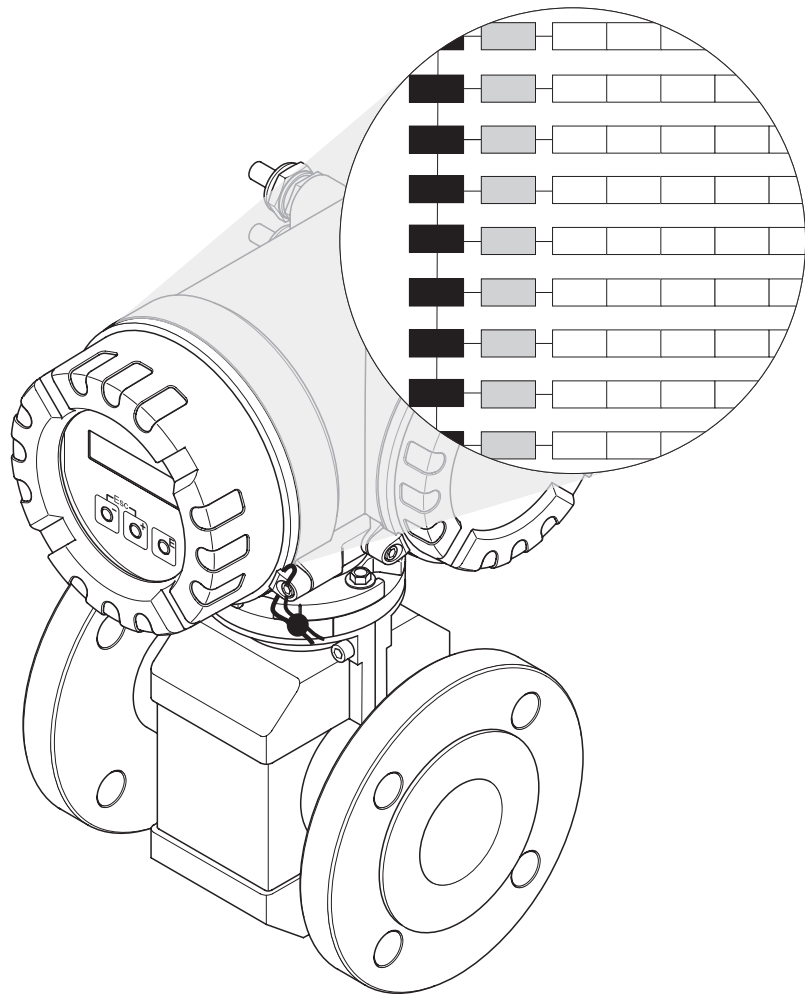Description of Device Functions

Proline Promag 51

Electromagnetic Flow Measuring System
For custody transfer with cold water

HART®
FIELD COMMUNICATION PROTOCOL

Endress+Hauser

People for Process Automation

Remarks for Custody Transfer Mode

Caution

Please note that special conditions apply in custody transfer mode:

- After official approval or leaded sealing, configuration can no longer be carried out using the local display. In custody transfer mode, device functions can then only be selected or altered via the HART interface or using the ToF Tool – Fieldtool Package software.
- In custody transfer mode, all custody transfer relevant functions are disabled automatically and cannot be changed. In both the function matrix and the function descriptions, such device functions are indicated by a keyhole symbol ( ).
- The pulse output functions are only disabled for custody transfer mode if previously the "YES" setting was selected in the "PULSE CT APPROV." function. Finally, enter the custody transfer code "5100" to set the pulse output to a mode suitable for custody transfer.
- Additional features in custody transfer mode are described in the Promag 51 Operating Instructions (BA 080D/06/en).

Contents

Registered trademarks

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

S–DAT®
Registered or registration-pending trademark of Endress+Hauser Flowtec AG, Reinach, CH

1   Function matrix Promag 51

1.1   The function matrix – layout and use

Complex measuring operations necessitate additional functions that you can configure as necessary and customize to suit your process parameters. The function matrix, therefore, comprises a multiplicity of functions which, for the sake of clarity, are arranged in different function groups.

