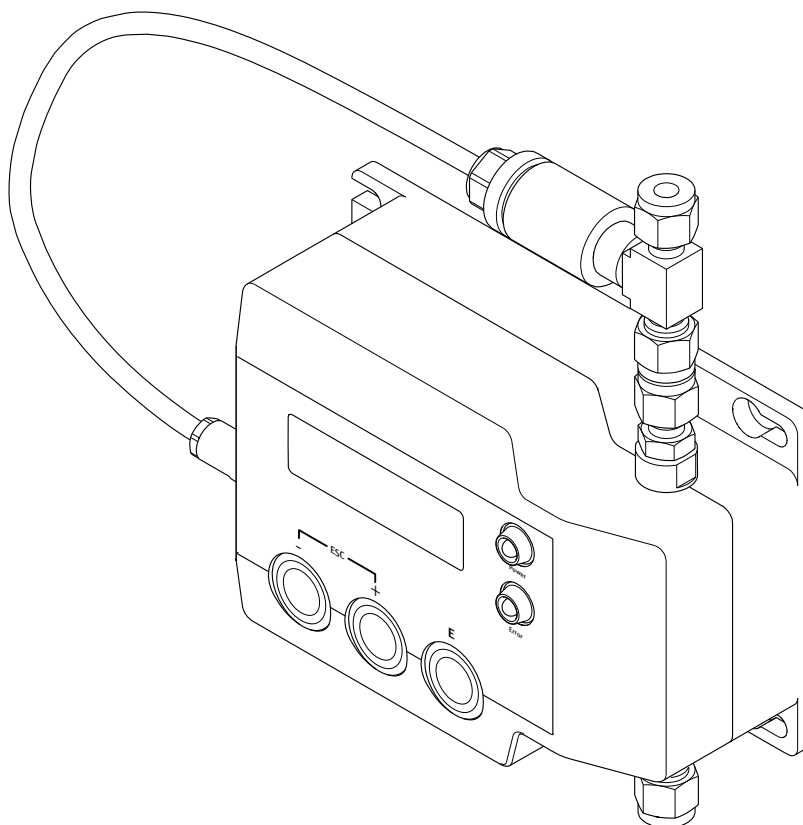


Valid as of version
V 3.200 (Device software)
V 3.2.0 (Nanomass Communication)

Operating Instructions

Nanomass Gas Density

MEMS Coriolis density meter



- Make sure the Operating Instructions are stored in a safe place such that they are always available when working on or with the measuring device.
- To avoid danger to individuals or the facility, read the "Basic safety instructions" section carefully, as well as all other safety instructions in the Operating Instructions that are specific to working procedures.
- The manufacturer reserves the right to modify technical data without prior notice. Your Endress+Hauser Sales Center will supply you with current information and updates to these Operating Instructions.

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1 Notes on the Operating Instructions

1.1 Document function

These Operating Instructions contain all the information that is required in the various phases of the life cycle of the device; from product identification, incoming acceptance and storage, to mounting, connection, operation and commissioning through to troubleshooting, maintenance and disposal.

1.2 Symbols used

1.2.1 Safety symbols

Symbol	Meaning
 A0011189-EN	DANGER This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.
 A0011190-EN	WARNING This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.
 A0011191-EN	CAUTION This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium personal injury.
 A0011192-EN	NOTE This symbol contains information on procedures and other facts which do not result in personal injury.

1.2.2 Electrical symbols

Symbol	Meaning
 A0011197	Direct current A terminal to which DC voltage is applied or through which direct current flows.
 A0011198	Alternating current A terminal to which alternating voltage is applied or through which alternating current flows.
 A0017381	Direct current and alternating current ▪ A terminal to which alternating voltage or DC voltage is applied. ▪ A terminal through which alternating current or direct current flows.
 A0011200	Ground connection A grounded terminal which, as far as the operator is concerned, is grounded via a grounding system.

1.2.3 Symbols for certain types of information

Symbol	Meaning
 A0011182	Permitted Indicates procedures, processes or actions that are permitted.
 A0011183	Preferred Indicates procedures, processes or actions that are preferred.

Symbol	Meaning
 A0011184	Forbidden Indicates procedures, processes or actions that are forbidden.
 A0011193	Tip Indicates additional information.
 A0011194	Reference to documentation Refers to the corresponding measuring device documentation.
 A0011195	Reference to page Refers to the corresponding page number.
1., 2., 3.,...	Series of steps
	Result of a sequence of actions
 A0013562	Help in the event of a problem
 A0015502	Visual inspection

1.2.4 Symbols in graphics

Symbol	Meaning
1, 2, 3,...	Item numbers
A, B, C, ...	Views
A-A, B-B, C-C,...	Sections
 A0013441	Flow direction
 A0011187	Hazardous area Indicates the hazardous area.
 A0011188	Safe area (non-hazardous area) Indicates the non-hazardous area.

1.2.5 Abbreviations

Abbreviation	Meaning
MEMS	Micro-electro mechanical system (MEMS)

1.3 Technical documentation

For an overview of the scope of the associated Technical Documentation, refer to the following:

- CD-ROM provided.
- *W@M Device Viewer*: Enter the serial number indicated on the nameplate (www.endress.com/deviceviewer).
- *The Endress+Hauser Operations App*: Enter the serial number indicated on the nameplate or scan the 2-D matrix code (QR code) provided on the nameplate.

 For a detailed list of the individual documents along with the documentation code (→  77).

1.3.1 Standard documentation

Document type	Purpose and content of the document
Technical Information	Planning aid for your measuring device This document contains all the technical data for the measuring device and provides an overview of the specific accessories and spare parts that can be ordered.
Brief Operating Instructions	Guide that takes you quickly to the 1st measured value The Brief Operating Instructions contain all the essential information from incoming acceptance to initial commissioning.

1.3.2 Supplementary device-dependent documentation

Additional documents are supplied depending on the device version ordered. The instructions in the supplementary documentation must also be followed when commissioning and operating the device. The supplementary documentation is an integral part of the device documentation.

1.4 Registered trademarks

Applicator[®], Nanomass[®]

Registered or registration-pending trademarks of the Endress+Hauser Group

BOROFLOAT[®]

Registered trademark of Schott AG, Jena, Germany

Microsoft[®]

Registered trademark of the Microsoft Corporation, Redmond, Washington, USA

Swagelok[®]

Registered trademark of Swagelok & Co., Solon, USA

2 Basic safety instructions

2.1 Requirements for personnel

Personnel involved in installation, commissioning, diagnostics and maintenance must meet the following requirements:

- Are trained specialists with relevant qualifications for the specific functions and tasks.
- Are authorized by the plant owner/operator.
- Are familiar with federal/national regulations.
- Before starting work, personnel must read and understand the instructions in the manual and supplementary documentation as well as the certificates (depending on the application).
- Follow instructions and comply with basic conditions.

Operating personnel must meet the following requirements:

- Are instructed and authorized according to the requirements of the task by the facility's owner-operator.
- Follow the instructions in the manual.

2.2 Designated use

Application and media

The measuring device described in this manual is intended for the density and concentration measurement of non-corrosive gases only. Only permitted media can be used. See the "Media" section (→  72).

Depending on the version ordered, the measuring device can also measure explosive and flammable media.

Measuring devices designed for use in hazardous areas are specially labeled as such on the nameplate.

To ensure that the measuring device remains in perfect condition during the operating time, compliance with the following conditions is mandatory:

- ▶ Only use the measuring device in full compliance with the data on the nameplate and the general conditions in the Operating Instructions and supplementary documentation.
- ▶ Based on the nameplate, check whether the ordered measuring device is permitted for the intended use in the hazardous area (e.g. explosion protection, pressure vessel safety).
- ▶ Use the measuring device only for media against which the process-wetted materials are adequately resistant. See the "Media" section (→  72).
- ▶ If the measuring device is not operated at atmospheric temperature, compliance with relevant basic conditions specified in the device documentation provided is absolutely essential. See also the "Technical Documentation" (→  68).

Incorrect use

Non-designated use can compromise safety. The manufacturer is not liable for damage caused by improper or non-designated use.

Clarification of borderline cases:

- ▶ For special fluids and fluids for cleaning, Endress+Hauser is glad to provide assistance in verifying the corrosion resistance of fluid-wetted materials, but does not accept any warranty or liability as even minute changes in the temperature, concentration or level of contamination in the process can alter the corrosion resistance properties.

Residual risks

Possible burn hazard due to fluid temperatures

- ▶ If fluid temperatures are high, ensure protection against contact to prevent burns.

2.3 Occupational safety

If working on and with the measuring device:

- ▶ Wear the required personal protective equipment according to federal/national regulations.

2.4 Operational safety

Risk of injury

- ▶ Only operate the measuring device in proper technical condition, free from errors and faults.
- ▶ The operator is responsible for the interference-free operation of the device.

Modifications to the measuring device

Unauthorized modifications to the measuring device are not permitted and can lead to unforeseeable dangers.

- ▶ If, despite this, modifications are required, consult with Endress+Hauser.

Repairs

To ensure continued operational safety and reliability:

- ▶ Carry out repairs on the measuring device only if they are expressly permitted.
- ▶ Observe federal/national regulations pertaining to repair of an electrical device.
- ▶ Use original spare parts and accessories from Endress+Hauser only.

2.5 Product safety

This measuring device is designed in accordance with good engineering practice to meet state-of-the-art safety requirements, has been tested, and left the factory in a condition in which it is safe to operate. It meets general safety standards and legal requirements. It also complies with the EC directives listed in the device-specific EC Declaration of Conformity. Endress+Hauser confirms this by affixing the CE mark to the device.

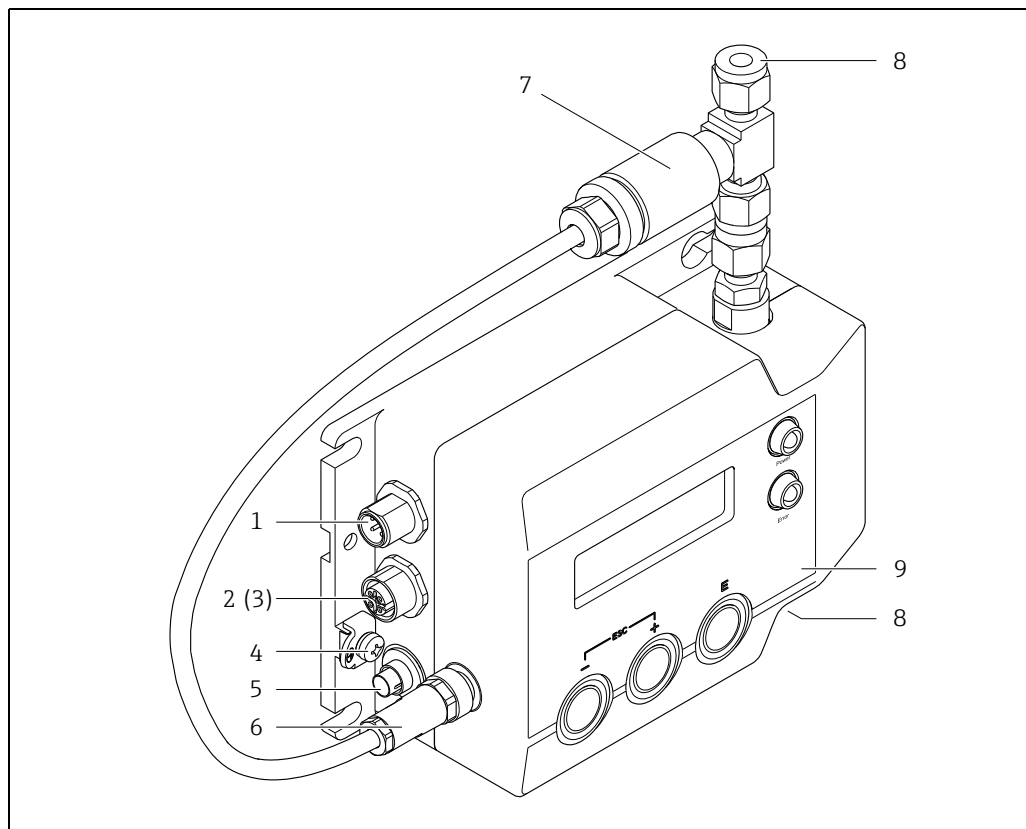
2.6 IT security

We only provide a warranty if the measuring device is installed and used as described in the Operating Instructions. The measuring device is equipped with security mechanisms to protect it against any inadvertent changes to the device settings.

IT security measures in line with operators' security standards and designed to provide additional protection for the measuring device and device data transfer must be implemented by the operators themselves.

3 Product description

3.1 Product design



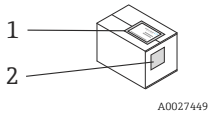
A0026432

Fig. 1: Important components of the measuring device (device version with RS232 interface)

- 1 Connection for 4-20 mA analog outputs
- 2 RS232 interface for digital signal transmission (optional)
- 3 USB port for digital signal transmission and supply voltage (optional, not illustrated in graphic)
- 4 Ground terminal
- 5 Connection for supply voltage
- 6 Connection for pressure sensor
- 7 Pressure sensor
- 8 Connections for inlet and outlet
- 9 Local operation with display, operating elements and LED status indication

4 Incoming acceptance and product identification

4.1 Incoming acceptance

Is the order code on the delivery note (1) identical to the order code on the product sticker (2)?	 ☐
Is the measuring device undamaged?	☐
Do the nameplate data match the ordering information on the delivery note?	☐



If one of the conditions is not satisfied, contact your Endress+Hauser Sales Center.

4.2 Product identification

The following options are available for identification of the measuring device:

- Nameplate specifications
- Order code with breakdown of the device features on the delivery note.
- Enter the serial number indicated on the nameplate in *W@M Device Viewer* (www.endress.com/deviceviewer): All the information about the measuring device is displayed.
- Enter the serial number indicated on the nameplate into the *Endress+Hauser Operations App* or scan the 2-D matrix code (QR code) on the nameplate with the *Endress+Hauser Operations App*: All the information about the measuring device is displayed.

For an overview of the scope of the Technical Documentation provided, refer to the following:

- "Additional standard device documentation" section (→  7) and "Supplementary device-dependent documentation" section (→  7)
- *W@M Device Viewer*: Serial number indicated on the nameplate (www.endress.com/deviceviewer)
- *The Endress+Hauser Operations App*: Enter the serial number indicated on the nameplate or scan the 2-D matrix code (QR code) provided on the nameplate.

4.2.1 Nameplate

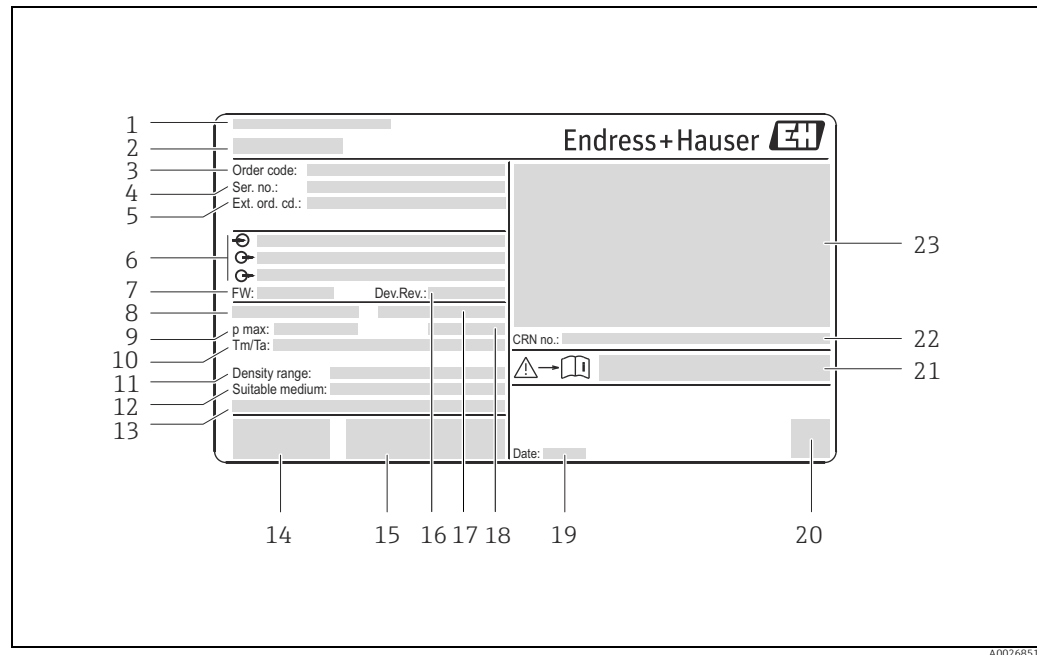


Fig. 2: Example of a nameplate

- | | |
|----|--|
| 1 | Place of manufacture |
| 2 | Name of the measuring device |
| 3 | Order code |
| 4 | Serial number (ser. no.) |
| 5 | Extended order code (ext. ord. co.) |
| 6 | Electrical connection data, e.g. available inputs and outputs, supply voltage |
| 7 | Firmware version (FW) |
| 8 | Nominal diameter of the micro-channel |
| 9 | Maximum permitted system pressure |
| 10 | Permitted ambient temperature range (T_a) and medium temperature range (T_m) |
| 11 | Permitted medium density range |
| 12 | Permitted media |
| 13 | Additional information on the device version; special product |
| 14 | CE mark, C-tick |
| 15 | Additional information on the device version; certificates, approvals |
| 16 | Device version (Dev.Rev.) |
| 17 | Nominal diameter of the process connection |
| 18 | IP protection class |
| 19 | Date of manufacture; year-month |
| 20 | 2-D matrix code |
| 21 | Document number of safety-related supplementary documentation |
| 22 | Approval information for CRN |
| 23 | Approval information for explosion protection |



Order code

The measuring device is reordered using the order code.



Extended order code

- The device type (product root) and basic specifications (mandatory features) are always listed.
- With regard to optional specifications (optional features), only safety and approval-related specifications are listed (e.g. LA). If other optional specifications have also been ordered, they are indicated by the placeholder symbol "#" (e.g. #LA#).
- If ordered optional specifications do not include any safety and approval-related specifications, they are indicated by the placeholder symbol (+) (e.g. DCEBN7-AAACAA01AA11+).

4.2.2 Symbols on measuring device

Symbol	Meaning
	WARNING This symbol alerts you to a life-threatening situation. Failure to avoid this situation can result in serious or fatal injury.
 A0011199	Protective ground connection A terminal which must be connected to ground prior to establishing any other connections.
 A0011194	Reference to documentation Refers to the corresponding measuring device documentation.

5 Storage, transportation, disposal of packaging

5.1 Storage conditions

Observe the following notes for storage:

- Store in the original packaging to ensure protection from shock.
- Do not remove protection caps mounted on connections.
They prevent contaminations of the micro-electro mechanical system (MEMS).
- Protect from direct sunlight to avoid unacceptably high surface temperatures.
- Select a storage location where moisture cannot collect in the measuring device as fungus and bacteria infestation can damage the MEMS.
- Store in a dry and dust-free place.
- Do not store outdoors.
- Storage temperature →  71.

5.2 Transporting the product

Observe the following during transport:

- Transport the measuring device to the measuring point in the original packaging.
- Do not remove protection caps mounted on connections. They prevent contaminations of the MEMS.
- Observe the transport instructions on the adhesive label on the packaging.

5.3 Disposal of packaging

All packaging materials are environmentally friendly and 100% recyclable:

- Measuring device secondary packaging:
 - Polymer stretch wrap
 - PE foam
- Protection caps on process connections; polymer LDPE
- Packaging: Box in accordance with European Packaging Directive 94/62EC; recyclability is confirmed by the affixed recycling symbol.
- Carrying and mounting hardware:
 - Disposable plastic pallet
 - Plastic straps
 - Plastic adhesive strips
- Dunnage: Paper cushion

6 Installation

6.1 Installation conditions

No special measures such as supports are necessary. External forces are absorbed by the construction of the device.

6.1.1 Mounting position

Mounting location

The measuring device is usually installed in a bypass pipe. If flow rates are low, the device can also be installed in the main pipe.

