BA00114D/6/EN/14.14
71261907

Valid as of version
PROFIBUS DP:
V 3.06.XX (Device software)
PROFIBUS PA:
V 3.06.XX (Device software)

Products	Solutions	Services

Description of device functions

Proline t-mass 65 PROFIBUS DP/PA

Thermal Mass Flowmeter

Endress+Hauser

People for Process Automation
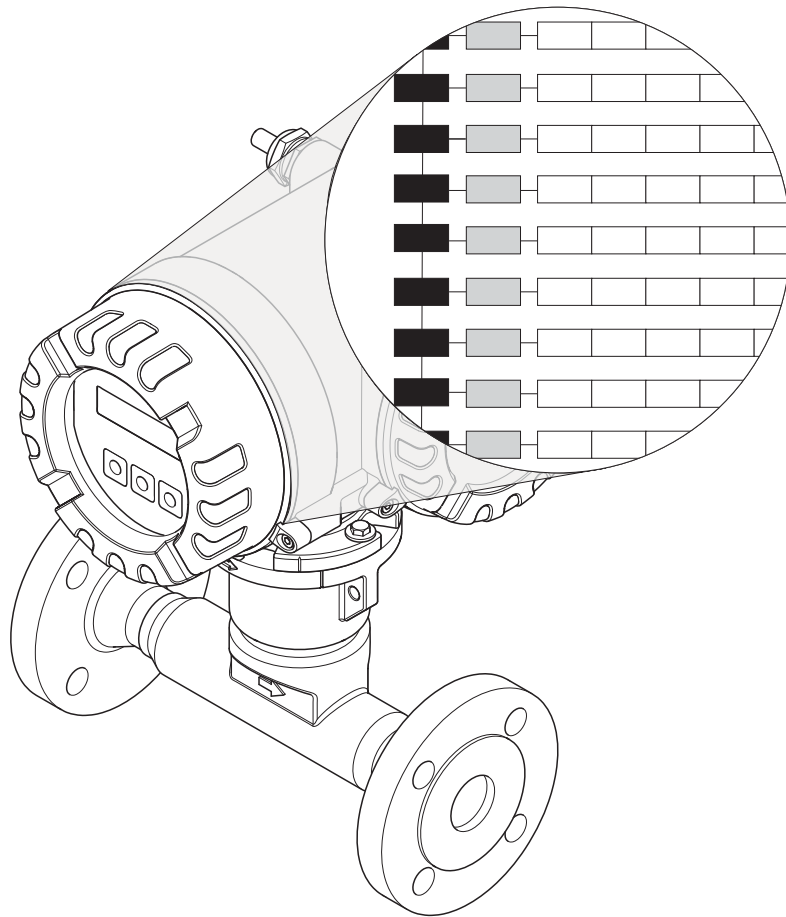
Table of contents

1   The function matrix: layout and use

The function matrix is a two-level construction: the groups form one level and the groups' functions the other. The groups are the highest-level grouping of the control options for the measuring device. A number of functions is assigned to each group. You select a group in order to access the individual functions for operating and configuring the measuring device. You can find an overview of all the groups available in the table of contents on page 3 and in the graphic representation of the function matrix on page 6. On page 6 you can also find an overview of all the functions available with the page references to the specific function description. A description of the individual functions is provided on page 7 and onwards.
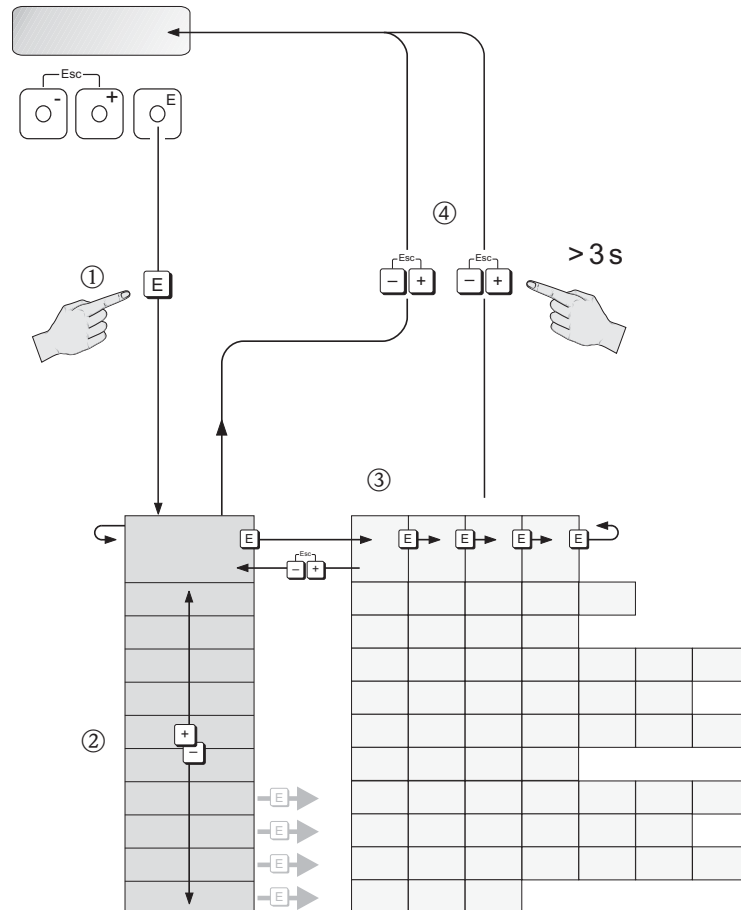
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2   Illustration of the function matrix

Groups/function groups   **Functions**

MEASURING VALUES → 🖹 7	MASS FLOW	CORRECTED VOLUME FLOW	HEAT FLOW	TEMPERATURE

↓

SYSTEM UNITS → 🖹 8	UNIT MASS FLOW	UNIT MASS	UNIT CORRECTED VOLUME FLOW	UNIT CORRECTED VOLUME
	UNIT CALORIFIC VALUE MASS	UNIT CALORIFIC VALUE CORRECTED VOLUME	UNIT HEAT FLOW	UNIT HEAT
	UNIT PRESSURE	UNIT TEMPERATURE	UNIT DENSITY	UNIT LENGTH

↓

Quick Setup → 🖹 12	QUICK SETUP COMMISSIONING	QUICK SETUP SENSOR	QUICK SETUP GAS	QUICK SETUP PRESSURE
	QUICK SETUP HEAT FLOW	T-DAT SAVE/LOAD		

↓

OPERATION → 🖹 24	LANGUAGE	ACCESS CODE	DEFINE PRIVATE CODE	STATUS ACCESS
	ACCESS CODE COUNTER			

↓

USER INTERFACE → 🖹 26	ASSIGN LINE 1	ASSIGN LINE 2	100% VALUE LINE 1	100% VALUE LINE 2
	FORMAT	DISPLAY DAMPING	CONTRAST LCD	BACKLIGHT
	TEST DISPLAY			

↓

TOTALIZER → 🖹 29	SELECT TOTALIZER	SUM	OVERFLOW	CHANNEL
	UNIT TOTALIZER	SET TOTALIZER	PRESET TOTALIZER	MODE TOTALIZER
	CYCL. CALC. TOT.			

↓

COMMUNICATION → 🖹 32	TAG NAME	FIELDBUS ADDRESS	WRITE PROTECTION	SELECTION GSD
	UNIT TO BUS	PROFIL VERSION	ACTUAL BAUD RATE	DEVICE ID
	CHECK CONFIGURATION	BLOCK SELECTION	CHANNEL	AI1 - OUT VALUE
	AI2 - OUT VALUE	AI3 - OUT VALUE	AO - DISPLAY VALUE	AO - PRESSURE VALUE

↓

PROCESS PARAMETER → 🖹 35	PROCESS PRESSURE 1	PROCESS PRESSURE 2	PROCESS PRESSURE	REFERENCE PRESSURE
	REFERENCE TEMPERATURE	REFERENCE DENSITY	NET CALORIFIC VALUE	GROSS CALORIFIC VALUE
	MOLE % GAS 1	ASSIGN LOW FLOW CUT OFF	ON-VALUE LOW FLOW CUT OFF	OFF-VALUE LOW FLOW CUT OFF
	ZERO POINT ADJUST	INSTALLATION FACTOR		

↓

GAS → 🖹 38	SELECT GROUP	NUMBER OF GASES	GAS TYPE 1	MOLE % GAS 1
	DESCRIPTION	CORRECTION FACTOR	REFERENCE DENSITY	GAS TYPE 2 to 8
	MOLE % GAS 2 to 8	CHECK VALUES	SAVE CHANGES	

↓

HEAT FLOW → 🖹 43	CALORIFIC VALUE TYPE	MODE 1	HEATING VALUE 1	MODE 2

Groups/function groups | **Functions**

↓

HEATING VALUE 2	REFERENCE COMBUS-TION TEMPERATURE

SYSTEM PARAMETER → 🕮 45

POSITIVE ZERO RETURN	FLOW DAMPING

↓

SENSOR DATA → 🕮 46

PIPE TYPE	PIPE STANDARD	NOMINAL DIAMETER	OUTER DIAMETER
WALL THICKNESS	INTERNAL DIAMETER	INTERNAL HEIGHT	INTERNAL WIDTH
MOUNTING	MOUNTING SET LENGTH	INSERTION DEPTH	FLOW CONDITIONER
CALIBRATION DATE			

↓

SUPERVISION → 🕮 50

ACTUAL SYSTEM CONDI-TION	PREVIOUS SYSTEM CON-DITION	ALARM DELAY	SYSTEM RESET
OPERATION HOURS	HOURS SINCE RESET		

↓

SIMULATION SYSTEM → 🕮 51

SIMULATION FAILSAFE MODE	SIMULATION MEASUR-AND	VALUE SIMULATION MEASURAND

↓

SENSOR VERSION → 🕮 52

SENSOR TYPE	SERIAL NUMBER	TRANSDUCER SERIAL NUMBER	SOFTWARE REVISION NUMBER S-DAT
PRE-AMPLIFIER SOFT-WARE REVISION NUM-BER	PRE-AMPLIFIER HARD-WARE REVISION NUM-BER		

↓

AMPLIFIER VERSION → 🕮 53

DEVICE SOFTWARE	HARDWARE REVISION NUMBER AMPLIFIER	SOFTWARE REVISION NUMBER AMPLIFIER	SOFTWARE REVISION NUMBER T-DAT
I/O MODULE TYPE	SOFTWARE REVISION NUMBER I/O MODULE		

3   MEASURING VALUES

Function description, MEASURING VALUES group	
✎ Note! The engineering unit of the measured variable displayed here is configured in the SYSTEM UNITS group (→ 📖 8)	
MASS FLOW	**Description** The currently measured mass flow appears on the display. **Display:** 5-digit floating-point number, including unit e.g. 462.87 kg/h; 731.63 lb/min
CORRECTED VOLUME FLOW	**Description** The calculated corrected volume flow appears on the display. The corrected volume flow is calculated from the measured mass flow and the reference density of the gas. **Display:** 5-digit floating-point number, including unit e.g. 104.97 Nm3/h; 110.73 Sm3/h; etc.
HEAT FLOW	**Description** The calculated heat flow appears on the display. **Display:** 5-digit floating-point number, including unit, (e.g. 175.00 kJ/h; 50.000 kBtu/h; etc.)
TEMPERATURE	**Description** The currently measured temperature appears on the display. **Display:** 5-digit fixed-point number, incl. unit and sign e.g. −23.4 ℃, 160.0 ℉, 295.4 K

