Value from function (COEFFICIENT A2 (7034))
A3 Value from function (COEFFICIENT A3 (7035))
A4 Value from function (COEFFICIENT A4 (7036))
B1 Value from function (COEFFICIENT B1 (7037))
B2 Value from function (COEFFICIENT B2 (7038))
B3 Value from function (COEFFICIENT B3 (7039))
T Currently measured temperature in °C

Example:
The following is a concentration table from a reference source.

<table>
<thead>
<tr>
<th>Density</th>
<th>Temperature</th>
<th>10°C</th>
<th>15°C</th>
<th>20°C</th>
<th>25°C</th>
<th>30°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>825 kg/m³</td>
<td>93.6%</td>
<td>92.5%</td>
<td>91.2%</td>
<td>90.0%</td>
<td>88.7%</td>
<td></td>
</tr>
<tr>
<td>840 kg/m³</td>
<td>89.3%</td>
<td>88.0%</td>
<td>86.6%</td>
<td>85.2%</td>
<td>83.8%</td>
<td></td>
</tr>
<tr>
<td>855 kg/m³</td>
<td>84.4%</td>
<td>83.0%</td>
<td>81.5%</td>
<td>80.0%</td>
<td>78.5%</td>
<td></td>
</tr>
<tr>
<td>870 kg/m³</td>
<td>79.1%</td>
<td>77.6%</td>
<td>76.1%</td>
<td>74.5%</td>
<td>72.9%</td>
<td></td>
</tr>
<tr>
<td>885 kg/m³</td>
<td>73.4%</td>
<td>71.8%</td>
<td>70.2%</td>
<td>68.6%</td>
<td>66.9%</td>
<td></td>
</tr>
<tr>
<td>900 kg/m³</td>
<td>67.3%</td>
<td>65.7%</td>
<td>64.0%</td>
<td>62.3%</td>
<td>60.5%</td>
<td></td>
</tr>
<tr>
<td>915 kg/m³</td>
<td>60.8%</td>
<td>59.1%</td>
<td>57.3%</td>
<td>55.5%</td>
<td>53.7%</td>
<td></td>
</tr>
</tbody>
</table>

Note!
The coefficients for the Promass 83 concentration algorithm should be determined with the density in units of kg/liter, temperature in °C and concentration in decimal form (0.50, not 50%). The coefficients B1, B2 and B3 must be entered in scientific notation into the matrix positions 7037, 7038 and 7039 as a product with \(10^{-3}\), \(10^{-6}\) or \(10^{-9}\).

Assume:
Density (\(\rho\)): 870 kg/m³ → 0.870 kg/l
Temperature (T): 20°C

Coefficients determined for table above:
A0 = -2.6057
A1 = 11.642
A2 = -8.8571
A3 = 0
A4 = 0
B1 = -2.7747·10⁻³
B2 = -7.3469·10⁻⁶
B3 = 0
Calculation:

\[ K = A0 + A1 \cdot \rho + A2 \cdot \rho^2 + A3 \cdot \rho^3 + A4 \cdot \rho^4 + B1 \cdot T + B2 \cdot T^2 + B3 \cdot T^3 \]

\[ = -2.6057 + 11.642 \cdot 0.870 + (-8.8571) \cdot 0.870^2 + 0 \cdot 0.870^3 + (-2.7747) \cdot 10^{-3} \cdot 20 + (-7.3469) \cdot 10^{-6} \cdot 20^3 + 0 \cdot 20^3 \]

\[ = 0.7604 \]

\[ = 76.04\% \]

*Calculation type “% MASS 2D” or “% VOLUME 2D”*

For this type of calculation, the relationship between the two variables concentration and reference density must be known (2-dimensional), e.g. by a table. In this way, the concentration can be calculated from the measured density and temperature values by means of the following formula (the coefficients A0, A1, etc. have to be determined either by the user or by the ToF Tool – Fieldtool Package or Fieldcare program):

\[ K = A0 + A1 \cdot \rho_{\text{ref}} + A2 \cdot \rho_{\text{ref}}^2 + A3 \cdot \rho_{\text{ref}}^3 + A4 \cdot \rho_{\text{ref}}^4 \]

*Note!*

Promass determines the reference density by means of the density and temperature currently measured. To do so, both the reference temperature (function REFERENCE TEMPERATURE) and the expansion coefficients (function EXPANSION COEFF........) must be entered in the measuring system.

The parameters important for measuring the reference density can also be configured directly via the “Commissioning” Quick Setup menu.

*Calculation type “OTHER 3D” or “OTHER 2D”*

With this option, users can enter a free selectable designation for their specific concentration unit or target parameters (see function TEXT ARBITRARY CONCENTRATION (0606)).
6.4.5 Advanced diagnostic functions

Changes to the measuring system, e.g. coating build-up or corrosion and abrasion on the measuring tubes can be detected at an early stage by means of the optional software package “Advanced Diagnostics” (F-Chip, accessories → Page 83). Normally, these influences reduce the measuring accuracy of the system or may lead to serious system errors.

By means of the diagnostic functions it is now possible to record various process and device parameters during operation, e.g. mass flow, density/reference density, temperature values, measuring tube damping etc.

By analysing the trend of these measured values, deviations of the measuring system from a “reference status” can be detected in good time and corrective measures can be taken.

Reference values as the basis for trend analysis

Reference values of the parameters in question must always be recorded for trend analysis. These reference values are determined under reproducible, constant conditions. Such reference values are initially recorded during calibration at the factory and saved in the measuring device.

Reference data can also be ascertained under customer-specific process conditions, e.g. during commissioning or at certain process stages (cleaning cycles, etc.).

Reference values are recorded and saved in the measuring system always by means of the device function "REFERENCE CONDITION USER" (7401).

Caution!
It is not possible to analyse the trend of process/device parameters without reference values! Reference values can only be determined under constant, non-changing process conditions.

Methods of ascertaining data

Process and device parameters can be recorded in two different ways which you can define in the function ACQUISITION MODE (7410):
- PERIODICAL option: Measuring device acquires data periodically. Enter the desired time interval by means of the function ACQUISITION PERIOD (7411).
- SINGLE SHOT option: The user himself acquires the data manually at different, free selectable periods.

Ensure that the process conditions always correspond to the reference status when data is being recorded. It is only in this way that deviations from the reference status can be clearly determined.

Note!
The last ten entries are retained in chronological order in the measuring system. The “history” of such values can be called up via various functions:

<table>
<thead>
<tr>
<th>Diagnosis parameters</th>
<th>Data saved (per parameter)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mass flow</td>
<td>Reference value → “REFERENCE VALUE” function</td>
</tr>
<tr>
<td>Density</td>
<td>Lowest measured value → “MINIMUM VALUE” function</td>
</tr>
<tr>
<td>Reference density</td>
<td>Highest measured value → “MAXIMUM VALUE” function</td>
</tr>
<tr>
<td>Temperature</td>
<td>List of the last ten measured values → “HISTORY” function</td>
</tr>
<tr>
<td>Measuring tube damping</td>
<td>Deviation measured/reference value → “ACTUAL DEVIATION” function</td>
</tr>
<tr>
<td>Sensor symmetry</td>
<td></td>
</tr>
</tbody>
</table>

More detailed information can be found in the “Description of Device Functions” Manual.
**Triggering warning messages**

If required, a limit value can be assigned to all the process/device parameters relevant to the diagnostic functions. A warning message is triggered if this limit value is exceeded → function WARNING MODE (7403).

The limit value is entered into the measuring system as an absolute (+/-) or relative deviation from the reference value → function WARNING LEVEL (74...).

Deviations arising and recorded by the measuring system can also be output via the current or relay outputs.

**Data interpretation**

The way the data recorded by the measuring system is interpreted depends largely on the application in question. This means that users must have a very good knowledge of their specific process conditions and the related deviation tolerances in the process, which have to be determined by the users themselves in each individual case.

For example, when using the limit function it is especially important to know the minimum and maximum deviation tolerances allowed. Otherwise there is the danger that a warning message is triggered inadvertently during "normal" process fluctuations.

There can be various reasons for deviating from the reference status. The following table provides examples and pointers for each of the six diagnosis parameters recorded:

<table>
<thead>
<tr>
<th>Diagnosis parameters</th>
<th>Possible reasons for deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mass flow</td>
<td>A deviation from the reference status indicates possible zero point shift.</td>
</tr>
<tr>
<td>Density</td>
<td>A deviation from the reference status can be caused by a change in the measuring tube resonance frequency, e.g. from deposits in the measuring tube, corrosion or abrasion.</td>
</tr>
<tr>
<td>Reference density</td>
<td>The reference density values can be interpreted in the same way as the density values. If the fluid temperature cannot be kept completely constant, you can analyse the reference density (density at a constant temperature, e.g. at 20 °C) instead of the density. Ensure that the parameters required for calculating the reference density have been correctly configured (functions REFERENCE TEMPERATURE and EXPANSION COEFF.).</td>
</tr>
<tr>
<td>Temperature</td>
<td>Use this diagnosis parameter to check the functionality of the PT 100 temperature sensor.</td>
</tr>
<tr>
<td>Measuring tube damping</td>
<td>A deviation from the reference status can be caused by a change in measuring tube damping, e.g. from mechanical changes (coating build-up, corrosion, abrasion).</td>
</tr>
<tr>
<td>Sensor symmetry</td>
<td>Use this diagnosis parameter to determine whether the sensor signals are symmetrical.</td>
</tr>
</tbody>
</table>
6.5 Adjustment

6.5.1 Zero point adjustment

All Promass measuring devices are calibrated with state-of-the-art technology. The zero point obtained in this way is printed on the nameplate. Calibration takes place under reference operating conditions. → Page 106

Consequently, the zero point adjustment is generally not necessary for Promass!

Experience shows that the zero point adjustment is advisable only in special cases:
- To achieve highest measuring accuracy also with very small flow rates.
- Under extreme process or operating conditions (e.g. very high process temperatures or very high viscosity fluids).

Preconditions for a zero point adjustment

Note the following before you perform a zero point adjustment:
- A zero point adjustment can be performed only with fluids that contain no gas or solid contents.
- Zero point adjustment is performed with the measuring tubes completely filled and at zero flow \((v = 0 \text{ m/s})\). This can be achieved, for example, with shut-off valves upstream and/or downstream of the sensor or by using existing valves and gates.
  - Normal operation → valves 1 and 2 open
  - Zero point adjustment with pump pressure → Valve 1 open / valve 2 closed
  - Zero point adjustment without pump pressure → Valve 1 closed / valve 2 open

Caution!
- If the fluid is very difficult to measure (e.g. containing entrained solids or gas) it may prove impossible to obtain a stable zero point despite repeated zero point adjustments. In instances of this nature, please contact your E+H service center.
- You can view the currently valid zero point value using the “ZERO POINT” function (see the “Description of Device Functions” manual).
Performing a zero point adjustment
1. Operate the system until operating conditions have settled.
2. Stop the flow \( v = 0 \text{ m/s} \).
3. Check the shut-off valves for leaks.
4. Check that operating pressure is correct.
5. Using the local display, select the ZEROPRO POINT ADJUSTMENT function in the function matrix:
   \( \text{BASIC FUNCTIONS} \rightarrow \text{PROCESS PARAMETER} \rightarrow \text{ADJUSTMENT} \rightarrow \text{ZERO POINT ADJUSTMENT} \)
6. When you press \( \text{O} \) or \( \text{S} \) you are automatically prompted to enter the access code if the function matrix is still disabled. Enter the code (factory setting = 83).
7. Use \( \text{O} \) or \( \text{S} \) to select START and press \( \text{F} \) to confirm. Select YES at the prompt and press \( \text{F} \) again to confirm. Zero point adjustment now starts.
   - The message “ZEROPRO POINT ADJUST RUNNING” appears on the display for 30...60 seconds while adjustment is in progress.
   - If the flow in the pipe exceeds 0.1 m/s, the following error message appears on the display: “ZERO ADJUST NOT POSSIBLE.”
   - When the zero point adjustment completes, the “ZERO ADJUST.” function reappears on the display.
8. Back to the HOME position:
   - Press and hold down Esc key \( \text{X} \) for longer than three seconds or
   - Repeatedly press and release the Esc key \( \text{X} \).

6.5.2 Density adjustment
It is advisable to perform a density adjustment when optimum measuring accuracy is required for calculating density dependent values. The application may require a 1-point or 2-point density adjustment.

1-point density adjustment (with one fluid):
This type of density adjustment is necessary under the following circumstances:
- The sensor does not measure exactly the density value that the user expects on the basis of laboratory analyses.
- The fluid properties are outside the measuring points set at the factory, or the reference operating conditions used to calibrate the measuring device.
- The system is used exclusively to measure a fluid’s density which must be registered to a high degree of accuracy under constant conditions.
  Example: Brix density measurement for apple juice.

2-point density adjustment (with two fluids):
This type of adjustment is always to be carried out if the measuring tubes have been mechanically altered by, e.g. material build-up, abrasion or corrosion. In such cases, the resonant frequency of the measuring tubes has been affected by these factors and is no longer compatible with the calibration data set at the factory. The 2-point density adjustment takes these mechanically-based changes into account and calculates new, adjusted calibration data.

Performing a 1-point or 2-point density adjustment
Caution!
- On-site density adjustment can be performed only if the user has detailed knowledge of the fluid density, obtained for example from detailed laboratory analyses.
- The target density value specified in this way must not deviate from the measured fluid density by more than ±10%.
- An error in defining the target density affects all calculated density and volume functions.
- The 2-point 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. ERROR" appears on the display.
Density adjustment changes the factory density calibration values or the calibration values set by the service technician.

The functions outlined in the following instructions are described in detail in the “Description of Device Functions” manual.

1. Fill the sensor with fluid. Make sure that the measuring tubes are completely filled and that liquids are free of gas bubbles.

2. Wait until the temperature difference between fluid and measuring tube has equalised. The time you have to wait for equalisation depends on the fluid and the temperature level.

3. Using the local display, select the SETPOINT DENSITY function in the function matrix and perform density adjustment as follows:

<table>
<thead>
<tr>
<th>Function No.</th>
<th>Function name</th>
<th>Setting to be selected ( 0 or 1  ) (to next function with 1 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>6482</td>
<td>DENSITY ADJUST MODE</td>
<td>Use 0 to select a 1- or 2-point adjustment.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Note! When you press 0 you are automatically prompted to enter the access code if the function matrix is still disabled. Enter the code.</td>
</tr>
<tr>
<td>6483</td>
<td>DENSITY SET VALUE 1</td>
<td>Use 0 to enter the target density of the first fluid and press 1 to save this value (input range = actual density value ±10%).</td>
</tr>
<tr>
<td>6484</td>
<td>MEASURE FLUID 1</td>
<td>Use 0 to select START and press 1. The message “DENSITY MEASUREMENT RUNNING” appears on the display for approximately 10 seconds. During this time Promass measures the current density of the first fluid (measured density value).</td>
</tr>
</tbody>
</table>

▼ For 2-point density adjustment only:

<table>
<thead>
<tr>
<th>Function No.</th>
<th>Function name</th>
<th>Setting to be selected ( 0 or 1  ) (to next function with 1 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>6485</td>
<td>DENSITY SET VALUE 2</td>
<td>Use 0 to enter the target density of the second fluid and press 1 to save this value (input range = actual density value ±10%).</td>
</tr>
<tr>
<td>6486</td>
<td>MEASURE FLUID 2</td>
<td>Use 0 to select START and press 1. The message “DENSITY MEASUREMENT RUNNING” appears on the display for approximately 10 seconds. During this time Promass measures the current density of the second fluid (measured density value).</td>
</tr>
</tbody>
</table>

▼

<table>
<thead>
<tr>
<th>Function No.</th>
<th>Function name</th>
<th>Setting to be selected ( 0 or 1  ) (to next function with 1 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>6487</td>
<td>DENSITY ADJUSTMENT</td>
<td>Use 0 to select DENSITY ADJUSTMENT and press 1. Promass compares the measured density value and the target density value and calculates the new density coefficient.</td>
</tr>
<tr>
<td>6488</td>
<td>RESTORE ORIGINAL</td>
<td>If the density adjustment does not complete correctly, you can select the RESTORE ORIGINAL function to reactivate the default density coefficient.</td>
</tr>
</tbody>
</table>

Back to the HOME position:

→ Press and hold down Esc key (02a) for longer than three seconds or
→ Repeatedly press and release Esc key (02a) → Exit the function matrix step by step
6.6 Purge and pressure monitoring connections

The sensor housing protects the inner electronics and mechanics and is filled with dry nitrogen. Beyond that, up to a specified measuring pressure it additionally serves as secondary containment.