Installation in a bypass pipe is recommended in the following cases:

- Flow rate >1 l/min (0.26 gal/min.)
- Pipeline diameter >6 mm (0.24 in)

Orientation

The orientation of the device does not affect the measuring accuracy.

Flow direction

The flow direction does not affect the measuring accuracy.

Inlet and outlet runs

Inlet and outlet runs do not affect the measuring accuracy.

6.1.2 Requirements from environment and process

Ambient temperature range

Non-Ex version	-20 to +60 °C (-4 to +140 °F)
Ex ia IIC T4 version	-20 to +60 °C (-4 to +140 °F)

- If operating via USB port: Operating temperature is limited to 0 to 60 °C (32 to 140 °F).
- If operating outdoors: Avoid direct sunlight, particularly in warm climatic regions.

System pressure

Permitted absolute system pressure	Max. 20 bar (290 psi)
------------------------------------	-----------------------

The relative accuracy of the density measurement increases with increasing system pressure.

Filter

To prevent the micro-channel from clogging, it is advisable to install a filter upstream from the measuring device. The filter is included in the delivery.

- Recommended filter pore size: ≤15 µm
- Included filter in delivery: ¼"-Swagelok in-line filter SS-4F-15

Thermal insulation

Due to a low thermal capacity of the medium, the medium temperature can be greatly affected by the ambient temperature through the supply line and the measuring device. The influence of the ambient temperature on the medium temperature can be reduced by insulating the supply line.

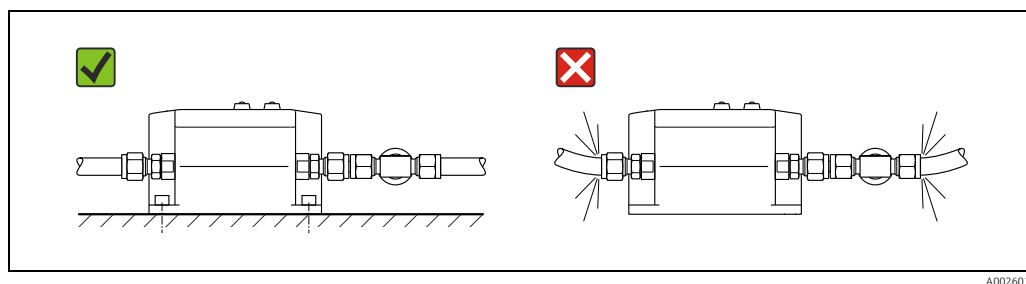
Vibrations

Due to the high operating frequency of the micro-channel, vibrations (<20 kHz) do not affect measuring accuracy.

6.1.3 Special mounting instructions

Wall mounting

- Use drill holes and M6 screws to secure the filter to a wall or a secure base.



A0026012

Pipe mounting

- Use the "pipe mounting kit" accessory to secure to a pipe or post.

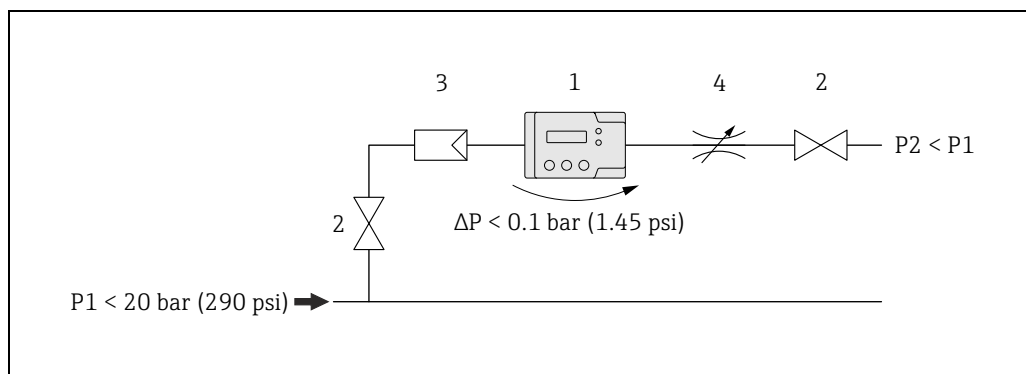
Installation in a bypass pipe

Note the following when installing in a bypass pipe:

- A pressure drop must be created for the medium to flow through the measuring device.
- The maximum permissible pressure drop of 0.1 bar (1.45 psi) across the measuring device may not be exceeded.
- The bypass pipe can be routed to the atmosphere or back to the process pipe.

Examples:

- Create necessary pressure drop with throttle (or flow monitor) downstream from the measuring device.



A0026152

Fig. 3: 1 = Nanomass; 2 = Valve; 3 = Filter; 4 = Throttle

- Create necessary pressure drop with orifice plate in process pipe and with throttle (or flow monitor) downstream from the measuring device.

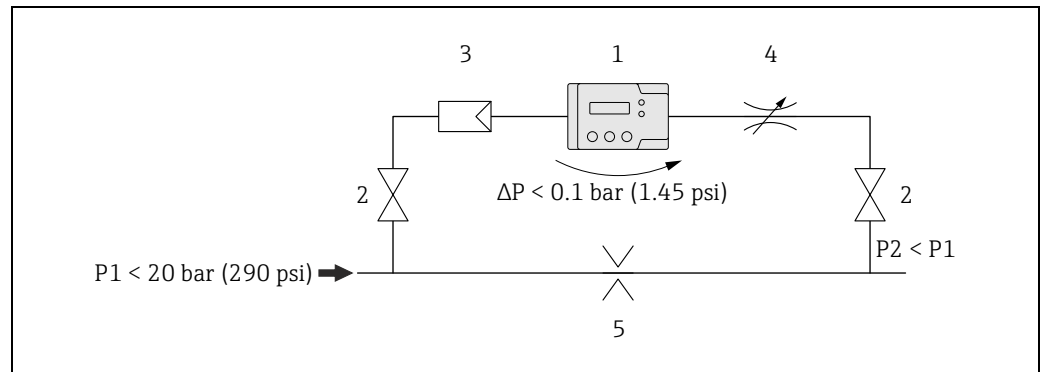


Fig. 4: 1 = Nanomass; 2 = Valve; 3 = Filter; 4 = Throttle; 5 = Orifice plate

- Create necessary pressure drop with compressor upstream and throttle (or flow monitor) downstream from the measuring device.

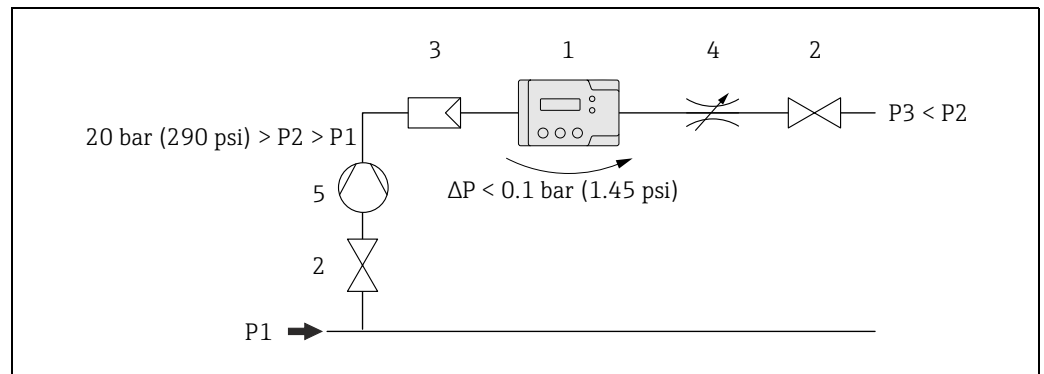


Fig. 5: 1 = Nanomass; 2 = Valve; 3 = Filter; 4 = Throttle; 5 = Compressor

- If process pressure $> 20 \text{ bar}$: Create necessary pressure drop with pressure reduction valve upstream and throttle (or flow monitor) downstream from the measuring device.

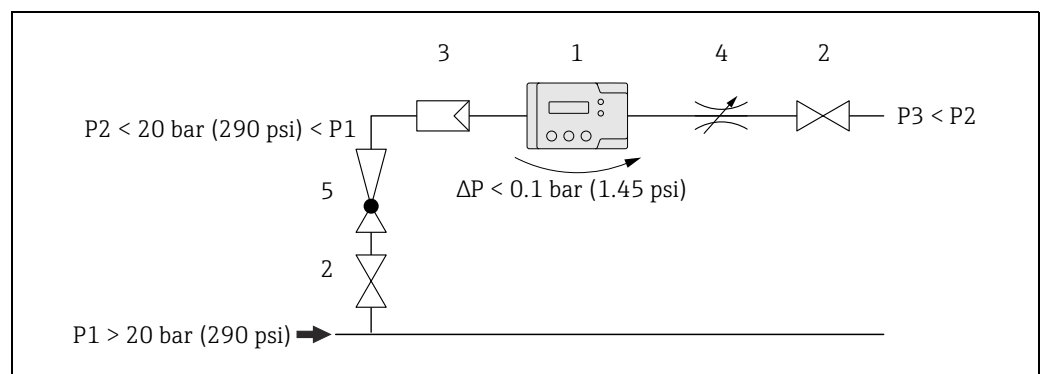


Fig. 6: 1 = Nanomass; 2 = Valve; 3 = Filter; 4 = Throttle; 5 = Pressure reduction valve

Swagelok pipe union

The measuring device and the filter supplied are mounted in the pipe using a 1/4" Swagelok pipe union.

1. Cut the pipe at a right-angle and deburr it.
2. Push the pipe into the fitting as far as it will go.
3. Tighten the nut finger-tight.
4. Mark the nut at the 6-o'clock position.
5. Tighten the nut. In doing so, observe the following options:
 - When mounting for the first time, tighten with **1 1/4** rotations.
 - When mounting a second time, tighten with a **1/4** rotation.

For more information, see the installation instructions for pipe unions provided by Swagelok.

Pressure sensor

The measuring device only provides correct measured values when the pressure sensor is connected. The pressure sensor is already connected when the device is delivered.

- ▶ Make sure that the pressure sensor is connected correctly.

6.2 Mounting the measuring device

6.2.1 Required tools

For process connections: Use an appropriate tool for mounting with Swagelok pipe unions.

6.2.2 Preparing the measuring device

1. Remove all remaining transport packaging.
2. Remove the protection caps on the inlet and outlet.

6.2.3 Mounting the measuring device

WARNING

Incorrect device mounting

Burst pipes can cause injury.

- ▶ Never install the device in the pipe in such a way that it is suspended freely without additional support.

NOTICE

Mechanical load on the process connections

Pipe forces can affect the vibrations of the micro-channel and thereby impact the accuracy of measurement.

- ▶ Avoid high mechanical load on the pipes at process connections.
- ▶ If mounting on the process pipe, use a wrench to cushion the torque. Do not allow torques to act on the measuring device.

NOTICE

Blockage of the micro-channel

- ▶ Install a filter upstream from the measuring device (→  15).

1. To ensure compliance with the maximum flow specifications in the measuring device and the recommended pressure drop across the measuring device, use a bypass pipe with appropriate assemblies where necessary (→  16).

2. Connect the filter to the pipe (→  15) and secure with a Swagelok pipe union (→  18).
3. Mount the measuring device on a wall or ceiling using drill holes (→  16).
4. Connect the measuring device to the pipe and secure with a Swagelok pipe union (→  18).

6.3 Post-installation check

Is the device undamaged (visual inspection)?	☐
If assemblies are installed, are they undamaged (visual inspection)?	☐
Does the measuring device conform to the measuring point specifications? For example: ■ Medium →  72 ■ Medium temperature range →  72 ■ Process pressure (refer to the section on "Pressure-temperature ratings" in the "Technical Information" document) ■ Ambient temperature range →  15 ■ Measuring range →  68	☐
Are the measuring point identification and labeling correct (visual inspection)?	☐
Is the measuring device adequately protected from precipitation and direct sunlight?	☐
Are the securing screws tightened securely?	☐
Is the pressure sensor connected?	☐

7 Electrical connection



The measuring device does not have an internal circuit breaker. For this reason, assign the measuring device a switch or power-circuit breaker so that the power supply line can be easily disconnected from the mains.

7.1 Connection conditions

7.1.1 Required tools

- For cable entries: Use an appropriate tool.
- When using stranded cables: Use a crimper for wire end ferrule.

7.1.2 Connecting cable requirements

The connecting cables provided by the customer must fulfill the following requirements:

Electrical safety

In accordance with applicable national regulations.

Permitted temperature range

- -40 to 80 °C (-40 to 176 °F)
- Minimum requirement: Cable temperature range $\geq$ ambient temperature + 20 K

Power supply cable

Outer diameter	3.5 to 5 mm
Number of cores	Min. 2
Cable resistance	77.8 Ω /km at 20 °C
Shielding	Single shielding

Signal cable

Shielding	A shielded cable is recommended. Observe grounding concept of the plant.
-----------	--

USB cable

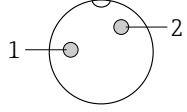
Cable type	Mini USB, type B, Buccaneer; standard USB, type A
Cable length	Max. 5 m

RS232 cable

Cable type	M12, 4-pin; D-Sub, 9-pin
Cable length	Max. 5 m
Transmission rate	57600 Bd

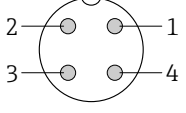
7.1.3 Pin assignment of connector

Connector for supply voltage

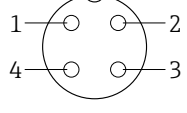
 A0026825	Pin	Assignment		Coding, connector face	Connector/ socket
	1	L-	DC 8 to 30 V	A	Connector
	2	L+			

Connector for signal transmission

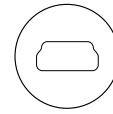
4-20 mA connector

 A0026826	Pin	Assignment		Coding, connector face	Connector/ socket
	1	+/-	Current output 1, 4-20 mA (passive)		
	2	-/+	Current output 1, 4-20 mA (passive)		
	3	+/-	Current output 2, 4-20 mA (passive)		
	4	-/+	Current output 2, 4-20 mA (passive)		

RS232 device socket

 A0026827	Pin	Assignment	Coding, connector face	Connector/ socket
	1	Shield (shield ground)	A	Socket
	2	Txout (transmitted data)		
	3	Rxin (received da)		
	4	Common ground (signal ground)		

USB device socket

 A0026828	Assignment		Connector/socket
	Mini USB, type B, Buccaneer		Socket

7.1.4 Preparing the measuring device

- Remove the protection caps from the connections.

NOTICE

Measuring device not leak tight

If the measuring device is not leak tight, this can impair the operational reliability of the measuring device.

- Only remove the protection caps if connections are used.

7.2 Connecting the measuring device

⚠ WARNING

Improper connection can cause serious injury or death

- ▶ Have electrical connection work carried out by correspondingly trained specialists only.
- ▶ Observe applicable federal/national installation codes and regulations.
- ▶ Comply with local workplace safety regulations.
- ▶ If using in hazardous areas, observe the explosion protection documentation.

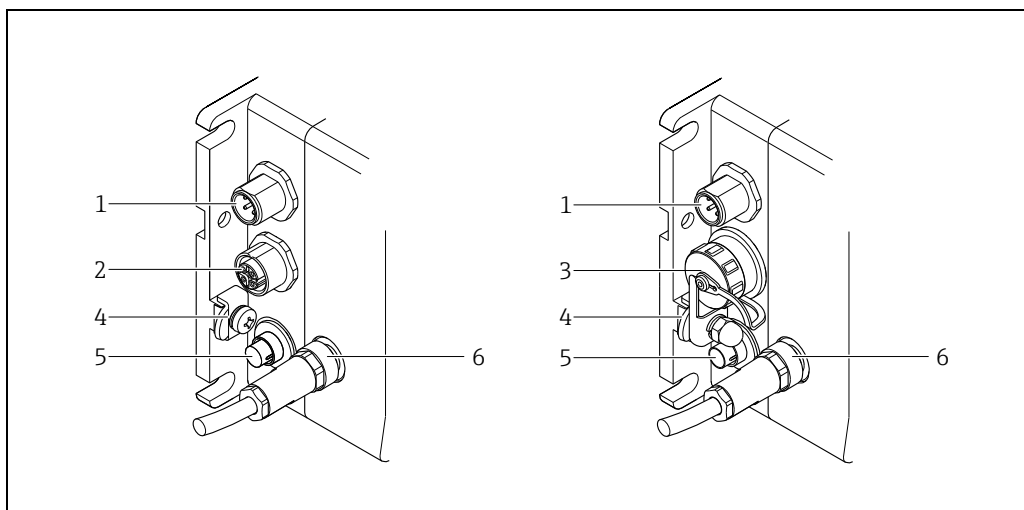


Fig. 7: Measuring device versions and connection versions

- | | |
|---|---|
| 1 | Connector for 4-20 mA |
| 2 | RS232 interface (optional) |
| 3 | USB port (optional) |
| 4 | Ground terminal |
| 5 | Connector for supply voltage |
| 6 | Connector for pressure sensor (connected on delivery) |

7.2.1 Connecting the supply voltage cable

The supply voltage can be connected via the supply voltage connection and optionally via the USB port in a non-hazardous area. If the supply voltage connection is to be used for the supply voltage, perform the following steps:

1. Measuring device with USB port: Make sure that the measuring device is disconnected from the USB port.
2. If necessary, strip 10 mm (0.4 in) of the supply voltage cable and cable ends. In the case of stranded cables, also fit ferrules.
3. Where applicable, connect the cable to the connector for supply voltage in accordance with the pin assignment → 21.
4. Insert the connector into the supply voltage connection of the measuring device and screw tight.
5. If using in hazardous areas: Fit the USB protection cap and tighten securely.

7.2.2 Connecting the signal cables

Signals can be transmitted digitally via a USB port or RS232 interface or by analog communication via the passive 4-20 mA connection.

Connect the 4-20 mA cable

1. Strip 10 mm (0.4 in) of the cable and cable ends. In the case of stranded cables, also fit ferrules.
2. Connect the cable to the 4-20 mA connector in accordance with the pin assignment →  21.
3. Insert the connector into the 4-20 mA connection of the measuring device and screw tight.
4. Connect the signal cable to the 12-24 V power supply →  24.

Connect the RS232 cable (optional)

1. If necessary, strip 10 mm (0.4 in) of the cable and cable ends. In the case of stranded cables, also fit ferrules.
2. Where applicable, connect the cable to the RS232 connector in accordance with the pin assignment →  21.
3. Connect the RS232 cable to the RS232 socket of the measuring device and the COM port (RS232) of the PC and screw tight.

Connect the USB cable (optional)

1. Make sure that the measuring device is disconnected from the supply voltage.
2. Connect the USB cable to the USB port of the measuring device and the USB port of the PC.
3. Secure the cable to the device with a protection cap and cable clamp.