An overview of all the function groups can be found in the table of contents or in the function matrix on Page 6. This matrix contains all the device functions of Promag 51, including appropriate page references for the individual function descriptions.

✎   Note!
In **custody transfer mode**, all custody transfer relevant functions are disabled automatically and cannot be changed. In both the function matrix and the function descriptions, such device functions are indicated by a keyhole symbol (🗝).

Configuration example (e.g. changing the language for the UI):

1.   Enter the function matrix by pressing the ⌨ button.
2.   Select the function group (OPERATION)
3.   Select the function (LANGUAGE). Change the language with ⊞ , e.g. from ENGLISH to DEUTSCH, and save with ⌨ .
4.   Exit the function matrix (press and hold down ⊟⊞ for more than 3 seconds).

A0001142

Fig. 1:   Selection of function groups and functions (function matrix)

1.2 Illustration of the function matrix

Function groups ▶   **Functions** →

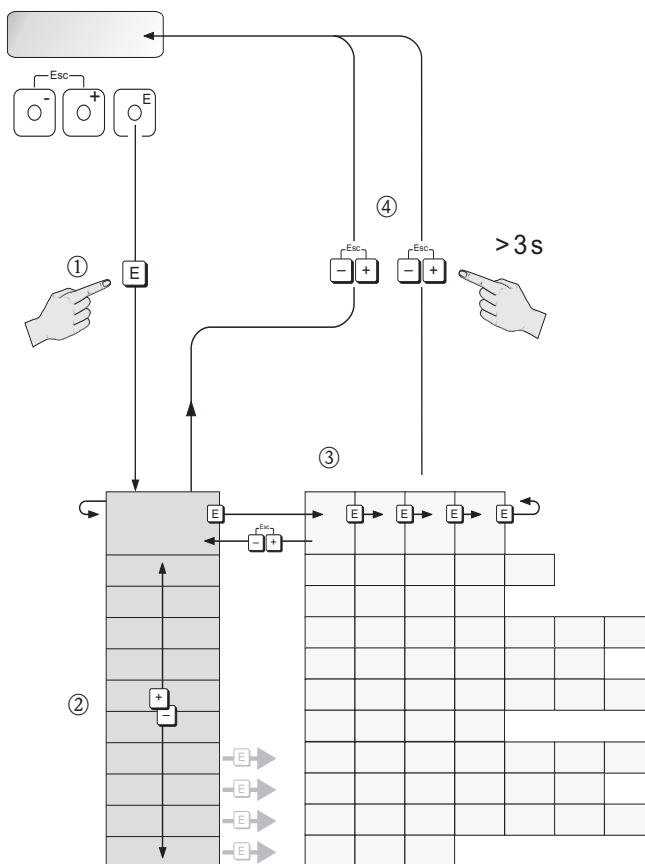| Function group									
MEASURING VALUES (P. 7)	VOLUME FLOW (P. 7)								
SYSTEM UNITS (P. 8)	UNIT VOL. FLOW (P. 8)	UNIT VOLUME (P. 8)	UNIT LENGTH (P. 9)						
QUICK SETUP (P. 10)	QS COMMISSION (P. 10)								
OPERATION (P. 11)	LANGUAGE (P. 11)	ACCESS CODE (P. 12)	PRIVATE CODE (P. 12)	STATUS ACCESS (P. 12)	ACCESS CODE COUNTER (P. 12)	PULSE CT APPROVAL (P. 13)			
USER INTERFACE (P. 14)	ASSIGN LINE 1 (P. 14)	ASSIGN LINE 2 (P. 14)	100% VALUE (P. 14)	FORMAT (P. 15)	DISPL. DAMPING (P. 15)	CONTRAST LCD (P. 15)	BACKLIGHT (P. 15)	DISPLAY TEST (P. 16)	
TOTALIZER 1 (P. 17)	ASSIGN TOTALIZER (P. 17)	SUM (P. 17)	OVERFLOW (P. 17)	UNIT TOTALIZER (P. 18)	TOTALIZER MODE (P. 18)	RESET TOTALIZ. (P. 18)			
TOTALIZER 2 (P. 17)	ASSIGN TOTALIZER (P. 17)	SUM (P. 17)	OVERFLOW (P. 17)	UNIT TOTALIZER (P. 18)	TOTALIZER MODE (P. 18)	RESET TOTALIZ. (P. 18)			
HANDLING TOTAL. (P. 19)	RESET ALL TOTAL. (P. 19)	FAILSAFE MODE (P. 19)							
CURRENT OUTPUT (P. 20)	ASSIGN CURRENT OUTP. (P. 20)	CURRENT SPAN (P. 21)	VALUE 20 mA (P. 22)	TIME CONSTANT (P. 22)	FAILSAFE MODE (P. 22)	ACTUAL CURRENT (P. 22)	SIMULATION CURRENT (P. 23)	VALUE SIM. CURRENT (P. 23)	