Warning!
For a process pressure above the specified containment pressure, the housing does not serve as an additional secondary containment. In case a danger of measuring tube failure exists due to process characteristics, e.g. with corrosive process fluids, we recommend the use of sensors whose housing is equipped with special pressure monitoring connections (ordering option). With the help of these connections, fluid collected in the housing in the event of tube failure can be drained off. This diminishes the danger of mechanical overload of the housing, which could lead to a housing failure and accordingly is connected with an increased danger potential. These connections can also be used for gas purging (gas detection).

The following instructions apply to handling sensors with purge or pressure monitoring connections:
- Do not open the purge connections unless the containment can be filled immediately with a dry inert gas.
- Use only low gauge pressure to purge. Maximum pressure 5 bar.

6.7 Data storage device (HistoROM), F-CHIP

At Endress+Hauser, the term HistoROM refers to various types of data storage modules on which process and measuring device data are stored. By plugging and unplugging such modules, device configurations can be duplicated onto other measuring devices to cite just one example.

6.7.1 HistoROM/S-DAT (sensor-DAT)
The S-DAT is an exchangeable data storage device in which all sensor relevant parameters are stored, i.e., diameter, serial number, calibration factor, zero point.

6.7.2 HistoROM/T-DAT (transmitter-DAT)
The T-DAT is an exchangeable data storage device in which all transmitter parameters and settings are stored.

Storing of specific parameter settings from the EEPROM to the T-DAT and vice versa has to be carried out by the user (= manual save function). Detailed instructions regarding this can be found in the handbook “Description of Device Functions” (function “T-DAT SAVE/LOAD”, No. 1009).

6.7.3 F-CHIP (Function-Chip)
The F-Chip is a microprocessor chip that contains additional software packages that extend the functionality and application possibilities of the transmitter.

In the case of a later upgrade, the F-Chip can be ordered as an accessory and can simply be plugged on to the I/O board. After start up, the software is immediately made available to the transmitter.

Accessories → Page 83
Plugging on to the I/O board → Page 96

Caution!
To ensure an unambiguous assignment, the F-Chip is coded with the transmitter serial number once it is plugged in. Thus, it cannot be reused with other measuring devices.
7 Maintenance

No special maintenance work is required.

7.1 External cleaning

When cleaning the exterior of measuring devices, always use cleaning agents that do not attack the surface of the housing and the seals.

7.2 Cleaning with pigs (Promass H, I)

If pigs are used for cleaning, it is essential to take the inside diameters of measuring tube and process connection into account. See also Technical Information. → Page 126

7.3 Replacing seals

Under normal circumstances, fluid wetted seals of the Promass A and Promass M sensors do not require replacement. Replacement is necessary only in special circumstances, for example if aggressive or corrosive fluids are incompatible with the seal material.

Note!
- The period between changes depends on the fluid properties and on the frequency of cleaning cycles in the case of CIP/SIP cleaning.
- Replacement seals (accessories)
8 Accessories

Various accessories, which can be ordered separately from Endress+Hauser, are available for the transmitter and the sensor. Detailed information on the order code in question can be obtained from the Endress+Hauser service organisation.

### 8.1 Device-specific accessories

<table>
<thead>
<tr>
<th>Accessory</th>
<th>Description</th>
<th>Order code</th>
</tr>
</thead>
</table>
| Transmitter Proline Promass 83 | Transmitter for replacement or for stock. Use the order code to define the following specifications:  
- Approvals  
- Degree of protection / version  
- Cable entries  
- Display / power supply / operation  
- Software  
- Outputs / inputs | 83XXX - XXXXX * * * * * |
| Inputs/outputs | Conversion kit with appropriate plug-in point modules for converting the input/output configuration in place to date to a new version. | DK8UI - * * * |
| Software packages for - Proline Promass 83 | Software add-ons on F-Chip, can be ordered individually:  
- Advanced diagnostics  
- Batching functions  
- Concentration measurement | DK8SO - * |

### 8.2 Measuring principle-specific accessories

<table>
<thead>
<tr>
<th>Accessory</th>
<th>Description</th>
<th>Order code</th>
</tr>
</thead>
</table>
| Mounting set for transmitter | Mounting set for remote version. Suitable for:  
- Wall mounting  
- Pipe mounting  
- Installation in control panel  
Mounting set for aluminium field housing: Suitable for pipe mounting (3/4"...3") | DK8WM - * |
| Post mounting set for the Promass A sensor | Post mounting set for the Promass A | DK8AS - * * |
| Mounting set for the Promass A sensor | Mounting set for Promass A, comprising:  
- 2 process connections  
- Seals | DK8MS - * * * * * |
| Set of seals for sensor | For regular replacement of the seals of the Promass M and Promass A sensors. Set consists of two seals. | DKS - * * * |

### 8.3 Communication-specific accessories

<table>
<thead>
<tr>
<th>Accessory</th>
<th>Description</th>
<th>Order code</th>
</tr>
</thead>
<tbody>
<tr>
<td>HART Communicator DXR 375 handheld terminal</td>
<td>Handheld terminal for remote parameterisation and for obtaining measured values via the current output HART (4...20 mA). Contact your Endress+Hauser representative for more information.</td>
<td>DXR375 - * * *</td>
</tr>
</tbody>
</table>
## 8.4 Service-specific accessories

<table>
<thead>
<tr>
<th>Accessory</th>
<th>Description</th>
<th>Order code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applicator</td>
<td>Software for selecting and configuring flowmeters. Applicator can be downloaded from the Internet or ordered on CD-ROM for installation on a local PC. Contact your Endress+Hauser representative for more information.</td>
<td>DKA80 - *</td>
</tr>
</tbody>
</table>
| ToF Tool - Fieldtool Package | Modular software package consisting of the service program “ToF Tool” for configuration and diagnosis of ToF level measuring devices (time-of-flight measurement) and the "Fieldtool" service program for the configuration and diagnosis of Proline flowmeters. The Proline flowmeters are accessed via a service interface or via the service interface FXA 193. Contents of the “ToF Tool – Fieldtool Package”:  
  - Commissioning, maintenance analysis  
  - Configuring flowmeters  
  - Service functions  
  - Visualisation of process data  
  - Trouble-shooting  
  - Controlling the “Fieldcheck” tester/simulator  
  Contact your Endress+Hauser representative for more information. | DXS10 - * * * * |
| Fieldcheck                | Tester/simulator for testing flowmeters in the field. When used in conjunction with the “ToF Tool – Fieldtool Package” software package, test results can be imported into a database, printed and used for official certification. Contact your Endress+Hauser representative for more information. | 50098801   |
9 Trouble-shooting

9.1 Trouble-shooting instructions

Always start trouble-shooting with the following checklist if faults occur after commissioning or during operation. The routine takes you directly to the cause of the problem and the appropriate remedial measures.

<table>
<thead>
<tr>
<th>Check the display</th>
<th></th>
</tr>
</thead>
</table>
| No display visible and no output signals present. | 1. Check the supply voltage → Terminals 1, 2  
2. Check device fuse → Page 100  
85...260 V AC: 0.8 A slow-blow / 250 V  
20...55 V AC and 16...62 V DC: 2 A slow-blow / 250 V  
3. Measuring electronics defective → order spare parts → Page 95 |
| No display visible, but output signals are present. | 1. Check whether the ribbon-cable connector of the display module is correctly plugged into the amplifier board → Page 95 ff.  
2. Display module defective → order spare parts → Page 95  
3. Measuring electronics defective → order spare parts → Page 95 |
| Display texts are in a foreign language. | Switch off power supply. Press and hold down both the \( \text{P} \) keys and switch on the measuring device. The display text will appear in English (default) and is displayed at maximum contrast. |
| Measured value indicated, but no signal at the current or pulse output | Measuring electronics defective → order spare parts → Page 95 |

▼

Error messages on display

Errors that occur during commissioning or measuring are displayed immediately. Error messages consist of a variety of icons. The meanings of these icons are as follows (example):

- Type of error: \( S = \) System error, \( P = \) Process error
- Error message type: \( \text{!} = \) Fault message, \( \text{¡} = \) Notice message
- \( \text{MEDIUM INHOM.} = \) Error designation, e.g. fluid is not homogeneous
- \( 03:00:05 = \) Duration of error occurrence (in hours, minutes and seconds)
- \( \#702 = \) Error number

Caution!

- See the information on → Page 39.
- The measuring system interprets simulations and positive zero return as system errors, but displays them as notice message only.

Error number:

- No. 001 - 399  
  System error (device error) has occurred → Page 86
- No. 501 - 699

Error number:

- No. 400 - 499  
  Process error (application error) has occurred → Page 91
- No. 700 - 799

▼

Other error (without error message)

Some other error has occurred.  
Diagnosis and rectification → Page 93
### 9.2 System error messages

Serious system errors are **always** recognised by the instrument as “Fault message”, and are shown as a lightning flash (\(\mathbf{\text{\textregistered}}\)) on the display! Fault messages immediately affect the inputs and outputs. Simulations and positive zero return, on the other hand, are classed and displayed as “Notice messages”.

![Caution!](image)

In the event of a serious fault, a flowmeter might have to be returned to the manufacturer for repair. Important procedures must be carried out before you return a flowmeter to Endress+Hauser. → Page 8

Always enclose a duly completed "Declaration of contamination" form. You will find a preprinted blank of this form at the back of this manual.

Note!
- The listed error message types below correspond to the factory setting.
- Also observe the information on the following pages: → Page 39

<table>
<thead>
<tr>
<th>No.</th>
<th>Error message / Type</th>
<th>Cause</th>
<th>Remedy / spare part</th>
</tr>
</thead>
<tbody>
<tr>
<td>S</td>
<td>System error</td>
<td></td>
<td></td>
</tr>
<tr>
<td>!</td>
<td>Fault message (with an effect on the inputs and outputs)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>!</td>
<td>Notice message (without any effect on the inputs and outputs)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### No. # 0xx → Hardware error

<table>
<thead>
<tr>
<th>No.</th>
<th>Error message / Type</th>
<th>Cause</th>
<th>Remedy / spare part</th>
</tr>
</thead>
<tbody>
<tr>
<td>001</td>
<td>S: CRITICAL FAILURE</td>
<td>Serious device error</td>
<td>Replace the amplifier board. Spare part → Page 95</td>
</tr>
<tr>
<td></td>
<td># 001</td>
<td></td>
<td></td>
</tr>
<tr>
<td>011</td>
<td>S: AMP HW EEPROM</td>
<td>Amplifier: Defective EEPROM</td>
<td>Replace the amplifier board. Spare parts → Page 95</td>
</tr>
<tr>
<td></td>
<td># 011</td>
<td></td>
<td></td>
</tr>
<tr>
<td>012</td>
<td>S: AMP SW EEPROM</td>
<td>Measuring amplifier: Error when accessing data of the EEPROM</td>
<td>The EEPROM data blocks in which an error has occurred are displayed in the &quot;TROUBLE-SHOOTING&quot; function. Press Enter to acknowledge the errors in question; default values are automatically inserted instead of the errored parameter values. Note! The measuring device has to be restarted if an error has occurred in a totalizer block [see error No. 111 / CHECKSUM TOTAL].</td>
</tr>
<tr>
<td></td>
<td># 012</td>
<td></td>
<td></td>
</tr>
<tr>
<td>031</td>
<td>S: SENSOR HW DAT</td>
<td>Sensor DAT: 1. S-DAT is defective. 2. S-DAT is not plugged into the amplifier board or is missing.</td>
<td>1. Replace the S-DAT. Spare parts → Page 95 Check the spare part set number to ensure that the new, replacement DAT is compatible with the measuring electronics. 2. Plug the S-DAT into the amplifier board → Page 96 → Page 98</td>
</tr>
<tr>
<td></td>
<td># 031</td>
<td></td>
<td></td>
</tr>
<tr>
<td>032</td>
<td>S: SENSOR SW DAT</td>
<td>Sensor DAT: Error accessing the calibration values stored in the S-DAT.</td>
<td>1. Check whether the S-DAT is correctly plugged into the amplifier board → Page 96 → Page 98 2. Replace the S-DAT if it is defective. Spare parts → Page 95 Before replacing the DAT, check that the new, replacement DAT is compatible with the measuring electronics. Check the:  – Spare part set number  – Hardware revision code 3. Replace measuring electronics boards if necessary. Spare parts → Page 95</td>
</tr>
<tr>
<td></td>
<td># 032</td>
<td></td>
<td></td>
</tr>
<tr>
<td>041</td>
<td>S: TRANSM. HW DAT</td>
<td>Sensor DAT: 1. T-DAT is defective. 2. T-DAT is not plugged into the amplifier board or is missing.</td>
<td>1. Replace the T-DAT. Spare parts → Page 95 Check the spare part set number to ensure that the new, replacement DAT is compatible with the measuring electronics. 2. Plug the T-DAT into the amplifier board → Page 96 → Page 98</td>
</tr>
<tr>
<td></td>
<td># 041</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No.</td>
<td>Error message / Type</td>
<td>Cause</td>
<td>Remedy / spare part</td>
</tr>
<tr>
<td>-------</td>
<td>----------------------</td>
<td>--------------------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>042</td>
<td>S: TRANSM. SW DAT</td>
<td>Sensor DAT: Error accessing the calibration values stored in the S-DAT.</td>
<td>1. Check whether the T-DAT is correctly plugged into the amplifier board → Page 96 → Page 98</td>
</tr>
<tr>
<td></td>
<td># 042</td>
<td></td>
<td>2. Replace the T-DAT if it is defective. Spare parts → Page 95</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Before replacing the DAT, check that the new, replacement DAT is compatible with the measuring electronics. Check the:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Spare part set number</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Hardware revision code</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3. Replace measuring electronics boards if necessary. Spare parts → Page 95</td>
</tr>
<tr>
<td>051</td>
<td>S: A / C COMPATIB.</td>
<td>The I/O board and the amplifier board are not compatible.</td>
<td>Use only compatible modules and boards. Check the compatibility of the modules used.</td>
</tr>
<tr>
<td></td>
<td># 051</td>
<td></td>
<td>Check the:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Spare part set number</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Hardware revision code</td>
</tr>
<tr>
<td>061</td>
<td>S: HW F-CHIP</td>
<td>Transmitter F-Chip: 1. F-Chip is defective.</td>
<td>1. Replace the F-Chip.</td>
</tr>
<tr>
<td></td>
<td># 061</td>
<td>2. F-Chip is not plugged into the I/O board or is missing.</td>
<td>Accessories &lt;Undefined Cross-Reference&gt;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2. Plug the F-Chip into the I/O board → Page 96 → Page 98</td>
</tr>
<tr>
<td>111</td>
<td>S: CHECKSUM TOTAL.</td>
<td>Totalizer checksum error</td>
<td>1. Restart the measuring device</td>
</tr>
<tr>
<td></td>
<td># 111</td>
<td></td>
<td>2. Replace the amplifier board if necessary. Spare parts → Page 95</td>
</tr>
<tr>
<td>121</td>
<td>S: A / C COMPATIB.</td>
<td>Due to different software versions, I/O board and amplifier board are only partially compatible (possibly restricted functionality).</td>
<td>Module with lower software version has either to be actualized by ToF Tool – Fieldtool Package with the required software version or the module has to be replaced. Spare parts → Page 95</td>
</tr>
<tr>
<td></td>
<td># 121</td>
<td></td>
<td>Note!</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- This message is only listed in the error history.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Nothing is displayed on the display.</td>
</tr>
<tr>
<td>205</td>
<td>S: LOAD T-DAT</td>
<td>Transmitter DAT: Data backup (downloading) to TDAT failed, or error when accessing (uploading) the calibration values stored in the TDAT.</td>
<td>1. Check whether the T-DAT is correctly plugged into the amplifier board → Page 96 → Page 98</td>
</tr>
<tr>
<td></td>
<td># 205</td>
<td></td>
<td>2. Replace the T-DAT if it is defective. Spare parts → Page 95</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Before replacing the DAT, check that the new, replacement DAT is compatible with the measuring electronics. Check the:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Spare part set number</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Hardware revision code</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3. Replace measuring electronics boards if necessary. Spare parts → Page 95</td>
</tr>
<tr>
<td>206</td>
<td>S: SAVE T-DAT</td>
<td></td>
<td>1. Check whether the T-DAT is correctly plugged into the amplifier board → Page 96 → Page 98</td>
</tr>
<tr>
<td></td>
<td># 206</td>
<td></td>
<td>2. Replace the T-DAT if it is defective. Spare parts → Page 95</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Before replacing the DAT, check that the new, replacement DAT is compatible with the measuring electronics. Check the:</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>- Spare part set number</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Hardware revision code</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3. Replace measuring electronics boards if necessary. Spare parts → Page 95</td>
</tr>
<tr>
<td>251</td>
<td>S: COMMUNICATION I/ O</td>
<td>Internal communication fault on the amplifier board.</td>
<td>Remove the amplifier board. Spare parts → Page 95</td>
</tr>
<tr>
<td></td>
<td># 251</td>
<td></td>
<td>1. Change the upper or lower limit setting, as applicable.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2. Increase or reduce flow, as applicable.</td>
</tr>
<tr>
<td>261</td>
<td>S: COMMUNICATION I/ O</td>
<td>No data reception between amplifier and I/O board or faulty internal data transfer.</td>
<td>Check the BUS contacts</td>
</tr>
<tr>
<td></td>
<td># 261</td>
<td></td>
<td>1. Change the upper or lower limit setting, as applicable.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2. Increase or reduce flow, as applicable.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Recommendations in the event of fault category = FAULT MESSAGE (&gt;):</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Configure the fault response of the output to “ACTUAL VALUE”, so that the temporary buffer can be cleared.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>→ Page 95</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Clear the temporary buffer by the measures described under Item 1.</td>
</tr>
</tbody>
</table>