7.3 Special connection instructions

7.3.1 Connection examples

Current output 4-20 mA

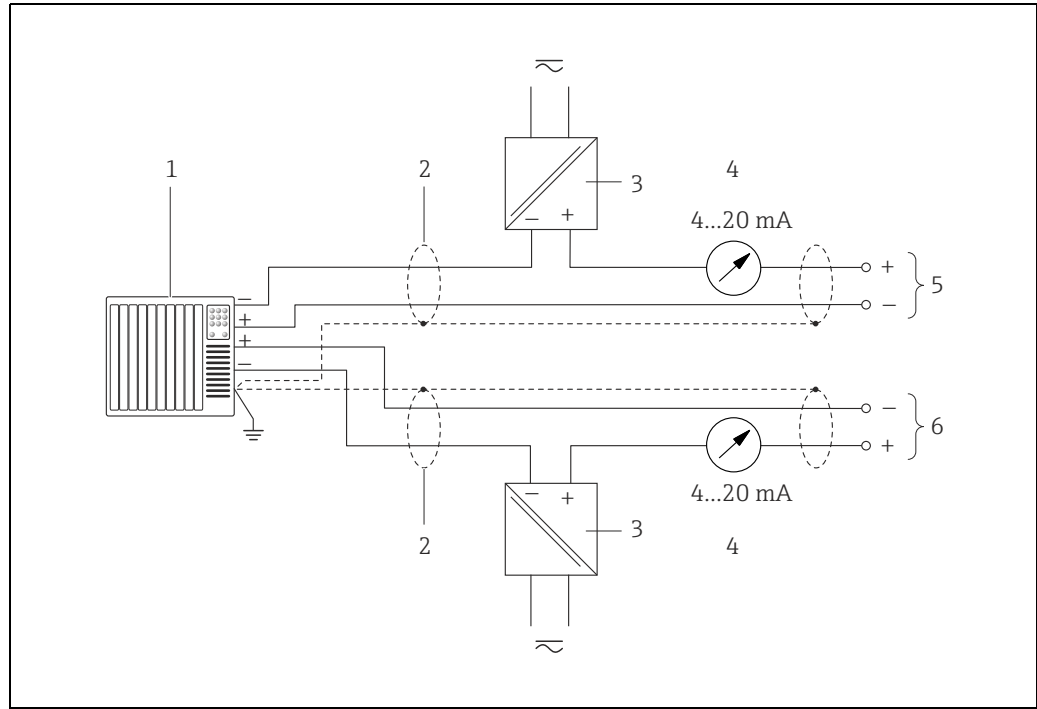


Fig. 8: Connection example for 4-20 mA current output

- 1 Automation system with current input (e.g. PLC)
- 2 Cable shield, comply with connecting cable requirements (→ 20)
- 3 Power supply 12-24 V
- 4 Analog display unit: Observe maximum load (→ 68)
- 5 Measuring device, current output 1 (pin 1 and 2, protected against reverse polarity)
- 6 Measuring device, current output 2 (pin 3 and 4, protected against reverse polarity)

7.4 Guaranteeing the degree of protection

The measuring device meets all the requirements of IP65/67 protection.

To guarantee IP65/67 protection, carry out the following steps after electrical connection:

For USB port:

1. Check whether the seals of the protection caps are clean and inserted correctly.
2. Fit the protection caps and tighten securely.

7.5 Post-connection check

Are cables and the device undamaged (visual inspection)?	☐
Do the cables comply with the requirements (→  20)?	☐
Do the cables have adequate strain relief?	☐
Does the supply voltage match the specifications on the nameplate?	☐
Are all connectors installed and protection caps securely tightened?	☐
Is the pin assignment of the connectors correct?	☐
Depending on the device option and the use of the device: Is the USB connector secure?	☐
If supply voltage is provided, is the power LED on the measuring device lit?	☐

8 Operating options

8.1 Overview of operating options

The measuring device offers users the following operating options:

- Local operation
- "Nanomass Communication" operating tool (via USB port or RS232 interface)

 The operating language of the measuring device is English. Other language options are not supported.

NOTICE

Errors during measured value transmission

Errors may occur at the current outputs during transmission of the measured values when the device is operated locally or using the "Nanomass Communication" operating tool.

- Complete operation for correct measured value.

8.2 Access to the measuring device via the local display

8.2.1 Operational display

The operational display is used to display measured variables, parameters, dialog texts and error messages.

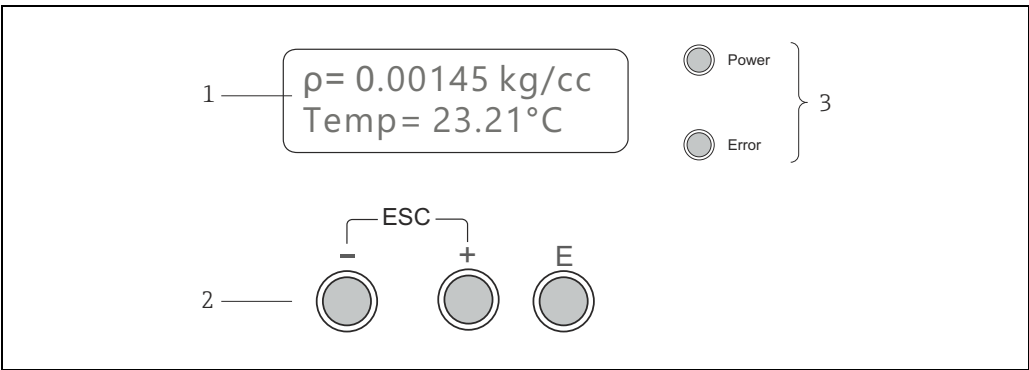


Fig. 9: Operational display

1 Measured value display and parameter configuration view (2-lines)

2 Operating elements

3 LED status indicator

Measured value display

A measured variable is displayed on every line. A maximum of four measured variables in total can be displayed in multiplex mode. In multiplex mode, the measured variables alternate on the screen every 5 seconds.

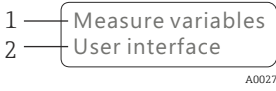
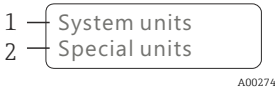
Measured variables

Abbreviation	Description
ρ	Density
ρr	Reference density
Temp	Temperature
Conc	Concentration
Press	Pressure

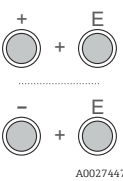
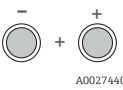
 The number and display format of the measured values can be configured in the "User interface" → "Assign" menu.

Parameter configuration views

 The user is in the operational display mode: Press Enter to open parameter configuration mode.

Menu	Submenu	Parameter
		
1 Selected menu item 2 Next menu item	1 Selected submenu item 2 Next submenu item	1 Parameter name 2 Parameter value

Operating elements

Key	Description
	Minus key <i>In a menu or submenu</i> Navigate between the menus or submenus <i>In a parameter</i> Change a parameter value
	Plus key <i>In a menu or submenu</i> Navigate between the menus or submenus <i>In a parameter</i> Change the parameter value
	Enter key <i>In a menu or submenu</i> Call a submenu or parameter <i>In a parameter</i> Confirm an entry or navigate to the next parameter
	Back/Forwards key combination (press keys simultaneously) <i>In a parameter</i> Navigate within a parameter value to the next or previous number or digit.
	Escape key combination (press keys simultaneously) <i>In a menu</i> Exit the parameter configuration view and go to the measured value display <i>In a submenu</i> Exit the submenu and go to the menu <i>In a parameter</i> Exit the parameter and go to the submenu

LED status indicators

For a description, see "Diagnostic information via light emitting diodes" →  58.

8.2.2 Functions

Function	Operation
Display measured values	Once the measuring device has been connected to the supply voltage and the measuring device is ready for operation, the measured values appear on the operational display.
Enter parameter configuration	The user is in the operational display mode. ► Press Enter.
Disable write protection via access code	Parameter configuration is protected by an access code. This code cannot be configured. ► Enter the access code 0074 using the plus and minus keys. Press Enter to confirm each digit.
Navigate between the menus or submenus	The user is in the parameter configuration view in a menu or submenu. ► Press the Plus or Minus key.
Call submenus or parameters	The user is in the parameter configuration view in a menu or submenu. ► Press Enter.
Change parameter values	The user has called up a parameter. ► Press the Plus or Minus key.
Navigate within the parameter value to the next number or digit	The user has called up a parameter and makes changes to a parameter value. ► Press the Plus and Enter key or the Minus and Enter key simultaneously.
Confirm entries	The user has called up a parameter and makes changes to a parameter value. ► Press Enter.
Navigate to the next parameter	The user has called up a parameter. ► Press Enter.
Return to the previous menu or submenu	► Press the Plus and Minus key simultaneously. The user has reached the end of a parameter list. ► System returns to the previous menu automatically after one second.

8.3 Access to the measuring device via the "Nanomass Communication" operating tool

8.3.1 Function scope

The measuring device can be operated and configured via the "Nanomass Communication" operating tool. The parameter structure is the same as with the local display (→  78). In addition to the measured values and the parameters, status information on the measuring device is also displayed and allows the user to monitor the status of the device. Furthermore the measuring device data can be managed and visualized and basic device parameters (e.g. calibration factors or device clock) can be configured.

8.3.2 Prerequisites

Hardware

Connecting cable	Depends on the device interface: ■ USB cable: Mini USB, type B, Buccaneer; standard USB, type A or ■ RS232 cable: M12, 4-pin, gold contact; D-Sub, 9-pin
Computer	Depends on the device interface: ■ USB port or ■ RS232 interface Disk drives (for the installation of the "Nanomass Communication" operating tool): ■ CD-ROM drive

Computer software

Recommended operating system	PC: ■ Windows 8.1 (32 bit or 64 bit) ■ Windows 7 (32 bit or 64 bit) ■ Windows XP  For installing on Windows XP, Windows 7 and Windows 8.1 administrator rights are required.
Driver	■ USB driver
Configuring the computer	The following components must be installed on the PC to be able to install the "Nanomass Communication" operating tool. If the components are not already installed, they will be installed automatically when the setup file is run. ■ National Instruments VISA Runtime, Version 5.4 or higher ■ For USB port: Virtual serial interface according to RS232 (virtual com port)
System configuration	The decimal separator "." (decimal point) must be configured.

8.3.3 Installing the "Nanomass Communication" operating tool

NOTICE

Upgrading from an earlier version

If an earlier version of the tool is installed, installing a new version can cause problems.

- Uninstall the earlier version before installing the new "Nanomass Communication" operating tool.

NOTICE

Incorrect measured value display

The "Nanomass Communication" operating tool uses a decimal point as the decimal separator. If a comma is set as the decimal separator in the operating system, the decimal places are ignored and are displayed as zeros.

- In the operating system, configure decimal point "." as the decimal separator for decimal places. In Windows, this setting can be made in Control Panel under "Region and Language" or "Clock, Language, and Region".

Installing the "Nanomass Communication" operating tool

1. Close all applications.
2. Insert the CD-ROM supplied in the drive.
3. Start the installation by double clicking on "setup.exe" in the CD directory "software/Nanomass Communication".
4. Follow the instructions in the installation window.

8.3.4 Connecting the measuring device to the PC

For information on connecting the device via an RS232 or USB cable →  23.

8.3.5 Establishing a connection

The "Nanomass Communication" operating tool automatically detects the measuring device connected to the PC. Several devices can be connected simultaneously. Only one measuring device can be selected in the operating tool, however.

1. Start Nanomass Communication.
 - ↳ The PC assigns the COM port automatically for the connected measuring device.
2. In the "COM-Port" selection box, select the COM port assigned by the PC for the connected measuring device.

** Connecting the device for the first time**

If the device is connected for the first time with the PC, the PC or "Nanomass Communication" operating tool does not detect the device correctly.

- Install the USB driver the first time the device is connected.

Installing the USB driver:

1. Depending on the version, connect the device to your computer via the USB port or the RS232 interface.
2. Open the Device Manager.
3. Update the driver software by right clicking on the device not detected.
4. Select manual search and installation of the driver software in the installation window. The driver software is located in the "drivers/USB_driver_F" directory.
5. Follow the instructions in the subsequent installation windows.

** No COM port is displayed**

1. Select "Refresh" in the "COM-Port" selection box.
 - ↳ The PC updates the picklist.
2. In the "COM-Port" selection box, select the COM port assigned by the PC for the connected measuring device.

8.3.6 User interface

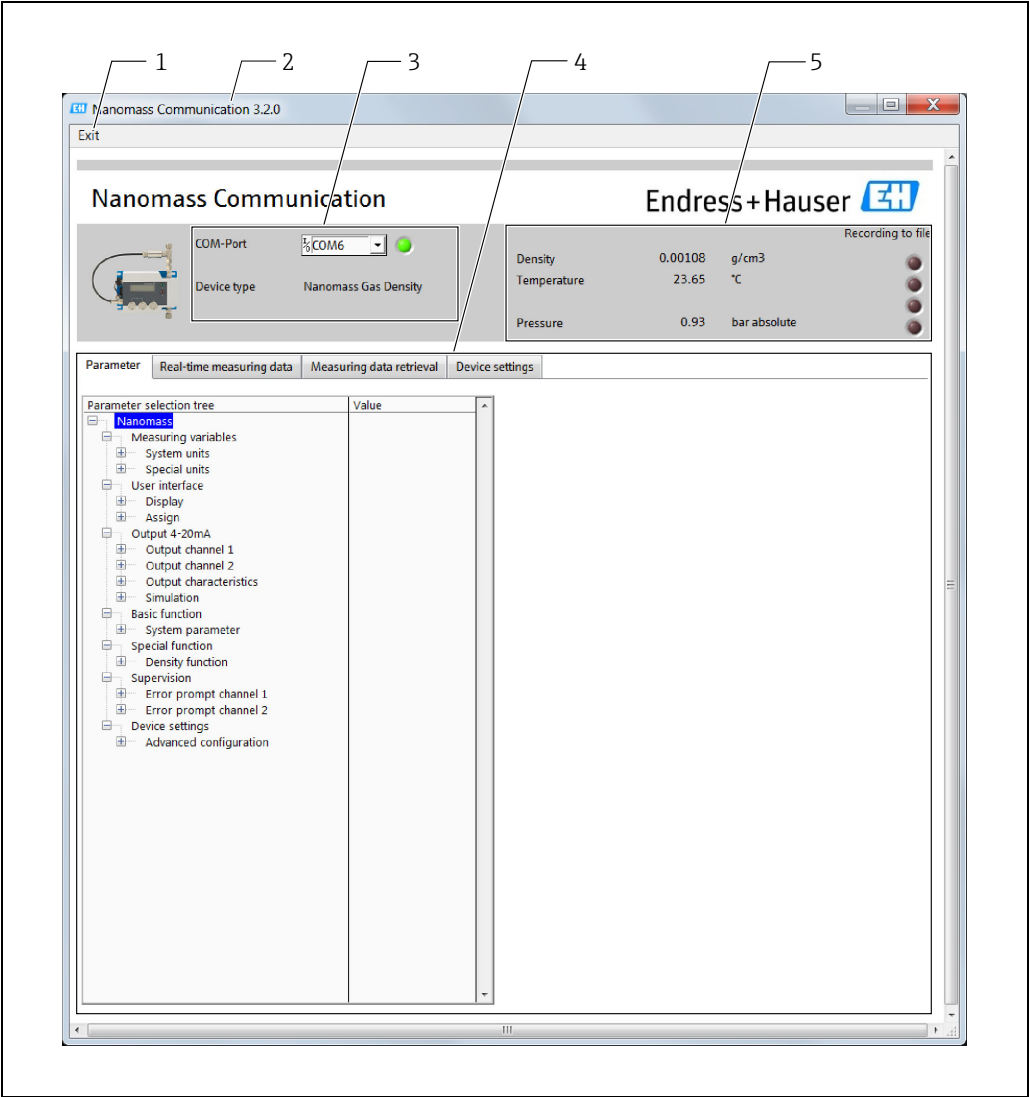


Fig. 10: User interface

- 1 Exit Nanomass Communication
- 2 Nanomass Communication software version
- 3 Establishing a connection
- 4 Device configuration and device functions
- 5 Measured value display and status indication

Establishing a connection

Selection/display	Description
COM port	Communication interface Select the communication interface for communicating with the measuring device. The list displayed contains all the COM ports available. A "Refresh" function is also provided to update the list.
Device type	Device type Displays the type of device that is connected ("Nanomass Gas Density").

Device configuration and device functions

Function area	Description
Parameter	Parameter Access to the device's operating menu structure; same as local display: ■ Configuration of parameters
Real-time measuring data	Real-time measured data Access to current measured values: ■ Graphic display of current measured values ■ Recording of current measured values (in text file)
Measuring data retrieval	Measured data retrieval Access to the internal data memory: ■ Settings for saving measured values ■ Export saved measured values (to text file)
Device settings	Device settings Access to device information and device settings: ■ Display device information ■ Configure the communication port (COM port) ■ Configure the display delay ■ Configure the device clock ■ Configure the calibration parameters ■ Service functions (protected by a code)  To access the "Device settings" function area, you must enter the access code 0074 in the "Access code for technician mode" field and then press "OK" to confirm. The system automatically returns to the "Parameter" function area after approx. three minutes.

Measured value display

The measured variables listed below are displayed along with their unit in the measured value display area. The display format can be changed via the parameter settings. A red signal to the right of the measured value indicates whether this value is being saved to a file.

Measured variables

Measured variable	Description
Density	Density Displays the measured density.
Reference Density	Reference density Displays the calculated reference density. The measured variable is only displayed if the "Ref. Density" parameter value is selected in the "Density function" parameter.
Temperature	Temperature Displays the medium temperature measured during density measurement.
Concentration	Concentration Displays the calculated concentration of a substance. The measured variable is only displayed if the "Concentration Measurement" application package is used and the "Concentration" or "Concentration predefined" parameter value is selected in the "Density function" parameter.
Pressure	Pressure Displays the pressure measured by the sensor during density measurement.

8.3.7 Parameter

Users can access the operating menu structure of the device in the "Parameter" function area. This menu structure can also be called via local operation.

Screen layout

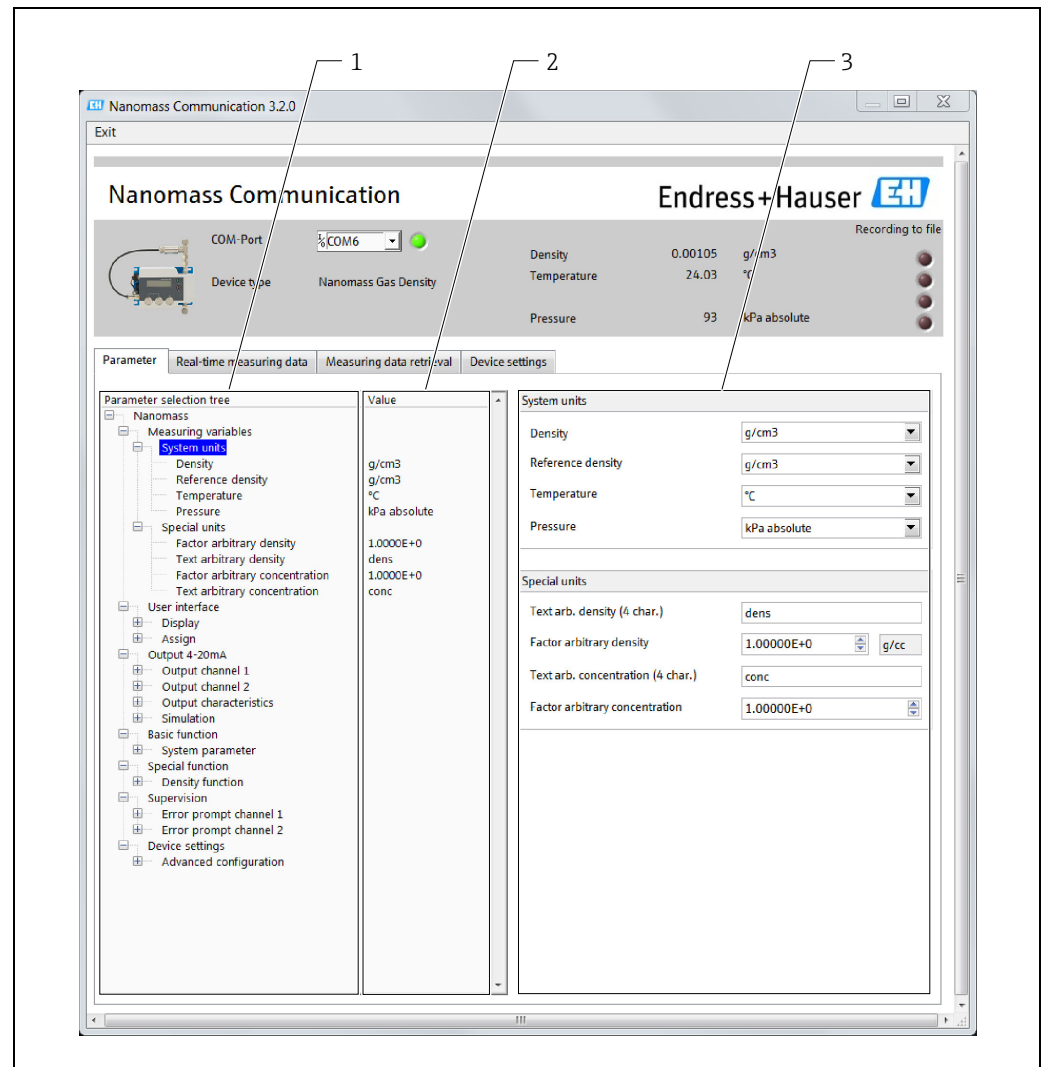


Fig. 11: Parameter

- 1 Navigation area
- 2 Displays the configured parameter value
- 3 Configuration area

Choosing parameters



It is not possible to directly select an individual parameter in the navigation area.