PULSE/FREQ. OUTP. (P. 24)	OPERATION MODE (P. 24)	ASSIGN FREQ. (P. 24)	END VALUE FREQ. (P. 25)	VALUE f HIGH (P. 25)	OUTPUT SIGNAL (P. 26)	TIME CONSTANT (P. 28)	FAILSAFE MODE (P. 28)	FAILSAFE VALUE (P. 28)	ACTUAL FREQ. (P. 29) / SIMUL. FREQ. (P. 29)
		ASSIGN PULSE P. 30)	PULSE VALUE (P. 30)	PULSE WIDTH (P. 31)	OUTPUT SIGNAL (P. 32)	FAILSAFE MODE (P. 34)	SIMULATION PULSE (P. 34)	VALUE SIM. PULSE (P. 35)	VALUE SIM. FREQ. (P. 29)
STATUS OUTPUT (P. 36)	ASSIGN STATUS (P. 36)	ON-VALUE (P. 36)	OFF-VALUE (P. 37)	TIME CONSTANT (P. 37)	ACTUAL STATUS (P. 37)	SIM. SWITCH POINT (P. 37)	VAL. SIM. SWIT. PT. (P. 38)		
STATUS INPUT (P. 42)	ASSIGN STATUS (P. 42)	ACTIVE LEVEL (P. 42)	MIN. PULSE WIDTH (P. 42)	SIM. STATUS INP. (P. 43)	VALUE SIM. STATUS (P. 43)				
COMMUNICATION (P. 44)	TAG NAME (P. 44)	TAG DESCR. (P. 44)	BUS ADDRESS (P. 44)	HART PROTOCOL (P. 44)	MANUFACT. ID (P. 44)	DEVICE Re (P. 44)	DEVICE REVISION (P. 44)		
PROCESS PARAM. (P. 45)	ASSIGN LF CUT OFF (P. 45)	ON-VALUE (P. 45)	OFF-VALUE (P. 45)	EMPTY PIPE DET. (P. 47)	EPD/OED ADJ. (P. 48)	EPD/OED RESP.TIME (P. 49)			
SYSTEM PARAM. (P. 50)	INSTALL. DIRECT. (P. 50)	MEASURING MODE (P. 51)	POS. ZERO RETURN (P. 53)	SYSTEM DAMPING (P. 53)	INTEGRAT. TIME (P. 53)				
SENSOR DATA (P. 54)	K-FACTOR POS. (P. 54)	K-FACTOR NEG. (P. 54)	ZERO POINT (P. 54)	NOM. DIAMETER (P. 54)	MEAS. PERIOD (P. 55)	OVERVLTG TIME (P. 55)	EPD ELECTRODE (P. 55)		
SUPERVISION (P. 56)	CURR. SYS. COND. (P. 56)	PREV. SYS. COND. (P. 56)	ASSIGN SYS. ERR. (P. 56)	ERROR CATEG. (P. 56)	ASSIGN PROC. ERR. (P. 57)	ERROR CATEG. (P. 57)	ALARM DELAY (P. 57)	SYSTEM RESET (P. 58)	CUSTODY TRANSFER (P. 58) / OPERAT. HOURS (P. 58)
SIMULAT. SYSTEM (P. 59)	SIM. FAILS. MODE (P. 59)	SIM. MEAS. VARIAB. (P. 59)	VAL.SIM.MEAS.VAR. (P. 59)						
SENSOR VERSION (P. 60)	SERIAL NUMBER (P. 60)	SENSOR TYPE (P. 60)	SW REV. NO. S-DAT (P. 60)						
AMPLIFIER VERS. (P. 60)	DEVICE SOFTWARE (P. 60)	SW REV. AMPL. (P. 60)	LANGUAGE GROUP (P. 60)	I/O MODULE TYPE (P. 60)	SW REV. I/O MOD. (P. 60)				