4   SYSTEM UNITS

Function description, SYSTEM UNITS group	
UNIT MASS FLOW	**Description** For selecting the unit required and displayed for the mass flow. The unit you select here is also valid for: • Low flow cut off The following time units can be selected: s = second, m = minute, h = hour, d = day **Options** SI: Gram → g/time unit Kilogram → kg/time unit Metric ton → t/time unit US: Ounce → oz/time unit Pound → lb/time unit Ton → ton/time unit **Factory setting** kg/h or lb/h (country dependent → 📖 54)
UNIT MASS	**Description** For selecting the unit required and displayed for the mass. **Options** SI: Gram → g Kilogram → kg Metric ton → t US: Ounce → oz Pound → lb Ton → ton **Factory setting** kg or lb (country dependent → 📖 54)
UNIT CORRECTED VOL- UME FLOW	**Description** For selecting the unit required and displayed for the corrected volume flow. The unit you select here is also valid for: • Low flow cut off The following time units can be selected: s = second, m = minute, h = hour, d = day **Options** SI: Norm cubic meter → Nm³/time unit Norm liter → Nl/time unit US: Standard cubic meter → Sm³/time unit Standard cubic feet → Sft³/time unit **Factory setting** Nm³/h or Sm³/h (country dependent → 📖 54)

Function description, SYSTEM UNITS group	
UNIT CORRECTED VOL-UME	**Description** For selecting the unit required and displayed for the corrected volume. **Options** SI: Norm cubic meter → Nm³ Norm liter → Nl US: Standard cubic meter → Sm³ Standard cubic feet → Sft³ **Factory setting** Nm³ or Sm³ (country dependent → 🕮 54)
UNIT CALORIFIC VALUE MASS	**Description** For selecting the unit required and displayed for the gross/net calorific value. **Options (SI units)** kJ/kg MJ/kg kWh/kg MWh/kg kcal/kg Mcal/kg **Options (US units)** Btu/lb kBtu/lb **Factory setting** MJ/kg or kBtu/lb (country dependent → 🕮 54)
UNIT CALORIFIC VALUE CORRECTED VOLUME	**Description** For selecting the unit required and displayed for the calorific value based on the corrected volume. **Options (SI units):** kJ/Nm³ MJ/Nm³ kWh/Nm³ MWh/Nm³ kcal/Nm³ Mcal/Nm³ **Options (US units):** kJ/Sm³ MJ/Sm³ kWh/Sm³ MWh/Sm³ kcal/Sm³ Mcal/Sm³ Btu/Sft³ kBtu/Sft³ **Factory setting** MJ/Nm³ or kBtu/Sft³ (country dependent → 🕮 54)

| Function description, SYSTEM UNITS group	
UNIT HEAT FLOW	**Description** For selecting the unit required and displayed for the heat flow. The following time units can be selected: s = second, m = minute, h = hour, d = day **Options (SI unit)** kW MW kJ/time unit MJ/time unit GJ/time unit kcal/time unit Mcal/time unit Gcal/time unit **Options (US unit)** tons kBtu/time unit MBtu/time unit GBtu/time unit **Factory setting** kW or kBtu/h (country dependent → 🖺 54)
UNIT HEAT	**Description** For selecting the unit required and displayed for the heat. The following time units can be selected: s = second, m = minute, h = hour, d = day **Options (SI units)** kWh MWh kJ MJ GJ kcal Mcal Gcal **Options (US units)** tonh kBtu MBtu GBtu **Factory setting** kWh or kBtu (country dependent → 🖺 54)
UNIT PRESSURE	**Description** Use this function to select the unit for pressure. The unit you select here is also valid for: • Process pressure (see PROCESS PARAMETER group, → 🖺 35) • Reference pressure (see PROCESS PARAMETER group, → 🖺 35) **Options** bar a (bar absolute) psi a (pound per square inch absolute) kPa a (kilopascal absolute) mmHg 0℃ a (millimeter mercury absolute) inHg 32℉ a (inch mercury absolute) mmH2O 4℃ a (millimeter water absolute) inH2O 39℉ a (inch water absolute) kg/cm2 a (kilogram per centimeter squared absolute) **Factory setting** bar a or psi a (country dependent → 🖺 54)

Function description, SYSTEM UNITS group	
UNIT TEMPERATURE	**Description** For selecting the unit required and displayed for the temperature. **Options** ℃ (CELSIUS) K (KELVIN) ℉ (FAHRENHEIT) R (RANKINE) **Factory setting** ℃ or ℉ (country dependent → 🖹 54)
UNIT DENSITY	**Description** For selecting the unit required and displayed for the calculated gas density at process conditions. The unit you select here is also valid for: • Reference density (see PROCESS PARAMETER group, → 🖹 35) **Options** SI: g/cm³ g/cc kg/dm³ kg/l kg/m³ US: lb/ft³ **Factory setting** kg/m³ or lb/ft³ (country dependent → 🖹 54)
UNIT LENGTH	**Prerequisite** This function is **only** available for the insertion sensor (t-mass 65I) **Description** For selecting the unit of length required and displayed for the pipe internal diameter or the inner dimensions of rectangular ducts (see SENSOR DATA function group → 🖹 46). **Options** MILLIMETER INCH **Factory setting** MILLIMETER or INCH (country dependent → 🖹 54)

5 Quick Setup

Function description, Quick Setup group	
QUICK SETUP COM-MISSIONING	**Description** Starts the Quick Setup menu for commissioning. For a flowchart of the QUICK SETUP COMMISSIONING: → 🖺 14. **Options** NO YES **Factory setting** NO
QUICK SETUP COM-MUNICATION	**Description** Use this function to start the setup menu for the settings of the PROFIBUS DP communication parameters. For a flowchart of the QUICK SETUP COMMUNICATION: → 🖺 16. **Options** NO YES **Factory setting** NO
QUICK SETUP SENSOR	**Prerequisite** This function is **only** available for insertion sensors (t-mass 65I). **Description** Use this function to start the application-specific setup to calculate the insertion depth for the insertion sensor. For a flowchart of the QUICK SETUP SENSOR: → 🖺 17. **Options** NO YES **Factory setting** NO
QUICK SETUP GAS	**Description** Use this function to start the application-specific setup for programming the gas or gas mixture. For a flowchart of the QUICK SETUP GAS: → 🖺 18. **Options** NO YES **Factory setting** NO
QUICK SETUP PRES-SURE	**Description** Use this function to start the application-specific setup for programming the process pressure for each gas group. For a flowchart of the QUICK SETUP PRESSURE: → 🖺 20 **Options** NO YES **Factory setting** NO

Function description, Quick Setup group

QUICK SETUP HEAT FLOW	**Description** Use this function to start the application-specific setup for heat flow. For a flowchart of the QUICK SETUP HEAT FLOW: → 🖺 21. **Options** NO YES **Factory setting** NO
T-DAT SAVE/LOAD	**Description** Use this function to save the configuration/settings of the **transmitter** to a transmitter-DAT (T-DAT), or to load a configuration from the T-DAT to the EEPROM (**manual** backup function). For a flowchart of the T-DAT SAVE/LOAD: → 🖺 23. Application examples: • After commissioning, the current measuring point parameters can be saved to the T-DAT as a backup. • If the transmitter is replaced for some reason, the data from the T-DAT can be loaded into the new transmitter (EEPROM). **Options** CANCEL SAVE (from the EEPROM to the T-DAT) LOAD (from the T-DAT to the EEPROM) ✎ Note! • If the target device has an older software version, the message "TRANSM. SW-DAT" is displayed during startup. Then only the "SAVE" option is available. • LOAD This option is only possible: – if the target device has the same software version as, or a more recent software version than, the source device or – if the T-DAT contains valid data that can be called up • SAVE This function is always available. **Factory setting** CANCEL

5.1   Quick Setup "Commissioning"
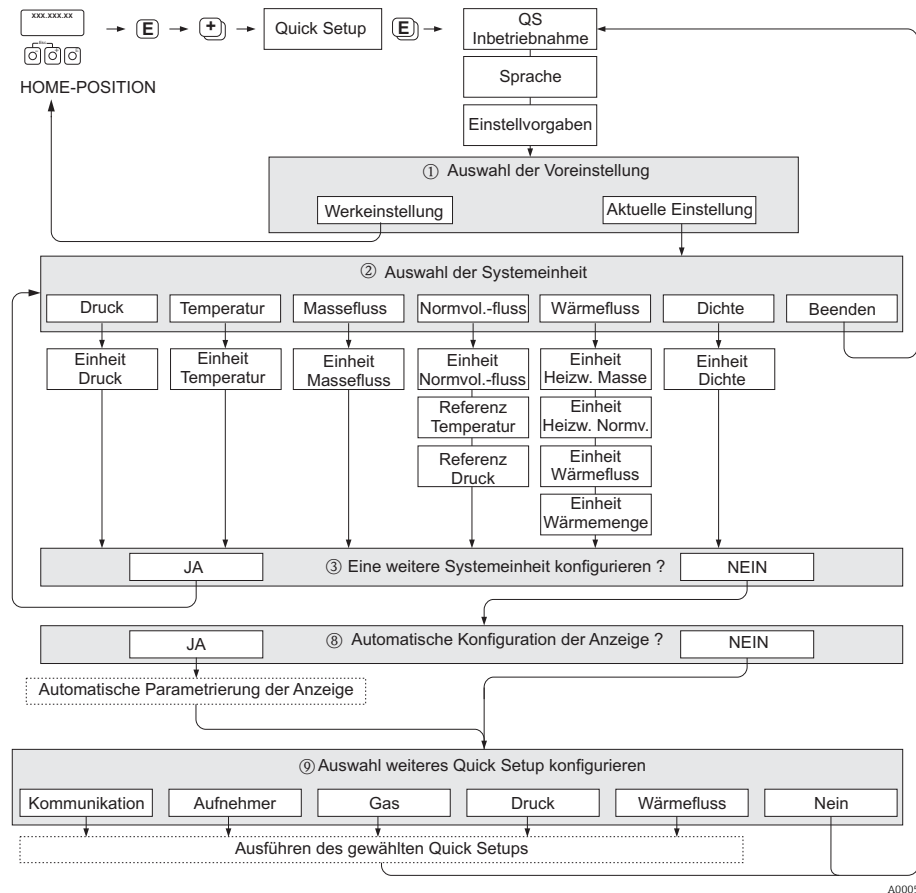
Fig. 1:   *QUICK SETUP COMMISSIONING- menu for straightforward configuration of the major device functions*

✎ Note!
The display returns to the QUICK SETUP cell if you press the ESC key combination ( ) during programming of a parameter anywhere in the menu. The configuration settings already made remain valid, however.

QUICK SETUP - COMMISSION

Use the + or − key at the prompt "QS-COMMISSION NO" and the device access code entry appears. Enter the device access code "65" and press E ; programming is enabled. The prompt "QS-COMMISSION NO" appears. Use the + or − key to change NO to YES and press E .

LANGUAGE

Use the + or − key to select the required language and continue with E .

PRE-SETTING.

①   Select ACTUAL SETTINGS to continue programming the device and go to the next level or select DELIVERY SETTINGS to reset the device. The device restarts and returns to the Home position.

- ACTUAL SETTINGS are the actual programmed parameters in the device

- DELIVERY SETTINGS are the programmed parameters (factory settings plus customer specific settings) originally delivered with the device

SYSTEM UNITS

Select required system unit function and carry out parameterization or select QUIT to return to the QUICK SETUP function if no further programming is required.