- ▶ To select a parameter, select the menu or submenu in question e.g. "Measuring variables" or "System units".
 - ↳ Parameters pertaining to the menu are displayed in the configuration area to the right of the navigation area.

Changing parameter values

- ▶ Enter or select the parameter value in the input box.
 - ↳ The measuring device adopts the new parameter value and "Refreshing" is displayed on the screen.

9 System integration

9.1 Overview of device description files

9.1.1 Current version data for the device

Firmware version	■ On the title page of the Operating instructions ■ On the nameplate (→ 12) ■ In Nanomass Communication: Function area "Device settings" → "Device information" → "Firmware Version" ■ On the local display during device start-up.
Release date of firmware version	30.11.2016
Device type ID	■ In Nanomass Communication: Header → "Device type" ■ On the local display during device start-up.
Device version	On the nameplate (→ 12).

9.1.2 Operating tools

Operating tools via serial interface	Sources for obtaining device descriptions
Nanomass Communication	■ www.endress.com → Download Area ■ CD-ROM (contact Endress+Hauser)

9.2 Measured variables via serial interface

9.2.1 General settings for the serial interface

Baud rate	19200
Data bits	8
Stop bits	1
Parity bit	None (0)
FlowControl	None (0)
Transmission mode	By packet (char = 8 bit or 1 byte)

10 Commissioning

10.1 Function check

Before commissioning the device, make sure that the post-installation and post-connection checks have been performed.

- "Post-installation check" checklist →  19.
- "Post-connection check" checklist →  25.

10.2 Switching on the measuring device

After a successful function check, switch on the measuring device. If power is supplied via the USB port, the measuring device starts automatically as soon as the USB cable is connected.

After a successful startup, the local display switches automatically from the startup display to the operational display.

 If nothing appears on the local display or an error message is displayed, refer to the section on "Diagnostics and troubleshooting" →  57.

10.3 Setting the operating language

The operating language of the measuring device is English. Other language options are not supported.

10.4 Configuring the measuring device

 An overview of all the device parameters and a description of the parameters is provided in the appendix →  78.

 Additional settings must be made if an application package is used: Please refer to the section on the "Datalog Function" application package →  44 or the section on the "Concentration Measurement" application package →  46.

10.4.1 Defining the tag name

Navigation

Function area "Device settings" → "Device information" → "Tag name"

 To access the "Device settings" function area, you must enter the access code **0074** in the "Access code for technician mode" window and then press "OK" to confirm.

Defining the tag name

1. Call up the "Device settings" function area.
2. Enter the new tag name under "Tag name" in the "Device information" area.
3. Click "Send" to confirm the name.
 - ↳ The message "Tag name changed" appears.
 - ↳ The name is saved in the device.
4. Click "OK" to confirm the message.

10.4.2 Setting the serial port delay time

The delay time for sending and receiving data via the serial port must be defined via the "Nanomass Communication" operating tool.

Navigation

Function area "Device settings" → "COM-Port" → "Data retrieval delay"



To access the "Device settings" function area, you must enter the access code **0074** in the "Access code for technician mode" field and then press "OK" to confirm.

Setting the delay time

1. Call up the "Device settings" function area.
2. Under "Data retrieval delay" in the "COM-Port" area, enter a delay time of between 300 and 500 ms for the serial port.

10.4.3 Setting the date and time

The date and time should be checked when the measuring device is commissioned to ensure that the measured data can be saved with the correct time.



If the "Datalog Function" application package is used, the internal data memory may need to be formatted once the date and time have been configured. Please refer to the section on the "Datalog Function" application package → 44.

Navigation "Nanomass Communication" operating tool

Function area "Device settings" → "Device settings" → "Set clock hh:mm:ss"

Function area "Device settings" → "Device settings" → "date format DD.MM.YYYY"



To access the "Device settings" function area, you must enter the access code **0074** in the "Access code for technician mode" field and then press "OK" to confirm.

Setting the date and time

1. Call up the "Device settings" function area.
2. Click the "Set clock" button in the "Device settings" area.
 - ↳ The date and time are now editable.
3. Enter the time and date and click the "Send date and time" button to confirm your settings.
 - ↳ The message "Date and time changed" appears.
 - ↳ The date and time are saved in the measuring device.
4. Click "OK" to confirm the message.

Navigation local display

Function area "Device settings" → "Device settings" → "Act time hhmmss"

10.4.4 Configuring the current output

Various parameters are used to configure the current output.



The "Error prompt min current" and "Error prompt max current" parameters can be used to display all fault states. If a connected system can only process one fault state, the parameters must have the same settings. In this case, the "Density range", for example, must be selected in "Error prompt min current" and "Error prompt max current".

Navigation

1. Menu "Measuring variables" → "System units"
2. Menu "Output 4-20 mA" → "Output channel 1" and "Output channel 2"
3. Menu "Supervision" → "Error prompt channel 1/2"

Parameter overview with brief description

Menu "Measuring variables" → "System units"

Parameter	Procedure	Selection/input	Factory setting
Density	Select the unit for density. <i>Result</i> The selected unit applies to: ■ The "Density" process variable ■ The "4mA Ch1" parameter ■ The "20mA Ch1" parameter ■ The "4mA Ch2" parameter ■ The "20mA Ch2" parameter <i>Note</i> If the unit is changed, configured current output values are automatically adapted to the new unit. Specific Gravity = measured density / density of air; Molecular weight = average molar mass according to the ideal gas law.	■ g/cm³ ■ g/cc ■ kg/L ■ kg/m³ ■ Lb/ft³ ■ Lb/gal ■ Unit defined under "Text arb. density" ■ Specific gravity ■ Molecular weight	kg/m ³
Reference density	Select the unit for reference density. <i>Result</i> The selected unit applies to the "Reference Density" process variable. <i>Note</i> If the unit is changed, configured current output values are automatically adapted to the new unit.	■ g/cm³ ■ g/cc ■ kg/L ■ kg/m³ ■ Lb/ft³ ■ Lb/gal	kg/m ³
Temperature	Select the unit for temperature. <i>Result</i> The selected unit applies to: ■ The "Temperature" process variable ■ The "4mA Ch1" parameter ■ The "20mA Ch1" parameter ■ The "4mA Ch2" parameter ■ The "20mA Ch2" parameter <i>Note</i> If the unit is changed, configured current output values are automatically adapted to the new unit.	■ °C ■ K ■ °F ■ °R	Country-specific: ■ °C ■ °F
Pressure	Select the unit for pressure. <i>Result</i> The selected unit applies to: ■ The "Pressure" process variable ■ The "4mA Ch1" parameter ■ The "20mA Ch1" parameter ■ The "4mA Ch2" parameter ■ The "20mA Ch2" parameter <i>Note</i> If the unit is changed, configured current output values are automatically adapted to the new unit.	■ bar absolute ■ bar gauge ■ psi absolute ■ psi gauge ■ kPa absolute ■ kPa gauge	Country-specific: ■ bar absolute ■ psi absolute

Menu "Output 4-20mA" → "Output channel 1"

Parameter	Description	Selection/input	Factory setting
Assign	Select process variable for current output 1.	■ Off ■ Density ■ Ref. density ■ Concentration (optional) ■ Concentration predefined (optional) ■ Temperature ■ Pressure	Density
4mA Ch1	Enter the lower limit for 4 mA current.	Decimal	0 (kg/m ³)
20mA Ch1	Enter the upper limit for 20 mA current.	Decimal	30 (kg/m ³)

Menu "Output 4-20mA" → "Output channel 2"

Parameter	Description	Selection/input	Factory setting
Assign	Select process variable for current output 2.	■ Off ■ Density ■ Ref. density ■ Concentration (optional) ■ Concentration predefined (optional) ■ Temperature ■ Pressure	Temperature
4mA Ch2	Enter the lower limit for 4 mA current.	Decimal	-20 (°C)
20mA Ch2	Enter the upper limit for 20 mA current.	Decimal	60 (°C)

Menu "Supervision" → "Error prompt channel 1"

Parameter	Description	Selection/input	Factory setting
Span	Select current span for current output 1.	■ Namur 4-20 mA ■ Non Namur 4-20 mA	Non Namur 4-20 mA
Error prompt min current	Select the diagnostic message if the current range for current output 1 is undershot.	■ Tube not oscillating ■ Density range ■ Pressure range ■ Temperature range	Tube not oscillating
Error prompt max current	Select the diagnostic message if the current range for current output 1 is exceeded.	■ Tube not oscillating ■ Density range ■ Pressure range ■ Temperature range	Tube not oscillating
Priority state	Diagnostic message if the failure mode configured for "Error prompt min current" and "Error prompt max current" occurs simultaneously. If "Min current" is selected, the diagnostic message chosen under "Error prompt min current" is output. If "Max current" is selected, the diagnostic message chosen under "Error prompt max current" is output.	■ Min current ■ Max current	Min current

Menu "Supervision" → "Error prompt channel 2"

Parameter	Description	Selection/input	Factory setting
Span	Select current span for current output 2.	■ Namur 4-20 mA ■ Non Namur 4-20 mA	Non Namur 4-20 mA
Error prompt min current	Select the diagnostic message if the current range for current output 2 is undershot.	■ Tube not oscillating ■ Density range ■ Pressure range ■ Temperature range	Tube not oscillating
Error prompt max current	Select the diagnostic message if the current range for current output 2 is exceeded.	■ Tube not oscillating ■ Density range ■ Pressure range ■ Temperature range	Tube not oscillating
Priority state	Diagnostic message if the failure mode configured for "Error prompt min current" and "Error prompt max current" occurs simultaneously. If "Min current" is selected, the diagnostic message chosen under "Error prompt min current" is output. If "Max current" is selected, the diagnostic message chosen under "Error prompt max current" is output.	■ Min current ■ Max current	Min current

10.4.5 Configuring the local display

Various parameters are used to configure the local display.

Navigation

1. Menu "User interface" → "Assign display" → "Top line"
2. Menu "User interface" → "Assign display" → "Top line multiplex"
3. Menu "User interface" → "Assign display" → "Bottom line"
4. Menu "User interface" → "Assign display" → "Bottom line multiplex"

Parameter overview with brief description*Menu "User interface" → "Assign display"*

Parameter	Description	Selection/input	Factory setting
Top line	Select the measured value that is shown on the top line of the local display.	■ Off ■ Density ■ Ref. density ■ Concentration (optional) ■ Concentration predefined (optional) ■ Temperature ■ Pressure	Density
Top line multiplex	Select the measured value that is shown on the top line of the local display when the display changes.	■ Off ■ Density ■ Ref. density ■ Concentration (optional) ■ Concentration predefined (optional) ■ Temperature ■ Pressure	Off

Parameter	Description	Selection/input	Factory setting
Bottom line	Select the measured value that is shown on the second line of the local display.	■ Off ■ Density ■ Ref. density ■ Concentration (optional) ■ Concentration predefined (optional) ■ Temperature ■ Pressure	Temperature
Bottom line multiplex	Select the measured value that is shown on the second line of the local display when the display changes.	■ Off ■ Density ■ Ref. density ■ Concentration (optional) ■ Concentration predefined (optional) ■ Temperature ■ Pressure	Pressure

10.4.6 Configuring the output behavior

Various parameters are used to configure the output behavior.

Navigation

1. Menu "Output 4-20mA" → "Output characteristics" → "Time constant output"
2. Menu "Basic function" → "System parameter" → "Measurement value damping"

Parameter overview with brief description

Menu "Output 4-20mA" → "Output characteristics" → "Time constant output"

Parameter	Description	Selection/input	Factory setting
Time constant output	Set the response time of the output signal to variations in the measured value.	Positive integer 0 to 120 s	0 s

Menu "Basic function" → "System parameter" → "Measurement value damping"

Parameter	Description	Selection/input	Factory setting
Measurement value damping	Set the response time of the local display to variations in the measured value.	Positive integer 0 to 120 s	0 s

10.5 Advanced settings

The measuring device supports the entry of user-defined units. Furthermore, it is possible to configure reference density measurement and concentration measurement as well as density adjustment.

10.5.1 Entering user-defined density units

A user-defined unit can be entered for the "Density" measured variable in the "Special Units" menu. The unit is then available for selection in the "Density" parameter in the menu "Measuring variables" → "System units".

Navigation

Menu "Measuring variables" → "Special units"

Parameter overview with brief description

Menu "Measuring variables" → "Special units"

Parameter	Description	Selection/input	Factory setting
Text arb. density (4 char.)	Enter the text string for the arbitrary density unit. The unit is then available for selection in the "Density" parameter in the "System unit" menu.	XXXX (max. 4 characters)	dens
Factor arbitrary density	Enter the quantity factor for the arbitrary density unit. The factor converts the original measured value into the arbitrary unit.	6-digit floating point number and 1-digit exponent	1.00000E+0

10.5.2 Configuring reference density measurement

Settings for calculating the reference density can be made in the "Special Function" menu.

Navigation

Menu "Special function" → "Density function"

Parameter overview with brief description

Menu "Special function" → "Density function"

Parameter	Description	Selection/input	Factory setting
Density type	Select the density function for calculating special density values or the percentage of components in binary mixtures.	Ref. density	Off
Reference pressure	Enter the reference pressure for calculating the reference density.	Decimal	Country-specific: 14.5 psi a 1 bar
Reference temperature	Enter the reference temperature for calculating the reference density.	Decimal number with sign	Country-specific: 60 °F 15 °C

10.5.3 Configuring the concentration measurement

Information on concentration measurement →  46

10.5.4 Performing density adjustment with medium

A density adjustment can be performed under process conditions to achieve optimum accuracy. The density adjustment must be performed using the "Nanomass Communication" operating tool.



In addition to density adjustment with a medium where the known density value is entered, density adjustment can also be performed using a gas that is already preprogrammed in the measuring device. Please refer to the "Performing density adjustment with gas" section →  60.

Navigation

Function area "Device settings" → Menu "Calibrate density" → "Single point density calibration"



To access the "Device settings" function area, you must enter the access code **0074** in the "Access code for technician mode" field and then press "OK" to confirm.

Performing density adjustment with medium



The measuring device must be filled with a medium to perform a density adjustment. Furthermore, the exact density of the medium at the indicated temperature and pressure must be known.

1. Call up the "Device settings" function area.
2. In the "Calibrate density" section, click the "Enter actual density" button to enter the current density.
 - ↳ The "Prompt" window opens.
3. Enter the value of the current density in the "Density" field and click "OK" to confirm.
 - ↳ The message "Are you sure you want to continue?" appears.
4. Click "Yes, calibrate" to perform the density adjustment.
 - ↳ Density adjustment commences.



Density adjustment has failed

If the density adjustment does not go to plan, the default factory density coefficients can be restored with the "Reset field calibration" function.

1. Call up the "Device settings" function area.
2. In the "Calibrate density" section, click the "Perform reset" button to reset the density calibration to the factory default setting.
 - ↳ The "Reset field calibration density offset value" message appears on the display.
3. Click "Continue" to continue the process.
 - ↳ The density calibration is reset to the factory default.

10.6 Simulation

The "Simulation" function allows users to simulate different process variables and the device alarm behavior without a real measuring situation.

Navigation

Menu "Output 4-20mA" → "Simulation"

Parameter overview with brief description

Menu "Output 4-20mA" → "Simulation"

Parameter	Description	Selection/input	Factory setting
Activate simulation	Parameter is only visible on the local display. Switch simulation of the current outputs on and off.	■ On ■ Off	Off
Current test value (mA)	Local operation: Enter the current value for simulation. Via "Nanomass Communication" operating tool: 1. Enter the current value for simulation. 2. Click on "Activate". ↳ The window opens. 3. Click "Continue" to perform the simulation.	2.00 to 23.00 mA	2.00 mA

10.7 "Datalog Function" application package

10.7.1 Availability

If the "Datalog Function" application package was ordered for the measuring device ex works, the function is available when the measuring device is delivered from the factory. The function is accessed via Nanomass Communication. No particular measures are required to be able to put the function into operation.

Ways to check function availability:

- Using the serial number on the device:
W@M Device Viewer → order code option EB "Datalog Function"
- Via the Nanomass Communication operating tool:
Check whether the function appears in Nanomass Communication. If you can open the "Measuring data retrieval" function area, the function is activated.

If the function cannot be accessed, the application package was not selected when the device was ordered. It is possible to subsequently activate the function.

10.7.2 Activation

A conversion kit from Endress+Hauser is required for activation. Among other things, this kit contains an activation code which must be entered via Nanomass Communication to activate the "Datalog Function".

The activation function is available under "Device Settings" → "Service mode" → "Activate software options". Once activated the "Datalog Function" application package is permanently available in the measuring device.

 To access the "Device settings" function area, you must enter the access code **0074** in the "Access code for technician mode" field and then press "OK" to confirm. To be able to access the functions of the "Service mode", the code **4685** for the service mode must be entered.

10.7.3 General information

The "Datalog Function" application package can only be accessed via Nanomass Communication. After activating the application package, measured data that are saved in the internal data memory can be retrieved in the "Measuring data retrieval" function area. Furthermore, the measured data and the physical units can be saved to a text file that can be imported into a database. If the application package was not activated, the "Measuring data retrieval" function area is disabled and the measured data cannot be accessed.

 For further information on retrieving measured data, please refer to the "Retrieving measured data" section →  54.

10.7.4 Time delay between working memory and internal data memory

The measured data are first stored temporarily in a working memory. The working memory can store up to 68 log entries approximately. The data are only stored in the internal data memory when the working memory is full. The time delay between the working memory and internal data memory depends on the configured sampling rate.

Example of time delay

- Working memory: 68 log entries (2048 bytes)
- Configured sampling rate: 10 s
- Time delay: $68 * 10 \text{ s} = 680 \text{ seconds} = \text{approx. } 11 \text{ minutes}$

10.7.5 Storage space of internal data memory

When the internal data memory is full, the oldest data records are overwritten with the most recent data records. The internal data memory has 250 MB of storage space. It is sufficient for approx. 30 months based on a configured sampling rate of 10 s. It is therefore recommended to call up the data on the internal data memory frequently and to store the data externally.

10.7.6 Setting the sampling rate

To configure the datalog function, the user can define the required sampling rate using the "Nanomass Communication" operating tool. The sampling rate refers to the frequency with which data are stored in the internal data memory. The default setting is 10 s.

Navigation "Nanomass Communication" operating tool

Function area "Device settings" → "Internal data logger" → "Sampling rate"



To access the "Device settings" function area, you must enter the access code **0074** in the "Access code for technician mode" field and then press "OK" to confirm.

Setting the sampling rate

1. Call up the "Device settings" function area.
2. Under "Sampling rate" in the "Internal data logger" section, enter the sampling rate at which data are saved in the internal data memory. The sampling rate can be between 1 and 3600 seconds.
3. Click the "Set sampling rate" button to confirm the sampling rate.
 - ↳ The sampling rate is saved in the device.

Navigation local display

Function area "Device settings" → "Device settings" → "Sampl. rate log."

10.7.7 Formatting the internal data memory

The data memory must be formatted so that the measuring device can store the data correctly. Before the internal data memory is formatted, the date and time must be specified in the measuring device using the "Nanomass Communication" operating tool; please refer to the "Setting the date and time" section (→ 37). The internal data memory must be formatted using the "Nanomass Communication" operating tool.



The measuring device is not available during the formatting process.

Navigation

Function area "Measuring data retrieval" → "Erase flash memory"

Formatting the internal data memory

1. Open the "Measuring data retrieval" function area.
2. In the "Erase flash memory" area, click on "Perform reset".
 - ↳ All of the data are deleted from the internal data memory.