Legend:

XXXX XXXXX (P. XX)   ⬭   Function disabled in custody transfer mode

XXXX XXXXX (P. XX)   Function disabled in custody transfer mode if pulses are suitable for custody transfer

2   Group MEASURING VALUES

Function description MEASURING VALUES
✎ Note! ■ The engineering unit of the measured variable displayed here can be set in the SYSTEM UNITS group (see Page 8). ■ If the fluid in the pipe flows backwards, a negative sign prefixes the flow reading on the display.

|	
VOLUME FLOW	The volume flow currently measured appears on the display. **User interface:** 5-digit floating-point number, including unit and sign (e.g. 5.5445 dm^3/min; 1.4359 m^3/h; −731.63 gal/d; etc.)

3   Group SYSTEM UNITS

Function description SYSTEM UNITS	
UNIT VOLUME FLOW	Use this function to select the unit for displaying the volume flow. The unit you select here is also valid for: ■ Current output ■ Frequency output ■ Switch points (limit value for volume flow, flow direction) ■ Low flow cut off **Options:** Metric: Cubic centimeter → cm^3/s; cm^3/min; cm^3/h; cm^3/day Cubic decimeter → dm^3/s; dm^3/min; dm^3/h; dm^3/day Cubic meter → m^3/s; m^3/min; m^3/h; m^3/day Milliliter → ml/s; ml/min; ml/h; ml/day Liter → l/s; l/min; l/h; l/day Hectoliter → hl/s; hl/min; hl/h; hl/day Megaliter → Ml/s; Ml/min; Ml/h; Ml/day US: Cubic centimeter → cc/s; cc/min; cc/h; cc/day Acre foot → af/s; af/min; af/h; af/day Cubic foot → ft^3/s; ft^3/min; ft^3/h; ft^3/day Fluid ounce → oz f/s; oz f/min; oz f/h; oz f/day Gallon → gal/s; gal/min; gal/h; gal/day Kilo gallons → Kgal/s; Kgal/min; Kgal/h; Kgal/day Million gallons → Mgal/s; Mgal/min; Mgal/h; Mgal/day Barrel (normal fluids: 31.5 gal/bbl) → bbl/s; bbl/min; bbl/h; bbl/day Barrel (beer: 31.0 gal/bbl) → bbl/s; bbl/min; bbl/h; bbl/day Barrel (petrochemicals: 42.0 gal/bbl) → bbl/s; bbl/min; bbl/h; bbl/day Barrel (filling tanks: 55.0 gal/bbl) → bbl/s; bbl/min; bbl/h; bbl/day Imperial Gallon → gal/s; gal/min; gal/h; gal/day Mega gallon → Mgal/s; Mgal/min; Mgal/h; Mgal/day Barrel (beer: 36.0 gal/bbl) → bbl/s; bbl/min; bbl/h; bbl/day Barrel (petrochemicals: 34.97 gal/bbl) → bbl/s; bbl/min; bbl/h; bbl/day **Factory setting:** Depends on nominal diameter and country (see Page 61 ff., "Full scale value")
UNIT VOLUME	🖑 Caution! This function is only disabled in custody transfer mode if "YES" was selected in the "PULSE CT APPROVAL" function (see Page 13). Use this function to select the unit for displaying the volume. The unit you select here is also valid for the pulse weighting (e.g. m^3/p) **Options:** Metric → cm^3; dm^3; m^3; ml; l; hl; Ml Mega US → cc; af; ft^3; oz f; gal; Kgal; Mgal; bbl (normal fluids); bbl (beer); bbl (petrochemicals) → bbl (filling tanks) Imperial → gal; Mgal; bbl (beer); bbl (petrochemicals) **Factory setting:** Depends on nominal diameter and country (see Page 61 ff., "Totalizer") ✎ Note! The unit of the totalizer is independent of your choice here. The unit for the totalizer is selected separately (see Page 18).