No. # 1xx → Software error

<table>
<thead>
<tr>
<th>No.</th>
<th>Error message / Type</th>
<th>Cause</th>
<th>Remedy / spare part</th>
</tr>
</thead>
<tbody>
<tr>
<td>111</td>
<td>S: CHECKSUM TOTAL.</td>
<td>Totalizer checksum error</td>
<td>1. Restart the measuring device</td>
</tr>
<tr>
<td></td>
<td># 111</td>
<td></td>
<td>2. Replace the amplifier board if necessary. Spare parts → Page 95</td>
</tr>
<tr>
<td>121</td>
<td>S: A / C COMPATIB.</td>
<td>Due to different software versions, I/O board and amplifier board are only partially compatible (possibly restricted functionality).</td>
<td>Module with lower software version has either to be actualized by ToF Tool – Fieldtool Package with the required software version or the module has to be replaced. Spare parts → Page 95</td>
</tr>
<tr>
<td></td>
<td># 121</td>
<td></td>
<td>Note!</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- This message is only listed in the error history.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Nothing is displayed on the display.</td>
</tr>
</tbody>
</table>

No. # 2xx → Error in DAT / no communication

<table>
<thead>
<tr>
<th>No.</th>
<th>Error message / Type</th>
<th>Cause</th>
<th>Remedy / spare part</th>
</tr>
</thead>
<tbody>
<tr>
<td>205</td>
<td>S: LOAD T-DAT</td>
<td>Transmitter DAT: Data backup (downloading) to TDAT failed, or error when accessing (uploading) the calibration values stored in the TDAT.</td>
<td>1. Check whether the T-DAT is correctly plugged into the amplifier board → Page 96 → Page 98</td>
</tr>
<tr>
<td></td>
<td># 205</td>
<td></td>
<td>2. Replace the T-DAT if it is defective. Spare parts → Page 95</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Before replacing the DAT, check that the new, replacement DAT is compatible with the measuring electronics. Check the:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Spare part set number</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Hardware revision code</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3. Replace measuring electronics boards if necessary. Spare parts → Page 95</td>
</tr>
<tr>
<td>206</td>
<td>S: SAVE T-DAT</td>
<td></td>
<td>1. Check whether the T-DAT is correctly plugged into the amplifier board → Page 96 → Page 98</td>
</tr>
<tr>
<td></td>
<td># 206</td>
<td></td>
<td>2. Replace the T-DAT if it is defective. Spare parts → Page 95</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Before replacing the DAT, check that the new, replacement DAT is compatible with the measuring electronics. Check the:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Spare part set number</td>
</tr>
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<td></td>
<td>- Hardware revision code</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>3. Replace measuring electronics boards if necessary. Spare parts → Page 95</td>
</tr>
<tr>
<td>251</td>
<td>S: COMMUNICATION I/ O</td>
<td>Internal communication fault on the amplifier board.</td>
<td>Remove the amplifier board. Spare parts → Page 95</td>
</tr>
<tr>
<td></td>
<td># 251</td>
<td></td>
<td>1. Change the upper or lower limit setting, as applicable.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2. Increase or reduce flow, as applicable.</td>
</tr>
<tr>
<td>261</td>
<td>S: COMMUNICATION I/ O</td>
<td>No data reception between amplifier and I/O board or faulty internal data transfer.</td>
<td>Check the BUS contacts</td>
</tr>
<tr>
<td></td>
<td># 261</td>
<td></td>
<td>1. Change the upper or lower limit setting, as applicable.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2. Increase or reduce flow, as applicable.</td>
</tr>
</tbody>
</table>

No. # 3xx → System limits exceeded

<table>
<thead>
<tr>
<th>No.</th>
<th>Error message / Type</th>
<th>Cause</th>
<th>Remedy / spare part</th>
</tr>
</thead>
<tbody>
<tr>
<td>339</td>
<td>S: STACK CUR OUT n</td>
<td>The temporarily buffered flow portions (measuring mode for pulsating flow) could not be cleared or output within 60 seconds.</td>
<td>1. Change the upper or lower limit setting, as applicable.</td>
</tr>
<tr>
<td></td>
<td># 339...342</td>
<td></td>
<td>2. Increase or reduce flow, as applicable.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Recommendations in the event of fault category = FAULT MESSAGE (&gt;):</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Configure the fault response of the output to “ACTUAL VALUE”, so that the temporary buffer can be cleared.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>→ Page 95</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Clear the temporary buffer by the measures described under Item 1.</td>
</tr>
<tr>
<td>343</td>
<td>S: STACK FREQ. OUT n</td>
<td></td>
<td>1. Change the upper or lower limit setting, as applicable.</td>
</tr>
<tr>
<td></td>
<td># 343...346</td>
<td></td>
<td>2. Increase or reduce flow, as applicable.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Recommendations in the event of fault category = FAULT MESSAGE (&gt;):</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Configure the fault response of the output to “ACTUAL VALUE”, so that the temporary buffer can be cleared.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>→ Page 95</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Clear the temporary buffer by the measures described under Item 1.</td>
</tr>
</tbody>
</table>
## Trouble-shooting Proline Promass 83

### S: STACK PULSE OUT n t: # 347...350

The temporarily buffered flow portions (measuring mode for pulsating flow) could not be cleared or output within 60 seconds.

1. Increase the setting for pulse weighting
2. Increase the max. pulse frequency, if the totalizer can handle a higher number of pulses.
3. Increase or reduce flow, as applicable.

Recommendations in the event of fault category = FAULT MESSAGE (\(\$\)):
- Configure the fault response of the output to “ACTUAL VALUE”, so that the temporary buffer can be cleared.
- Clear the temporary buffer by the measures described under Item 1.

### S: CURRENT RANGE n t: # 351...354

Current output:
The actual value for the flow lies outside the set limits.

1. Change the upper or lower limit setting, as applicable.
2. Increase or reduce flow, as applicable.

### S: FREQ. RANGE n t: # 355...358

Frequency output:
The actual value for the flow lies outside the set limits.

1. Change the upper or lower limit setting, as applicable.
2. Increase or reduce flow, as applicable.

### S: PULSE RANGE t: # 359...362

Pulse output:
Pulse output frequency is out of range.

1. Increase the setting for pulse weighting
2. When selecting the pulse width, choose a value that can still be processed by a connected counter (e.g. mechanical counter, PLC etc.).

   **Determine the pulse width:**
   - Variant 1: Enter the minimum duration that a pulse must be present at the connected counter to ensure its registration.
   - Variant 2: Enter the maximum (pulse) frequency as the half “reciprocal value” that a pulse must be present at the connected counter to ensure its registration.

   **Example:**
   The maximum input frequency of the connected counter is 10 Hz. The pulse width to be entered is:

   \[
   \frac{1}{2 \times 10Hz} = 50ms
   \]

3. Reduce flow.

### S: CUR. IN RANGE t: # 363

Current input:
The actual value for the current lies outside the set limits.

1. Change set lower-range or upper-range value.
2. Check settings of the external sensor.

### S: FREQ. LIM t: # 379...380

The measuring tube oscillation frequency is outside the permitted range.

Causen:
- Change the upper or lower limit setting, as applicable.
- Increase or reduce flow, as applicable.

Contact your E+H service organisation.

### S: FLUID TEMP. MIN. t: # 381

The temperature sensor on the measuring tube is likely defective.

Check the following electrical connections before you contact your E+H service organisation:
- Verify that the sensor signal cable connector is correctly plugged into the amplifier board
  - Page 96 → Page 98.
- Remote version:
  - Check sensor and transmitter terminal connections No. 9 and 10.
  - Page 24

### S: FLUID TEMP. MAX. t: # 382

The temperature sensor on the measuring tube is likely defective.

Check the following electrical connections before you contact your E+H service organisation:
- Verify that the sensor signal cable connector is correctly plugged into the amplifier board
  - Page 96 → Page 98.
- Remote version:
  - Check sensor and transmitter terminal connections No. 11 and 12.
  - Page 24

### S: CARR. TEMP. MIN. t: # 383

The temperature sensor on the carrier tube is likely defective.

Check the following electrical connections before you contact your E+H service organisation:
- Verify that the sensor signal cable connector is correctly plugged into the amplifier board
  - Page 96 → Page 98.
- Remote version:
  - Check sensor and transmitter terminal connections No. 11 and 12.
  - Page 24

### S: CARR. TEMP. MAX. t: # 384

Check the following electrical connections before you contact your E+H service organisation:
- Verify that the sensor signal cable connector is correctly plugged into the amplifier board
  - Page 96 → Page 98.
- Remote version:
  - Check sensor and transmitter terminal connections No. 11 and 12.
  - Page 24
<table>
<thead>
<tr>
<th>No.</th>
<th>Error message / Type</th>
<th>Cause</th>
<th>Remedy / spare part</th>
</tr>
</thead>
</table>
| 385 | S: INLSENS.DEF. #: # 385 | One of the measuring tube exciter coils (inlet) is likely defective. | Check the following electrical connections before you contact your E+H service organisation:  
- Verify that the sensor signal cable connector is correctly plugged into the amplifier board → Page 96  
- Remote version: Check sensor and transmitter terminal connections No. 4, 5, 6 and 7. → Page 24 |
| 386 | S: OUTFSENS.DEF. #: # 386 | One of the measuring tube exciter coils (outlet) is likely defective. | |
| 387 | S: SENASY.EXCEED #: # 387 | Measuring pipe excitation coil is probably faulty. | |
| 388 | S: AMP. FAULT #: # 388...390 | Amplifier error | Contact your E+H service organisation. |

No. # 5xx → Application error

<table>
<thead>
<tr>
<th>No.</th>
<th>Error message / Type</th>
<th>Cause</th>
<th>Remedy / spare part</th>
</tr>
</thead>
<tbody>
<tr>
<td>501</td>
<td>S: SW.-UPDATE ACT. #: # 501</td>
<td>New amplifier or communication (I/O module) software version is loaded. Currently no other functions are possible.</td>
<td>Wait until process is finished. The device will restart automatically.</td>
</tr>
<tr>
<td>502</td>
<td>S: UP-/DOWNLOAD ACT. #: # 502</td>
<td>Up- or downloading the device data via configuration program. Currently no other functions are possible.</td>
<td>Wait until process is finished.</td>
</tr>
<tr>
<td>571</td>
<td>S: BATCH RUNNING #: # 571</td>
<td>Batching is started and active (valves are open)</td>
<td>No measures needed (during the batching process some other functions may not be activated).</td>
</tr>
</tbody>
</table>
| 572 | S: BATCH HOLD #: # 572 | Batching has been interrupted (valves are closed) | 1. Continue batching with command “GO ON”.  
2. Interrupt batching with “STOP” command. |
| 586 | S: OSC. AMP. LIMIT #: # 586 | The fluid properties do not allow a continuation of the measurement.  
Causes:  
- Extremely high viscosity  
- Process fluid is very inhomogeneous (gas or solid content) | Change or improve process conditions. |
| 587 | S: TUBE OSC. NOT #: # 587 | Extreme process conditions exist. The measuring system can therefore not be started. | Change or improve process conditions. |
| 588 | S: GAIN RED.IMPOS #: # 588 | Overdriving of the internal analog to digital converter.  
Causes:  
- Cavitation  
- Extreme pressure pulses  
- High gas flow velocity  
A continuation of the measurement is no longer possible! | Change or improve process conditions, e.g. by reducing the flow velocity. |