10.8 "Concentration Measurement" application package

10.8.1 Availability

If the "Concentration Measurement" application package was ordered for the measuring device ex works, the function is available when the measuring device is delivered from the factory. The function is accessed via the measuring device local display or via Nanomass Communication. No particular measures are required to be able to put the function into operation.

Ways to check function availability in the measuring device:

- Using the serial number:
W@M Device Viewer → order code option EC "Concentration"
- In the operating menu:
Check whether the function appears in the operating menu: Menu "Special function" → "Density function" → "Density type". The function is activated if the "Concentration" and "Concentration predefined" options are available.

If the function cannot be accessed in the measuring device, the application package was not selected when the device was ordered. It is possible to subsequently activate the function.

10.8.2 Activation

A conversion kit from Endress+Hauser is required for activation. Among other things, this kit contains an activation code which must be entered via Nanomass Communication to activate the "Concentration Measurement" function.

The activation function is available under "Device Settings" → "Service mode" → "Activate software options". Once activated the "Concentration Measurement" application package is permanently available in the measuring device.



To access the "Device settings" function area, you must enter the access code **0074** in the "Access code for technician mode" field and then press "OK" to confirm. To be able to access the functions of the "Service mode", the code **4685** for the service mode must be entered.

10.8.3 General principles

Once the "Concentration Measurement" application package is activated, the measuring device can output the concentration of a binary gas mixture. The concentration indicates the quantity of a pure substance that is in a gas mixture. The density, pressure and temperature measured variables make it possible to calculate the concentration of a fluid using thermodynamic models. If a gas mixture consists of two substances (e.g. methane and carbon dioxide), the measuring device can calculate the concentration of one of the substances (e.g. methane or carbon dioxide) and display this information.

10.8.4 Concentration measurement with mixtures predefined in the measuring device

Certain mixtures for concentration measurement are already preprogrammed in the measuring device. The concentration can be measured straight away.

Predefined mixtures:

- Carbon dioxide/Methane
- Carbon dioxide/Hydrogen
- Air/Carbon dioxide
- Hydrogen/Carbon monoxide
- Air/Hydrogen
- Nitrogen/Hydrogen
- Argon/Hydrogen
- Nitrogen/Carbon dioxide
- Oxygen/Carbon dioxide
- Air/Oxygen
- Methane/Hydrogen

Settings for displaying a predefined concentration can be made in the "Special Function" menu with the "Concentration predefined" function.

Navigation

1. Menu "Special function" → "Density function"

Parameter overview with brief description

Menu "Special function" → "Density function" → "Density type"

Parameter	Description	Selection/input	Factory setting
Density type	Select the density function for calculating special density values or the percentage of components in binary gas mixtures.	■ Concentration predefined	Off
Select mixture	Select the gas mixture.	■ Carbon dioxide/Methane ■ Carbon dioxide/Hydrogen ■ Air/Carbon dioxide ■ Air/Hydrogen ■ Hydrogen/Carbon monoxide ■ Nitrogen/Hydrogen ■ Argon/Hydrogen ■ Nitrogen/Carbon dioxide ■ Oxygen/Carbon dioxide ■ Air/Oxygen ■ Methane/Hydrogen	Carbon dioxide/Methane
Select component in mixture	Select the component of the gas mixture for the display.	Depends on the gas mixture chosen in the "Select mixture" parameter.	Carbon dioxide

10.8.5 Customer-specific concentration measurement

Customer-specific mixtures can be shown by entering coefficients. The coefficients must be entered in the measuring device for this purpose. Your Endress+Hauser Sales Center will provide the coefficients. The following information is needed to determine the coefficients:

- Composition (concentration range) of the binary gas mixture to be measured
- Temperature range in which the gas mixture is measured
- Pressure range in which the gas mixture is measured

The accuracy depends on the difference in density between the two substances in the gas mixture and on the pressure in the measuring device. The greater the difference in density and pressure, the more accurate the measured values. The measuring device cannot

calculate binary gas mixtures where both substances have the same density (e.g. nitrogen and carbon monoxide).

Settings for calculating a customer-specific concentration can be made in the "Special Function" menu with the "Concentration" function.

Navigation

1. Menu "Measuring variables" → "Special units"
2. Menu "Special function" → "Density function"

Parameter overview with brief description

Menu "Measuring variables" → "Special units"

Parameter	Description	Selection/input	Factory setting
Text arb. concentration (4 char.)	Enter the text string for the arbitrary concentration unit. The unit is then available for selection as "Other 3D" in the "Concentration unit" parameter in the "Density function" menu.	XXXX (max. 4 characters)	conc
Factor arbitrary concentration	Enter the quantity factor for the arbitrary concentration unit. The factor changes the original measured value from the concentration specification.	6-digit floating point number and 1-digit exponent	1.00000E+0

Menu "Special function" → "Density function" → "Density type"

Parameter	Description	Selection/input	Factory setting
Density type	Select the density function for calculating special density values or the percentage of components in binary gas mixtures.	■ Concentration	Off
Concentration unit	Select the unit for calculating the concentration.	■ % Mass 3D ■ % Volume 3D ■ Other 3D	% Volume 3D
Concentration selection	Select the concentration specification.	The names that were defined in the "Concentration names" parameter for the concentration specifications.	1st coeff
Concentration names	Enter the specific name for the concentration specification.	Character string consisting of a maximum of ten letters, numbers, blank spaces and/or special characters.	1st coeffs, 2nd coeffs, 3rd coeffs, 4th coeffs
Display precision	Select the accuracy of the concentration display.	■ 1 ■ 0.1 ■ 0.01	0.01
Concentration offset	Enter an offset value for the calculated concentration.	Decimal number with sign -5.000 to 5.000	0.0
A0	Enter the function coefficient A0.	6-digit floating point number and 1-digit exponent	0.00000E+0
A1	Enter the function coefficient A1.	6-digit floating point number and 1-digit exponent	0.00000E+0
A2	Enter the function coefficient A2.	6-digit floating point number and 1-digit exponent	0.00000E+0
A3	Enter the function coefficient A3.	6-digit floating point number and 1-digit exponent	0.00000E+0
A4	Enter the function coefficient A4.	6-digit floating point number and 1-digit exponent	0.00000E+0

Parameter	Description	Selection/input	Factory setting
A5	Enter the function coefficient A5.	6-digit floating point number and 1-digit exponent	0.00000E+0

Menu "Special function" → "Density function" → Density type "Concentration predefined"

Parameter	Description	Selection/input	Factory setting
Density type	Select the density function for calculating special density values or the percentage of components in binary gas mixtures.	■ Concentration predefined	Off
Select mixture	Select the gas mixture.	■ Carbon dioxide/Methane ■ Carbon dioxide/Hydrogen ■ Air/Carbon dioxide ■ Air/Hydrogen ■ Hydrogen/Carbon monoxide ■ Nitrogen/Hydrogen ■ Argon/Hydrogen ■ Nitrogen/Carbon dioxide ■ Oxygen/Carbon dioxide ■ Air/Oxygen ■ Methane/Hydrogen	Carbon dioxide/Methane
Select component in mixture	Select the component of the gas mixture for the display.	Depends on the gas mixture chosen in the "Select mixture" parameter.	Carbon dioxide

11 Operation

11.1 Changing the operating language

The operating language of the measuring device is English. Other language options are not supported.

11.2 Configuring the local display

Settings for the local display (→  40).

11.3 Reading measured values on the local display

All the current measured values for every process variable can be read on the local display with the "Main values" submenu.

Navigation

Menu "Measuring variables" → "Main values"

Parameter overview with brief description

Menu "Measuring variables" → "Main values"

Parameter	Description	Display
Density	Displays the density currently measured.	Floating point number with sign
Temperature	Displays the temperature currently measured.	Floating point number with sign
Pressure	Displays the pressure currently measured.	Floating point number with sign

11.4 Accessing real-time measured data

Real-time measured data can be graphically displayed and recorded in a text file using the "Real-time measuring data" function area in Nanomass Communication.

11.4.1 Screen layout

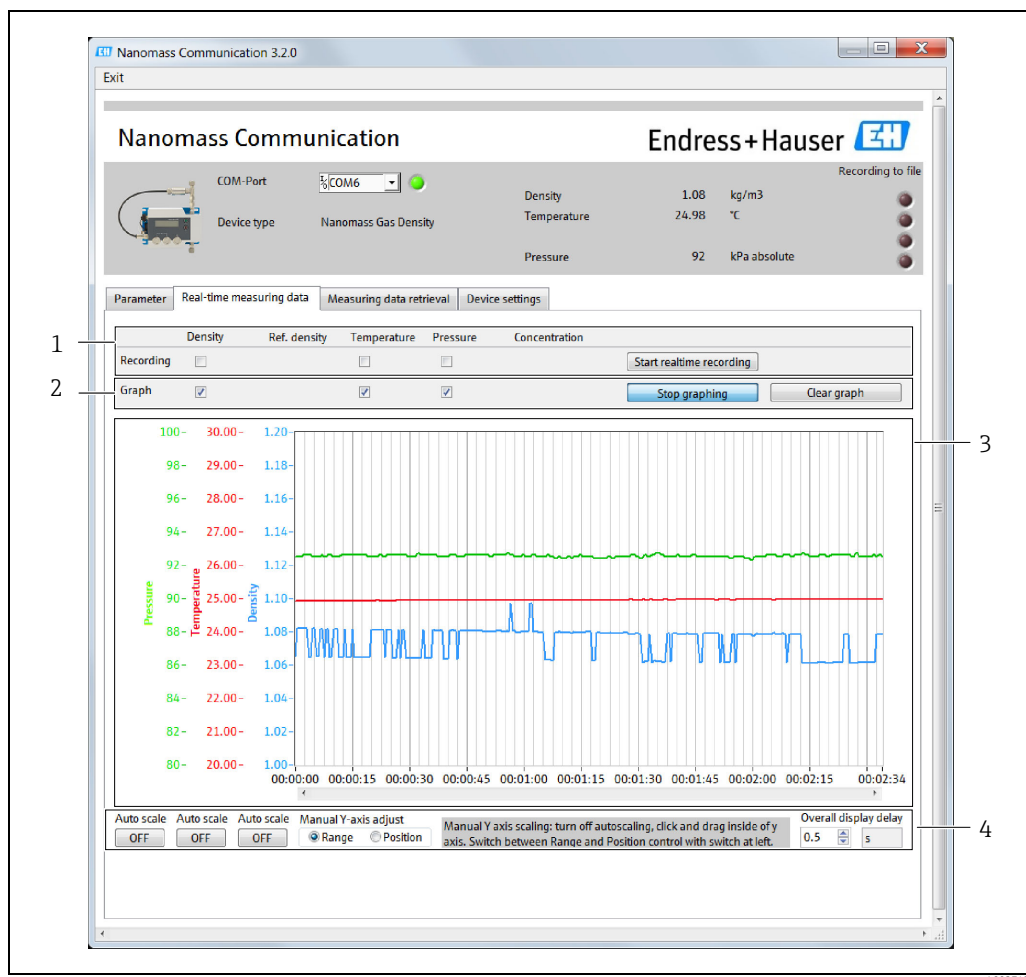


Fig. 13: Real-time measured data

- 1 Recording functions
- 2 Graph functions
- 3 Graph display
- 4 Graph display functions

11.4.2 Recording real-time measured data in a text file

i No additional measured variables or physical units can be added while measured data are being recorded. If you wish to add more measured variables, you must start the recording process again.

1. In the "Recording" section, select the measured variable to be recorded.
2. Press the "Start realtime recording" button.
→ The "Record Data" window appears.
3. Select the file where the real-time measured data will be saved. You can choose from the following options:
 - Select "Create new file" to save real-time measured data in a new file.
 - Select "Extend existing file" to insert real-time measured data into an existing file.
 - Select "Overwrite existing file" to overwrite an existing file with real-time measured data.

4. Press the "Select" button.
 - ↳ A window opens where you can select where the file should be saved.
5. Select the desired storage location. You can choose from the following options:
 - If you selected "Create new file" previously, select the desired storage location for the new file.
 - If you selected "Extend existing file" previously, select the existing file to which real-time measured data are to be added.
 - If you selected "Overwrite existing file" previously, select the existing file which should be overwritten.
6. Press the "Create file" button to confirm your choice.
 - ↳ The selected storage location is displayed in the "Record Data" window.
7. If necessary, enter a preferred comment for the file header in the "Comment header" input box.
8. If necessary, enter a preferred comment for every line of measured data in the file in the "Comment each" input box.
9. Press "Start" to start recording.
 - ↳ Real-time measured data are written to the selected file.
 - ↳ In the measured value display area, a red signal appears to the right of the measured variable that is being recorded.

11.4.3 Stopping recording

- ▶ Press the "Stop realtime recording" button.
 - ↳ The device stops recording real-time measured data.

11.4.4 Displaying real-time measured data in graphs

 You can add additional measured variables while graphing is in progress by simply ticking the appropriate check boxes.

 A maximum of three measured variables only can be displayed.

1. In the "Graph" section, select the measured variable to be displayed in graph format.
2. Press the "Start graphing" button.
 - ↳ Real-time measured data for the selected measured variable are shown in graph format.

11.4.5 Stopping graphing

- ▶ Press the "Stop graphing" button.
 - ↳ Graphing is stopped.

11.4.6 Clearing graphs

- ▶ Press the "Clear graph" button.
 - ↳ All graphs are cleared.

11.4.7 Scaling the Y-axis on the graph

1. Click the "Autoscale" button to switch off the autoscale function.

Note: The autoscale function is switched off if the button is no longer blue and "OFF" is displayed.
2. Select the "Manual Y axis adjust" function by clicking the "Range" option.
3. Left-click the desired Y-axis, press and hold, and then drag.
 - ↳ The Y-axis is scaled.

11.4.8 Moving the Y-axis position of the graph

1. Click the "Autoscale" button to switch off the autoscale function.
Note: The autoscale function is switched off if the button is no longer blue and "OFF" is displayed.
2. Select the "Manual Y axis adjust" function by clicking the "Position" option.
3. Left-click the desired Y-axis, press and hold, and then drag.
↳ The Y-axis is moved.

11.4.9 Configuring the time for displaying measured values on the graph

- Using the "Overall display" function, enter the number of seconds to set the time in which the current measured value should be displayed.

11.5 Retrieving measured data

 The "Measuring data retrieval" function area can only be accessed if the "Datalog Function" application package is used. Otherwise the function area cannot be selected (→  44).

 The measuring device cannot be used while measured data are being retrieved.

Measured data that are saved in the internal data memory can be retrieved using the "Measuring data retrieval" function area in the Nanomass Communication tool. This also includes saving of measured data to a text file that can be imported into a database.

 Retrieval of the measured data can sometimes take longer. For example, if the configured sampling rate is 30 s, it takes approx. 20 minutes to call up the measured data for one month.

11.5.1 Screen layout

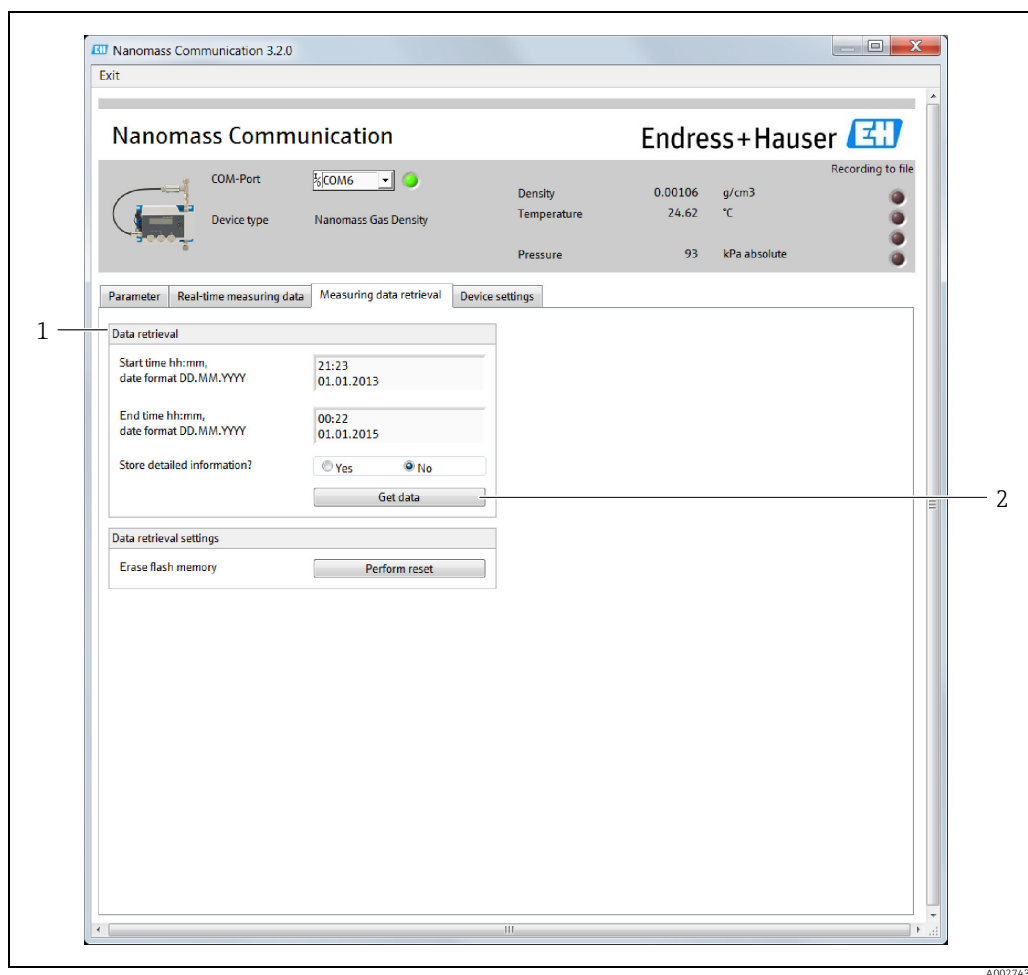


Fig. 14: Measured data

- 1 Retrieval settings
- 2 Retrieval function

11.5.2 Saving measured data to a text file

1. Under "Start time hh:mm, date format DD.MM.YYYY", enter the start date and start time as of which measured data should be retrieved from the internal data memory.
2. Under "End time hh:mm, date format DD.MM.YYYY", enter the end date and end time up to which measured data should be retrieved from the internal data memory.
Note: The end date can only go up as far as the day preceding the current date. The current date cannot be entered.
3. Under "Store data information", select the "Yes" option.
4. Press the "Get data" button.
 - ↳ The "Record Data" window appears.
5. Select the file where the real-time measured data will be saved. You can choose from the following options:
 - Select "Create new file" to save measured data in a new file.
 - Select "Extend existing file" to insert measured data into an existing file.
 - Select "Overwrite existing file" to overwrite an existing file with measured data.
6. Press the "Select" button.
 - ↳ A window opens where you can select where the file should be saved.
7. Select the desired storage location. You can choose from the following options:
 - If you selected "Create new file" previously, select the desired storage location for the new file.
 - If you selected "Extend existing file" previously, select the existing file to which measured data are to be added.
 - If you selected "Overwrite existing file" previously, select the existing file which should be overwritten.
8. Press the "Create file" button to confirm your choice.
 - ↳ The selected storage location is displayed in the "Record Data" window.
9. If necessary, enter a preferred comment for the file header in the "Comment header" input box.
10. If necessary, enter a preferred comment for every line of measured data in the file in the "Comment each" input box.
11. Press the "Start" button to retrieve data from the internal memory and start saving the data to a file. When the message "Meter will not be usable during download process" appears, click "OK" to confirm.
 - ↳ A new window "Download deep memory v2.015.vi" appears during the saving process.
 - ↳ Measured data are written to the selected file.

11.5.3 Stopping saving

- ▶ Press "Abort" in the "Download deep memory v2.015.vi" window.
 - ↳ The device stops saving the measured data.