② Only units not yet configured in the current setup are available for selection in each cycle.

③ The YES option remains visible until all the units have been configured.
NO is the only option displayed when no further units are available.

Automatic configuration of the display

⑧ The "automatic parameterization of the display" option contains the following basic settings/factory settings:

- YES: main line = MASS FLOW, additional line = TOTALIZER 1

- NO: The existing (selected) settings remain.

Carry out another Quick Setup?

⑨ Select additional Quick Setups to complete commissioning or select NO to exit.

5.2   Quick Setup "Communication"

To establish cyclic data transfer, various arrangements between the PROFIBUS Master (class 1) and the slave are required which have to be taken into consideration when configuring various functions. These functions can be configured quickly and easily by means of the Communication Quick Setup. The configuration options for the parameters are explained in detail in the table that follows.
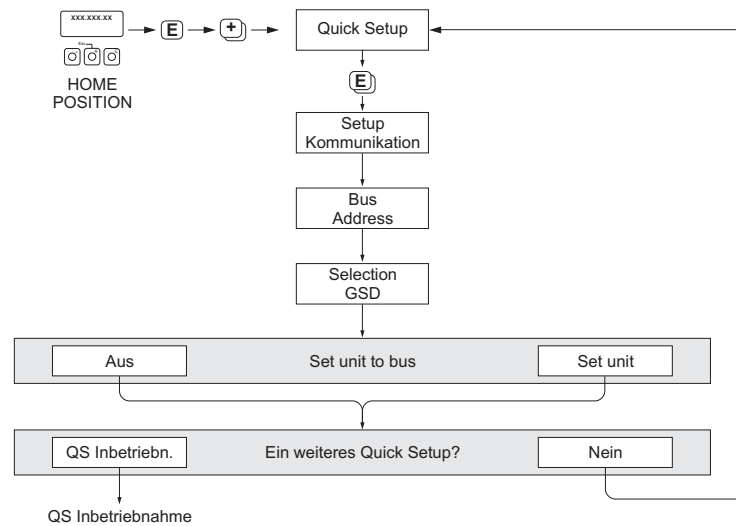

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Fig. 2:   Quick Setup Communication

Settings for the Communication Setup menu:		
Function name	**Suggested settings**	**Description**
Call up through the function matrix:		
Quick Setup	QUICK SETUP COMMUNICA-TIONQuick Setup	→ 🖹 12
QUICK SETUP COMMUNICATION	YES	→ 🖹 12
Basic configuration:	**Factory setting:**	
FIELDBUS ADDRESS	126	→ 🖹 32
SELECTION GSD	MANUFACT. SPEC.	→ 🖹 32
UNIT TO BUS	SET UNIT	→ 🖹 32

5.3   Quick Setup "Sensor"

It is essential that the insertion sensor is setup according to the actual pipe or duct and then installed at the calculated insertion depth. This Quick Setup guides you systematically through the procedure to setup the sensor.

✎ Note!
The QUICK SETUP SENSOR function is not available for flanged type sensors.
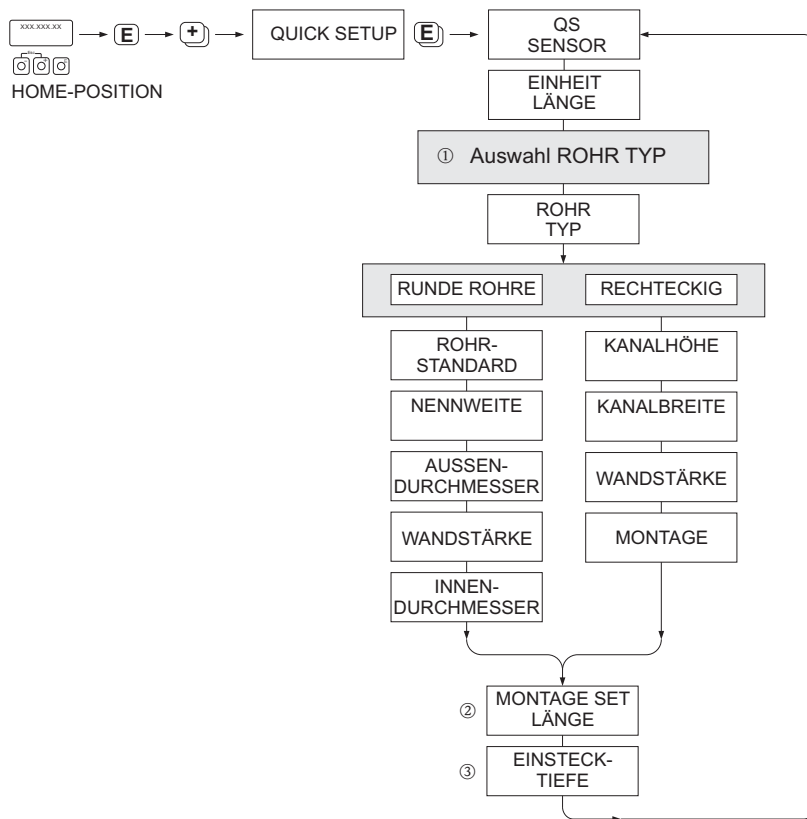
A0009910-en

PIPE TYPE

① • CIRCULAR
- in case that the pipe is of a standard type, then parameterize functions PIPE STANDARD and NOMINAL DIAMETER
- In case that the pipe is a non-standard type, then select OTHERS in the function PIPE STANDARD and parameterize the functions WALL THICKNESS and OUTER DIAMETER.
- The function INTERNAL DIAMETER displays the calculated internal diameter and is read only.
• RECTANGULAR
- Enter the INTERNAL HEIGHT, INTERNAL WIDTH and WALL THICKNESS of the duct
- Select the MOUNTING orientation of the sensor: HORIZONTAL or VERTICAL

MOUNTING SET LENGTH

② Enter the measured length of the mounting set (including the compression fitting).

INSERTION DEPTH

③ This function calculates the insertion depth value for the mounting of the sensor.

Press E to save settings and return to QUICK SETUP SENSOR group.

5.4   "Gas" Quick Setup menu

The device can be setup with 1 or 2 individual gas groups in memory. This means that up to 2 different gas flow streams (e.g. nitrogen and argon) can be measured in a single pipe with one flowmeter.
In the case of 2 gas groups being used, a digital input can be assigned to switch between the gas groups or, alternatively, the switch can be done manually via a function in the device software. Furthermore, a programmed gas mixture can be dynamically updated, via a signal from a gas analyzer.
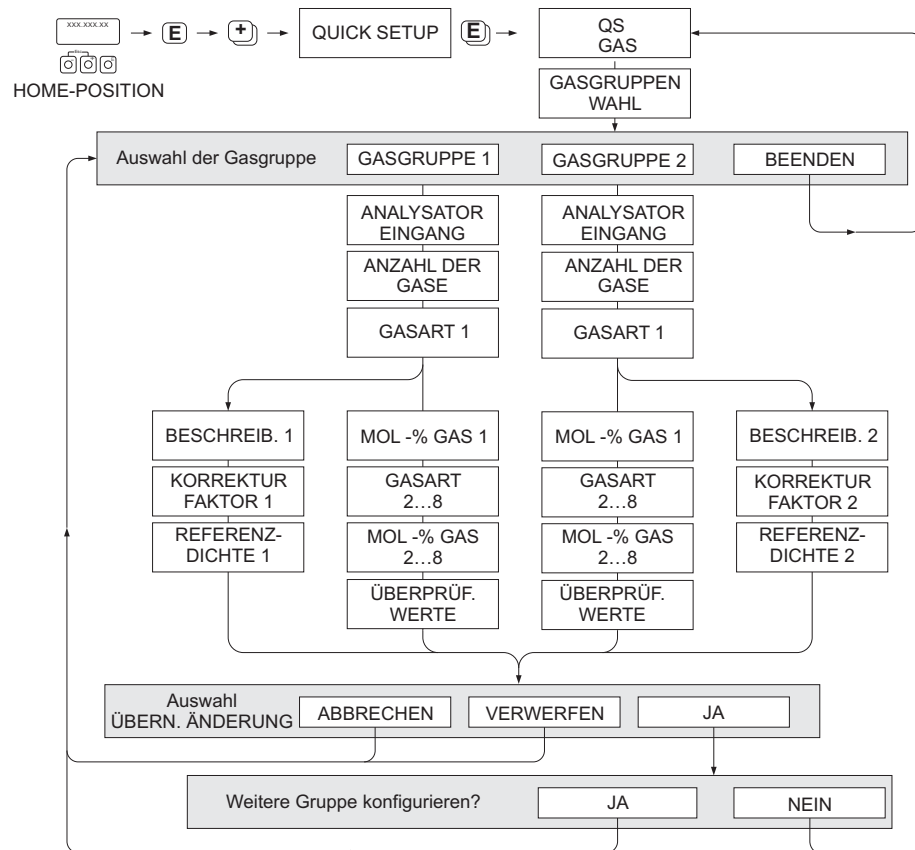
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Programming a gas group
The device allows flexible change of the gas group parameters, independent of the original factory setup and calibration
A gas group can be programmed as:
– one single gas or
– one gas mixture (of up to 8 components)
A single gas can be:
– selected from a list of standard gases or
– setup for other suitable types of gases, such as Ozone, using manual correction factors and the option called SPECIAL GAS. This requires application evaluation at the factory - consult your Endress+Hauser sales center prior to using this function.

Setting or viewing the active gas group

Go to the function SELECT GROUP (→ 🗒 39) and simply select 1 or 2 and then exit using ESC
(🖧 keys simultaneously). No save function is necessary.

✎ Note!
This Quick Setup Gas function is not available if an in-situ calibration function has been per-
formed on the device as the in-situ calibration curve refers to the sensor power at each
recorded flow point. Therefore, the programmed gas settings become redundant.

Performing the Quick Setup
1. GAS GROUP
   Use the ⊞ or ⊟ key to select the required GAS GROUP and continue with ⒠.
   – Set the ANALYZER INPUT to ON if a gas compensation input is being used
   – Select the NUMBER OF GASES in the group from 1 to 8.
   – select the GAS TYPE from the choose list.
   – enter the MOLE % for each GAS TYPE (only if NUMBER OF GASES is 2 and more).
   – The error message CHECK VALUES appears if the total mixture % does not equal
     100%. Go back and check the mixture settings.

2. SAVE CHANGES?
   – Select YES to save the settings in GAS GROUP 1 or 2 and activate the last gas group
     selected. Press ⒠ to continue or
   – Select CANCEL to save the entered settings in buffer memory but not activate them
     for measurement. If this function is selected, then it will be necessary to come back to
     this gas group and save it at a later stage.
   – Select DISCARD to clear the last changes and return to CONFIGURE GROUP to make
     new settings.

3. ANOTHER GAS GROUP?
   – Select YES to continue to the CONFIGURE GROUP function. Use the ⊞ or ⊟ key to
     select the desired GAS GROUP and proceed as per the above instructions.
   – Select NO to exit to the Quick Setup.