No. # 6xx → Simulation mode active

<table>
<thead>
<tr>
<th>No.</th>
<th>Error message / Type</th>
<th>Cause</th>
<th>Remedy / spare part</th>
</tr>
</thead>
</table>
| 601 | S: POSITIVE ZERO RETURN #: # 601 | Positive zero return active.  
Caution! This message has the highest display priority. | Switch off positive zero return |
| 611 | S: SIM. CURR. OUT. n #: # 611...614 | Simulation current output active | |
| 621 | S: SIM. FREQ. OUT. n #: # 621...624 | Simulation frequency output active | Switch off simulation |
| 631 | S: SIM. PULSE n #: # 631...634 | Simulation pulse output active | Switch off simulation |
| 641 | S: SIM. STAT. OUT n #: # 641...644 | Simulation status output active | Switch off simulation |
| 651 | S: SIM. RELAY n #: # 651...654 | Simulation relay output active | Switch off simulation |
| 661 | S: SIM. CURR. IN n #: # 661...664 | Simulation current input active | Switch off simulation |
### Troubleshooting Proline Promass 83

#### 671-674

**S: SIM. STAT. IN n**
- **Error Message**: # 671-674
- **Description**: Simulation status input active
- **Remedy**: Switch off simulation

#### 691

**S: SIM. FAILSAFE**
- **Error Message**: # 691
- **Description**: Simulation of response to error (outputs) active
- **Remedy**: Switch off simulation

#### 692

**S: SIM. MEASURAND**
- **Error Message**: # 692
- **Description**: Simulation of measuring variables (e.g. mass flow)
- **Remedy**: Switch off simulation

#### 698

**S: DEV. TEST AKT.**
- **Error Message**: # 698
- **Description**: The measuring device is being checked on site via the test and simulation device.
- **Remedy**: –

#### # 8xx → Other error messages with software options (Coriolis flowmeter)

<table>
<thead>
<tr>
<th>No.</th>
<th>Error message / Type</th>
<th>Cause</th>
<th>Remedy / spare part</th>
</tr>
</thead>
<tbody>
<tr>
<td>800</td>
<td>S: M. FL. DEV. LIMIT</td>
<td>Advanced Diagnostics: The mass flow is outside the limit value, set in the corresponding diagnosis function.</td>
<td>–</td>
</tr>
<tr>
<td>801</td>
<td>S: DENS. DEV. LIMIT</td>
<td>Advanced Diagnostics: The density is outside the limit value, set in the corresponding diagnosis function.</td>
<td>–</td>
</tr>
<tr>
<td>802</td>
<td>S: REF. D. DEV. LIM.</td>
<td>Advanced Diagnostics: The reference density is outside the limit value, set in the corresponding diagnosis function.</td>
<td>–</td>
</tr>
<tr>
<td>803</td>
<td>S: TEMP. DEV. LIMIT</td>
<td>Advanced Diagnostics: The temperature is outside the limit value, set in the corresponding diagnosis function.</td>
<td>–</td>
</tr>
<tr>
<td>804</td>
<td>S: T. DAMP. DEV. LIM.</td>
<td>Advanced Diagnostics: The tube damping is outside the limit value, set in the corresponding diagnosis function.</td>
<td>–</td>
</tr>
<tr>
<td>805</td>
<td>S: E. D. SEN. DEV. LIM.</td>
<td>Advanced Diagnostics: The electrodynamic sensor is outside the limit value, set in the corresponding diagnosis function.</td>
<td>–</td>
</tr>
</tbody>
</table>
### 9.3 Process error messages

Process errors can be defined as either “Fault” or “Notice” messages and can thereby be weighted differently. This is specified via the function matrix (→ “Description of Device Functions” manual).

Note!
- The listed error message types below correspond to the factory setting.
- Also observe the information on the following pages: → Page 39 → Page 94

<table>
<thead>
<tr>
<th>No.</th>
<th>Error message / Type</th>
<th>Cause</th>
<th>Remedy / spare part</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>Process error</td>
<td></td>
<td></td>
</tr>
<tr>
<td>↓</td>
<td>Fault message (with an effect on the inputs and outputs)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>!</td>
<td>Notice message (without an effect on the inputs and outputs)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| 471 | P: > BATCH TIME     | The maximum permitted batching time was exceeded. | 1. Increase flow rate  
   ↓: # 471 | 2. Check valve (opening)  
   !: # 471 | 3. Adjust time setting to changed batch quantity  
   Note! If the errors listed above occur, these are displayed in the Home position flashing continuously.  
   General: These error messages can be reset by configuring any batching parameter. It is sufficient to confirm with the key and then the key.  
   Batching via status input: The error message can be reset by means of a pulse. Another pulse then restarts the batching.  
   Batching via operating keys (soft keys) The error message is reset by pressing the START key. Pressing the START key a second time starts the batching process.  
   Batching via the BATCHING PROCESS function (7260): The error message can be reset by pressing the STOP, START, HOLD or GO ON keys. Pressing the START key a second time starts the batching process. |
| 472 | P: >< BATCH QUANTITY | EPD calibration not possible as the fluid conductivity is too low or too high. | Underbatching:  
   ↓: # 472 | 1. Increase fixed correction quantity.  
   !: # 472 | 2. Valve closes too quickly with active after run correction. Enter smaller after run as mean value.  
   Note! If the batching quantity changes, the minimum batching quantity must be adjusted.  
   Overbatching:  
   1. Reduce fixed correction quantity.  
   2. Valve closes too slowly with active after run correction. Enter larger after run as mean value.  
   3. If the batching quantity changes, the maximum batching quantity must be adjusted.  
   Note! Please observe Note in error message No. 471 |
| 473 | P: PROGRESS NOTE    | End of filling process approaching. The running filling process has exceeded the predefined batch quantity point for the display warning message. | No measures required (if necessary prepare to replace container). |
| 474 | P: MAX. FLOW        | Maximum flow value entered is overshot. | Reduce the flow value  
   ↓: # 474 | Note! Please observe Note in error message No. 471 |
<table>
<thead>
<tr>
<th>No.</th>
<th>Error message / Type</th>
<th>Cause</th>
<th>Remedy / spare part</th>
</tr>
</thead>
<tbody>
<tr>
<td>700</td>
<td>P: EMPTY PIPE</td>
<td>The process fluid density is outside the upper or lower limit values set in the “EPD” function. Causes: – Air in the measuring tube – Partly filled measuring tube</td>
<td>1. Ensure that there is no gas content in the process liquid. 2. Adapt the values in the “EPD” function to the current process conditions.</td>
</tr>
<tr>
<td>701</td>
<td>P: EXC. CURR. LIM</td>
<td>The maximum current value for the measuring tube exciter coils has been reached, since certain process fluid characteristics are extreme, e.g. high gas or solid content. The instrument continues to work correctly.</td>
<td>In particular with outgassing fluids and/or increased gas content, the following measures are recommended to increase system pressure: 1. Install the instrument at the outlet side of a pump. 2. Install the instrument at the lowest point of an ascending pipeline. 3. Install a flow restriction, e.g. reducer or orifice plate, downstream from the instrument.</td>
</tr>
<tr>
<td>702</td>
<td>P: FLUID INHOM.</td>
<td>Frequency control is not stable, due to inhomogeneous process fluid, e.g. gas or solid content.</td>
<td></td>
</tr>
<tr>
<td>703</td>
<td>P: NOISE LIM. CH0</td>
<td>Overdriving of the internal analog to digital converter. Causes: – Cavitation – Extreme pressure pulses – High gas flow velocity A continuation of the measurement is still possible!</td>
<td>Change or improve process conditions, e.g. by reducing the flow velocity.</td>
</tr>
<tr>
<td>704</td>
<td>P: NOISE LIM. CH1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>705</td>
<td>P: FLOW LIMIT</td>
<td>The mass flow is too high. The electronics’ measuring range will be exceeded.</td>
<td>Reduce flow</td>
</tr>
<tr>
<td>731</td>
<td>P: ADJ. ZERO FAIL</td>
<td>The zero point adjustment is not possible or has been cancelled.</td>
<td>Make sure that zero point adjustment is carried out at “zero flow” only (v = 0 , \text{m/s}). <strong>All Promass measuring devices are calibrated with state-of-the-art technology. The zero point obtained in this way is printed on the nameplate. Calibration takes place under reference operating conditions. → Page 106 on page 78</strong></td>
</tr>
</tbody>
</table>
## 9.4 Process errors without messages

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Rectification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comment: You may have to change or correct certain settings of the function matrix in order to rectify faults. The functions outlined below, such as DISPLAY DAMPING, for example, are described in detail in the “Description of Device Functions” manual.</td>
<td></td>
</tr>
<tr>
<td>Measured value reading fluctuates even though flow is steady.</td>
<td>1. Check the fluid for presence of gas bubbles.</td>
</tr>
<tr>
<td></td>
<td>2. “TIME CONSTANT” function → increase value (→ OUTPUTS / CURRENT OUTPUT / CONFIGURATION)</td>
</tr>
<tr>
<td></td>
<td>3. “DISPLAY DAMPING” function → increase value (→ USER INTERFACE / CONTROL / BASIC CONFIGURATION)</td>
</tr>
<tr>
<td>Flow values are negative, even though the fluid is flowing forwards through the pipe.</td>
<td>Change the setting in the “INSTALLATION DIRECTION SENSOR” function accordingly</td>
</tr>
<tr>
<td>Measured-value reading or measured-value output pulsates or fluctuates, e.g. because of reciprocating pump, peristaltic pump, diaphragm pump or pump with similar delivery characteristic.</td>
<td>Run the “Pulsating Flow” Quick Setup. *** ‘Certain types of pump such as reciprocating, peristaltic and cam-type pumps, for example, create a flow characterised by severe periodic fluctuations. Negative flows can occur with pumps of these types on account of the closing volume of the valves or valve leaks.’ on page 58 *** If the problem persists despite these measures, a pulsation damper will have to be installed between pump and measuring device.</td>
</tr>
<tr>
<td>There are differences between the flowmeter’s internal totalizer and the external metering device.</td>
<td>This symptom is due primarily to backflow in the piping, because the pulse output cannot subtract in the “STANDARD” or “SYMMETRY” measuring modes. The problem can be solved as follows: Allow for flow in both directions. Set the “MEASURING MODE” function to “Pulsating Flow” for the pulse output in question.</td>
</tr>
<tr>
<td>Measured value reading shown on display, even though the fluid is at a standstill and the measuring tube is full.</td>
<td>1. Check the fluid for presence of gas bubbles.</td>
</tr>
<tr>
<td></td>
<td>2. Activate the “ON-VAL. LF-CUTOFF” function, i.e. enter or increase the value for the low flow cut off (→ BASIC FUNCTION / PROCESSPARAMETER / CONFIGURATION).</td>
</tr>
</tbody>
</table>
9.5 Response of outputs to errors

Note!
The failsafe mode of totalizers, current, pulse and frequency outputs can be customised by means of various functions in the function matrix. You will find detailed information on these procedures in the “Description of Device Functions” manual.

You can use positive zero return to set the signals of the current, pulse and status outputs to their fallback value, for example when measuring has to be interrupted while a pipe is being cleaned. This function takes priority over all other device functions. Simulations, for example, are suppressed.

<table>
<thead>
<tr>
<th>Failsafe mode of outputs and totalizers</th>
<th>Process/system error is present</th>
<th>Positive zero return is activated</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Current output</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MIN. CURRENT</td>
<td>The current output will be set to the lower value of the signal on alarm level depending on the setting selected in the CURRENT SPAN (see the “Description of Device Functions” manual).</td>
<td>Output signal corresponds to “zero flow”</td>
</tr>
<tr>
<td>MAX. CURRENT</td>
<td>The current output will be set to the higher value of the signal on alarm level depending on the setting selected in the CURRENT SPAN (see the “Description of Device Functions” manual).</td>
<td></td>
</tr>
<tr>
<td>HOLD VALUE</td>
<td>Measured value display on the basis of the last saved value preceding occurrence of the fault.</td>
<td></td>
</tr>
<tr>
<td>ACTUAL VALUE</td>
<td>Measured value display on the basis of the current flow measurement. The fault is ignored.</td>
<td></td>
</tr>
<tr>
<td><strong>Pulse output</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FALLBACK VALUE</td>
<td>Signal output → no pulses</td>
<td>Output signal corresponds to “zero flow”</td>
</tr>
<tr>
<td>HOLD VALUE</td>
<td>Last valid value (preceding occurrence of the fault) is output.</td>
<td></td>
</tr>
<tr>
<td>ACTUAL VALUE</td>
<td>Fault is ignored, i.e. normal measured value output on the basis of ongoing flow measurement.</td>
<td></td>
</tr>
<tr>
<td><strong>Frequency output</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FALLBACK VALUE</td>
<td>Signal output → 0 Hz</td>
<td>Output signal corresponds to “zero flow”</td>
</tr>
<tr>
<td>FAILSAFE VALUE</td>
<td>Output of the frequency specified in the FAILSAFE VALUE function.</td>
<td></td>
</tr>
<tr>
<td>HOLD VALUE</td>
<td>Last valid value (preceding occurrence of the fault) is output.</td>
<td></td>
</tr>
<tr>
<td>ACTUAL VALUE</td>
<td>Fault is ignored, i.e. normal measured value output on the basis of ongoing flow measurement.</td>
<td></td>
</tr>
<tr>
<td><strong>Totalizer</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STOP</td>
<td>The totalizers are paused until the error is rectified.</td>
<td>Totalizer stops</td>
</tr>
<tr>
<td>ACTUAL VALUE</td>
<td>The fault is ignored. The totalizer continues to count in accordance with the current flow value.</td>
<td></td>
</tr>
<tr>
<td>HOLD VALUE</td>
<td>The totalizers continue to count the flow in accordance with the last valid flow value (before the error occurred).</td>
<td></td>
</tr>
<tr>
<td><strong>Relay output</strong></td>
<td>In event of fault or power supply failure: relay → de-energised</td>
<td>No effect on the relay output</td>
</tr>
<tr>
<td></td>
<td>The “Description of Device Functions” manual contains detailed information on relay switching response for various configurations such as error message, flow direction, EPD, full scale value, etc.</td>
<td></td>
</tr>
</tbody>
</table>
9.6 Spare parts

The previous sections contain a detailed trouble-shooting guide. → Page 85 ff.
The measuring device, moreover, provides additional support in the form of continuous self-diagnosis and error messages.
Fault rectification can entail replacing defective components with tested spare parts. The illustration below shows the available scope of spare parts.

Note!
You can order spare parts directly from your E+H service organisation by providing the serial number printed on the transmitter's nameplate. → Page 9

Spare parts are shipped as sets comprising the following parts:
- Spare part
- Additional parts, small items (threaded fasteners, etc.)
- Mounting instructions
- Packaging

Fig. 42: Spare parts for transmitter 83 (field and wall-mount housings)

1 Power unit board (85...260 V AC, 20...55 V AC, 16...62 V DC)
2 Amplifier board
3 I/O board (COM module), flexible assignment
4 → Page 83 ff. Pluggable input/output submodules; ordering structure
5 I/O board (COM module), permanent assignment
6 S-DAT (sensor data memory)
7 T-DAT (transmitter data memory)
8 F-Chip (function chip for optional software)
9 Display module
9.6.1 Removing and installing printed circuit boards

Field housing

Warning!
- Risk of electric shock. Exposed components carry dangerous voltages. Make sure that the power supply is switched off before you remove the cover of the electronics compartment.
- Risk of damaging electronic components (ESD protection). Static electricity can damage electronic components or impair their operability. Use a workplace with a grounded working surface purposely built for electrostatically sensitive devices!
- If you cannot guarantee that the dielectric strength of the device is maintained in the following steps, then an appropriate inspection must be carried out in accordance with the manufacturer’s specifications.
- When connecting Ex-certified devices, see the notes and diagrams in the Ex-specific supplement to these Operating Instructions.