11.6 Adapting the measuring device to the process conditions

See also:

- Configuring the measuring device (→  36)
- Advanced settings (→  41)

11.7 Updating the firmware

Firmware updates must be carried out using the "Nanomass Communication" operating tool (digitally via the USB port or the RS232 interface).

Navigation

Function area "Device settings" → "Service mode"



To access the "Device settings" function area, you must enter the access code **0074** in the "Access code for technician mode" field and then press "OK" to confirm.

Updating the firmware

NOTICE

Damage to firmware

If the power supply is disconnected during the update process, this can damage the firmware.

- ▶ Do not switch off the power supply while upgrading the firmware.



The measuring device cannot be used during the update process.

1. Call up the "Device settings" function area.
2. In the "Service mode" area, click the "Activate" button.
 - ↳ The "Access code for expert mode" window appears.
3. Enter the code **4685** for the service mode and click "OK" to confirm.
 - ↳ The functions of the service mode are displayed.
4. Click the "Perform update" button to update the firmware of the measuring device.
 - ↳ A selection field is displayed.
5. Click the Folder icon to select the file on the computer that contains the update and click "OK" to confirm.
 - ↳ The name of the selected file is displayed in the "Select HEX-File" field.
6. Click "Start" to run the update.
 - ↳ A message is displayed.
7. Click "Continue" to continue the process.
 - ↳ The update is installed. The device is restarted as soon as the update is complete and the "Nanomass Communication" operating tool closes.
 - ↳ If the update process was successful, the message "Firmware update successful" is displayed. If the update process was not successful, the message "Firmware update failed". Please try again." is displayed.
8. Restart the "Nanomass Communication" operating tool so that the changes come into effect.

12 Diagnostics and troubleshooting

12.1 General troubleshooting

For local display

Problem	Possible causes	Remedy
Local display dark and no output signals. LEDs on the measuring device are not lit.	Supply voltage via supply voltage cable:	
	The supply voltage does not match the specifications on the nameplate.	Apply the correct supply voltage (→ 69).
	The connector is not plugged in correctly at the measuring device.	Check the contact point and correct if necessary.
	The connector is not assigned correctly.	Check the pin assignment and correct if necessary.
	Supply voltage via USB:	
	PC is switched off.	Switch on the PC.
	The connector is not plugged in correctly at the measuring device and PC.	Check the contact point and correct if necessary.
	Measuring device is defective	Contact Endress+Hauser Service.
Local display is dark, but signal output is within the valid range. LEDs on the measuring device are lit.	Display is set too bright or too dark.	Using Nanomass Communication, make the display darker or brighter with the "Backlight" parameter.
	Display module is defective.	Contact Endress+Hauser Service.
Error message "Access Code Incorrect" appears after entering the access code for configuring the device.	The access code for write protection was not entered correctly.	Use access code "0074" to disable write protection.

For output signals

Problem	Possible causes	Remedy
Signal output outside the valid range.	Configuration error, or measuring device is being operated outside the application range.	1. Check the configuration and correct it if necessary. 2. Observe the limit values specified in the "Technical Data".
Measuring device shows the correct value on local display. However the signal output is incorrect, although it is in the valid range.	Configuration error.	Check the configuration and correct it if necessary.
Measuring device is not measuring correctly.	Configuration error, or measuring device is being operated outside the application range.	1. Check the configuration and correct it if necessary. 2. Observe the limit values specified in the "Technical Data".

For access via the "Nanomass Communication" operating tool

Problem	Possible causes	Remedy
Not possible to establish connection to the "Nanomass Communication" operating tool.	Cable is too long.	Check the cable length and correct if necessary.
	Incorrect COM port is used.	Check the COM port selected and correct if necessary.

Problem	Possible causes	Remedy
Error message "Access denied" appears after entering the access code to open the "Device settings" function area.	The access code for write protection was not entered correctly.	Use access code "0074" to disable write protection.
The measured values the device shows on the local display are different to those in the operating tool. All of the decimal places of all the measured values are "0".	The decimal separator selected in system settings was "," (comma) instead of "." (decimal point).	Change the decimal separator to "." (decimal point) in the computer's Control Panel.

12.2 Diagnostic information via light emitting diodes

Two light emitting diodes (LED) on the measuring device provide information on the device status.

For local display

LED	Signal	Meaning
Power	Lit green	Power is supplied to the device.
Error	Lit red	An error has occurred.

12.3 Diagnostic information on local display

Errors which the measuring device recognizes are shown on the local display.

Diagnostics message	Description	Measures
Tube not oscillating	Measuring channel not oscillating or oscillating in the wrong frequency range.	Perform internal cleaning (→  62)
Density range	Density value is outside the permitted range.	1. Observe the limit values specified in the "Technical Data". 2. Perform internal cleaning (→  62)
Pressure range	Pressure value is outside the permitted range.	1. Check the configuration and correct it if necessary. 2. Observe the limit values specified in the "Technical Data".
Temperature range	Temperature value is outside the permitted range.	1. Check the configuration and correct it if necessary. 2. Observe the limit values specified in the "Technical Data".

12.4 Diagnostic information in the operating tool

Any faults detected by the measuring device are indicated in the operating tool by red LEDs under "Device state" in the "Device settings" function area.

Diagnostics message	Description	Measures
Temperature range	Temperature value is outside the permitted range.	1. Check the configuration and correct it if necessary. 2. Observe the limit values specified in the "Technical Data".
Pressure range	Pressure value is outside the permitted range.	1. Check the configuration and correct it if necessary. 2. Observe the limit values specified in the "Technical Data".
Density range	Density value is outside the permitted range.	1. Observe the limit values specified in the "Technical Data". 2. Perform internal cleaning (→  62)
Tube not oscillating	Measuring channel not oscillating or oscillating in the wrong frequency range.	Perform internal cleaning (→  62)

12.5 Resetting the measuring device to factory default settings

With the "Factory reset" function, it is possible to reset the entire device configuration to the as-delivered state.

Navigation

Menu "Device settings" → "Advanced configuration"

Parameter overview with brief description

Menu "Device settings" → "Advanced configuration"

Parameter	Description	Selection/input	Factory setting
Factory reset	Local operation: Select "Yes" to reset all the device settings to the factory default settings.	■ No ■ Yes	No
	Via "Nanomass Communication" operating tool 1. Click on the "Perform reset" button. ↳ The window opens. 2. Select "Continue" to reset all the device settings to the factory default settings.	-	-

12.6 Performing density adjustment with gas

The density value can be adjusted in the field using a clean, dry calibration gas. The density characteristics of various gases, depending on the temperature and pressure, are stored in the device.

Navigation

Function area "Device settings" → "Calibrate density" → "Density calibration using gas"



To access the "Device settings" function area, you must enter the access code **0074** in the "Access code for technician mode" field and then press "OK" to confirm.

Performing density adjustment with gas



The measuring device must first be cleaned properly and filled with clean, dry calibration gas in order to perform the density adjustment.

1. Call up the "Device settings" function area.
2. Select the required calibration gas from the "Density calibration using gas" list in the "Calibrate density" section.
3. Click on the "Perform" button to perform the density adjustment.
 - ↳ The message "Ensure meter has been cleaned properly and filled with clean dry gas" appears.
4. Click "Continue" to continue the process.
 - ↳ Density adjustment is performed.

Resetting density coefficients to factory default settings

1. Call up the "Device settings" function area.
2. In the "Calibrate density" section, click the "Perform reset" button to reset the density coefficients to the factory default setting.
 - ↳ The "Reset field calibration density offset value" message appears on the display.
3. Click "Continue" to continue the process.
 - ↳ The density coefficients are reset to the factory default.

12.7 Device information

Device information can be viewed via Nanomass Communication in the "Device settings" function area, or via the local display during the measuring device startup routine.

Navigation

Function area "Device settings" → "Device information"



To access the "Device settings" function area, you must enter the access code **0074** in the "Access code for technician mode" field and then press "OK" to confirm.

Function area "Device settings" → "Device information"

Parameter	Description	Display	Factory setting
Application Version	Displays the "Nanomass Communication" operating tool version.	Character string with the following format: x.y.z	-
Firmware Version	Displays the device firmware version installed.	Character string with the following format: xx.yyy	-
Serial number	Displays the serial number of the measuring device.	Max. 11-digit character string comprising letters and numbers	-
External sensor	Displays the type of sensor that is connected.	Character string consisting of letters and numbers	-
Density upper bound	Displays the upper density limit.	Positive integer	-
Density lower bound	Displays the lower density limit.	Positive integer	-
Oscillation frequency	Displays the oscillation frequency of the measuring channel (updated when user exits the "Device settings" function area).	Positive integer with two decimal places	-
Oscillation damping	Displays the oscillation damping of the measuring channel (updated when user exits the "Device settings" function area).	Positive integer with two decimal places	-
Tag name	Displays the tag name.	Character string consisting of letters and numbers	"Your info here"

Saving device information

The "Save service information" button can be used to save device and service information in XML format that is relevant for service technicians.



It is recommended to open the XML file using an XML viewer (e.g. "Notepad") in order to avoid display errors.

13 Maintenance

13.1 Maintenance tasks

13.1.1 Exterior cleaning

When cleaning the exterior of the measuring device, always use cleaning agents that do not corrode the surface of the housing or the seals.

NOTICE

Cleaning agents can damage the aluminum housing and the polycarbonate glass

- ▶ Do not use high-pressure steam.
- ▶ Only use cleaning agents that are specified as permitted.

Permitted cleaning agents for aluminum housing and polycarbonate glass:

- Mild soap solutions
- Commercially available household cleaners
- Methyl alcohol or isopropyl alcohol

13.1.2 Interior cleaning

NOTICE

Risk of damaging the measuring channel

- ▶ Never clean with water.
- ▶ Only use cleaning agents that are specified as permitted.

Cleaning



If the density changes during the cleaning process, this means that there is cleaning agent in the measuring channel.

1. Rinse with permitted cleaning agent.
2. Then dry it out with dry air.

Permitted cleaning agents for interior cleaning

- Isopropyl alcohol (IPA)
- Acetone
- Hexane

13.1.3 Filter cleaning

- ▶ To avoid clogging, regularly check the filter installed upstream from the device for fouling and clean or replace the filter depending on the degree of contamination.

13.2 Measuring and test equipment

Endress+Hauser offers a wide variety of measuring and test equipment, such as W@M or device tests.



Your Endress+Hauser Sales Center can provide detailed information on the services.



For a list of some of the measuring and test equipment, refer to the "Accessories" section of the "Technical Information" document for the measuring device.

13.3 Endress+Hauser services

Endress+Hauser offers a wide variety of services for maintenance such as recalibration, maintenance service or device tests.



Your Endress+Hauser Sales Center can provide detailed information on the services.

14 Repair

14.1 General notes

Repair and conversion concept

The Endress+Hauser repair and conversion concept provides for the following:

- Spare parts are grouped into logical kits with the associated Installation Instructions.
- Repairs are carried out by Endress+Hauser Service or by appropriately trained customers.
- A certified measured device can only be converted to another certified device by Endress+Hauser Service or at the factory.

Notes for repair and conversion

For repair and modification of a measuring device, observe the following notes:

- Use only original Endress+Hauser spare parts.
- Carry out the repair according to the Installation Instructions.
- Comply with applicable standards, national regulations, explosion protection documentation and certificates.
- Document every repair and each conversion and enter them into the W@M life cycle management database.

14.2 Spare parts

W@M Device Viewer (www.endress.com/deviceviewer):

This contains a list of all the spare parts for the measuring device including the order code. In addition, spare parts can also be ordered here. If available, users can also download the associated Installation Instructions.



The serial number which is needed to order a spare part is located on the nameplate.

14.3 Endress+Hauser services



Contact your Endress+Hauser Sales Center for information on services and spare parts.

14.4 Return

The measuring device must be returned if repairs or a factory calibration are required, or if the wrong product has been ordered or delivered. Legal specifications require Endress+Hauser, as an ISO-certified company, to follow certain procedures when handling products that are in contact with the medium.

To ensure safe, swift and professional device returns, please refer to the procedure and conditions for returning devices provided on the Endress+Hauser website at www.services.endress.com/return-material

14.5 Disposal

14.5.1 Removing the measuring device

1. Switch off the measuring device.
2. **Warning!** Danger to persons from process conditions. Beware of hazardous process conditions such as pressure in the measuring device, high temperatures or aggressive fluids. Carry out the mounting and connection procedure described in the "Mounting the measuring device" and "Connecting the measuring device" sections in the logically reverse order. Observe the safety instructions.

14.5.2 Disposing of the measuring device

WARNING

Danger to personnel and environment from fluids that are hazardous to health.

- Ensure that the measuring device and all cavities are free of fluid residues that are hazardous to health or the environment, e.g. substances that have permeated into crevices or diffused through plastic.

Observe the following notes during disposal:

- Observe valid federal/national regulations.
- Ensure proper separation and reuse of the device components.

14.5.3 Disposing of batteries

Observe the regulations applicable in your country. Batteries must be disposed off in accordance with local regulations. Recycle used batteries.

15 Accessories

Various accessories are available for the measuring device, and can be ordered with the measuring device or at a later stage from Endress+Hauser. Detailed information on the appropriate order code is available from your local Endress+Hauser Sales Center or on the product page of the Endress+Hauser website: www.endress.com.

15.1 Device-specific accessories

Accessories	Description
Power cable	Cable with a length of 5 m (15 ft) for power supply.
Power connector	Connector for power cable, 2-pin.
RS232 service cable	Cable of 2 m (6 ft) length for communication with Nanomass Communication.
RS232 connector	Connector for service cable.
4-20 mA connector	Kit of 2 connectors for connecting the analog measuring signal with a higher-order system.
USB cable	Cable of 2 m (6 ft) length for power supply and communication with Nanomass Communication.
Ground terminal	Ground terminal for RS232 or USB version.
¼" Swagelok pipe union	For mounting the measuring device and the filter in the pipeline.
Filter cartridge	Kit of 3 spare filter cartridges to replace used filter cartridges.
Pipe mounting set	To secure to a pipe or post.
Tabletop stand	To secure to a tabletop.

15.2 Service-specific accessories

Accessories	Description
Applicator	Software for selecting and sizing Endress+Hauser measuring devices: - Calculation of all the necessary data for identifying the optimum flowmeter: E.g. nominal diameter, pressure loss, accuracy or process connections. - Graphic illustration of the calculation results Administration, documentation and access to all project-related data and parameters throughout the entire life cycle of a project. Applicator is available: - Via the Internet: https://wapps.endress.com/applicator - On CD-ROM for local PC installation
W@M	Life cycle management for your plant. W@M supports you with a wide range of software applications over the entire process: From planning and procurement, to the installation, commissioning and operation of the measuring devices. All the relevant device information, such as the device status, spare parts and device-specific documentation, is available for every device over the entire life cycle. The application already contains the data of your Endress+Hauser device. Endress+Hauser also takes care of maintaining and updating the data records. W@M is available: - Via the Internet: www.endress.com/lifecyclemanagement - On CD-ROM for local PC installation

15.3 System components

Accessories	Description
Memograph M graphic display recorder	The Memograph M graphic display recorder provides information on all relevant measured variables. Measured values are recorded correctly, limit values are monitored and measuring points analyzed. The data are stored in the 256 MB internal memory and also on a SD card or USB stick.  For details, see "Technical Information" TI00133R and Operating Instructions BA0024TR.

16 Technical data

16.1 Application

The measuring device is suitable for density and concentration measurement of gases only. Depending on the version ordered, the measuring device can also measure potentially explosive, flammable, poisonous and oxidizing media.

To ensure that the device remains in proper operating condition for its service life, use the measuring device only for media against which the process-wetted materials are adequately resistant (→  72).

16.2 Function and system design

Measuring principle	Density and concentration measurement based on determining the frequency of a micro-channel which is caused to oscillate at resonance frequency and which is part of a micromechanical system (MEMS).
Measuring system	For information on the structure of the measuring device, see "Product description" (→  10).

16.3 Input

Measured variable	Direct measured variables ▪ Density ▪ Temperature (during density measurement) ▪ Pressure (during density measurement)  As the ambient temperature can influence the medium temperature in the micro-channel, the measured temperature can deviate from the actual process temperature. Derived measured variables ▪ Reference density according to the ideal gas law ▪ Average molar mass according to the ideal gas law ▪ Concentration according to user-configurable model in the case of binary gas mixtures (optional)
-------------------	--

Measuring range	Measuring range for gases <table><tr><td>Range for full scale values (density) ρ_{min} to ρ_{max}</td><td>0 to 30 kg/m³ (0 to 0.03 g/cm³, 0 to 0.03 SGU)</td></tr></table>	Range for full scale values (density) ρ_{min} to ρ_{max}	0 to 30 kg/m ³ (0 to 0.03 g/cm ³ , 0 to 0.03 SGU)
Range for full scale values (density) ρ_{min} to ρ_{max}	0 to 30 kg/m ³ (0 to 0.03 g/cm ³ , 0 to 0.03 SGU)		

16.4 Output

Output signal	Current output <table><tr><td>Current output</td><td>2× 4-20 mA (passive)</td></tr><tr><td>Maximum output values</td><td>23 mA</td></tr><tr><td>Load</td><td>0 to 700 Ω</td></tr></table>	Current output	2× 4-20 mA (passive)	Maximum output values	23 mA	Load	0 to 700 Ω
Current output	2× 4-20 mA (passive)						
Maximum output values	23 mA						
Load	0 to 700 Ω						

Resolution	8 μ A
Damping	Configurable: 0 to 120 s
Assignable measured variable	■ Density ■ Reference density ■ Concentration ■ Temperature ■ Pressure

Signal on alarm

Breakdown information is displayed as follows.

Current output

Failure mode	Choice of breakdown information (in accordance with NAMUR Recommendation NE 43) if the tube does not oscillate correctly or a value is outside the density range: ■ Minimum value: 2 mA ■ Maximum value: 22 mA (not Namur: 23 mA)
Breakdown of power supply	Breakdown information during disconnection of power supply: ■ <1 mA

Local display

Plain text display	Error message on operational display.
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"Nanomass Communication" operating tool

Status information	Error message with status information
--------------------	---------------------------------------

Light emitting diodes (LED)

Status information	Status indicated by two light emitting diodes (in accordance with NAMUR Recommendation NE 43). The light emitting diodes indicate the following information: ■ Supply voltage active ■ Data transmission active ■ Device alarm/error has occurred
--------------------	--

Galvanic isolation

The current outputs are galvanically isolated from the rest of the system.

16.5 Power supply

Pin assignment of connector

(→  21)

Supply voltage

Power connection	DC 8 to 30 V, the power unit must be tested to ensure it meets safety requirements (e.g. PELV, SELV)
USB port (optional)	DC 5 V

Power consumption

Maximum power consumption	400 mW
---------------------------	--------

Current consumption

Maximum switch-on current	1 A (< 0.125 ms)
---------------------------	------------------

Power supply failure

- The configuration and recorded data are retained in the data memory.
- Internal real-time clock is battery-backed and continues to run. The operating life of the real-time battery is 10 years.

Electrical connection→  20**Cable connection**

Power connection	M9, 2-pin (connector)
4-20 mA	M12, 4-pin (connector)
USB port (optional)	Mini USB, type B (socket)
RS232 interface (optional)	M12, 4-pin (socket)

Cable specification→  20

16.6 Performance characteristics

Reference operating conditions

- Gases with density <30 kg/m³; temperature +5 to +60 °C (+59 to +113 °F); pressure 0 to 20 bar (0 to 290 psi)
- Specifications as per calibration protocol

Maximum measured error**Base accuracy under reference operating conditions****Density (gases)**±0.1 kg/m³ (±0.0001 g/cm³)

In the case of field density calibration: ±0.05 kg/m³ (±0.00005 g/cm³) (applies following field density calibration under process conditions)



The relative accuracy of the density measurement increases with increasing system pressure.

Temperature (during density measurement)

±0.5 °C

Pressure (during density measurement)

±0.05 bar

Accuracy of outputs

o.r. = of measuring range of current output

In the case of analog outputs, take the accuracy of the output into consideration for the measured error.