✎ Note!
You can find more detailed information on the GAS GROUP in chapter GAS → 🗒 38

5.5 "Pressure" Quick Setup menu

Use this Quick Setup to program the individual process pressure for each gas group. If only one gas group is being used, then only the function PROCESS PRESSURE 1 needs to be programmed, PROCESS PRESSURE 2 can remain with default settings.
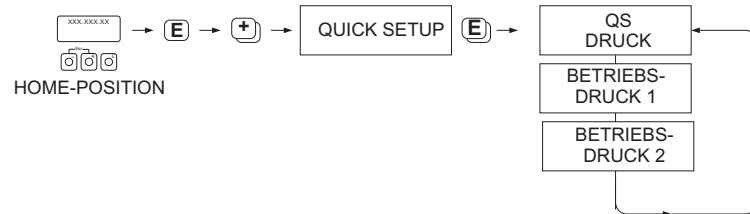

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✎ Note!
- The device operates with absolute pressure only. Convert any gauge pressures to absolute pressure.
- If a pressure compensating input is being used, then the input signal value overrides the manually programmed value. The pressure input value applies to both gas groups. i.e. 2 independent pressure values are no longer possible.
- This Quick Setup Gas function is not available if an in-situ calibration function has been performed on the device as the in-situ calibration curve refers to the sensor power at each recorded flow point. Therefore, the programmed pressure settings become redundant.

5.6   "Heat Flow" Quick Setup menu

The device can calculate and output the heat of combustion of common fuel gases such as methane, natural gas, propane, butane, ethane and hydrogen.
Use this Quick Setup menu to program the method used to calculate the heating value or calorific value (CV). The device can be configured to give two independent heating value outputs and totalized values. For example, the pipeline has either natural gas or propane running at separate times and the heating value is required for both gases.

A0009909-en
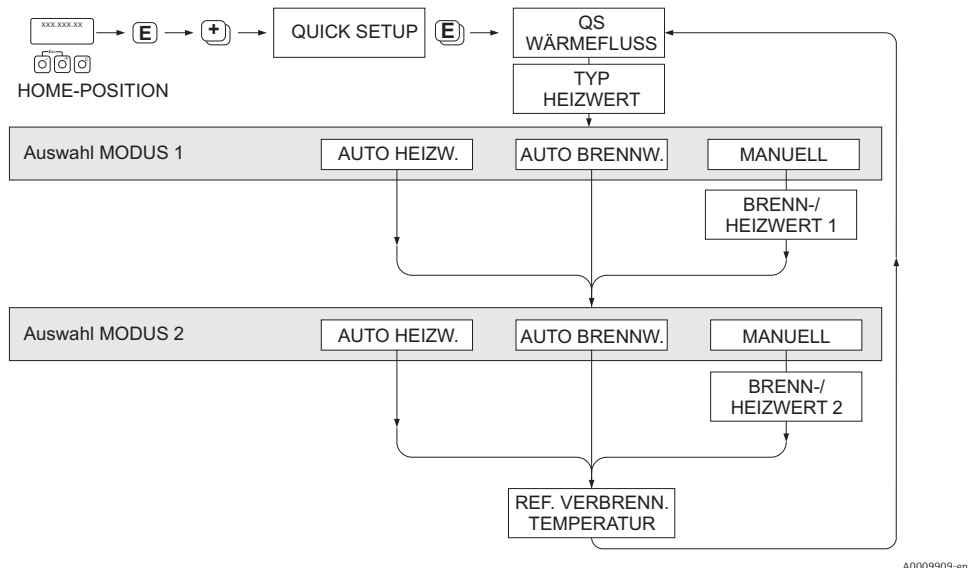
Calculation mode 1 and 2

- The heating value for CALCULATION MODE 1 corresponds to the settings in the function GAS GROUP 1.
- The heating value for CALCULATION MODE 2 corresponds to the settings in the function GAS GROUP 2.

Note!
- If only one gas group is used, then leave mode 2 as default settings.
- The units of measure are selected in the SYSTEM UNITS section
  → 🖹 8.

Auto Gross

The gross heating value (or higher heating value) is the total heat obtained by complete combustion at constant pressure of a volume of gas in air, including the heat released by the water vapor in the combustion products (gas, air and combustion products taken at reference combustion temperature and standard pressure).

Auto Net

The net heating value (or lower heating value) is determined by subtracting the heat of vaporization of the water vapor from the higher heating value. This treats any water formed as water vapor. The energy required to vaporize the water therefore is not realized as heat.

Manual

This function allows entry of a user-specific heating value if the required value is different from the value in the following table.

Gas	Formula	Net/lower heating value		Gross/upper heating value	
		[Mj/kg]	Btu/lb	[Mj/kg]	Btu/lb
Hydrogen	H_2	119.91	51.56	141.78	60.97
Ammonia	NH_3	18.59	7.99	22.48	9.67
Carbon Monoxide	CO	10.1	4.34	10.1	4.34
Hydrogen Sulphide	H_2S	15.2	6.54	19.49	8.38
Methane	CH_4	50.02	21.51	55.52	23.87
Ethane	C_2H_6	47.5	20.43	51.93	22.33
Propane	C_3H_8	46.32	19.92	50.32	21.64
Butane	C_4H_{10}	45.71	19.66	49.51	21.29
Ethylene	C_2H_4	47.16	20.28	50.31	21.63

* According to ISO 6976:1995(E) and GPA Standard 2172-96

reference combustion temperature

The following reference temperatures are used:

Country	reference combustion temperature
Austria, Belgium, Denmark, Germany, Italy, Luxembourg, The Netherlands, Poland, Russia, Sweden, Switzerland	25 ℃
Brazil, China	20 ℃
France, Japan	0 ℃
Australia, Canada, Czech Republic, Hungary, India, Ireland, Malaysia, Mexico, South Africa, Great Britain	15 ℃
Slovakia	25 ℃
USA, Venezuela	60 ℉

5.7   Data backup/transmission

Using the T-DAT SAVE/LOAD function, you can transfer data (device parameters and settings) between the T-DAT (exchangeable memory) and the EEPROM (device storage unit).

This is required in the following instances:
- Creating a backup: current data are transferred from an EEPROM to the T-DAT.
- Replacing a transmitter: current data are copied from an EEPROM to the T-DAT and then transferred to the EEPROM of the new transmitter.
- Duplicating data: current data are copied from an EEPROM to the T-DAT and then transferred to EEPROMs of identical measuring points.

✎ Note!
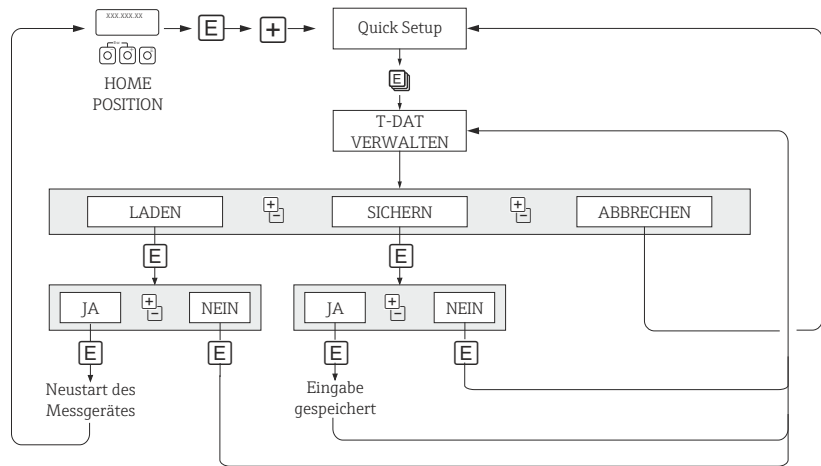For information on installing and removing the T-DAT see Operating Instructions
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Fig. 3:   Data backup/transmission with T-DAT SAVE/LOAD function

Information on the LOAD and SAVE options available

LOAD
Data are transferred from the T-DAT to the EEPROM.

✎ Note!
- Any settings already saved on the EEPROM are deleted.
- This option is only available, if the T-DAT contains valid data.
- This option can only be executed if the software version of the T-DAT is the same or newer than that of the EEPROM. Otherwise, the error message "TRANSM. SW-DAT" appears after restarting and the LOAD function is then no longer available.

SAVE
Data are transferred from the EEPROM to the T-DAT

6 OPERATION

Function description, OPERATION group	
LANGUAGE	**Description** For selecting the language in which all messages are shown on the local display. If you press the ⊞ keys simultaneously at startup, the language defaults to "ENGLISH". **Options:** ENGLISH DEUTSCH FRANCAIS ESPANOL ITALIANO NEDERLANDS NORSK SVENSKA SUOMI PORTUGUES POLSKI CESKI **Factory setting** country dependent → 🗎 54
ACCESS CODE	**Description** All data of the measuring device are protected against inadvertent change. Programming is disabled and the settings cannot be changed until a code is entered. If you press the ⊞ operating elements in any function, the measuring device automatically goes to this function and the prompt to enter the code appears on the display (programming disabled). You can enable programming by entering the private code (factory setting = 65, see DEFINE PRIVATE CODE function (→ 🗎 24). • The programming levels are disabled if you do not press the operating elements within 60 seconds following a return to the HOME position. • Programming can also be disabled by entering any number (other than the private code). • Your Endress+Hauser sales center can be of assistance if you mislay your private code. **User input** Max. 4-digit number: 0 to 9999
DEFINE PRIVATE CODE	**Description** Use this function to specify the private code for enabling programming. • Programming is always enabled if the code defined = 0. • Programming has to be enabled before the code can be changed. When programming is disabled this function cannot be edited, thus preventing others from accessing your personal code. **User input** Max. 4-digit number: 0 to 9999 **Factory setting** 65
STATUS ACCESS	**Description** The access status for this function matrix appears on the display. **Display:** ACCESS CUSTOMER (parameters can be modified) LOCKED (parameters cannot be modified)

Function description, OPERATION group	
ACCESS CODE COUN-TER	**Description** The number of times the private and service code was entered to access the device appears on the display. **Display:** Integer **Factory setting** 0

Function description, OPERATION group	

7   USER INTERFACE

Function description, USER INTERFACE group	
ASSIGN LINE 1	**Description** For assigning a display value to the main line (top line of the local display). This value is displayed during normal operation. **Options** OFF MASS FLOW MASS FLOW IN % TEMPERATURE TOTALIZER 1 TOTALIZER 2 AI1 - OUT VALUE AI2 - OUT VALUE AI3 - OUT VALUE AO - DISPLAY VALUE AO - PRESSURE VALUE CORRECTED VOLUME FLOW CORRECTED VOLUME FLOW IN % HEAT FLOW HEAT FLOW IN % **Factory setting** MASS FLOW
ASSIGN LINE 2	**Description** For assigning a display value to the additional line (bottom line of the local display). This value is displayed during normal operation. **Options** OFF MASS FLOW MASS FLOW IN % MASS FLOW BARGRAPH IN % TEMPERATURE TOTALIZER 1 TOTALIZER 2 TAG NAME OPERATING/SYSTEM CONDITIONS CORRECTED VOLUME FLOW CORRECTED VOLUME FLOW IN % CORRECTED VOLUME FLOW BARGRAPH IN % AI1 - OUT VALUE AI2 - OUT VALUE AI3 - OUT VALUE AO - DISPLAY VALUE AO - PRESSURE VALUE HEAT FLOW HEAT FLOW IN % HEAT FLOW BARGRAPH IN % **Factory setting** TOTALIZER 1