| Function description SYSTEM UNITS |
|---|
| **UNIT LENGTH**   Use this function to select the unit for displaying the length of the nominal diameter.

The unit you select here is also valid for:
■ Nominal diameter of sensor (see function NOMINAL DIAMETER, Page 54)

Options:
MILLIMETER
INCH

Factory setting:
MILLIMETER (SI units: not for USA and Canada)
INCH (US units: only for USA and Canada) |

4   Group QUICK SETUP

| Function description QUICK SETUP	
QUICK SETUP COMMISSION	Use this function to start the Quick Setup menu for commissioning. **Custody transfer mode:** In custody transfer mode, you cannot run the "Commissioning" Quick Setup. The function is permanently set to "NO". **Options:** YES NO **Factory setting:** NO
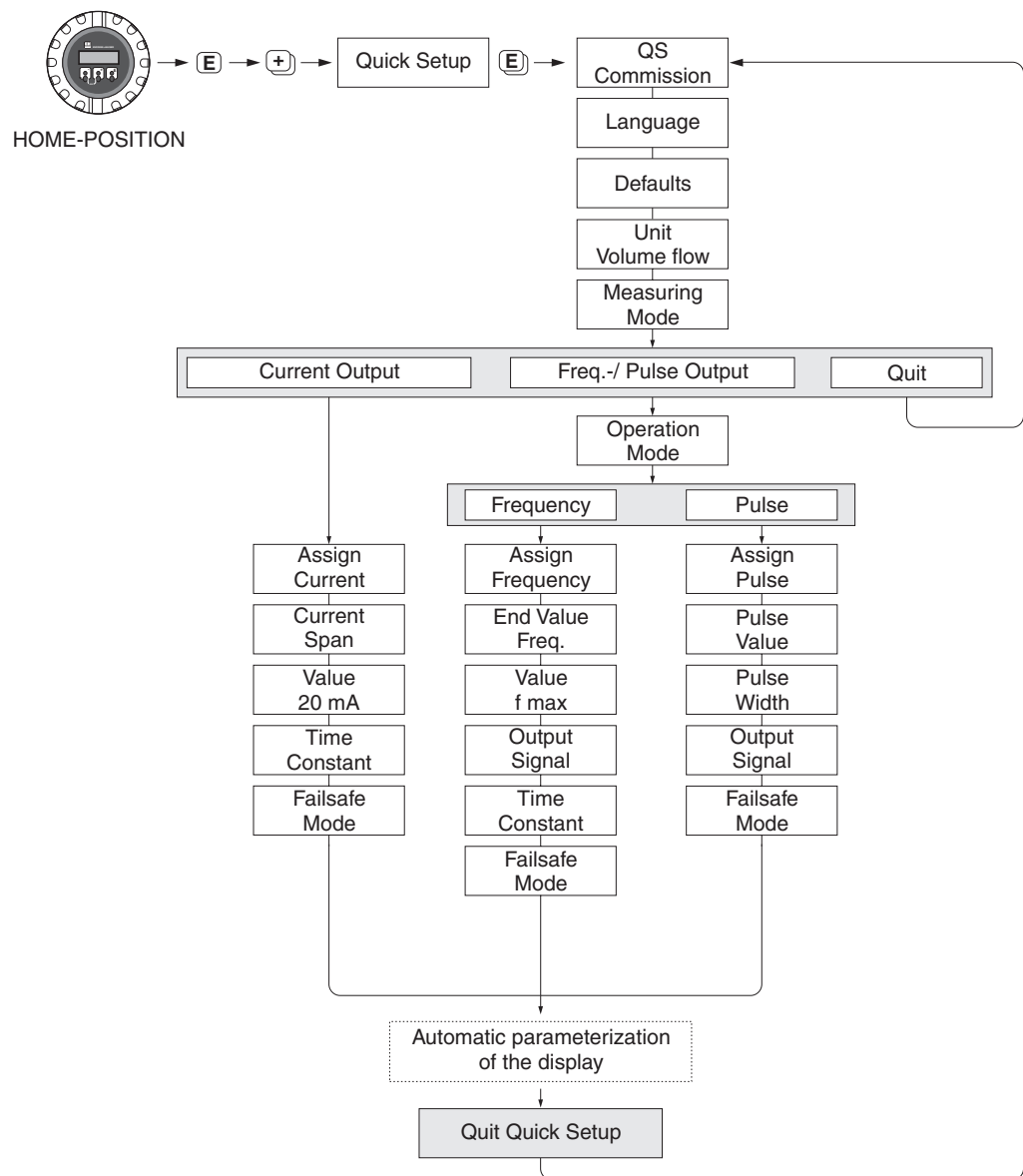
F06-50xxxxx-19-xx-xx-en-000