Current output

Max. ±0.1 % o.r. or ±15 µA

Repeatability	Base repeatability under reference operating conditions	
	Density (gases)	
		$\pm 0.05 \text{ kg/m}^3$ ($\pm 0.00005 \text{ g/cm}^3$)
	Temperature	$\pm 0.25 \text{ }^\circ\text{C}$
Response time	Pressure	$\pm 0.02 \text{ bar}$
	500 ms	
Influence of medium temperature	The medium temperature does not affect the measuring accuracy. The effects of temperature are compensated for by measuring the temperature in the micro-channel.	
Influence of variations in the medium temperature	If the medium temperature changes quickly ($>2 \text{ }^\circ\text{C/min}$), the measured error can be higher than specified under reference operating conditions.	
Influence of ambient temperature	o.r. = of measuring range of current output	
	Current output	
	Temperature coefficient	Max. $+50 \text{ ppm/}^\circ\text{C}$ o.r. or $\pm 1 \text{ } \mu\text{A/}^\circ\text{C}$
Influence of medium pressure	Pressure effects are compensated for by measuring the pressure. The medium pressure therefore does not affect the absolute measuring accuracy.	
Influence of variations in the medium pressure	In the case of the derived measured variables (concentration, reference density and molar mass), the accuracy can be affected if the medium pressure changes quickly ($>0.1 \text{ bar/s}$).	

16.7 Installation

Please refer to the "Installation conditions" section ($\rightarrow$  15)

16.8 Environment

Ambient temperature range	Non-Ex version	$-20 \text{ to } +60 \text{ }^\circ\text{C}$ ($-4 \text{ to } +140 \text{ }^\circ\text{F}$)
	Ex ia IIC T4 version	$-20 \text{ to } +60 \text{ }^\circ\text{C}$ ($-4 \text{ to } +140 \text{ }^\circ\text{F}$)
■ If operating via the USB port: The operating temperature is limited to $0 \text{ to } 60 \text{ }^\circ\text{C}$ ($32 \text{ to } 140 \text{ }^\circ\text{F}$). ■ If operating outdoors: Avoid direct sunlight, particularly in warm climatic regions.		
Storage temperature	$-20 \text{ to } +60 \text{ }^\circ\text{C}$ ($-40 \text{ to } +140 \text{ }^\circ\text{F}$), preferably $+20 \text{ }^\circ\text{C}$	

Climate class	DIN EN 60068-2-38 (test Z/AD)
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Degree of protection	IP65/67
-----------------------------	---------

Shock resistance	As per IEC/EN 60068-2-31
-------------------------	--------------------------

Interior cleaning	Permitted cleaning agents: ■ Isopropyl alcohol (IPA) ■ Acetone ■ Hexane
--------------------------	---

Electromagnetic compatibility (EMC)	■ In accordance with IEC/EN 61326 ■ Complies with emission limit for industry as per EN 550011 (Class A) For details, please refer to the Declaration of Conformity.
--	---

16.9 Process

Media	Permitted media are the gases listed below with the following features: ■ Non-corrosive ■ Absolute humidity < 10 g/m³ (dew point < 11 °C) ■ Relative humidity (non-condensing) < 80 % ■ Concentration of helium < 50 ppm (pure helium is not permitted)
--------------	---

Permitted gases or mixtures of such gases:

- Nitrogen (N₂)
- Oxygen (O₂)
- Air
- Carbon dioxide (CO₂)
- Neon (Ne)
- Argon (Ar)
- Krypton (Kr)
- Xenon (Xe)
- Hydrogen (H₂)
- Methane (CH₄)
- Natural gas (maximum permitted helium concentration: 50 ppm)
- Ethyne (acetylene) (C₂H₂)
- Ethylene (C₂H₄)
- Ethane (C₂H₆)
- Propene (C₃H₆)
- Propane (C₃H₈)
- Butane (C₄H₁₀)
- LPG (supplied as gas)

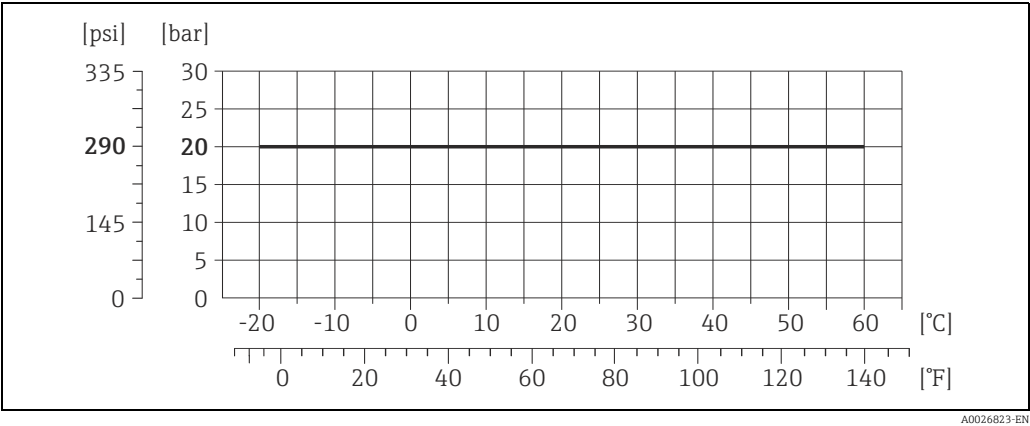
If you are using gases other than those indicated above, please contact your Endress+Hauser Sales Center at www.endress.com/worldwide.

Medium temperature range	-20 to +60 °C (-4 to +140 °F)
---------------------------------	-------------------------------

Medium density range	0 to 30 kg/m ³ (0 to 1.9 lb/ft ³)
-----------------------------	--

Pressure-temperature ratings

The following pressure/temperature diagram refers to the entire measuring device and not just the process connection.



Secondary containment pressure rating

The sensor housing is filled with dry nitrogen on delivery and protects the electronics and mechanics inside.
The housing does not have pressure vessel classification.

Flow limit

Recommended max. flow for complete accuracy	1 l/min (0.26 gal/min)
---	------------------------

Pressure loss

Recommended max. pressure drop across the measuring device for complete accuracy	0.1 bar (1.45 psi)
--	--------------------

System pressure

Permitted absolute system pressure	Max. 20 bar (290 psi)
------------------------------------	-----------------------

The relative accuracy of the density measurement increases with increasing system pressure.

Thermal insulation

Due to a low thermal capacity of the medium, the medium temperature can be greatly affected by the ambient temperature through the supply line and the measuring device. The influence of the ambient temperature on the medium temperature can be reduced by insulating the supply line.

Vibrations

Due to the high operating frequency of the micro-channel, vibrations (<20 kHz) do not affect measuring accuracy.

16.10 Mechanical construction

Design, dimensions

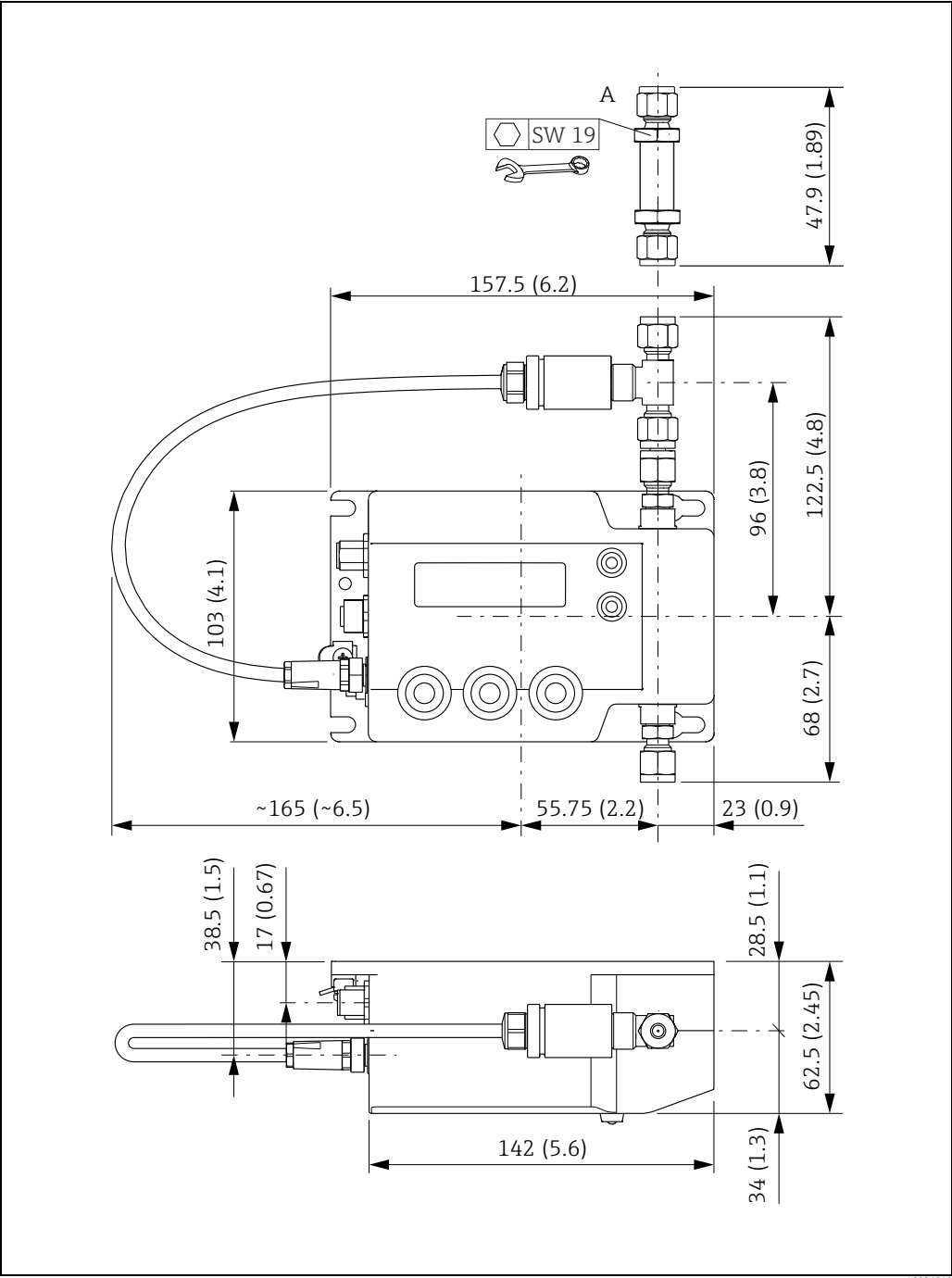


Fig. 15: Dimensions in mm (in)
A = 1/4" Swagelok in-line filter SS-4F-15

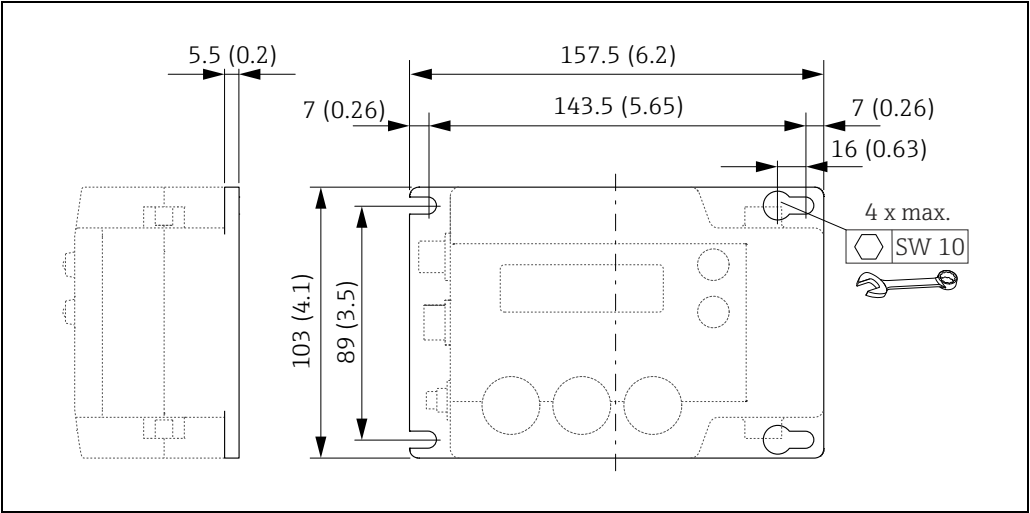


Fig. 16: Mounting holes, dimensions in mm (in)

Weight Approx. 1.5 kg (3.3 lb)

Materials

Housing

- Aluminum, powder-coated
- Window material: Polycarbonate

Connections

4-20 mA connection	■ Socket: Die-cast zinc, nickel-plated ■ Contact housing: Polyamide ■ Contacts: Brass, gold-plated
RS232 interface	■ Socket: Die-cast zinc, nickel-plated ■ Contact housing: Polyamide ■ Contacts: Brass, gold-plated
USB port	■ Socket: Polyester ■ Contact housing: Polyester ■ Contacts: Copper base alloy, gold-plated ■ Protection cap: Polyester
Power connection	■ Socket: Brass, nickel-plated ■ Contact housing: Polyamide ■ Contacts: Brass, gold-plated
Pressure sensor connection	■ Socket: Brass, nickel-plated ■ Contact housing: Polyamide ■ Contacts: Brass, gold-plated

Wetted parts, fluidic system

Process connection	Stainless steel, 1.4404 (316L)
Manifold	Stainless steel, 1.4542 (17-4 PH)
MEMS chip	■ Silicon ■ BOROFLOAT 33 glass ■ Epoxy
Pressure sensor	■ Stainless steel, 1.4404 (316L) ■ Ceramic (Al₂O₃) ■ Viton
Threaded seals	PTFE

Process connection ¼" Swagelok pipe union

16.11 Operability

Local display

Display elements

- 2-line liquid crystal display with 16 characters per line.
- Format for displaying various measured variables can be individually configured.

Operating elements

Local operation with three keys (☐ ⊕ ☒).

Remote control

- Operation via "Nanomass Communication" operating tool for Windows desktops.

Reliable operation

- If the power supply fails, data stored in the measuring device and device configurations are retained.

Languages

The operating language is English.

16.12 Certificates and approvals

CE mark

The measuring system meets the legal requirements of the EC Directives. Endress+Hauser confirms that the device has been successfully tested by applying the CE mark.

C-Tick symbol

The measuring system complies with the EMC requirements of the "Australian Communications and Media Authority (ACMA)".

CRN approval

As an option, the measuring system can also be ordered with CRN approval (Canadian Registration Number).

Ex approval

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

Other standards and guidelines

- EN 60529
Degrees of protection provided by enclosures (IP code)
- IEC/EN 60068-2-6
Environmental testing: Test procedure - Test Fc: Vibration (sinusoidal)
- IEC/EN 60068-2-31
Environmental testing: Test procedure - Test Ec: Rough handling shocks, primarily for equipment-type specimens
- EN 61010-1
Safety requirements for electrical equipment for measurement, control and laboratory use – general requirements
- IEC/EN 61326
"Emission in accordance with Class A requirements". Electromagnetic compatibility (EMC requirements)

- NAMUR NE 43

Standardization of the signal level for the breakdown information of digital transmitters with analog output signal

16.13 Application packages

Application packages are available for the device to extend the device functionality, where needed. The application packages can be ordered with the device or subsequently from Endress+Hauser. Detailed information on the appropriate order code is available from your local Endress+Hauser Sales Center or on the product page of the Endress+Hauser website: www.endress.com.

Package	Description
Concentration Measurement	Concentrations are calculated and displayed. Using the application package, the measuring device can output the concentration of a gas in a binary mixture. Certain mixtures are already preprogrammed in the measuring device. Furthermore, the concentration of any binary gas mixture can be determined by entering coefficients. Your Endress+Hauser Sales Center can provide you with the information that is needed to determine the coefficients, which must be stored in the measuring device to calculate the concentration.
Datalog function	Retrieval and storage of measured data. Using the "Measuring data retrieval" function area, measured data that are saved in the internal data memory can be retrieved. Furthermore, the measured data can be saved to a text file that can be imported into a database.

16.14 Accessories

Overview of accessories available for order →  66.

16.15 Documentation

For an overview of the scope of the associated Technical Documentation, refer to the following:

- CD-ROM provided.
- *W@M Device Viewer*: Enter the serial number indicated on the nameplate (www.endress.com/deviceviewer).
- *The Endress+Hauser Operations App*: Enter the serial number indicated on the nameplate or scan the 2-D matrix code (QR code) provided on the nameplate.

Standard documentation

Document type	Documentation code
Operating Instructions	BA01449D
Brief Operating Instructions	KA01192D

Supplementary device-dependent documentation

Document type	Documentation code
Safety Instruction CL.I, Div.1, Zone 0 for IS	XA01376D

17 Appendix

17.1 Overview of the device parameters

The following table provides an overview of the menu structure and the parameters in the individual menus. The page reference indicates where the associated description of the submenu or parameter can be found. Parameters marked with an asterisk (*) are only visible in this location on the local display. It may be possible to view them in a different location in the "Nanomass Communication" operating tool.



The parameter names listed below may appear in an abbreviated form on the local display.

Measured variables		
Main values*		→ 80
	Density*	
	Temperature*	
	Pressure*	
	Oscillation damping *	
	Oscillation frequency*	
System units		→ 80
	Density	
	Reference density	
	Temperature	
	Pressure	
Special units		→ 81
	Text arb. density (4 char.)	
	Factor arbitrary density	
	Text arb. concentration (4 char.) ¹	
	Factor arbitrary concentration ¹	
User interface		
Display		→ 82
	Display contrast	
	Display backlight	
Assign display		→ 83
	Top line	
	Top line multiplex	
	Bottom line	
	Bottom line multiplex	
Output 4-20mA		
Output channel 1		→ 84
	Assign	
	4mA Ch1	
	20mA Ch1	
Output channel 2		→ 85
	Assign	
	4mA Ch2	
	20mA Ch2	
Output characteristics		→ 85
	Time constant output	
Simulation		
	Activate simulation*	
	Current test value (mA)	

¹ This function is only available if the "Concentration Measurement" application package is used.

Basic function		
	System parameter	→ 86
	Measurement value damping	
Special function		
	Density function	→ 87
	Density type: Ref. density	
	Reference pressure	
	Reference temperature	
	Density type: Concentration ¹	
	Concentration unit	
	Concentration selection	
	Concentration names	
	Display precision	
	Concentration offset	
	Formula coefficients	
	Density type: Concentration predefined	
	Select mixture	
	Select component in mixture	
Supervision		
	Assign error prompt for channel 1	→ 89
	Span	
	Error prompt min current	
	Error prompt max current	
	Priority state	
	Assign error prompt for channel 2	→ 90
	Span	
	Error prompt min current	
	Error prompt max current	
	Priority state	
Device settings		
	Device information*	→ 90
	Firmware version*	
	Serial number*	
	Device lower bound*	
	Density upper bound*	
	Device settings*	→ 91
	Sampling rate logger*	
	Actual time hh:mm:ss*	
	Set time hh:mm:ss*	
	Actual date ddmmyy*	
	Set date ddmmyy*	
	Set tag name*	
	Activate software options*	
	Advanced configuration	→ 92
	Restart device	
	Factory reset	
	Density offset*	
	Reset density offset*	
	Density calibration using gas*	
	Single point calibration*	

¹ This function is only available if the "Concentration Measurement" application package is used.

17.2 Menu "Measuring variables" → "Main values"



The "Main values" submenu is only visible via the local display. In "Nanomass Communication", measured values are displayed in the top section of the operating tool.

Density	
Description	Displays the density currently measured.
Temperature	
Description	Displays the temperature currently measured during density measurement.
Pressure	
Description	Displays the pressure currently measured during density measurement.
Oscillation damping	
Description	Displays the oscillation damping of the measuring channel.
Oscillation frequency	
Description	Displays the oscillation frequency of the measuring channel.