Function description, USER INTERFACE group	
100% VALUE LINE 1	**Prerequisite** This function is **only** available if one of the following options was selected in the ASSIGN LINE 1 function (→ 📖 26): • MASS FLOW IN % • CORRECTED VOLUME FLOW IN % • HEAT FLOW IN % **Description** Use this function to enter the flow value which should be shown on the display as the 100% value. **User input** 5-digit floating-point number **Factory setting** 10 kg/h (with mass flow) 10 Nm³/h (with corrected volume flow) 10 kW (with heat flow)
100% VALUE LINE 2	**Prerequisite** This function is **only** available if one of the following options was selected in the ASSIGN LINE 2 function (→ 📖 26): • MASS FLOW IN % • CORRECTED VOLUME FLOW IN % • HEAT FLOW IN % • MASS FLOW BARGRAPH IN % • CORRECTED VOLUME FLOW BARGRAPH IN % • HEAT FLOW BARGRAPH IN % **Description** Use this function to enter the flow value which should be shown on the display as the 100% value. **User input** 5-digit floating-point number **Factory setting** 10 kg/h (with mass flow) 10 Nm³/h (with corrected volume flow) 10 kW (with heat flow)
FORMAT	**Description** For selecting the number of decimal places for the display value in the main line. • Note that this setting only affects the reading as it appears on the display, it has no influence on the accuracy of the system's calculations. • The places after the decimal point as computed by the measuring device cannot always be displayed, depending on this setting and the engineering unit. In these instances an arrow appears on the display between the measured value and the engineering unit (e.g. 1.2 → kg/h), indicating that the measuring device is computing with more decimal places than can be shown on the display. **Options** XXXXX. - XXXX.X - XXX.XX - XX.XXX -X.XXXX **Factory setting** X.XXXX
DISPLAY DAMPING	**Description** For entering a time constant defining how the display reacts to severely fluctuating flow variables, either very quickly (enter a low time constant) or with damping (enter a high time constant). The setting 0 seconds switches off damping. **User input** 0 to 100 seconds **Factory setting** 3 seconds

Function description, USER INTERFACE group	
CONTRAST LCD	**Description** For adjusting the display contrast to suit local operating conditions. **User input** 10 to 100% **Factory setting** 50%
BACKLIGHT	**Description** For adjusting the background lighting to suit local operating conditions. Entering the value "0" means that the backlight is "switched off". The display then no longer emits any light, i.e. the display texts can no longer be read in the dark. **User input** 0 to 100% **Factory setting** 50%
TEST DISPLAY	**Description** Use this function to test the operability of the local display and its pixels. Test sequence: 1. Start the test by selecting ON. 2. All pixels of the main line and additional line are darkened for minimum 0.75 seconds. 3. The main line and additional line show an "8" in each field for minimum 0.75 seconds. 4. The main line and additional line show a "0" in each field for minimum 0.75 seconds. 5. The main line and additional line show nothing (blank display) for minimum 0.75 seconds. 6. When the test is completed, the local display returns to its initial state and displays the option OFF. **Options** OFF ON **Factory setting** OFF

8   TOTALIZER

Function description, TOTALIZER group	
SELECT TOTALIZER	**Description** For selecting the totalizer. ✎ Note! If the GSD PROFILE option was selected in the function SELECTION GSD → 🖹 32, only the TOTALIZER 1 option is available in this function. **Options:** TOTALIZER 1 TOTALIZER 2 **Factory setting** TOTALIZER 1
SUM	**Description** To display the current totalizer value incl. unit. This function is available separately for each totalizer. The selection of the current totalizer takes place in the SELECT TOTALIZER function (). **Display:** Max. 7-digit floating-point number, including unit (e.g. 15467.04 kg)
OVERFLOW	**Description** The total for the totalizer's overflow aggregated since measuring commenced appears on the display. Total flow is represented by a floating-point number consisting of max. 7 digits. Higher numerical values (>9,999,999) can be viewed as overflows. The effective quantity is thus the total of the SUM function (→ 🖹 29) plus the value displayed in the OVERFLOW function. This function is available separately for each totalizer. The selection of the current totalizer takes place in the SELECT TOTALIZER function (). **Example:** Reading after 2 overflows: 2 E7 kg (= 20000000 kg) The value displayed in the SUM function = 196845.7 kg Effective total quantity = 20196845.7 kg **Display:** Integer with exponent, including unit, e.g. 2 E7 kg
CHANNEL	**Description** For assigning the measured variable to the totalizer. The totalizer is reset to 0 as soon as the selection is changed. This function is available separately for each totalizer. The selection of the current totalizer takes place in the SELECT TOTALIZER function (). **Options:** OFF MASS FLOW CORRECTED VOLUME FLOW HEAT FLOW **Factory setting** MASS FLOW

Function description, TOTALIZER group	
UNIT TOTALIZER	**Description** For selecting the unit for the measured variable assigned to the totalizer. This function is available separately for each totalizer. The selection of the current totalizer takes place in the SELECT TOTALIZER function (). **Options (ASSIGN TOTALIZER = MASS FLOW):** SI → g , kg, t US → oz, lb, ton **Factory setting** kg or lb (country dependent → 🗎 54) **Options (ASSIGN TOTALIZER = CORRECTED VOLUME FLOW):** SI → Nl, Nm³ US → Sm³, Sft³ **Factory setting** Nm³ or Sm³ (country dependent → 🗎 54) **Options (ASSIGN TOTALIZER = HEAT FLOW):** SI → kWh, MWh, kJ, MJ, GJ, kcal, Mcal, Gcal US → kBtu, MBtu, GBtu, tonh **Factory setting** MWh or kBtu (country dependent → 🗎 54)
SET TOTALIZER	**Description** Control of totalizer. This function is available separately for each totalizer. The selection of the current totalizer takes place in the SELECT TOTALIZER function (). If RESET or PRESET is selected, the totalizer is set to 0 or the preset value but it does not stop totalizing. This means, it continues totalizing immediately from the new setting. To stop the totalizer, the HOLD VALUE option must be selected in the TOTALIZER MODE function. **Options** TOTALIZE Totalizes the measured variable selected in the CHANNEL function. RESET Reset the totalizer to 0. PRESET The totalizer is set to the value defined in the PRESET TOTALIZER function. **Factory setting** TOTALIZE
PRESET TOTALIZER	**Prerequisite** This value is not accepted by the totalizer unless the PRESET option is selected in the SET TOTALIZER function. **Description** Specifies a start value. This function is available separately for each totalizer. The selection of the current totalizer takes place in the SELECT TOTALIZER function (). **User input** −99999...99999 **Factory setting** 0

Function description, TOTALIZER group

MODE TOTALIZER	**Description** For selecting the totalizing mode of the totalizer. This function is available separately for each totalizer. The selection of the current totalizer takes place in the SELECT TOTALIZER function (). ✎ Note! The device cannot measure any negative flow. **Options** BALANCE This option operates the same as the POSITIVE option. POSITIVE (forwards) Positive flow components only. NEGATIVE (backwards) The functionality of this option is not supported, because the device cannot measure any negative flow. HOLD VALUE The totalizer stays at the last value. No more components are totalled. **Factory setting** BALANCE
CYCL. CALC. TOT.	**Description** This function is used to determine if the totalizers on the local display and in the operating program (e.g. oparating program "FieldCare") are updated.. Particularly in the case of time-critical applications, optimization can be carried out on totalizer function blocks which are not needed. To do this, the "OFF" option must be selected in this function. It is very important when selecting the "OFF" option that the totalizers on the local display and in the operating program (e.g. Field-Care) are no longer updated. **Options** ON Totalizers are always updated. OFF Totalizers are updated only if the relevant totalizer function block (TOTAL module or function) is configured for cyclical data transfer. **Factory setting** ON

9   COMMUNICATION

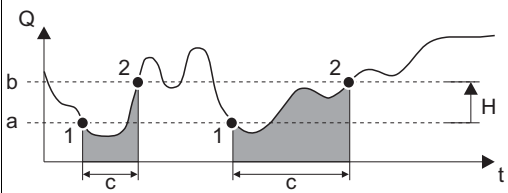| Function description, COMMUNICATION group	
TAG NAME	**Description** For entering a tag name for the measuring device. You can edit and read this tag name via the local display or an operating program (e.g. FieldCare). **User input** Max. 16-character text, permitted characters are: A-Z, 0-9, +,−, punctuation marks **Factory setting** "– – – – – – – – – – – – – – – –" (no text)
FIELDBUS ADDRESS	**Description** For entering the device address. **User input** 1 to 126 **Factory setting** 126
WRITE PROTECTION	**Description** Indicates whether write access to the device via PROFIBUS (acyclical data transfer, e.g. via operating program "FieldCare") is possible. Write protection is activated and deactivated by means of a jumper on the I/O module (see Operating Instructions BA00113D/06). **Display:** OFF = write access via PROFIBUS possible ON = write access via PROFIBUS disabled **Factory setting** OFF
SELECTION GSD	**Description** Select the operating mode (GSD file) which should be used for cyclic communication with the PROFIBUS Master (class 1). For PROFIBUS network configuration, make sure that the right device master file (GSD file) of the measuring device is used for the selected operating mode. For more information please refer to the Operating Instructions BA00113D/06/de. **Options** MANUFACT. SPEC. The measuring device is operated with complete device functionality. GSD PROFIL The measuring device is operated in the PROFIBUS Profile mode. **Factory setting** MANUFACT. SPEC.
UNIT TO BUS	**Description** If this function is executed, the measured variables (AI modules) transmitted cyclically are transmitted to the PROFIBUS Master (class 1) with the system units configured in the measuring device. ☝ Caution! Activating this function can cause the measured variables (AI modules) transmitted to the PROFIBUS Master (class 1) to change suddenly; this, in turn, can affect subsequent control routines. **Options** OFF SET UNIT

Function description, COMMUNICATION group	
PROFIL VERSION	**Description** To display the profile version. **Options** 3.0
ACTUAL BAUD RATE	**Description** The data transmission rate with which the device is communicating appear on the display.
DEVICE ID	**Description** The PROFIBUS device ID appears on the display. The display depends on the options selected in the SELECTION GSD function. **Display** If MANUFACTURER SPEC. is selected: • PROFIBUS DP communication output = 1545 Hex • PROFIBUS PA communication output = 1550 Hex bei der Auswahl GSD PROFIL: • PROFIBUS DP communication output = 9740 Hex • PROFIBUS PA communication output = 9740 Hex
CHECK CONFIGURA-TION	**Description** Indicates whether the configuration for cyclic data transmission of the PROFIBUS master (class 1) was accepted by the measuring device. **Options** ACCEPTED (configuration accepted) NOT ACCEPTED (configuration not accepted)
BLOCK SELECTION	**Description** Use this function to select the PROFIBUS function block for displaying the corresponding input resp. output of the selected function block in the following functions. ✎ Note! If the PROFILE-GSD option is selected in the SELECTION GSD function, only the AI1 - OUT VALUE option is available in this function. **Options** AI1 - OUT VALUE Display of output value in the AI1 - OUT VALUE function AI2 - OUT VALUE Display of output value in the AI2 - OUT VALUE function AI3 - OUT VALUE Display of output value in the AI3 - OUT VALUE function AO - DISPLAY VALUE Display of output value in the AO - DISPLAY VALUE function AO - PRESSURE VALUE Display of output value in the AO - PRESSURE VALUE function **Factory setting** AI1 - OUT VALUE