Caution!
Use only original Endress+Hauser parts.

Fig. 43, installation and removal:

1. Unscrew cover of the electronics compartment from the transmitter housing.
2. Remove the local display (1) as follows:
   - Press in the latches (1.1) at the side and remove the display module.
   - Disconnect the ribbon cable (1.2) of the display module from the amplifier board.
3. Remove the screws and remove the cover (2) from the electronics compartment.
4. Remove power unit board (4) and I/O board (6, 7):
   Insert a thin pin into the hole (3) provided for the purpose and pull the board clear of its holder.
5. Remove submodules (6.1):
   No tools are required for removing the submodules (inputs/outputs) from the I/O board.
   Installation is also a no-tools operation.
   Caution!
   Only certain combinations of submodules on the I/O board are permissible. → Page 27
   The individual slots are marked and correspond to certain terminals in the connection compartment of the transmitter:
   Slot “INPUT / OUTPUT 2” = Terminals 24 / 25
   Slot “INPUT / OUTPUT 3” = Terminals 22 / 23
   Slot “INPUT / OUTPUT 4” = Terminals 20 / 21
6. Remove amplifier board (5):
   - Disconnect the plug of the sensor signal cable (5.1) including S-DAT (5.3) from the board.
   - Gently disconnect the plug of the excitation current cable (5.2) from the board, i.e. without moving it back and forward.
   - Insert a thin pin into the hole (3) provided for the purpose and pull the board clear of its holder.
7. Installation is the reverse of the removal procedure.
Fig. 43: Field housing: removing and installing printed circuit boards

1 Local display
1.1 Latch
1.2 Ribbon cable (display module)
2 Screws of electronics compartment cover
3 Aperture for installing/removing boards
4 Power unit board
5 Amplifier board
5.1 Signal cable (sensor)
5.2 Excitation current cable (sensor)
5.3 S-DAT (sensor data memory)
5.4 T-DAT (transmitter data memory)
6 I/O board (flexible assignment)
6.1 F-Chip (function chip for optional software)
6.2 Pluggable submodules (status input and current input, current output, frequency output and relay output)
7 I/O board (permanent assignment)
7.1 F-Chip (function chip for optional software)
Wall-mount housing

Warning!

- Risk of electric shock. Exposed components carry dangerous voltages. Make sure that the power supply is switched off before you remove the cover of the electronics compartment.
- Risk of damaging electronic components (ESD protection). Static electricity can damage electronic components or impair their operability. Use a workplace with a grounded working surface purposely built for electrostatically sensitive devices!
- If you cannot guarantee that the dielectric strength of the device is maintained in the following steps, then an appropriate inspection must be carried out in accordance with the manufacturer’s specifications.
- When connecting Ex-certified devices, see the notes and diagrams in the Ex-specific supplement to these Operating Instructions.

Caution!

Use only original Endress+Hauser parts.

Fig. 44, installation and removal:

1. Remove the screws and open the hinged cover (1) of the housing.
2. Remove the screws securing the electronics module (2). Then push up electronics module and pull it as far as possible out of the wall-mount housing.
3. Disconnect the following cable plugs from amplifier board (7):
   - Sensor signal cable plug (7.1) including S-DAT (7.3)
   - Unplug excitation current cable (7.2). Gently disconnect the plug, i.e. without moving it back and forward.
   - Ribbon cable plug (3) of the display module.
4. Remove the cover (4) from the electronics compartment by loosening the screws.
5. Remove the boards (6, 7, 8, 9):
   Insert a thin pin into the hole (5) provided for the purpose and pull the board clear of its holder.
6. Remove submodules (8.1):
   No tools are required for removing the submodules (inputs/outputs) from the I/O board.
   Installation is also a no-tools operation.

Caution!

Only certain combinations of submodules on the I/O board are permissible. → Page 27

The individual slots are marked and correspond to certain terminals in the connection compartment of the transmitter:

Slot “INPUT / OUTPUT 2” = Terminals 24 / 25
Slot “INPUT / OUTPUT 3” = Terminals 22 / 23
Slot “INPUT / OUTPUT 4” = Terminals 20 / 21

7. Installation is the reverse of the removal procedure.
Fig. 44: Field housing: removing and installing printed circuit boards

1 Housing cover  
2 Electronics module  
3 Ribbon cable (display module)  
4 Screws of electronics compartment cover  
5 Aperture for installing/removing boards  
6 Power unit board  
7 Amplifier board  
7.1 Signal cable (sensor)  
7.2 Excitation current cable (sensor)  
7.3 S-DAT (sensor data memory)  
7.4 T-DAT (transmitter data memory)  
8 I/O board (flexible assignment)  
8.1 F-Chip (function chip for optional software)  
8.2 Pluggable submodules (status input and current input, current output, frequency output and relay output)  
9 I/O board (permanent assignment)  
9.1 F-Chip (function chip for optional software)
9.6.2 Replacing the device fuse

Warning!
Risk of electric shock. Exposed components carry dangerous voltages. Make sure that the power supply is switched off before you remove the cover of the electronics compartment.

The main fuse is on the power unit board.
The procedure for replacing the fuse is as follows:

1. Switch off power supply.
2. Remove the power unit board, → Page 96 → Page 98
3. Remove the protection cap (1) and replace the device fuse (2). Only use the following fuse type:
   - Now remove the following cable connectors from the amplifier board (7):
     - 20...55 V AC / 16...62 V DC → 2.0 A slow-blow / 250 V; 5.2 x 20 mm
     - Power supply 85...260 V AC → 0.8 A slow-blow / 250 V; 5.2 x 20 mm
     - Ex-rated devices → see the Ex documentation.
4. Installation is the reverse of the removal procedure.

Caution!
Use only original Endress+Hauser parts.

Fig. 45: Replacing the device fuse on the power unit board

1 Protective cap
2 Device fuse
9.7 Return

The following procedures must be carried out before a flowmeter requiring repair or calibration, for example, is returned to Endress+Hauser:

- Always enclose a duly completed “Declaration of contamination” form. Only then can Endress+Hauser transport, examine and repair a returned device.
- Enclose special handling instructions if necessary, for example a safety data sheet as per EN 91/155/EEC.
- Remove all residues. Pay special attention to the grooves for seals and crevices which could contain residues. This is particularly important if the substance is hazardous to health, e.g. flammable, toxic, caustic, carcinogenic, etc.

With Promass A and Promass M the threaded process connections must first be removed from the sensor and then cleaned.

Note!
You will find a preprinted “Declaration of contamination” form at the back of this manual.

Warning!
- Do not return a measuring device if you are not absolutely certain that all traces of hazardous substances have been removed, e.g. substances which have penetrated crevices or diffused through plastic.
- Costs incurred for waste disposal and injury (burns, etc.) due to inadequate cleaning will be charged to the owner-operator.

9.8 Disposal

Observe the regulations applicable in your country!

9.9 Software history

Note!
Up or downloading a software version normally requires a special service software.

<table>
<thead>
<tr>
<th>Date</th>
<th>Software version</th>
<th>Changes to software</th>
<th>Operating Instructions</th>
</tr>
</thead>
</table>
| 11.2004  | 2.00.XX          | Software expansion
- Assignment of reference density to the current input
- HART Command #3 extends functionalities for F-Chip (e.g. density functions)
- New sensor DN 250
- Chinese language package (English and Chinese contents)
New functionalities:
- Empty pipe detection via exciting current (EPD EXC.CURR.MAX (6426))
- Extension with batching option:
  - MAX.FLOW (7249) → Maximum flow exceeded during batching
  - BATCH TIME (7283) → Dosing time exceeded
- DEVICE SOFTWARE (8100) → Device software displayed
  (NAMUR-recommendation 53)
- REMOVE SW OPTION (8006) → Remove F-Chip options |
<p>|          |                  | 50098470/11.04                                                                     |                        |</p>
<table>
<thead>
<tr>
<th>Date</th>
<th>Software version</th>
<th>Changes to software</th>
<th>Operating Instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.2003</td>
<td>Amplifier: 1.06.XX</td>
<td>Software expansion:</td>
<td>50098470/10.03</td>
</tr>
<tr>
<td></td>
<td>Communication module: 1.03.XX</td>
<td>- Language groups</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Flow direction pulse output selectable</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Adjustments to Fieldcheck and Simubox</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>- Concentration measurement with 4 data records</td>
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<td></td>
<td>- Viscosity measurement with temperature compensation</td>
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<td>- Acquisition start via status input for advanced diagnostics</td>
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<td></td>
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<td>- SIL 2</td>
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<tr>
<td></td>
<td></td>
<td>New functionalities:</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>- Operation hours counter</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>- Intensity of background illumination adjustable</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Simulation pulse output</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Counter for access code</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Current input</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Simulation pulse output</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Compatible with:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- ToF-Tool FieldTool Package</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(the latest SW version can be downloaded</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>under: <a href="http://www.tof-fieldtool.endress.com">www.tof-fieldtool.endress.com</a>)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- HART Communicator DXR 375</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>with Device Rev. 5, DD Rev. 1</td>
<td></td>
</tr>
<tr>
<td>03.2003</td>
<td>Amplifier: 1.05.XX</td>
<td>Software adjustment</td>
<td>50098470/03.03</td>
</tr>
<tr>
<td></td>
<td>Communication module: 1.02.XX</td>
<td></td>
<td></td>
</tr>
<tr>
<td>08.2002</td>
<td>Amplifier: 1.04.XX</td>
<td>Software expansion:</td>
<td>50098470/08.02</td>
</tr>
<tr>
<td></td>
<td>Communication module: 1.02.XX</td>
<td>- Promass H</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Promass E</td>
<td></td>
</tr>
<tr>
<td>06.2001</td>
<td>Amplifier: 1.02.XX</td>
<td>Software expansion:</td>
<td>50098470/06.01</td>
</tr>
<tr>
<td></td>
<td>Communication module: 1.02.XX</td>
<td>- General instrument functions</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- &quot;Batching&quot; software function</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- &quot;Pulse width&quot; software function</td>
<td></td>
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<td></td>
<td></td>
<td>- &quot;Concentration measurement&quot; software function</td>
<td></td>
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<td></td>
<td></td>
<td>- &quot;Advanced Diagnostics&quot; software function</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- HART operating via Universal Commands and Common Practice Commands</td>
<td></td>
</tr>
<tr>
<td>03.2001</td>
<td>Amplifier: 1.01.XX</td>
<td>Software adjustment</td>
<td>50098470/11.00</td>
</tr>
<tr>
<td></td>
<td>Communication module: 1.01.XX</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.2000</td>
<td>Amplifier: 1.00.XX</td>
<td>Original software</td>
<td>50098470/11.00</td>
</tr>
<tr>
<td></td>
<td>Communication module: 1.01.XX</td>
<td>Compatible with:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Fieldtool</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- HART Communicator DXR 275</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(OS 4.6 and higher) with rev. 1, DD 1.</td>
<td></td>
</tr>
</tbody>
</table>
10 Technical data

10.1 Technical data at a glance

10.1.1 Applications

The measuring device described in these Operating Instructions is to be used only for measuring the mass flow rate of liquids and gases. At the same time, the system also measures fluid density and fluid temperature. These parameters are then used to calculate other variables such as volume flow. Fluids with widely differing properties can be measured.

Examples:
- Chocolate, condensed milk, liquid sugar
- Oils, fats
- Acids, alkalis, lacquers, paints, solvents and cleaning agents
- Pharmaceuticals, catalysts, inhibitors
- Suspensions
- Gases, liquefied gases, etc.

Resulting from incorrect use or from use other than that designated the operational safety of the measuring devices can be suspended. The manufacturer accepts no liability for damages being produced from this.

10.1.2 Function and system design

Measuring principle
Mass flow measurement by the Coriolis principle

Measuring system
The “Promass 80/83” flow measuring system consists of the following components:
- Promass 80 or 83 transmitter
- Promass F, Promass M, Promass E, Promass A, Promass H or Promass I sensor

Two versions are available:
- Compact version: transmitter and sensor form a single mechanical unit.
- Remote version: transmitter and sensor are installed separately.

10.1.3 Input

Measured variable
- Mass flow (proportional to the phase difference between two sensors mounted on the measuring tube to register a phase shift in the oscillation)
- Fluid density (proportional to resonance frequency of the measuring tube)
- Fluid temperature (measured with temperature sensors)

Measuring range

<table>
<thead>
<tr>
<th>DN</th>
<th>Measuring ranges for liquids (Promass F, M):</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>$0...2000 \text{ kg/h}$</td>
</tr>
<tr>
<td>15</td>
<td>$0...6500 \text{ kg/h}$</td>
</tr>
<tr>
<td>25</td>
<td>$0...18000 \text{ kg/h}$</td>
</tr>
<tr>
<td>40</td>
<td>$0...45000 \text{ kg/h}$</td>
</tr>
<tr>
<td>50</td>
<td>$0...70000 \text{ kg/h}$</td>
</tr>
<tr>
<td>80</td>
<td>$0...180000 \text{ kg/h}$</td>
</tr>
<tr>
<td>100 (only Promass F)</td>
<td>$0...350000 \text{ kg/h}$</td>
</tr>
<tr>
<td>150 (only Promass F)</td>
<td>$0...800000 \text{ kg/h}$</td>
</tr>
<tr>
<td>250 (only Promass F)</td>
<td>$0...2200000 \text{ kg/h}$</td>
</tr>
</tbody>
</table>
Measuring ranges for liquids (Promass H, I):

<table>
<thead>
<tr>
<th>DN</th>
<th>Range for full scale values (liquids)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>0...2000 kg/h</td>
</tr>
<tr>
<td>15</td>
<td>0...6500 kg/h</td>
</tr>
<tr>
<td>15 *</td>
<td>0...18000 kg/h</td>
</tr>
<tr>
<td>25</td>
<td>0...18000 kg/h</td>
</tr>
<tr>
<td>25 *</td>
<td>0...45000 kg/h</td>
</tr>
<tr>
<td>40</td>
<td>0...45000 kg/h</td>
</tr>
<tr>
<td>40 *</td>
<td>0...70000 kg/h</td>
</tr>
<tr>
<td>50</td>
<td>0...70000 kg/h</td>
</tr>
</tbody>
</table>

* DN 15, 25, 40 “FB” = Full bore versions of Promass I

Measuring ranges for liquids (Promass A):

<table>
<thead>
<tr>
<th>DN</th>
<th>Range for full scale values (liquids)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0...20 kg/h</td>
</tr>
<tr>
<td>2</td>
<td>0...100 kg/h</td>
</tr>
<tr>
<td>4</td>
<td>0...450 kg/h</td>
</tr>
</tbody>
</table>

Measuring ranges for liquids (Promass E):

<table>
<thead>
<tr>
<th>DN</th>
<th>Range for full scale values (liquids)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>0...2000 kg/h</td>
</tr>
<tr>
<td>15</td>
<td>0...6500 kg/h</td>
</tr>
<tr>
<td>25</td>
<td>0...18000 kg/h</td>
</tr>
<tr>
<td>40</td>
<td>0...45000 kg/h</td>
</tr>
<tr>
<td>50</td>
<td>0...70000 kg/h</td>
</tr>
</tbody>
</table>

Measuring ranges for gases (except Promass H)

The full scale values depend on the density of the gas. Use the formula below to calculate the full scale values:

\[
\dot{m}_{\text{max}(G)} = \dot{m}_{\text{max}(F)} \cdot \rho_{(G)} / x [\text{kg/m}^3]
\]

\[
\dot{m}_{\text{max}(G)} = \text{Max. full scale value for gas [kg/h]}
\]

\[
\dot{m}_{\text{max}(F)} = \text{Max. full scale value for liquid [kg/h]}
\]

\[
\rho_{(G)} = \text{Gas density in [kg/m}^3\text{] for process conditions}
\]

\[
x = 160 \ (\text{Promass F DN 8...100, M, I}); x = 250 \ (\text{Promass F DN 150...250}); x = 225 \ (\text{Promass E}); x = 32 \ (\text{Promass A})
\]

Here, \( \dot{m}_{\text{max}(G)} \) can never be greater than \( \dot{m}_{\text{max}(F)} \)

Calculation example for gas:

- Sensor type: Promass F, DN 50
- Gas: air with a density of 60.3 kg/m³ [at 20 °C and 50 bar]
- Measuring range: 70000 kg/h
- \( x = 160 \) (for Promass F DN 50)

Max. possible full scale value:

\[
\dot{m}_{\text{max}(G)} = \dot{m}_{\text{max}(F)} \cdot \rho_{(G)} / x [\text{kg/m}^3] = 70000 \text{ kg/h} \cdot 60.3 \text{ kg/m}^3 \div 160 \text{ kg/m}^3 = 26400 \text{ kg/h}
\]
**Operable flow range**
Greater than 1000 : 1. Flows above the preset full scale value do not overload the amplifier, i.e. totalizer values are registered correctly.