17.3 Menu "Measuring variables" → "System units"

Density	
Description	Use this function to select the unit for the density.
Options	■ g/cm³ ■ g/cc ■ kg/L ■ kg/m³ ■ Lb/ft³ ■ Lb/gal ■ Unit defined under "Text arb. density" ■ Specific gravity ■ Molecular weight
Factory setting	kg/m ³
Additional information	The selected unit applies to: ■ The "Density" process variable ■ The "4mA Ch1" parameter ■ The "20mA Ch1" parameter ■ The "4mA Ch2" parameter ■ The "20mA Ch2" parameter Specific gravity = measured density/density of air Molecular weight = average molar mass according to the ideal gas law The unit for the customer-specific density is specified in the "Text arb. density" parameter.

Reference density

Description	Use this function to select the unit for the reference density.
Options	▪ g/cm³ ▪ g/cc ▪ kg/L ▪ kg/m³ ▪ Lb/ft³ ▪ Lb/gal
Factory setting	kg/m ³
Additional information	The selected unit applies to the "Reference density" process variable.

Temperature

Description	Use this function to select the unit for the medium temperature during density measurement.
Options	▪ °C ▪ K ▪ °F ▪ °R
Factory setting	Country-specific: ▪ °C ▪ °F
Additional information	The selected unit applies to: ▪ The "Temperature" process variable ▪ The "20mA Ch1" parameter ▪ The "4mA Ch1" parameter ▪ The "20mA Ch2" parameter ▪ The "4mA Ch2" parameter

Pressure

Description	Use this function to select the unit for the medium pressure during density measurement.
Options	▪ bar absolute ▪ bar gauge ▪ psi absolute ▪ psi gauge ▪ kPa absolute ▪ kPa gauge
Factory setting	Country-specific: ▪ bar absolute ▪ psi absolute
Additional information	The selected unit applies to: ▪ The "Pressure" process variable ▪ The "4mA Ch1" parameter ▪ The "20mA Ch1" parameter ▪ The "4mA Ch2" parameter ▪ The "20mA Ch2" parameter ▪ The "Fixed pressure correction" parameter

17.4 Menu "Measuring variables" → "Special units"

Text arb. density (4 char.)

Description	Use this function to enter a text string for the arbitrary density unit.
User entry	XXXX (max. 4 characters)
Factory setting	dens
Additional information	Only the text string is defined. Valid characters are A-Z, 0-9, +, -, decimal point, white space or underscore. The unit is then available for selection in the "Density" parameter in the "System units" menu.

Factor arbitrary density

Description	Use this function to enter a quantity factor for the arbitrary density unit.
User entry	6-digit floating point number and 1-digit exponent
Factory setting	1.00000E+0
Additional information	The factor refers to the density value in gram per cubic centimeter. The factor converts the original measured value into the user-defined unit.

Text arb. concentration (4 char.)

Prerequisite	The optional "Concentration Measurement" application package must be used.
Description	Use this function to enter a text string for the arbitrary concentration unit.
User entry	XXXX (max. 4 characters)
Factory setting	conc
Additional information	Valid characters are A-Z, 0-9, +, -, decimal point, white space or underscore. The unit is then available for selection as "Other 3D" in the "Concentration unit" parameter in the "Density function" menu.

Factor arbitrary concentration

Prerequisite	The optional "Concentration Measurement" application package must be used.
Description	Use this function to enter a quantity factor for the arbitrary concentration unit.
User entry	6-digit floating point number and 1-digit exponent
Factory setting	1.00000E+0
Additional information	The factor converts the original measured value into the arbitrary concentration unit. The factor changes the original measured value from the concentration specification.

17.5 Menu "User interface" → "Display"

Display contrast

Description	Use this function to adapt the display contrast of the local display to the ambient conditions (e.g. the lighting or viewing angle).
User entry	0 to 100 %
Factory setting	50 %
Additional information	If the values "0" and "100" are set, the text on the local display cannot be read.

Display backlight

Description	Use this function to adapt the display backlight of the local display to the ambient conditions (e.g. the lighting or viewing angle).
User entry	0 to 100 %
Factory setting	50 %
Additional information	If the value "0" is set, the background lighting is switched off and it is not possible to read the text on the local display in the dark.

17.6 Menu "User interface" → "Assign display"

Top line	
Description	Use this function to assign a process variable to the first line of the local display.
Options	■ Off ■ Density ■ Ref. density ■ Concentration (optional) ■ Concentration predefined (optional) ■ Temperature ■ Pressure
Factory setting	Density
Additional information	During normal measuring operation, the process variable alternates (every 5 seconds) with the second display value ("Top line display multiplex" parameter) on the main line. The "Concentration" option is only available if the "Concentration Measurement" application package is used.
Top line multiplex	
Description	Use this function to assign a process variable to the first line of the local display when the display changes.
Options	■ Off ■ Density ■ Ref. density ■ Concentration (optional) ■ Concentration predefined (optional) ■ Temperature ■ Pressure
Factory setting	Off
Additional information	During normal measuring operation, the process variable alternates (every 5 seconds) with the first display value ("Top line display" parameter) on the main line. The "Concentration" option is only available if the "Concentration Measurement" application package is used.
Bottom line	
Description	Use this function to assign a process variable to the second line of the local display.
Options	■ Off ■ Density ■ Ref. density ■ Concentration (optional) ■ Concentration predefined (optional) ■ Temperature ■ Pressure
Factory setting	Temperature
Additional information	During normal measuring operation, the process variable alternates (every 5 seconds) with the second display value ("Bottom line display multiplex" parameter) on the information line. The "Concentration" option is only available if the "Concentration Measurement" application package is used.

Bottom line multiplex

Description	Use this function to assign a process variable to the second line of the local display when the display changes.
Options	■ Off ■ Density ■ Ref. density ■ Concentration (optional) ■ Concentration predefined (optional) ■ Temperature ■ Pressure
Factory setting	Pressure
Additional information	During normal measuring operation, the process variable alternates (every 5 seconds) with the first display value ("Bottom line display" parameter) on the information line. The "Concentration" option is only available if the "Concentration Measurement" application package is used.

17.7 Menu "Output 4-20 mA" → "Output channel 1"

Assign

Description	Use this function to assign a process variable for current output 1.
Options	■ Off ■ Density ■ Ref. density ■ Concentration (optional) ■ Concentration predefined (optional) ■ Temperature ■ Pressure
Factory setting	Density
Additional information	The "Concentration" option is only available if the "Concentration Measurement" application package is used.

4mA Ch1

Description	Use this function to enter the lower limit for the 4 mA current.
User entry	Decimal
Factory setting	0 (kg/m ³)
Additional information	Positive and negative values are permitted depending on the process variable assigned in the "Assign" parameter. In addition, the value must be smaller than the value assigned for the 20 mA current in the "20mA Ch1" parameter. The unit depends on the process variable selected in the "Assign" parameter. The permitted value range is indicated in Nanomass Communication with the "Min" and "Max" fields.

20mA Ch1

Description	Use this function to enter the upper limit for the 20 mA current.
User entry	Decimal
Factory setting	30 (kg/m ³)
Additional information	Positive and negative values are permitted depending on the process variable assigned in the "Assign" parameter. In addition, the value must be greater than the value assigned for the 4 mA current in the "4mA Ch1" parameter. The unit depends on the process variable selected in the "Assign" parameter. The permitted value range is indicated in Nanomass Communication with the "Min" and "Max" fields.

17.8 Menu "Output 4-20 mA" → "Output channel 2"

Assign	
Description	Use this function to assign a process variable for current output 2.
Options	■ Off ■ Density ■ Ref. density ■ Concentration (optional) ■ Concentration predefined (optional) ■ Temperature ■ Pressure
Factory setting	Temperature
Additional information	The "Concentration" option is only available if the "Concentration Measurement" application package is used.

4mA Ch2	
Description	Use this function to enter a value for the 4 mA current.
User entry	Decimal
Factory setting	-20 (°C)
Additional information	Positive and negative values are permitted depending on the process variable assigned in the "Assign" parameter. In addition, the value must be smaller than the value assigned for the 20 mA current in the "20mA Ch2" parameter. The unit depends on the process variable selected in the "Assign" parameter. The permitted value range is indicated in Nanomass Communication with the "Min" and "Max" fields.

20mA Ch2	
Description	Use this function to enter a value for the 20 mA current.
User entry	Decimal
Factory setting	60 (°C)
Additional information	Positive and negative values are permitted depending on the process variable assigned in the "Assign" parameter. In addition, the value must be greater than the value assigned for the 4 mA current in the "4mA Ch2" parameter. The unit depends on the process variable selected in the "Assign" parameter. The permitted value range is indicated in Nanomass Communication with the "Min" and "Max" fields.

17.9 Menu "Output 4-20 mA" → "Output characteristics"

Time constant output	
Description	Use this function to enter a delay time of the output signal to fluctuations in the measured value.
User entry	Positive integer 0 to 120 s
Factory setting	0 s
Additional information	The measure value is averaged over the time entered.

17.10 Menu "Output 4-20 mA" → "Simulation"



The "Activate simulation" parameter is only visible via the local display. In the "Nanomass Communication" operating tool, this setting is made using the "Activate" button.

Activate simulation	
Description	Switch current output simulation on or off.
Options	■ Off ■ On
Factory setting	Off
Additional information	Simulation is switched off again following a power failure.

Current test value (mA)	
Prerequisite	The "On" option is selected in the "Activate simulation" parameter on the local display.
Description	Use this function to enter a current value for the simulation.
User entry	2.00 to 23.00 mA
Factory setting	2.00 mA
Additional information	Local display: If simulation is enabled ("On" is selected), the message "Sim activ" appears on the local display. Operating tool: If simulation is enabled (click on "Activate"), the message "Current simulation activ" appears in the header section of the "Nanomass Communication" operating tool. The simulation overwrites the values on the two current outputs with fixed values.

17.11 Menu "Basic function" → "System parameter"

Measurement value damping	
Description	Use this function to enter a response time of the local display to fluctuations in the measured value.
User entry	Integer or decimal number 0 to 120 s
Factory setting	0 s
Additional information	The measure value is averaged over the time entered.

17.12 Menu "Special function" → "Density function"

Density type	
Prerequisite	The optional "Concentration Measurement" application package must be used for the "Concentration" and "Concentration predefined" functions.
Description	Use this function to select the density function for calculating special density values or the percentage (concentration) of components in two-phase media.
Options	■ Off ■ Ref. density ■ Concentration ■ Concentration predefined
Factory setting	Off
Additional information	If "Off" is selected, the other functions are not displayed. If "Ref. density" is selected a reference density of the medium can be output and if "Concentration" or "Concentration predefined" is selected a concentration can be output.
Reference pressure	
Prerequisite	This function is only available if the "Ref. density" option was selected in the "Density type" function.
Description	Use this function to enter a reference pressure for calculating the reference density ("Reference density").
User entry	Decimal
Factory setting	14.7 psi a
Additional information	The unit depends on the unit selected in the "Pressure" parameter.
Reference temperature	
Prerequisite	This function is only available if the "Ref. density" option was selected in the "Density type" function.
Description	Use this function to enter a reference temperature for calculating the reference density.
User entry	Decimal number with sign
Factory setting	15 °C
Additional information	The unit depends on the unit selected in the "Temperature" parameter.
Concentration unit	
Prerequisite	This function is only available if the "Concentration" option was selected in the "Density type" function.
Description	Use this function to select a unit for calculating the concentration.
Options	■ % Mass 3D ■ % Volume 3D ■ Other 3D
Factory setting	% Volume 3D
Concentration selection	
Prerequisite	This function is only available if the "Concentration" option was selected in the "Density type" function.
Description	Use this function to select the concentration specification that is to be displayed.
Options	The names that were defined in the "Concentration names" parameter for the concentration specifications.
Factory setting	1st coeffs

Additional information	Four different concentration specifications are available which can be used to define different concentrations. By selecting a concentration specification and the associated settings, up to four concentrations can be configured and selected where necessary.
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Concentration names

Prerequisite	This function is only available if the "Concentration" option was selected in the "Density type" function.
Description	Use this function to enter a specific name for the concentration specification.
User entry	Character string consisting of a maximum of ten letters, numbers, blank spaces and/or special characters.
Factory setting	1st coeffs, 2nd coeffs, 3rd coeffs, 4th coeffs

Display precision

Prerequisite	This function is only available if the "Concentration" option was selected in the "Density type" function.
Description	Use this function to select the display accuracy of the concentration.
Options	■ 1 ■ 0.1 ■ 0.01
Factory setting	0.01

Concentration offset

Prerequisite	This function is only available if the "Concentration" option was selected in the "Density type" function.
Description	Use this function to enter an offset value for the calculated concentration.
User entry	Decimal number with sign -5.000 to 5.000
Factory setting	0.0
Additional information	The offset is added or subtracted, depending on the sign.

Formula coefficients

Prerequisite	This function is only available if the "Concentration" option was selected in the "Density type" function.
Description	Use this function to enter the coefficients A0 to A5.
User entry	Floating point number with sign
Factory setting	0.00000E+0

Select mixture

Prerequisite	This function is only available if the "Concentration predefined" option was selected in the "Density type" function.
Description	Use this function to select the predefined, binary gas mixture.
User entry	■ Carbon dioxide/Methane ■ Carbon dioxide/Hydrogen ■ Air/Carbon dioxide ■ Air/Hydrogen ■ Hydrogen/Carbon monoxide ■ Nitrogen/Hydrogen ■ Argon/Hydrogen ■ Nitrogen/Carbon dioxide ■ Oxygen/Carbon dioxide ■ Air/Oxygen ■ Methane/Hydrogen
Factory setting	Carbon dioxide/Methane

Select component in mixture

Prerequisite	This function is only available if the "Concentration predefined" option was selected in the "Density type" function.
Description	Use this function to select the component of the binary gas mixture for display of the concentration.
User entry	Depends on the gas mixture chosen in the "Select mixtures" parameter.
Factory setting	Carbon dioxide

17.13 Menu "Supervision" → "Assign error prompt for channel 1"

Span

Description	Use this function to select the current range for current output 1.
Options	■ Namur 4-20ma ■ Non Namur 4-20mA
Factory setting	Non Namur 4-20mA
Additional information	The measured value is defined by the "20mA Ch1" and "4mA Ch1" parameters. If the measured value is outside the measuring range, the device displays the diagnostic message "Density range".

Error prompt min current

Description	Use this function to select the diagnostic message if the current range for current output 1 is undershot.
Options	■ Tube not oscillating ■ Density range ■ Pressure range ■ Temperature range
Factory setting	Tube not oscillating

Error prompt max current

Description	Use this function to select the diagnostic message if the current range for current output 1 is exceeded.
Options	■ Tube not oscillating ■ Density range ■ Pressure range ■ Temperature range
Factory setting	Tube not oscillating

Priority state

Description	Diagnostic message if the failure mode configured for "Error prompt min current" and "Error prompt max current" occurs simultaneously. If "Min current" is selected, the diagnostic message chosen under "Error prompt min current" is output. If "Max current" is selected, the diagnostic message chosen under "Error prompt max current" is output.
Options	■ Min current ■ Max current
Factory setting	Min current

17.14 Menu "Supervision" → "Assign error prompt for channel 2"

Span	
Description	Use this function to select the current range for current output 2.
Options	■ Namur 4-20ma ■ Non Namur 4-20mA
Factory setting	Non Namur 4-20mA
Additional information	The measured value is defined by the "20mA Ch2" and "4mA Ch2" parameters. If the measured value is outside the measuring range, the device displays the diagnostic message "Density range".

Error prompt min current	
Description	Use this function to select the diagnostic message if the current range for current output 2 is undershot.
Options	■ Tube not oscillating ■ Density range ■ Pressure range ■ Temperature range
Factory setting	Tube not oscillating

Error prompt max current	
Description	Use this function to select the diagnostic message if the current range for current output 2 is exceeded.
Options	■ Tube not oscillating ■ Density range ■ Pressure range ■ Temperature range
Factory setting	Tube not oscillating

Priority state	
Description	Diagnostic message if the failure mode configured for "Error prompt min current" and "Error prompt max current" occurs simultaneously. If "Min current" is selected, the diagnostic message chosen under "Error prompt min current" is output. If "Max current" is selected, the diagnostic message chosen under "Error prompt max current" is output.
Options	■ Min current ■ Max current
Factory setting	Min current

17.15 Menu "Device settings" → "Device information"



The "Device information" submenu is only visible via the local display. In the "Nanomass Communication" operating tool, the parameters can be viewed under "Device Settings".

Firmware version	
Description	Current firmware version on device
Options	-
Factory setting	-

Serial number

Description	Serial number of the device
Options	-
Factory setting	-

Density lower bound

Description	Displays the lower density limit kg/m ³
Options	-
Factory setting	-

Density upper bound

Description	Displays the upper density limit kg/m ³
Options	-
Factory setting	-

17.16 Menu "Device settings" → "Device settings"



The "Device settings" submenu is only visible via the local display. In the "Nanomass Communication" operating tool, the parameters can be viewed under "Device Settings".

Sampling rate datalogger

Description	Use this function to specify the intervals for data logging (in seconds)
Options	1 to 3600 s
Factory setting	10 s

Actual time hhmmss

Description	Displays the current time in the format hh:mm:ss
Options	Time in the 24h format
Factory setting	-

Set time hhmmss

Description	Configure the device clock
Options	Time in the 24h format
Factory setting	-

Actual date ddmmyy

Description	Displays the current date in the following format: dd.mm.yy
Options	Date
Factory setting	-

Set date ddmmyy

Description	Use this function to configure the device date
Options	Date
Factory setting	-

Set tag name

Description	Use this function to configure the device tag name
Options	11-digit, alphanumeric description
Factory setting	"Your_info_here"

Activate options

Description	Use this function to activate software options by means of the license code
Options	8-digit activation code
Factory setting	00000000

17.17 Menu "Device settings" → "Advanced configuration"



The parameters "Density offset", "Reset density offset", "Density calibration gas" and "Single point calibration" are only visible here using the local display. In the "Nanomass Communication" operating tool, the parameters can be viewed under "Device Settings".

Restart device

Description	Use this function to select whether the measuring device should be restarted.
Options	Local operation: ■ Yes ■ No
Factory setting	Local operation: No
Additional information	Local operation: If "Yes" is selected, the measuring device is restarted. Restarting the measuring device with the "Nanomass Communication" operating tool: 1. Click on the "Perform restart" button. ↳ The message "This action will restart the device. Cancel if not prepared." appears. 2. Click "Continue" to restart the measuring device.

Factory reset

Description	Use this function to select whether all the device settings are to be reset to factory defaults.
Options	Local operation: ■ Yes ■ No
Factory setting	Local operation: No
Additional information	Local operation: If "Yes" is selected, all the device settings are reset to the factory setting and the measuring device is restarted. Resetting the device settings to their factory values with the "Nanomass Communication" operating tool: 1. Click on the "Perform reset" button. ↳ The message "All device settings are set back to factory values. This action will restart the device. Cancel if not prepared." appears. 2. Click "Continue" to reset all the device settings to the factory default settings.

Density offset	
Description	Displays the density offset in g/cm ³ .
Options	-
Factory setting	0.00 g/cm ³
Reset density offset	
Description	Sets the density offset to 0 g/cm ³ .
Options	Local operation: ■ Yes ■ No
Factory setting	Local operation: No
Additional information	Local operation: If "Yes" is selected, the measuring device is restarted. Restarting the measuring device with the "Nanomass Communication" operating tool: 1. Click on the "Perform restart" button. ↳ The message "Are you sure?" appears. 2. Click "Yes" to restart the measuring device.
Density calibration gas	
Description	Use this function to perform density adjustment with gas.
Options	Local operation: ■ Air ■ Hydrogen ■ Nitrogen ■ Methane ■ Carbon dioxide
Factory setting	Local operation: Air
Additional information	Local operation: Select gas. Density adjustment is performed on confirmation. Performing density adjustment with the "Nanomass Communication" operating tool: 1. Select the required calibration gas. 2. Click on "Perform". ↳ The message "Ensure meter has been cleaned properly and filled with clean dry gas" appears. 3. Click "Continue" to continue the process. ↳ Density adjustment is performed.
Single point calibration	
Description	Use this function to enter a specific density value.
Options	Density value for the current unit.
Factory setting	-
Additional information	The value must correspond to the density at the indicated pressure and temperature. The value is entered in the selected density unit. The density offset is then set automatically.

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