Fig. 2:   *Quick Setup menu for commissioning*

5   Group OPERATION

Function description OPERATION
LANGUAGE	Use this function to select the language for all texts, parameters and messages shown on the local display. ✎ **Note!** The displayed options depend on the available language group shown in the LANGUAGE GROUP function. **Options:** Language group WEST EU / USA: ENGLISH DEUTSCH FRANCAIS ESPANOL ITALIANO NEDERLANDS PORTUGUESE Language group EAST EU / SCAND: ENGLISH NORSK SVENSKA SUOMI POLISH RUSSIAN CESKI Language group ASIA: ENGLISH BAHASA INDONESIA JAPANESE (Silbenschrift) **Factory setting:** Country-dependent (see Page 61 ff.) ✎ **Note!** ▪ If you press the ⊞⊟ keys simultaneously at startup, the language defaults to "ENGLISH". ▪ You can change the language group via the configuration program ToF Tool – Field-tool Package. Please do not hesitate to contact your Endress+Hauser sales office if you have any questions.

Function description OPERATION

ACCESS CODE	All data of the measuring system are protected against inadvertent change. Program-ming is disabled and the settings cannot be changed until a code is entered in this function. If you press the ± ⁻ keys in any function, the measuring system automatically goes to this function and the prompt to enter the code appears on the display (when programming is disabled). Programming can be enabled by entering a personal code (factory setting = 51, see PRIVATE CODE function, Page 12). **User input:** max. 4-digit number: 0...9999 ✎ Note! ■ The programming levels are disabled if you do not press a key within 60 seconds following automatic return to the HOME position. ■ You can also disable programming in this function by entering any number (other than the defined private code). ■ The Endress+Hauser service organization can be of assistance if you mislay your personal code. **Custody transfer mode – Entering a "Custody transfer code":** ■ When all the device functions have been completed, the Promag 51 flowmeter switches to custody transfer mode when you enter the custody transfer code "5100". Then, the message "CUSTODY TRANSFER YES" appears on the display. ■ Additional features in custody transfer mode are described in detail in the Operating Instructions Promag 51, BA 080D/06/en.
PRIVATE CODE	Use this function to enter a personal code number for enabling programming. **User input:** 0...9999 (max. 4-digit number) **Factory setting:** 51 ✎ Note! ■ Programming is always enabled with the code "0". ■ Programming has to be enabled before this code can be changed. When programming is disabled this function is not available, thus preventing others from accessing your personal code.
STATUS ACCESS	Use this function to check the access status for the function matrix. **User interface:** ACCESS CUSTOMER (parameterization possible) LOCKED (parameterization disabled)
ACCESS CODE COUNTER	Displays how often the customer code, service code or the digit "0" (code-free) has been entered to gain access to the function matrix. **Display:** max. 7-digit number: 0...9999999 **Factory setting:** 0