**Input signal**
*Status input (auxiliary input):*
U = 3...30 V DC, R_i = 5 kΩ, galvanically isolated.
Configurable for: totalizer reset, positive zero return, error message reset, start zero point adjustment, batching start/stop (optional)

*Current input:*
Active/passive selectable, galvanically isolated, resolution: 2 µA
- Active: 4...20 mA, R_i ≤ 150 Ω, U_{out} = 24 V DC, short-circuit proof
- Passive: 0/4...20 mA, R_i ≤ 150 Ω, U_{max} = 30 V DC

**Output**

*Output signal*
*Current output:*
Active/passive selectable, galvanically isolated, time constant selectable (0.05...100 s), full scale value selectable, temperature coefficient: typically 0.005% o.r./°C, resolution: 0.5 µA
- Active: 0/4...20 mA, R_L < 700 Ω (for HART: R_L ≥ 250 Ω)
- Passive: 4...20 mA; supply voltage V_S 18...30 V DC; R_i ≥ 150 Ω

*Pulse / frequency output:*
active/passive selectable, galvanically isolated
- Active: 24 V DC, 25 mA (max. 250 mA during 20 ms), R_L > 100 Ω
- Passive: open collector, 30 V DC, 250 mA
- Frequency output: full scale frequency 2...10000 Hz (f_{max} = 12500 Hz), on/off ratio 1:1, pulse width max. 2 s
- Pulse output: pulse value and pulse polarity selectable, pulse width configurable (0.05...2000 ms)

*Signal on alarm*
Current output:
Failsafe mode selectable (for example, according to NAMUR recommendation NE 43)

Pulse/frequency output:
Failsafe mode selectable

Relay output:
De-energised by fault or power supply failure

*Load*
See “Output signal”

*Switching output*
Relay output:
Normally closed (NC or break) or normally open (NO or make) contacts available (default: relay 1 = NO, relay 2 = NC), max. 30 V / 0.5 A AC; 60 V / 0.1 A DC, galvanically isolated.
Configurable for: error messages, Empty Pipe Detection (EPD), flow direction, limit values, batching valve 1 and 2 (optional).

*Low flow cut off*
Switch points for low flow cut off are selectable.

*Galvanic isolation*
All circuits for inputs, outputs, and power supply are galvanically isolated from each other.
10.1.5 Power supply

Electrical connections → Page 24 ff.

Supply voltage
- 85...260 V AC, 45...65 Hz
- 20...55 V AC, 45...65 Hz
- 16...62 V DC

Cable entry
- Power supply and signal cables (inputs/outputs):
  - Cable entry M20 x 1.5 (8...12 mm)
  - Threads for cable entries, 1/2" NPT, G 1/2"
- Connecting cable for remote version:
  - Cable entry M20 x 1.5 (8...12 mm)
  - Threads for cable entries, 1/2" NPT, G 1/2"

Cable specifications (remote version)
- see Page 25

Power consumption
- AC: <15 VA (including sensor)
- DC: <15 W (including sensor)
  - Switch-on current:
    - max. 13.5 A (< 50 ms) at 24 V DC
    - max. 3 A (< 5 ms) at 260 V AC

Power supply failure
- Lasting min. 1 power cycle:
  - EEPROM or HistoROM T-DAT saves measuring system data if power supply fails.
  - HistoROM/S-DAT: exchangeable data storage chip which stores the data of the sensor (nominal diameter, serial number, calibration factor, zero point, etc.)

Potential equalisation
- No measures necessary.

10.1.6 Performance characteristics

Reference operating conditions
- Error limits following ISO/DIS 11631:
  - 20...30 °C; 2...4 bar
  - Calibration systems as per national norms
  - Zero point calibrated under operating conditions
  - Field density calibrated (or special density calibration)
Maximum measured error

The following values refer to the pulse/frequency output. Deviation at the current output is typically ±5 µA.

**Mass flow (liquid)**

*Promass F, M, A:*

±0.10% ± [(zero point stability / measured value) x 100]% o.r.

*Promass E:*

±0.30% ± [(zero point stability / measured value) x 100]% o.r.

*Promass H, I:*

±0.125% ± [(zero point stability / measured value) x 100]% o.r.

**Mass flow (gas)**

*Promass F:*

±0.35% ± [(zero point stability / measured value) x 100]% o.r.

*Promass M, A, I:*

±0.50% ± [(zero point stability / measured value) x 100]% o.r.

*Promass E:*

±0.75% ± [(zero point stability / measured value) x 100]% o.r.

**Volume flow (liquid)**

*Promass F:*

±0.15% ± [(zero point stability / measured value) x 100]% o.r.

*Promass M, A:*

±0.25% ± [(zero point stability / measured value) x 100]% o.r.

*Promass E:*

±0.45% ± [(zero point stability / measured value) x 100]% o.r.

*Promass H, I:*

±0.50% ± [(zero point stability / measured value) x 100]% o.r.

**Zero point stability (Promass A):**

<table>
<thead>
<tr>
<th>DN</th>
<th>Maximum full scale value [kg/h] or [l/h]</th>
<th>Zero point stability [kg/h] or [l/h]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20</td>
<td>0.0010</td>
</tr>
<tr>
<td>2</td>
<td>100</td>
<td>0.0050</td>
</tr>
<tr>
<td>4</td>
<td>450</td>
<td>0.0225</td>
</tr>
</tbody>
</table>
### Zero point stability (Promass $F, M$):

<table>
<thead>
<tr>
<th>DN</th>
<th>Max. full scale value [kg/h] or [l/h]</th>
<th>Zero point stability</th>
<th>Promass $F$ [kg/h] or [l/h]</th>
<th>Promass $F$ (high-temperature) [kg/h] or [l/h]</th>
<th>Promass $M$ [kg/h] or [l/h]</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>2000</td>
<td>0.060</td>
<td>–</td>
<td>0.100</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>6500</td>
<td>0.200</td>
<td>–</td>
<td>0.325</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>18000</td>
<td>0.540</td>
<td>1.80</td>
<td>0.90</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>45000</td>
<td>2.25</td>
<td>–</td>
<td>2.25</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>70000</td>
<td>3.50</td>
<td>7.00</td>
<td>3.50</td>
<td></td>
</tr>
<tr>
<td>80</td>
<td>180000</td>
<td>9.00</td>
<td>18.00</td>
<td>9.00</td>
<td></td>
</tr>
<tr>
<td>100</td>
<td>350000</td>
<td>14.00</td>
<td>–</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>150</td>
<td>800000</td>
<td>32.00</td>
<td>–</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>250</td>
<td>2200000</td>
<td>88.00</td>
<td>–</td>
<td>–</td>
<td></td>
</tr>
</tbody>
</table>

* DN 15, 25, 40 “FB” = Full bore versions of Promass I

### Zero point stability (Promass $H, I$):

<table>
<thead>
<tr>
<th>DN</th>
<th>Maximum full scale value in [kg/h] or [l/h]</th>
<th>Zero point stability</th>
<th>Promass $H$ in [kg/h] or [l/h]</th>
<th>Promass $I$ in [kg/h] or [l/h]</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>2000</td>
<td>0.20</td>
<td>0.20</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>6500</td>
<td>0.65</td>
<td>0.65</td>
<td></td>
</tr>
<tr>
<td>15 *</td>
<td>18000</td>
<td>–</td>
<td>1.8</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>18000</td>
<td>1.8</td>
<td>1.8</td>
<td></td>
</tr>
<tr>
<td>25 *</td>
<td>45000</td>
<td>–</td>
<td>4.5</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>45000</td>
<td>4.5</td>
<td>4.5</td>
<td></td>
</tr>
<tr>
<td>40 *</td>
<td>70000</td>
<td>–</td>
<td>7.0</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>70000</td>
<td>–</td>
<td>7.0</td>
<td></td>
</tr>
</tbody>
</table>

* DN 15, 25, 40 “FB” = Full bore versions of Promass I

### Zero point stability (Promass $E$):

<table>
<thead>
<tr>
<th>DN</th>
<th>Maximum full scale value [kg/h] or [l/h]</th>
<th>Zero point stability [kg/h] or [l/h]</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>2000</td>
<td>0.200</td>
</tr>
<tr>
<td>15</td>
<td>6500</td>
<td>0.650</td>
</tr>
<tr>
<td>25</td>
<td>18000</td>
<td>1.80</td>
</tr>
<tr>
<td>40</td>
<td>45000</td>
<td>4.50</td>
</tr>
<tr>
<td>50</td>
<td>70000</td>
<td>7.00</td>
</tr>
</tbody>
</table>
Sample calculation

Calculation example (mass flow, liquid):
Given: Promass 83 F / DN 25, flow = 8000 kg/h
Max. measured error: \( \pm 0.10\% \pm \left(\frac{\text{zero point stability}}{\text{measured value}}\right) \times 100\% \) o.r.
Maximum measured error \( \rightarrow \) \( \pm 0.10\% \pm 0.54 \text{ kg/h} \div 8000 \text{ kg/h} \times 100\% = \pm 0.107\% \)

Density (liquid)

After field density calibration or under reference conditions:

- **Promass F**:
  \( \pm 0.0005 \text{ g/cc} \)

- **Promass M, E, A, H**:
  \( \pm 0.0010 \text{ g/cc} \)

- **Promass I**:
  \( \pm 0.0020 \text{ g/cc} \)

Special density calibration (optional), not for high-temperature version (calibration range = 0.8...1.8 g/cc, 5...80 °C):

- **Promass F**:
  \( \pm 0.001 \text{ g/cc} \)

- **Promass M, A, H**:
  \( \pm 0.002 \text{ g/cc} \)

- **Promass I**:
  \( \pm 0.004 \text{ g/cc} \)
Technical data

Promass F:
±0.01 g/cc

Promass M, E, A, H, I:
±0.02 g/cc

Temperature
±0.5 °C ±0.005 x T (T = fluid temperature in °C)

Repeatability

Mass flow (liquid):

Promass F, M, A, H, I:
±0.05% ± [1/2 x (zero point stability / measured value) x 100]% o.r.

Promass E:
±0.15% ± [1/2 x (zero point stability / measured value) x 100]% o.r.

Mass flow (gas):

Promass F, M, A, I:
±0.25% ± [1/2 x (zero point stability / measured value) x 100]% o.r.

Promass E:
±0.35% ± [1/2 x (zero point stability / measured value) x 100]% o.r.

Volume flow (liquid):

Promass F:
±0.05% ± [1/2 x (zero point stability / measured value) x 100]% o.r.

Promass F (high-temp. version):
±0.10% ± [(zero point stability / measured value) x 100]% o.r.

Promass M, A:
±0.10% ± [1/2 x (zero point stability / measured value) x 100]% o.r.

Promass E:
±0.25% ± [1/2 x (zero point stability / measured value) x 100]% o.r.

Promass H, I:
±0.20% ± [1/2 x (zero point stability / measured value) x 100]% o.r.

o.r. = of reading
Zero point stability: see “Max. measured error”

Calculation example (mass flow, liquid):
Given: Promass 83 F / DN 25, flow = 8000 kg/h
Repeatability: ±0.10% ± [(1/2 x zero point stability / measured value) x 100]% o.r.
Repeatability → ±0.10% ±1/2 · 0.54 kg/h ÷ 8000 kg/h · 100% = ±0.0053%
Density measurement (liquid)

Promass F:
±0.00025 g/cc (1 g/cc = 1 kg/l)

Promass M, H, E, A:
±0.0005 g/cc

Promass I:
±0.001 g/cc

Temperature measurement
±0.25 °C ±0.0025 x T (T = fluid temperature in °C)

Influence of medium temperature
When there is a difference between the temperature for zero point adjustment and the process temperature, the typical measured error of the Promass sensor is ±0.0002% of the full scale value / °C. The typical measured error of the Promass E sensor is ±0.0003% of the full scale value / °C.

Influence of medium pressure
The tables below show the effect on accuracy of mass flow due to a difference between calibration pressure and process pressure.

Promass F, M:

<table>
<thead>
<tr>
<th>DN</th>
<th>Promass F, high-temperature [% o.r./bar]</th>
<th>Promass M [% o.r./bar]</th>
<th>Promass M / (high pressure) [% o.r./bar]</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>No influence</td>
<td>0.009</td>
<td>0.006</td>
</tr>
<tr>
<td>15</td>
<td>No influence</td>
<td>0.008</td>
<td>0.005</td>
</tr>
<tr>
<td>25</td>
<td>No influence</td>
<td>0.009</td>
<td>0.003</td>
</tr>
<tr>
<td>40</td>
<td>-0.003</td>
<td>0.005</td>
<td>-</td>
</tr>
<tr>
<td>50</td>
<td>-0.008</td>
<td>No influence</td>
<td>-</td>
</tr>
<tr>
<td>80</td>
<td>-0.009</td>
<td>No influence</td>
<td>-</td>
</tr>
<tr>
<td>100</td>
<td>-0.012</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>150</td>
<td>-0.009</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>250</td>
<td>-0.009</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

o.r. = of reading

Promass E:
With nominal diameters DN 8...40, the effect on accuracy of mass flow due to a difference between calibration pressure and process pressure can be neglected.
With DN 50 the influence is -0.009% o.r. / bar (o.r. = of reading)

Promass A:
A difference between calibration pressure and process pressure has no effect on measuring accuracy.
10.1.7 Operating conditions: Installation

Installation instructions see Page 14 ff.

Inlet and outlet runs There are no installation requirements regarding inlet and outlet runs.

Length of connecting cable Max. 20 meters (remote version)

System pressure see Page 15

10.1.8 Operating conditions: Environment

Ambient temperature range Standard: –20...+60 °C (sensor, transmitter)
   Optional: –40...+60 °C (sensor, transmitter)

Note!
- Install the device at a shady location. Avoid direct sunlight, particularly in warm climatic regions.
- At ambient temperatures below –20 °C the readability of the display may be impaired.