Function description, COMMUNICATION group	
CHANNEL	**Prerequisite** This function is not available unless the AI1 -, AI2 - or AI3 - OUT VALUE option was selected in the BLOCK SELECTION function **Description** Assigning a measured variable to the Analog Input function block . ✎ Note! If the PROFILE-GSD option is selected in the SELECTION GSD function, only the MASS FLOW option is available in this function.. **Options:** MASS FLOW CORRECTED VOLUME FLOW TEMPERATURE HEAT FLOW **Factory setting** Depends on the selection in the BLOCK SELECTION function: AI1 - OUT VALUE Factory setting = MASS FLOW AI2 - OUT VALUE Factory setting = COR. VOLUME FLOW AI3 - OUT VALUE Factory setting = TEMPERATURE
AI1 - OUT VALUE	**Prerequisite** This function is not available unless the AI1 - OUT VALUE option was selected in the BLOCK SELECTION function. **Description** Use this function to display the measured variable which is cyclically transmitted to the PROFIBUS Master (class 1) via the Analog Input function block 1.
AI2 - OUT VALUE	**Prerequisite** This function is not available unless the AI2 - OUT VALUE option was selected in the BLOCK SELECTION function. **Description** Use this function to display the measured variable which is cyclically transmitted to the PROFIBUS Master (class 1) via the Analog Input function block 2.
AI3 - OUT VALUE	**Prerequisite** This function is not available unless the AI3 - OUT VALUE option was selected in the BLOCK SELECTION function. **Description** Use this function to display the measured variable which is cyclically transmitted to the PROFIBUS Master (class 1) via the Analog Input function block 2.
AO - DISPLAY VALUE	**Prerequisite** This function is not available unless the AI0 - DISPLAY VALUE option was selected in the BLOCK SELECTION function. **Description** Use this function to display the measured variable (DISPLAY_VALUE module) which is cyclically transmitted from the PROFIBUS master (Class 1).
AO - PRESSURE VALUE	**Prerequisite** This function is not available unless the AI0 - PRESSURE VALUE option was selected in the BLOCK SELECTION function. **Description** Use this function to display the process pressure, which is cyclically transmitted from the PROFIBUS Master (class 1). For more information: PROCESS PRESSURE function → 🗎 35.

10   PROCESS PARAMETER

Function description, PROCESS PARAMETER group	
PROCESS PRESSURE 1	**Prerequisite** This function is **not** available if the IN-SITU CALIBRATION function has been enabled. Refer to your Endress+Hauser sales center for more information. **Description** Use this function to enter the process pressure for GAS GROUP 1. (Selection and composition via the functions in the GAS 1/2 group) The unit is taken from the function UNIT PRESSURE (→ 🖺 10). **Input/display** 5-digit floating-point number **Factory setting** 1.0130 [bar a] or 14.692 [psi a] (country dependent → 🖺 54)
PROCESS PRESSURE 2	**Prerequisite** This function is **not** available if the IN-SITU CALIBRATION function has been enabled. Refer to your Endress+Hauser sales center for more information. **Description** Use this function to enter the process pressure for GAS GROUP 2. (Selection and composition via the functions in the GAS 1/2 group) The unit is taken from the function UNIT PRESSURE (→ 🖺 10). **Input/display** 5-digit floating-point number **Factory setting** 1.0130 [bar a] or 14.692 [psi a] (country dependent → 🖺 54)
PROCESS PRESSURE	**Description** Use this function to display the pressure value which is used for the flow calculation. The value is read from the following function: PROCESS PRESSURE 1 or 2 (depending on which gas group is active) The unit is taken from the function UNIT PRESSURE (→ 🖺 10). **Display** 5-digit floating-point number **Factory setting** 1.0130 [bar a] or 14.692 [psi a] (country dependent → 🖺 54)
REFERENCE PRESSURE	**Description** Use this function to enter the reference pressure for calculating the reference density (for corrected volume flow measurement). The unit is taken from the function UNIT PRESSURE (→ 🖺 10). **User input** 5-digit floating-point number **Factory setting** 1.0130 [bar a] or 14.692 [psi a] (country dependent → 🖺 54)
REFERENCE TEMPERA-TURE	**Description** Use this function to enter the reference temperature for calculating the reference density (for corrected volume flow measurement). The unit is taken from the function UNIT TEMPERATURE (→ 🖺 11). **User input** 5-digit floating-point number **Factory setting** 0.0 [°C] or +32.0 [°F] (country dependent → 🖺 54.)

Function description, PROCESS PARAMETER group

REFERENCE DENSITY	**Prerequisite** This function is **not** available if the IN-SITU CALIBRATION function has been enabled. Refer to your Endress+Hauser sales center for more information. **Description** Use this function to display the calculated reference density (for corrected volume flow measurement). The unit is taken from the function UNIT DENSITY (→ 🖹 11). **Display** 5-digit floating-point number
NET CALORIFIC VALUE	**Prerequisite** This function is **only** available if AUTO NET or MANUAL was selected in the MODE 1 or 2 function (→ 🖹 43) **Description** Use this function to display the current net calorific value of the gas. The unit is taken from the function UNIT CALORIFIC VALUE MASS (→ 🖹 9) or UNIT CALORIFIC VALUE CORRECTED VOLUME (→ 🖹 9). **Display** 5-digit floating-point number
GROSS CALORIFIC VALUE	**Prerequisite** This function is **only** available if AUTO GROSS was selected in the MODE 1 or 2 function (→ 🖹 43). **Description** Use this function to display the current gross calorific value of the gas. The unit is taken from the function UNIT CALORIFIC VALUE MASS (→ 🖹 9) or UNIT CALORIFIC VALUE CORRECTED VOLUME (→ 🖹 9). **Display** 5-digit floating-point number
MOLE % GAS 1	**Description** Use this function to display the Mole % of GAS TYPE 1.→ 🖹 39 **Display** 0.0 % to 100.0 %
ASSIGN LOW FLOW CUT OFF	**Description** For selecting the process variable on which low flow cut off should act. **Options** OFF MASS FLOW CORRECTED VOLUME FLOW **Factory setting** MASS FLOW
ON-VALUE LOW FLOW CUT OFF	**Prerequisite** This function is **not** available if OFF was selected in the ASSIGN LOW FLOW CUT OFF function (→ 🖹 36). **Description** Use this function to enter the on-value for low flow cut off. The unit is taken from the SYSTEM UNITS group (→ 🖹 8). Low flow cut off is switched on if the value entered is not equal to 0. An inverted plus sign is shown on the local display of the flow value as soon as the low flow cut off is active. **User input** 5-digit floating-point number **Factory setting** 1% of calibrated full scale value

Function description, PROCESS PARAMETER group

OFF-VALUE LOW FLOW CUT OFF	**Description** Use this function to enter the off-value for low flow cut off. Enter the off-value as a positive hysteresis from the on-value. *Fig. 4: Example for the behavior of low flow cutoff* *Q Flow rate [volume/time]* *t Time* *H Hysteresis* *a ON VALUE LOW FLOW CUT OFF = 20 kg/h* *b OFF-VALUE LOW FLOW CUTOFF = 10%* *c Low flow cutoff active* *1 Low flow cut off is switched on at 20 kg/h* *2 Low flow cut off is switched off at 22 kg/h* **User input** Integer 0 to 100% **Factory setting** 50%
ZERO POINT ADJUST	**Description** Use this function to start automatic zero point adjustment. ⚠ **Caution!** Prior to performing zero point adjustment, observe the exact procedure for zero point adjustment as specified in Operating Instructions BA00113D/06. ✎ **Note!** • If zero point adjustment is not possible due to unstable flow conditions, alarm #451 "ADJUST ZERO FAIL" appears on the display. • RESET: reset to factory calibration. **Options** START CANCEL RESET **Factory setting** CANCEL
INSTALLATION FACTOR	**Description** Disturbances in the flow may arise due to the design of the system, such as pipe bends, reducers, etc. The flow value measured is scaled by entering a constant factor. The flow disturbance can thus be compensated using the calculated flow signal: Flow output = measured flow × installation factor Enter a higher value: flow value output is increased. Enter a lower value: flow value output is decreased. **User input** 5-digit floating-point number 0.0000 to 99999 **Factory setting** 1.0000

11   GAS

Function description, GAS group

Prerequisite
This function is **not** available if the IN-SITU CALIBRATION function is enabled. This function is available again if the in-situ calibration is reset to the factory setting. Contact your Endress+Hauser service organization for more information.

Description
Use this function to view or change the gas configuration
- The device can be configured with one or two independent gas groups.
- Switching between two groups can be performed manually (function SELECT GROUP → 🖹 39)

General programming rules:
- A gas group can be configured with 1 single gas or a gas mixture (max. 8 gas constituents).
- The sum of the gas mixture constituents entered must total 100.0 Mole %.
- A gas constituent and its corresponding Mole % can be entered in any order within the mixture.
- A gas constituent may have a value of 0.0 Mole % within the mixture.
- The option NOT USED in the GAS TYPE 1 and GAS TYPE 2 to 8 functions is a place holder where no gas is assigned. The program does not use this option for calculations.
- The option SPECIAL GAS is a substitute for other gases. The Mole % value is always 100.0%

✎   Note!
For a flowchart of the GAS QUICK SETUP, see Operating Instructions BA00113D/06

Programming examples

a.   1 gas group: 1 standard gas

SELECT GROUP	GAS GROUP 1
NUMBER OF GASES	1
GAS TYPE 1	AIR
MOLE % GAS 1	100.0 %

b.   2 gas groups: 2 standard gases

SELECT GROUP	GAS GROUP 1	GAS GROUP 2
NUMBER OF GASES	1	1
GAS TYPE 1	ARGON	NITROGEN
MOLE % GAS 1	100.0 %	100.0 %

c.   2 gas groups: 1 standard gas, 1 special gas

SELECT GROUP	GAS GROUP 1	GAS GROUP 2
NUMBER OF GASES	1	1
GAS TYPE 1	OXYGEN	SPECIAL GAS
MOLE % GAS 1	100.0 %	100.0 %
DESCRIPTION	–	O2 90% OZONE 10%
CORRECTION FACTOR	–	1.2009
REFERENCE DENSITY	–	1.5005 kg/m3

Function description, GAS group	
SELECT GROUP	**Description** • select a gas group for editing • set the active gas group manually Setting the active gas group: • On completion of programming all the necessary functions in the gas group, select YES in the SAVE CHANGES function → 🖺 42, or • If the gas group is already programmed as required, simply select the required gas group and then exit using the ESC keys (X). **Options** GAS GROUP 1 GAS GROUP 2 **Factory setting** GAS GROUP 1
ANALYZER INPUT	**Description** Use this function to activate/deactivate automatic updating of gas mixtures (via a gas analyzer signal). A gas group must contain at least 2 gas types (e.g. Methane 60%, Carbon Dioxide 40%). **User input** OFF ON **Factory setting** OFF
NUMBER OF GASES	**Description** Use this function to enter the number of gases that are used in the gas group. **User input** 1 to 8 **Factory setting** 1
GAS TYPE 1	**Description** Use this function to select gas type 1. **Options** AIR AMMONIA ARGON BUTANE CARBON DIOXIDE CARBON MONOXIDE CHLORINE ETHANE ETHYLENE HELIUM 4 HYDROGEN NORMAL HYDROGEN CHLORIDE HYDROGEN SULFIDE KRYPTON METHANE NEON NITROGEN OXYGEN PROPANE XENON NOT USED SPECIAL GAS **Factory setting** AIR