Storage temperature –40...+80 °C (preferably +20 °C)

Degree of protection Standard: IP 67 (NEMA 4X) for transmitter and sensor

Shock resistance According to IEC 68-2-31

Vibration resistance Acceleration up to 1 g, 10...150 Hz, following IEC 68-2-6

CIP cleaning yes

SIP cleaning yes

Electromagnetic compatibility (EMC) To EN 61326/A1 and NAMUR recommendation NE 21

---

**Promass H, I:**

<table>
<thead>
<tr>
<th>DN</th>
<th>Promass H</th>
<th>Promass I</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[% o.r./bar]</td>
<td>[% o.r./bar]</td>
</tr>
<tr>
<td>8</td>
<td>-0.017</td>
<td>0.006</td>
</tr>
<tr>
<td>15</td>
<td>-0.021</td>
<td>0.004</td>
</tr>
<tr>
<td>15 *</td>
<td>-</td>
<td>0.006</td>
</tr>
<tr>
<td>25</td>
<td>-0.013</td>
<td>0.006</td>
</tr>
<tr>
<td>25 *</td>
<td>-</td>
<td>No influence</td>
</tr>
<tr>
<td>40</td>
<td>-0.018</td>
<td>No influence</td>
</tr>
<tr>
<td>40 *</td>
<td>-</td>
<td>0.006</td>
</tr>
<tr>
<td>50</td>
<td>-0.020</td>
<td>0.006</td>
</tr>
</tbody>
</table>

* DN 15, 25, 40 “FB” = Full bore versions of Promass I
  o.r. = of reading

---
## 10.1.9 Operating conditions: Process

<table>
<thead>
<tr>
<th>Medium temperature range</th>
<th>Sensor:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Promass F, A, H:</strong></td>
<td>–50...+200 °C</td>
</tr>
<tr>
<td><strong>Promass F (high-temperature version):</strong></td>
<td>–50...+350 °C</td>
</tr>
<tr>
<td><strong>Promass M, I:</strong></td>
<td>–50...+150 °C</td>
</tr>
<tr>
<td><strong>Promass E:</strong></td>
<td>–40...+125 °C</td>
</tr>
</tbody>
</table>

**Seals:**

- **Promass F, E, H, I:** No internal seals
- **Promass M:**
  - Viton –15...200 °C; EPDM –40...+160 °C; silicon –60...+200 °C; Kalrez –20...+275 °C;
  - FEP sheathed (not for gas applications): –60...+200 °C
- **Promass A**
  - (only for mounting sets with threaded connections)
  - Viton –15...200 °C; EPDM –40...+160 °C; silicon –60...+200 °C; Kalrez –20...+275 °C

<table>
<thead>
<tr>
<th>Limiting medium pressure range (rated pressure)</th>
<th>The material load diagrams (pressure-temperature diagrams) for the process connections are to be found in the following documents:</th>
</tr>
</thead>
</table>
| **Promass F:**                                   | - Technical Information Promass 80/83 F, M (TI 053D/06/en)  
- Technical Information Promass 80/83 E (TI 061D/06/en)  
- Technical Information Promass 80/83 A (TI 054D/06/en)  
- Technical Information Promass 80/83 H, I (TI 052D/06/en) |

**Pressure ranges of secondary containment:**

- **Promass F:**
  - DN 8...50: 40 bar or 600 psi; DN 80: 25 bar or 375 psi; 
  - DN 100...150: 16 bar or 250 psi; DN 250: 10 bar or 150 psi
- **Promass M:**
  - 100 bar or 1500 psi
- **Promass E:**
  - No secondary containment
- **Promass A:**
  - 25 bar or 375 psi
Promass H:
DN 8...15: 25 bar or 375 psi; DN 25...50: 16 bar or 250 psi

Promass I:
40 bar or 600 psi

Limiting flow
See "Measuring range" section. → Page 103 ff.
Select nominal diameter by optimising between required flow range and permissible pressure loss. See the "Measuring range" section for a list of max. possible full scale values. Page 103 ff.
- The minimum recommended full scale value is approx. 1/20 of the max. full scale value.
- In most applications, 20...50% of the maximum full scale value can be considered ideal.
- Select a lower full scale value for abrasive substances such as liquids with entrained solids (flow velocity < 1 m/s).
- For gas measurement the following rules apply:
  - Flow velocity in the measuring tubes should not be more than half the sonic velocity (0.5 Mach).
  - The maximum mass flow depends on the density of the gas: formula → Page 104 ff.

Pressure loss
Pressure loss depends on the properties of the fluid and on its flow. The following formulas can be used to approximately calculate the pressure loss:

**Pressure loss formulas for Promass F, M and E**

<table>
<thead>
<tr>
<th>Reynolds number</th>
<th>Formula</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Re ≥ 2300$^1$</td>
<td>[\Delta p = K \cdot u^{0.25} \cdot \frac{m^{1.85}}{\rho^{0.86}}]</td>
<td>To compute the pressure loss for gases, always use the formula for Re ≥ 2300.</td>
</tr>
<tr>
<td>Re &lt; 2300</td>
<td>[\Delta p = K_1 \cdot u \cdot m + \frac{K_2 \cdot u^{0.25} \cdot m^{2}}{\rho}]</td>
<td></td>
</tr>
</tbody>
</table>

$\Delta p$ = pressure loss [mbar]  
$\rho$ = fluid density [kg/m³]  
$v$ = kinematic viscosity [m²/s]  
$m$ = mass flow [kg/s]  
$d$ = inside diameter of measuring tubes [m]  
$K...K_2$ = constants (depending on nominal diameter)

$^1$) To compute the pressure loss for gases, always use the formula for Re ≥ 2300.

**Pressure loss formulas for Promass A, H and I**

<table>
<thead>
<tr>
<th>Reynolds number</th>
<th>Formula</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Re ≥ 2300$^1$</td>
<td>[\Delta p = K \cdot u^{0.25} \cdot \frac{m^{1.75}}{\rho^{0.75}} \cdot \frac{K_3 \cdot m^{2}}{\rho}]</td>
<td>To compute the pressure loss for gases, always use the formula for Re ≥ 2300.</td>
</tr>
<tr>
<td>Re &lt; 2300</td>
<td>[\Delta p = K_1 \cdot u \cdot m + \frac{K_3 \cdot m^{2}}{\rho}]</td>
<td></td>
</tr>
</tbody>
</table>

$\Delta p$ = pressure loss [mbar]  
$\rho$ = fluid density [kg/m³]  
$v$ = kinematic viscosity [m²/s]  
$m$ = mass flow [kg/s]  
$d$ = inside diameter of measuring tubes [m]  
$K...K_3$ = constants (depending on nominal diameter)

$^1$) To compute the pressure loss for gases, always use the formula for Re ≥ 2300.
Pressure loss coefficient for Promass F

<table>
<thead>
<tr>
<th>DN</th>
<th>d [m]</th>
<th>K</th>
<th>K1</th>
<th>K2</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>5.35 · 10^{-3}</td>
<td>5.70 · 10^{7}</td>
<td>9.60 · 10^{7}</td>
<td>1.90 · 10^{7}</td>
</tr>
<tr>
<td>15</td>
<td>8.30 · 10^{-3}</td>
<td>5.80 · 10^{6}</td>
<td>1.90 · 10^{7}</td>
<td>10.60 · 10^{5}</td>
</tr>
<tr>
<td>25</td>
<td>12.00 · 10^{-3}</td>
<td>1.90 · 10^{6}</td>
<td>6.40 · 10^{6}</td>
<td>4.50 · 10^{5}</td>
</tr>
<tr>
<td>40</td>
<td>17.60 · 10^{-3}</td>
<td>3.50 · 10^{5}</td>
<td>1.30 · 10^{6}</td>
<td>1.30 · 10^{5}</td>
</tr>
<tr>
<td>50</td>
<td>26.00 · 10^{-3}</td>
<td>7.00 · 10^{4}</td>
<td>5.00 · 10^{5}</td>
<td>1.40 · 10^{4}</td>
</tr>
<tr>
<td>80</td>
<td>40.50 · 10^{-3}</td>
<td>1.10 · 10^{4}</td>
<td>7.71 · 10^{4}</td>
<td>1.42 · 10^{4}</td>
</tr>
<tr>
<td>100</td>
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<td>3.54 · 10^{4}</td>
<td>5.40 · 10^{3}</td>
</tr>
<tr>
<td>150</td>
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<td>2.04 · 10^{4}</td>
<td>6.46 · 10^{2}</td>
</tr>
<tr>
<td>250</td>
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<td>6.10 · 10^{3}</td>
<td>1.33 · 10^{2}</td>
</tr>
</tbody>
</table>

Fig. 47: Pressure loss diagram for water
**Pressure loss coefficient for Promass M**

<table>
<thead>
<tr>
<th>DN</th>
<th>d [m]</th>
<th>K</th>
<th>K1</th>
<th>K2</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>5.53 $\cdot$ 10^{-3}</td>
<td>5.2 $\cdot$ 10^{7}</td>
<td>8.6 $\cdot$ 10^{7}</td>
<td>1.7 $\cdot$ 10^{7}</td>
</tr>
<tr>
<td>15</td>
<td>8.55 $\cdot$ 10^{-3}</td>
<td>5.3 $\cdot$ 10^{6}</td>
<td>1.7 $\cdot$ 10^{7}</td>
<td>9.7 $\cdot$ 10^{5}</td>
</tr>
<tr>
<td>25</td>
<td>11.38 $\cdot$ 10^{-3}</td>
<td>1.7 $\cdot$ 10^{6}</td>
<td>5.8 $\cdot$ 10^{6}</td>
<td>4.1 $\cdot$ 10^{6}</td>
</tr>
<tr>
<td>40</td>
<td>17.07 $\cdot$ 10^{-3}</td>
<td>3.2 $\cdot$ 10^{5}</td>
<td>1.2 $\cdot$ 10^{6}</td>
<td>1.2 $\cdot$ 10^{5}</td>
</tr>
<tr>
<td>50</td>
<td>25.60 $\cdot$ 10^{-3}</td>
<td>6.4 $\cdot$ 10^{4}</td>
<td>4.5 $\cdot$ 10^{5}</td>
<td>1.3 $\cdot$ 10^{4}</td>
</tr>
<tr>
<td>80</td>
<td>38.46 $\cdot$ 10^{-3}</td>
<td>1.4 $\cdot$ 10^{4}</td>
<td>8.2 $\cdot$ 10^{4}</td>
<td>3.7 $\cdot$ 10^{4}</td>
</tr>
</tbody>
</table>

High pressure version

<table>
<thead>
<tr>
<th>DN</th>
<th>d [m]</th>
<th>K</th>
<th>K1</th>
<th>K2</th>
</tr>
</thead>
<tbody>
<tr>
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<td>6.0 $\cdot$ 10^{7}</td>
<td>1.4 $\cdot$ 10^{8}</td>
<td>2.8 $\cdot$ 10^{7}</td>
</tr>
<tr>
<td>15</td>
<td>7.75 $\cdot$ 10^{-3}</td>
<td>8.0 $\cdot$ 10^{6}</td>
<td>2.5 $\cdot$ 10^{7}</td>
<td>1.4 $\cdot$ 10^{6}</td>
</tr>
<tr>
<td>15</td>
<td>10.20 $\cdot$ 10^{-3}</td>
<td>2.7 $\cdot$ 10^{6}</td>
<td>8.9 $\cdot$ 10^{6}</td>
<td>6.3 $\cdot$ 10^{5}</td>
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</tbody>
</table>

**Fig. 48:** Pressure loss diagram for water

1. Promass M
2. Promass M (high pressure version)
**Pressure loss coefficient for Promass E**

<table>
<thead>
<tr>
<th>DN</th>
<th>d [m]</th>
<th>K</th>
<th>K1</th>
<th>K2</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>5.35 \cdot 10^{-3}</td>
<td>5.70 \cdot 10^7</td>
<td>7.91 \cdot 10^7</td>
<td>2.10 \cdot 10^7</td>
</tr>
<tr>
<td>15</td>
<td>8.30 \cdot 10^{-3}</td>
<td>7.62 \cdot 10^6</td>
<td>1.73 \cdot 10^7</td>
<td>2.13 \cdot 10^6</td>
</tr>
<tr>
<td>25</td>
<td>12.00 \cdot 10^{-3}</td>
<td>1.89 \cdot 10^6</td>
<td>4.66 \cdot 10^6</td>
<td>6.11 \cdot 10^5</td>
</tr>
<tr>
<td>40</td>
<td>17.60 \cdot 10^{-3}</td>
<td>4.42 \cdot 10^5</td>
<td>1.35 \cdot 10^6</td>
<td>1.38 \cdot 10^5</td>
</tr>
<tr>
<td>50</td>
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<td>8.54 \cdot 10^4</td>
<td>4.02 \cdot 10^5</td>
<td>2.31 \cdot 10^4</td>
</tr>
</tbody>
</table>

![Pressure loss diagram for water](image.png)

*Fig. 49: Pressure loss diagram for water*
Pressure loss coefficient for Promass A

<table>
<thead>
<tr>
<th>DN</th>
<th>d [m]</th>
<th>K</th>
<th>K1</th>
<th>K3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.1 · 10^{-3}</td>
<td>1.2 · 10^{11}</td>
<td>1.3 · 10^{11}</td>
<td>0</td>
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<tr>
<td>2</td>
<td>1.8 · 10^{-3}</td>
<td>1.6 · 10^{10}</td>
<td>2.4 · 10^{10}</td>
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<tr>
<td>4</td>
<td>3.5 · 10^{-3}</td>
<td>9.4 · 10^{8}</td>
<td>2.3 · 10^{9}</td>
<td>0</td>
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</tbody>
</table>

High pressure version

<table>
<thead>
<tr>
<th>DN</th>
<th>d [m]</th>
<th>K</th>
<th>K1</th>
<th>K3</th>
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</thead>
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<tr>
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<td>1.4 · 10^{-3}</td>
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<td>3.0 · 10^{-3}</td>
<td>2.0 · 10^{9}</td>
<td>4.3 · 10^{9}</td>
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</tr>
</tbody>
</table>

Fig. 50: Pressure loss diagram for water

1 Standard version
2 High pressure version
**Pressure loss coefficient for Promass H**

<table>
<thead>
<tr>
<th>DN</th>
<th>d[m]</th>
<th>K</th>
<th>K1</th>
<th>K3</th>
</tr>
</thead>
<tbody>
<tr>
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<td>8,04 · 10⁶</td>
<td>3,28 · 10⁷</td>
<td>1,15 · 10⁶</td>
</tr>
<tr>
<td>15</td>
<td>12,00 · 10⁻³</td>
<td>1,81 · 10⁶</td>
<td>9,99 · 10⁶</td>
<td>1,87 · 10⁵</td>
</tr>
<tr>
<td>25</td>
<td>17,60 · 10⁻³</td>
<td>3,67 · 10⁵</td>
<td>2,76 · 10⁶</td>
<td>4,99 · 10⁴</td>
</tr>
<tr>
<td>40</td>
<td>25,50 · 10⁻³</td>
<td>8,75 · 10⁴</td>
<td>8,67 · 10⁵</td>
<td>1,22 · 10⁴</td>
</tr>
<tr>
<td>50</td>
<td>40,5 · 10⁻³</td>
<td>1,35 · 10⁴</td>
<td>1,72 · 10⁵</td>
<td>1,20 · 10⁴</td>
</tr>
</tbody>
</table>

Pressure loss data includes interface between measuring tube and piping.

*Fig. 51: Pressure loss diagram for water*
### Pressure loss coefficient for Promass I

<table>
<thead>
<tr>
<th>DN</th>
<th>d [m]</th>
<th>K</th>
<th>K1</th>
<th>K2</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>8.55 · 10⁻³</td>
<td>8.1 · 10⁶</td>
<td>3.9 · 10⁷</td>
<td>129.95 · 10⁴</td>
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<tr>
<td>15</td>
<td>11.38 · 10⁻³</td>
<td>2.3 · 10⁶</td>
<td>1.3 · 10⁷</td>
<td>23.33 · 10⁴</td>
</tr>
<tr>
<td>15¹</td>
<td>17.07 · 10⁻³</td>
<td>4.1 · 10⁵</td>
<td>3.3 · 10⁶</td>
<td>0.01 · 10⁴</td>
</tr>
<tr>
<td>25</td>
<td>17.07 · 10⁻³</td>
<td>4.1 · 10⁵</td>
<td>3.3 · 10⁶</td>
<td>5.89 · 10⁴</td>
</tr>
<tr>
<td>25¹</td>
<td>25.60 · 10⁻³</td>
<td>7.8 · 10⁴</td>
<td>8.5 · 10⁵</td>
<td>0.11 · 10⁴</td>
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<td>7.8 · 10⁴</td>
<td>8.5 · 10⁵</td>
<td>1.19 · 10⁴</td>
</tr>
<tr>
<td>40¹</td>
<td>35.62 · 10⁻³</td>
<td>1.3 · 10⁴</td>
<td>2.0 · 10⁵</td>
<td>0.08 · 10⁴</td>
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<tr>
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<td>1.3 · 10⁴</td>
<td>2.0 · 10⁵</td>
<td>0.25 · 10⁴</td>
</tr>
</tbody>
</table>

Pressure loss data includes interface between measuring tube and piping
¹ DN 15, 25, 40 "FB" = Full bore versions of Promass I

---

**Fig. 52:** Pressure loss diagram for water

1 Standard versions
2 Full bore versions (*)
10.1.10 Mechanical construction

**Design / dimensions**
Dimensions and the fitting lengths of the transmitter and sensor are given in the Technical Information. → Page 126

**Weight**
- Compact version: see table below
- Remote version
  - Sensor: see table below
  - Wall-mount housing: 5 kg

<table>
<thead>
<tr>
<th>Promass F / DN</th>
<th>8</th>
<th>15</th>
<th>25</th>
<th>40</th>
<th>50</th>
<th>80</th>
<th>100</th>
<th>150</th>
<th>250</th>
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</thead>
<tbody>
<tr>
<td>Compact version</td>
<td>11</td>
<td>12</td>
<td>14</td>
<td>19</td>
<td>30</td>
<td>55</td>
<td>96</td>
<td>154</td>
<td>400</td>
</tr>
<tr>
<td>Compact version, high-temperature</td>
<td>–</td>
<td>–</td>
<td>14.7</td>
<td>–</td>
<td>30.7</td>
<td>55.7</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Remote version</td>
<td>9</td>
<td>10</td>
<td>12</td>
<td>17</td>
<td>28</td>
<td>53</td>
<td>94</td>
<td>152</td>
<td>398</td>
</tr>
<tr>
<td>Remote version, high-temperature</td>
<td>–</td>
<td>–</td>
<td>13.5</td>
<td>–</td>
<td>29.5</td>
<td>54.5</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Promass M / DN</th>
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<th>15</th>
<th>25</th>
<th>40</th>
<th>50</th>
<th>80</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compact version</td>
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<td>12</td>
<td>15</td>
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<td>67</td>
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<tr>
<td>Remote version</td>
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<td>10</td>
<td>13</td>
<td>22</td>
<td>39</td>
<td>65</td>
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</table>

<table>
<thead>
<tr>
<th>Promass E / DN</th>
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<th>40</th>
<th>50</th>
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</thead>
<tbody>
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<td>10</td>
<td>15</td>
<td>22</td>
</tr>
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<td>Remote version</td>
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<td>6</td>
<td>8</td>
<td>13</td>
<td>20</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Promass A / DN</th>
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<th>2</th>
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</thead>
<tbody>
<tr>
<td>Compact version</td>
<td>10</td>
<td>11</td>
<td>15</td>
</tr>
<tr>
<td>Remote version</td>
<td>8</td>
<td>9</td>
<td>13</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Promass H / DN</th>
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<th>15</th>
<th>25</th>
<th>40</th>
<th>50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compact version</td>
<td>12</td>
<td>13</td>
<td>19</td>
<td>36</td>
<td>69</td>
</tr>
<tr>
<td>Remote version</td>
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<td>11</td>
<td>17</td>
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<td>67</td>
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</table>

<table>
<thead>
<tr>
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<th>15</th>
<th>25</th>
<th>25</th>
<th>40</th>
<th>40</th>
<th>50</th>
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</thead>
<tbody>
<tr>
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<td>20</td>
<td>41</td>
<td>41</td>
<td>67</td>
<td>67</td>
</tr>
<tr>
<td>Remote version</td>
<td>10</td>
<td>13</td>
<td>18</td>
<td>18</td>
<td>39</td>
<td>39</td>
<td>65</td>
<td>65</td>
</tr>
</tbody>
</table>

1) DN 15, 25, 40 “FB” = Full bore versions of Promass I

Weight data in [kg].
All values (weight) refer to devices with EN/DIN PN 40 flanges.
Material

Transmitter housing:
- Compact housing: stainless steel 1.4301/304
- Compact housing: powder coated die-cast aluminium
- Wall-mount housing: powder coated die-cast aluminium
- Remote field housing: powder-coated die-cast aluminium

Sensor housing / containment:

Promass F:
Acid- and alkali-resistant outer surface
DN 8...50: stainless steel 1.4301/304
DN 80...250: stainless steel 1.4301/304 and 1.4308/304L

Promass M:
Acid- and alkali-resistant outer surface
DN 8...50: steel, chemically nickel-plated
DN 80: stainless steel

Promass E, A, H, I:
Acid- and alkali-resistant outer surface
Stainless steel 1.4301/304

Connection housing, sensor (remote version):
- Stainless steel 1.4301/304 (standard)
- Powder coated die-cast aluminium (high-temperature version and version for heating)

Process connections

Promass F:
- Flanges EN 1092–1 (DIN 2501) / ANSI B16.5 / JIS B2238 → stainless steel 1.4404/316L
- Flanges EN 1092–1 (DIN 2501) / ANSI B16.5 / JIS B2238 → Alloy C-22 2.4602/N 06022
- Flange DIN 11864-2 Form A (flat flange) → stainless steel 1.4404/316L
- Hygienic coupling DIN 11851 / SMS 1145 → stainless steel 1.4404/316L
- Couplings ISO 2853 / DIN 11864–1 → stainless steel 1.4404/316L
- Tri-Clamp (OD-tubes) → stainless steel 1.4404/316L

Promass F (high-temperature version):
- Flanges EN 1092–1 (DIN 2501) / ANSI B16.5 / JIS B2238 → stainless steel 1.4404/316L
- Flanges EN 1092–1 (DIN 2501) / ANSI B16.5 / JIS B2238 → Alloy C-22 2.4602 (N 06022)
Proline Promass 83

Technical data

Promass M:
- Flanges EN 1092-1 (DIN 2501) / ANSI B16.5 / JIS B2238 → stainless steel 1.4404/316L, titanium grade 2
- Flange DIN 11864-2 Form A (flat flange) → stainless steel 1.4404/316L
- PVDF connection to DIN / ANSI / JIS
- Hygienic coupling DIN 11851 / SMS 1145 → stainless steel 1.4404/316L
- Couplings ISO 2853 / DIN 11864-1 → stainless steel 1.4404/316L
- Tri-Clamp (OD-tubes) → stainless steel 1.4404/316L

Promass M (high pressure version):
- Connector → stainless steel 1.4404/316L
- Couplings → stainless steel 1.4401/316

Promass E:
- Flanges EN 1092-1 (DIN 2501) / ANSI B16.5 / JIS B2238 → stainless steel 1.4404/316L
- Flange DIN 11864-2 Form A (flat flange) → stainless steel 1.4404/316L
- VCO connection → Stainless steel 1.4404/316L
- Hygienic coupling DIN 11851 / SMS 1145 → stainless steel 1.4404/316L
- Couplings ISO 2853 / DIN 11864-1 → stainless steel 1.4404/316L
- Tri-Clamp (OD-tubes) → stainless steel 1.4404/316L

Promass A:
  Loose flanges → stainless steel 1.4404/316L
- VCO coupling → stainless steel 1.4539/904L, Alloy C-22 2.4602/N 06022
- Tri-Clamp (OD-tubes) (1/2") → stainless steel 1.4539/904L
- Mounting set for SWAGELOK (1/4", 1/8") → stainless steel 1.4401/316
- Mounting set for NPT-F (1/4") → stainless steel 1.4539/904L1.4539/904L, Alloy C-22 2.4602/N 06022

Promass H:
- Flanges EN 1092-1 (DIN 2501) / ANSI B16.5 / JIS B2238 → stainless steel 1.4301/304, parts in contact with medium: zirconium 702

Promass I:
- Flanges EN 1092-1 (DIN 2501) / ANSI B16.5 / JIS B2238 → stainless steel 1.4301/304, parts in contact with medium: titanium grade 9
- Flange DIN 11864-2 Form A (flat flange) → titanium grade 2
- Hygienic coupling DIN 11851 / SMS 1145 → titanium grade 2
- Couplings ISO 2853 / DIN 11864-1 → titanium grade 2
- Tri-Clamp (OD-tubes) → titanium grade 2

Measuring tube(s):

Promass F:
- DN 8...100: stainless steel 1.4539 (904L)
- DN 150: stainless steel 1.4404/316L
- DN 250: stainless steel 1.4404/316L; manifold: CF3M
- DN 8...150: Alloy C-22 2.4602/N 06022

Promass F (high-temperature version):
- DN 25, 50, 80: Alloy C-22 2.4602/N 06022
Promass M:
- DN 8...50: titanium grade
- DN 80: titanium grade 2

Promass M (high pressure version):
- Titanium grade 9

Promass E:
- Stainless steel 1.4539/904L

Promass A:
- Stainless steel 1.4539/904L, Alloy C-22 2.4602/N 06022

Promass H:
- Zirconium 702/R 60702

Promass I:
- Titanium grade 9

Seals:

Promass F, E, H, I:
Welded process connections without internal seals

Promass M:
Viton, EPDM, silicon, Kalrez, FEP sheathing (not for gas applications)

Promass A:
Viton, EPDM, silicon, Kalrez

Material load diagram
The material load diagrams (pressure-temperature diagrams) for the process connections are to be found in the following documents:
- Technical Information Promass 80/83 F, M (TI 053D/06/en)
- Technical Information Promass 80/83 E (TI 061D/06/en)
- Technical Information Promass 80/83 A (TI 054D/06/en)
- Technical Information Promass 80/83 H, I (TI 052D/06/en)

Process connections
see Page 122 ff.

10.1.11 Human interface

Display elements
- Liquid crystal display: illuminated, four lines with 16 characters per line
- Selectable display of different measured values and status variables
- 3 totalizers
- At ambient temperatures below −20 °C the readability of the display may be impaired.

Operating elements
- Local operation with three optical sensors [-, +, E]
- Application specific Quick Setup menus for straightforward commissioning
## Language groups

Language groups available for operation in different countries:

- **Western Europe and America (WEA):** English, German, Spanish, Italian, French, Dutch and Portuguese
- **Eastern Europe and Scandinavia (EES):** English, Russian, Polish, Norwegian, Finnish, Swedish and Czech
- **South and East Asia (SEA):** English, Japanese, Indonesian
- **China (CIN):** English, Chinese

You can change the language group via the operating program "ToF Tool – Fieldtool Package."

## Remote operation

Operation by means of HART protocol

### 10.1.12 Certificates and approvals

#### Ex approval

Information about currently available Ex versions (ATEX, FM, CSA) can be supplied by your E+H Sales Centre on request. All explosion protection data are given in a separate documentation which is available upon request.

#### Sanitary compatibility

- 3A authorization (all measuring systems, except Promass H)
- EHEDG-tested (Promass A and Promass I only)

#### Pressure device approval

Flowmeters with a nominal diameter smaller or equal DN 25 are covered by Art. 3(3) of the European directive 97/23/EC (Pressure Equipment Directive) and are designed according to sound engineer practice. For larger nominal diameters, optional approvals according to Cat. II/III are available when required (depends on fluid and process pressure).

#### Functional safety

SIL 2:
In accordance with IEC 61508/IEC 61511-1 (FDIS)

#### CE mark

The measuring system is in conformity with the statutory requirements of the EC Directives. Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.

#### Other standards and guidelines

- **EN 60529:** Degrees of protection by housing (IP code)
- **EN 61010:** Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Procedures.
- **EN 61326/A1 (IEC 1326):** "Emission in accordance with requirements for Class A". Electromagnetic compatibility (EMC-requirements)
- **NAMUR NE 21:** Electromagnetic compatibility (EMC) of industrial process and laboratory control equipment.
- **NAMUR NE 43:** Standardisation of the signal level for the breakdown information of digital transmitters with analogue output signal.
- **NAMUR NE 53:** Software of field devices and signal-processing devices with digital electronics
10.1.13 **Ordering information**

The Endress + Hauser service organisation can provide detailed ordering information and information on the order codes on request.

10.1.14 **Accessories**

Various accessories, which can be ordered separately from Endress+Hauser, are available for the transmitter and the sensor. → Page 83

The Endress+Hauser service organisation can provide detailed information on the order codes of your choice.

10.1.15 **Documentation**

- System Information Promass (SI 032D/06/en)
- Technical Information Promass 80/83 F, M (TI 053D/06/en)
- Technical Information Promass 80/83 E (TI 061D/06/en)
- Technical Information Promass 80/83 A (TI 054D/06/en)
- Technical Information Promass 80/83 H, I (TI 052D/06/en)
- Description of Device Functions Promass 83 (BA 060D/06/en)
- Supplementary documentation on Ex-ratings: ATEX, FM, CSA
- Functional safety manual Promass 80/83 (SD077D/06/en)
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Declaration of contamination

Dear customer,
Because of legal determinations and for the safety of our employees and operating equipment, we need this Declaration of contamination with your signature before your order can be handled. Please, include the completely filled in declaration with the device and the shipping documents in any case. Add also safety sheets and / or specific handling instructions if necessary.

Type of device / sensor: __________________________ Serial no.: __________________________
Medium / concentration: __________________________ Temperature: __________________________
Cleaned with: __________________________ Conductivity: __________________________

Warning hints for medium used (mark the appropriate hints)

- ☐ radioactive
- ☐ explosive
- ☐ caustic
- ☐ poisonous
- ☐ harmful to health
- ☐ biologically hazardous
- ☐ inflammable
- ☐ safe

Reason for return
_________________________________________________________________________________
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I hereby certify that the returned equipment has been cleaned and decontaminated acc. to good industrial practices and is in compliance with all regulations. This equipment poses no health or safety risks due to contamination.

(Place, date) __________________________ (Company stamp and legally binding signature)

More information about services and repairs:
www.services.endress.com

Endress+Hauser
People for Process Automation