Function description, GAS group	
MOLE % GAS 1	**Prerequisite** This function is **not** available if the setting in NUMBER OF GASES (→ 📖 39) is 1. (The factory setting 100% is automatically used) **Description** Use this function to enter the Mole % of the gas selected in GAS TYPE 1. **User input** 000.00 % to 100.00 % **Factory setting** 100.00 %
DESCRIPTION	**Prerequisite** This function is **only** available if the option SPECIAL GAS is selected in the function GAS TYPE 1 (→ 📖 39). **Description** Use this function to enter a description for a special gas configuration. Example A special composition consisting of 93% oxygen and 7% ozone. User input: O2 93% OZONE 7% **User input** xxxx (max. 16 characters) Valid characters are A-Z, 0-9, +, -, decimal point, blank space or underscore **Factory setting** "– – – – – – – – – – – – – – – –" (no text)
CORRECTION FACTOR	**Prerequisite** This function is **only** available if the option SPECIAL GAS is selected in the function GAS TYPE 1 (→ 📖 39). **Description** Use this function to enter a manual correction factor for a special gas configuration. The correction factor is normally based on air and at the specified process conditions. The correction factor is determined by the factory. If the gas or process conditions change from the initial setting, then the correction factor value will also need updating. **User input** 5-digit floating-point number **Factory setting** 1.0
REFERENCE DENSITY	**Prerequisite** This function is **only** available if the option SPECIAL GAS is selected in the function GAS TYPE 1 (→ 📖 39). **Description** Use this function to enter a reference density for a special gas configuration when corrected volume flow is required, e.g. Nm^3 (Sft^3) The unit is taken from the function UNIT DENSITY (→ 📖 11). The reference density is determined by the factory. If the gas or reference conditions change from the initial setting, then the reference density value will also need updating. **User input** 5-digit floating-point number, with unit **Factory setting** 1.2930 [kg/m^3] or 0.0807 [lb/ft^3] (country dependent → 📖 54)

Function description, GAS group	
GAS TYPE 2 to 8	**Prerequisite** The number of functions available here is dependent upon the setting in the function NUMBER OF GASES (→ 🕮 39). **Description** Use this function to select the gas type. **Options** AIR AMMONIA ARGON BUTANE CARBON DIOXIDE CARBON MONOXIDE CHLORINE ETHANE ETHYLENE HELIUM 4 HYDROGEN NORMAL HYDROGEN CHLORIDE HYDROGEN SULFIDE KRYPTON METHANE NEON NITROGEN OXYGEN PROPANE XENON NOT USED **Factory setting** NOT USED
MOLE % GAS 2 to 8	**Prerequisite** The number of functions available here is dependent upon the setting in the function NUMBER OF GASES (→ 🕮 39). **Description** Use this function to enter the Mole % of the gas selected in GAS TYPE 2 to 8. **User input** 000.00 % to 100.00 % **Factory setting** 100.00 %
CHECK VALUES	**Prerequisite** This function is only available if there is an error in the Mole % values. **Description** The error message MIXTURE NOT 100% appears if the entered values do not add up to 100%. The entries have to be checked and corrected before the gas group can be saved and used for flow measurement (see option YES ® function SAVE CHANGES (→ 🕮 42). **Display** MIXTURE NOT 100%

Function description, GAS group	
SAVE CHANGES	**Description** Use this function to control the way entries are saved in the gas group and utilized for flow measurement. **Options** CANCEL The entered parameters are saved in the gas group but they are **not** used for flow measurement. The gas group can be activated, at a later time, by returning to the group, checking the parameters and then selecting the option YES in this function. YES The entered parameters are saved in the gas group and are used for flow measurement. DISCARD The entered parameters are not saved. The previous parameters remain valid and are used for flow measurement.

12   HEAT FLOW

Function description, HEAT FLOW group	
CALORIFIC VALUE TYPE	**Description** Use this function to select the measured variable on which the combustion value is based. **Options** • MASS • CORRECTED VOLUME **Factory setting** MASS
MODE 1	**Description** Use this function to select a mode for calculating the heat flow (GAS GROUP 1). **Options** • AUTO NET • AUTO GROSS • MANUAL **Factory setting** AUTO NET
HEATING VALUE 1	**Prerequisite** This function is **only** available if MANUAL was selected in the MODE 1 function (→ 🕮 43). **Description** Use this function to enter a user-specific calorific value. **Input/display** 5-digit floating-point number **Factory setting** 0.0 The corresponding unit is taken from the UNIT CALORIFIC VALUE MASS (→ 🕮 9) or UNIT CALORIFIC VALUE CORRECTED VOLUME function (→ 🕮 9).
MODE 2	**Description** Use this function to select a mode for calculating the heat flow (GAS GROUP 2). **Options** • AUTO NET • AUTO GROSS • MANUAL **Factory setting** AUTO NET
HEATING VALUE 2	**Prerequisite** This function is **only** available if MANUAL was selected in the MODE 2 function (→ 🕮 43). **Description** Use this function to enter a user-specific calorific value. **Input/display** 5-digit floating-point number **Factory setting** 0.0 The corresponding unit is taken from the UNIT CALORIFIC VALUE MASS (→ 🕮 9) or UNIT CALORIFIC VALUE CORRECTED VOLUME function (→ 🕮 9).

Function description, HEAT FLOW group	
REFERENCE COMBUS-TION TEMPERATURE	**Prerequisite** This function is **not** available if the option MANUAL is selected in MODE 1 oder 2 (→ 🕮 43). **Description** Use this function to enter the reference combustion temperature of the gas. This function is used to calculate the calorific value of the gas. The unit is taken from the function UNIT TEMPERATURE (→ 🕮 11). **User input** 5-digit floating-point number **Factory setting** 25.0 ℃ or 60.0 ℉ (country dependent → 🕮 54)

13   SYSTEM PARAMETER

Function description, SYSTEM PARAMETER group	
POSITIVE ZERO RETURN	**Description** Use this function to interrupt evaluation of measured variables. For example, the output signal should be set to zero flow during operations such as pipe cleaning. The setting acts on all functions and outputs of the measuring device. If the positive zero return is active, the notice message #601 "POSITIVE ZERO-RET" is displayed. **Options** OFF ON (signal output is set to zero flow value, temperature is as normal) **Factory setting** OFF
FLOW DAMPING	**Description** For setting the filter depth. The sensitivity of the flow measurement signal can be reduced with respect to transient flows and interference peaks. The response time of the measuring device increases with every increase in the filter setting. The damping acts prior to other damping functions (e. g. display, time constant). **User input** 0 to 100 s **Factory setting** 1 s

14   SENSOR DATA

Function description, SENSOR DATA group
This group of functions contains the essential data relating to the sensor geometry and calibration.

Flange version (t-mass 65 F): The sensor data cannot be changed and is read only.
Insertion version (t-mass 65 I): The sensor data can be changed to suit the application pipe.
The pipe or duct dimensions are essential for calculating the correct insertion depth.

✎   Note!
To record the sensor data for the insertion sensor (t-mass 65I), see the flowchart of the QUICK SETUP SENSOR in Operating Instructions BA00113D/06.

Refer to your Endress+Hauser sales center for more information.

|	
PIPE TYPE	**Prerequisite** This function is **only** available for insertion sensors (t-mass 65I). **Description** Use this function to select the type of pipe. **Options** CIRCULAR RECTANGULAR **Factory setting** CIRCULAR
PIPE STANDARD	**Prerequisite** This function is **only** available for insertion sensors (t-mass 65I). This function is **not** available if RECTANGULAR is selected in the PIPE TYPE function (→ 🖺 46). **Description** Use this function to select a pipe standard. If the option OTHERS is selected here, then values need to be entered in the functions OUTER DIAMETEROUTER DIAMETER and WALL THICKNESSWALL THICKNESS. **Options** DIN: PN6, PN10, PN25, PN40 ANSI: B36.10 SCHEDULE 10, 20, 30, 40, 60, 80 B36.19 SCHEDULE 10, 40, 80 OTHERS **Factory setting** PN10 or B36.10 SCHEDULE 10 (country dependent → 🖺 54)
NOMINAL DIAMETER	**Prerequisite** This function is **only** available for insertion sensors (t-mass 65I). This function is **not** available if OTHER was selected in the PIPE STANDARD function (→ 🖺 46) or RECTANGULAR in the PIPE TYPE function (→ 🖺 46). **Description** Use this function to select the nominal diameter of the pipe. **Options** 80/3", 100/4", 150/6", 200/8", 250/10", 300/12", 350/14", 400/16", 450/18", 500/20", 600/24", 700/28", 800/32", 900/36", 1000/40" **Factory setting** 150/6"

Function description, SENSOR DATA group	
OUTER DIAMETER	**Prerequisite** This function is **only** available for insertion sensors (t-mass 65I). This function is **only** available if CIRCULAR is selected in the PIPE TYPE function (→ 🖺 46) and OTHER was selected in the PIPE STANDARD function (→ 🖺 46). **Description** Use this function to enter the outer diameter of a circular pipe. The unit is taken from the function UNIT LENGTH (→ 🖺 11). **User input** 5-digit floating-point number 60 to 99999 (mm) or 2.362 to 3937 (inch) (country dependent → 🖺 54) **Factory setting** 168.3 (mm) or 6.0 (inch) (country dependent → 🖺 54)
WALL THICKNESS	**Prerequisite** This function is **only** available for insertion sensors (t-mass 65I). This function is **only** available if OTHER was selected in the PIPE STANDARD function (→ 🖺 46). **Description** Use this function to enter the wall thickness of a circular or rectangular duct. The unit is taken from the function UNIT LENGTH (→ 🖺 11). **User input** 5-digit floating-point number 2.0 to 40.0 (mm) or 0.08 to 1.57 (inch) (country dependent → 🖺 54) **Factory setting** 4.5 (mm) or 0.1771 (inch) (country dependent → 🖺 54)
INTERNAL DIAMETER	**Prerequisite** This function is **only** available for insertion sensors (t-mass 65I). This function is **only** available if OTHER is selected in the PIPE STANDARD function (→ 🖺 46) and CIRCULAR was selected in the PIPE TYPE function (→ 🖺 46). **Description** Use this function to view the internal diameter of a circular pipe. The unit is taken from the function UNIT LENGTH (→ 🖺 11). **Display** 5-digit floating-point number **Factory setting** Depends on the sensor size (country dependent → 🖺 54)
INTERNAL HEIGHT	**Prerequisite** This function is **only** available for insertion sensors (t-mass 65I). This function is **only** available if RECTANGULAR was selected in the PIPE TYPE function (→ 🖺 46). **Description** Use this function to enter the internal height of a rectangular duct. The unit is taken from the function UNIT LENGTH (→ 🖺 11). **User input** 5-digit floating-point number 45 to 99999 (mm) or 1.771 to 3937 (inch) (country dependent → 🖺 54) **Factory setting** 150.0 (mm) or 6.0 (inch) (country dependent → 🖺 54)

Function description, SENSOR DATA group	
INTERNAL WIDTH	**Prerequisite** This function is **only** available for insertion sensors (t-mass 65I). This function is **only** available if RECTANGULAR is selected in the PIPE TYPE function (→ 🖺 46). **Description** Use this function to enter the internal width of a rectangular duct. The unit is taken from the function UNIT LENGTH (→ 🖺 11). **User input** 5-digit floating-point number 45 to 99999 (mm) or 1.771 to 3937 (inch) (country dependent → 🖺 54) **Factory setting** 150.0 (mm) or 6.0 (inch) (country dependent → 🖺 54)
MOUNTING	**Prerequisite** This function is **only** available for insertion sensors (t-mass 65I). This function is **only** available if RECTANGULAR was selected in the PIPE TYPE function (→ 🖺 46). **Description** Use this function to select the installation direction of the insertion sensor in the rectangular duct. – If the VERTICAL option is selected, the value from the function INTERNAL HEIGHT (→ 🖺 47) is used to calculate the insertion depth – If the HORIZONTAL option is selected, the value from the function INTERNAL WIDTH (→ 🖺 48) is used to calculate the insertion depth **Options** HORIZONTAL VERTICAL **Factory setting** VERTICAL
MOUNTING SET LENGTH	**Prerequisite** This function is **only** available for insertion sensors (t-mass 65I). **Description** Use this function to enter a value for the length of the mounting set (including the sensor compression fitting). The unit is taken from the function UNIT LENGTH (→ 🖺 11). **User input** 5-digit floating-point number 75 to 900 (mm) or 2.953 to 35.433 (inch) (country dependent → 🖺 54) **Factory setting** 106.0 (mm) or 4.173 (inch) (country dependent → 🖺 54) The factory setting value is the length of the G1A compression fitting and standard Endress+Hauser mounting boss.
INSERTION DEPTH	**Prerequisite** This function is **only** available for insertion sensors (t-mass 65I). **Description** This function displays the calculated insertion depth for mounting the sensor. The unit is taken from the function UNIT LENGTH (→ 🖺 11). For more information on insertion depth calculation, please refer to the Operating Instructions BA00113D/06. **Display** 5-digit floating-point number

Function description, SENSOR DATA group	
ZERO POINT	**Description** This function shows the current zero point correction value for the sensor. The zero point is determined by the ZERO POINT ADJUST (→ 🕮 37) function. **User input** 5-digit floating-point number −20.000 to +20.000 **Factory setting** Depends on calibration.
FLOW CONDITIONER	**Description** Use this function to indicate if the t-mass 65F sensor has been calibrated with or without a flow conditioner. **Display** WITH WITHOUT **Factory setting** WITHOUT
CALIBRATION DATE	**Description** Use this function to display the date of the last factory calibration of the measuring device. This date is not updated by the IN-SITU CALIBRATION function. **Options** DD.MM.YYYY

15   SUPERVISION

Function description, SUPERVISION group	
ACTUAL SYSTEM CON-DITION	**Description** The current system status appears on the display. **Display** SYSTEM OK or The fault/notice message with the highest priority.
PREVIOUS SYSTEM CONDITION	**Description** The last 16 fault and notice messages appear on the display.
ALARM DELAY	**Description** Use this function to enter a time delay for which the criteria for an error always has to be satisfied before a fault or notice message is generated. Depending on the setting and the type of error, this suppression acts on the display. ✎ **Note!** If this function is used, fault and notice messages are delayed by the time corresponding to the setting before being forwarded to the higher-level controller (PLC, DCS, etc.). Therefore, check in advance whether a delay of this nature could affect the safety requirements of the process. If fault and notice messages are not be suppressed, than a value of 0 seconds must be entered here. **User input** 0 to 100 s (in steps of one second) **Factory setting** 0 s
SYSTEM RESET	**Description** Use this function to restart (reset) the measuring device. **Options** NO The device is not restarted. RESTART SYSTEM Restart without disconnecting main power. In doing so, all the data (functions) are accepted unchanged. **Factory setting** NO
OPERATION HOURS	**Description** The hours of operation of the device appear on the display. **Display** Depends on the number of hours of operation elapsed: Hours of operation < 10 hours → display format = 0:00:00 (hr:min:sec) Hours of operation 10 to 10 000 hours → display format = 0000:00 (hr:min) Hours of operation >10 000 hours → display format = 000000 (hr)
HOURS SINCE RESET	**Description** The hours of operation since the last reset of the device appear on the display. **Display** Depends on the number of hours of operation elapsed: Hours of operation < 10 hours → display format = 0:00:00 (hr:min:sec) Hours of operation 10 to 10 000 hours → display format = 0000:00 (hr:min) Hours of operation >10 000 hours → display format = 000000 (hr)

16   SIMULATION SYSTEM

Function description, SIMULATION SYSTEM group	
SIMULATION FAIL-SAFE MODE	**Description** Use this function to set all inputs, outputs and the totalizer to their error-response modes, in order to check whether they respond correctly. During this time, the message #691 "SIMULATION FAILSAFE" appears on the display. **Options** OFF ON **Factory setting** OFF
SIMULATION MEA-SURAND	**Description** Use this function to set all the inputs, outputs and the totalizer to their flow-response modes, in order to check whether they respond correctly. During this time, the message #692 "SIMULATION MEASURAND" appears on the display. ✎ Note! • The measuring device can only be used for measuring to a certain extent while the simulation is in progress. • The setting is not saved if the power supply fails. **Options** OFF MASS FLOW CORRECTED VOLUME FLOW TEMPERATURE HEAT FLOW **Factory setting** OFF
VALUE SIMULATION MEASURAND	**Prerequisite** Function is **only** available if the SIMULATION MEASURAND function (→ 🕮 51) is active. **Description** Use this function to specify an arbitrary value (e.g. 12 kg/s) to check the assigned functions in the device itself and downstream signal circuits. The unit depends on the option selected in the SIMULATION MEASURAND function and is taken from the SYSTEM UNITS group (→ 🕮 8). ✎ Note! The setting is not saved if the power supply fails. **User input** 5-digit floating-point number **Factory setting** (country dependent → 🕮 54) • 0 kg/h; 0 lb/h (MASS FLOW) • 0 Nm³/h; 0 Sm³/h (CORRECTED VOLUME FLOW) • 0 kW; 0 kBtu (HEAT FLOW) • 0 ℃; +32 ℉ (TEMPERATURE)

17   SENSOR VERSION

Function description, SENSOR VERSION group	
SENSOR TYPE	**Description** Use this function to view the sensor type. **Display** FLOWCELL (t-mass 65F flange sensor) INSERTION (t-mass 65I insertion sensor)
SERIAL NUMBER	**Description** The serial number of the sensor appears on the display.
TRANSDUCER SERIAL NUMBER	**Description** The serial number of the transducer appears on the display.
SOFTWARE REVISION NUMBER S-DAT	**Description** Use this function to view the software revision number of the S-DAT.
PRE-AMPLIFIER SOFT-WARE REVISION NUMBER	**Description** Use this function to view the software revision number of the preamplifier.
PRE-AMPLIFIER HARDWARE REVI-SION NUMBER	**Description** Use this function to view the hardware revision number of the preamplifier.

18 AMPLIFIER VERSION

Function description, AMPLIFIER VERSION group	
DEVICE SOFTWARE	**Description** Use this function to display the current device software version.
HARDWARE REVISION NUMBER AMPLIFIER	**Description** Use this function to view the hardware revision number of the amplifier board.
SOFTWARE REVISION NUMBER AMPLIFIER	**Description** Use this function to view the software revision number of the amplifier board.
SOFTWARE REVISION NUMBER T-DAT	**Description** Use this function to view the software revision number of the T-DAT.
I/O MODULE TYPE	**Description** Use this function to view the configuration of the I/O module.
SOFTWARE REVISION NUMBER I/O MODULE	**Description** Use this function to view the software revision number of the I/O module.

19   Factory settings

19.1   Language → 🕮 24

Country	Language	Country	Language
Australia	English	Norway	Norwegian
Belgium	English	Austria	German
Denmark	English	Poland	Polish
Germany	German	Portugal	Portuguese
England	English	Sweden	Swedish
Finland	Finnish	Switzerland	German
France	French	Singapore	English
The Netherlands	Dutch	Spain	Spanish
Hong Kong	English	South Africa	English
India	English	Thailand	English
Italy	Italian	Czechia	Czech
Luxembourg	French	Hungary	English
Malaysia	English	Other countries	English

19.2   SI units (not for USA and Canada)

19.2.1   Low flow cut off, full scale value, pulse value

t-mass F sensor
With air at ambient conditions (without a flow conditioner)

Nominal diameter [mm]	Low flow cut off [kg/h]	Full scale value [kg/h]	Pulse value [kg/p]
15	0.53	53	0.10
25	2.00	200	1.00
40	5.55	555	1.00
50	9.10	910	10.00
80	20.30	2030	10.00
100	37.50	3750	10.00

t-mass I sensor
With air at ambient conditions (without a flow conditioner)

Nominal diameter [mm]	Low flow cut off [kg/h]	Full scale value [kg/h]	Pulse value [kg/p]
80	20.30	2030	10.0
100	37.50	3750	10.0
150	75.00	7500	100.0
200	125.00	12500	100.0

Nominal diameter	Low flow cut off	Full scale value	Pulse value
[mm]	[kg/h]	[kg/h]	[kg/p]
250	200.00	20000	100.0
300	280.00	28000	100.0
400	500.00	50000	100.0
500	800.00	80000	100.0
600	1150.00	115000	100.0
700	1590.00	159000	100.0
1000	3200.00	320000	100.0
1500	7200.00	720000	100.0

19.2.2   System units→ 📖 8

	Unit
Temperature	℃
Density	kg/m³
Reference density	kg/m³
Calorific Value Mass	MJ/kg
Heat	kWh

	Unit
Length	mm
Pressure	bar a
Reference Pressure	bar a
Calorific Value Corr. Vol.	MJ/m³
Reference temperature	℃

19.2.3   Unit totalizer 1 and 2 → 📖 30

	Unit
Mass flow	kg
Heat flow	MWh

	Unit
Corrected volume flow	Nm³

19.2.4   Other Units

	Unit	
Ref. combustion temp.	℃	→ 📖 44
Pipe standard	according to DIN	→ 📖 46

19.3   US units (only for USA and Canada)

19.3.1   Low flow cut off, full scale value, pulse value

t-mass F sensor
With air at ambient conditions; (without a flow conditioner)

Nominal diameter [mm]	Low flow cut off [lb/hr]	Full scale value [lb/hr]	Pulse value [lb/p]
½"	1.16	116	0.20
1"	4.40	440	2.00
1½"	12.20	1220	2.00
2"	20.02	2002	20.00
3"	44.66	4466	20.00
4"	82.50	8250	20.00

t-mass I sensor
With air at ambient conditions; (without a flow conditioner)

Nominal diameter [mm]	Low flow cut off [lb/hr]	Full scale value [lb/hr]	Pulse value [lb/p]
3"	44.66	4466	20.00
4"	82.50	8250	20.00
6"	165.00	16500	200.00
8"	275.00	27500	200.00
10"	440.00	44000	200.00
12"	610.00	61000	200.00
16"	1100.00	110000	200.00
20"	1760.00	176000	200.00
24"	2530.00	253000	200.00
28"	3498.00	349800	200.00
40"	7040.00	704000	200.00
60"	15840.00	1584000	200.00

19.3.2   System units→ 🖺 8

	Unit
Temperature	°F
Density	lb/ft³
Reference density	lb/ft³
Calorific Value Mass	kBtu/lb
Heat	kBtu

	Unit
Length	inch
Pressure	psi a
Reference Pressure	psi a
Calorific Value Corr. Vol.	kBtu/Sft³
Reference temperature	°F

19.3.3　Unit totalizer 1 and 2 → 🕮 30

	Unit
Mass flow	lb
Heat flow	kBtu

	Unit
Corrected volume flow	Sm³

19.3.4　Other Units

	Unit	
Ref. combustion temp.	℉	→ 🕮 44
Pipe standard	according to ANSI	→ 🕮 46

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