Function description OPERATION	
PULSE CT APPROV.	Use this function to switch the pulse output to custody transfer mode, for example for quantity calculation via external totalizers. ✎ Note! ■ You must configure this function before entering the custody transfer code. ■ Selecting "YES" disables some of the functions in the "PULSE/FREQ. OUT." function group and the "UNIT VOLUME" function in custody transfer mode (see Matrix, Page 6). This means that you can no longer change these functions in custody transfer mode. ■ You cannot select "YES" if you selected the "FREQUENCY" setting in the "OPERATION MODE" function (see Page 24). **Options:** YES (pulse output for custody transfer mode) NO (no custody transfer mode) **Factory setting:** NO

6   Group USER INTERFACE

Function description USER INTERFACE	
ASSIGN LINE 1	Use this function to define which display value is assigned to the main line (top line of the local display) for display during normal measuring operation. **Custody transfer mode:** In the custody transfer mode, it is not possible to occupy both lines of the local display with the two totalizers 1 and 2: ■ By entering the custody transfer code, the ASSIGN LINE 1 function is automatically switched to VOLUME FLOW if TOTALIZER 1 or TOTALIZER 2 is set for the ASSIGN LINE 1 function. ■ Although the ASSIGN LINE 1 function is not locked in custody transfer mode, assignment with TOTALIZER 1 or TOTALIZER 2 is no longer possible. **Options:** OFF VOLUME FLOW VOLUME FLOW IN % TOTALIZER 1 TOTALIZER 2 **Factory setting:** VOLUME FLOW
ASSIGN LINE 2	Use this function to define which display value is assigned to the additional line (bottom line of the local display) for display during normal measuring operation. **Custody transfer mode:** In custody transfer mode, display line 2 is permanently set to "TOTALIZER 1" (max. 6 characters, no decimal places). **Options:** OFF VOLUME FLOW VOLUME FLOW IN % TOTALIZER 1 TAG NAME OPERATING/SYSTEM CONDITION FLOW DIRECTION VOLUME FLOW BARGRAPH IN % TOTALIZER 2 **Factory setting:** TOTALIZER 1
100% VALUE	✎ Note! This function is only available if VOLUME FLOW IN % or VOLUME FLOW BAR-GRAPH IN % was selected in the function ASSIGN LINE 1 or ASSIGN LINE 2. Use this function to define the flow value to be shown on the display as the 100% value. **User input:** 5-digit floating-point number **Factory setting:** Depends on nominal diameter and country (see Page 61 ff., "Full scale value")

Function description USER INTERFACE	
FORMAT	Use this function to define the maximum number of places after the decimal point displayed for the reading in the main line. **Options:** XXXXX. – XXXX.X – XXX.XX – XX.XXX – X.XXXX **Factory setting:** X.XXXX ✎ Note! ■ 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 such instances an arrow appears on the display between the measuring value and the engineering unit (e.g. 1.2 → l/h), indicating that the measuring system is computing with more decimal places than can be shown on the display. ■ In custody transfer mode, the selected setting here has no effect on display line 2 (totalizer).
DISPLAY DAMPING	Use this function to enter 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). **User input:** 0...100 seconds **Factory setting:** 3 s ✎ Note! Setting the time constant to "0" seconds switches off damping.
CONTRAST LCD	Use this function to optimize display contrast to suit local operating conditions. **User input:** 10...100% **Factory setting:** 50%
BACKLIGHT	Use this function to optimize the backlight to suit local operating conditions. **User input:** 0...100% ✎ Note! 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. **Factory setting:** 50%

Function description USER INTERFACE	
DISPLAY TEST	Use this function to test the operability of the local display and its pixels. **Options:** OFF ON **Factory setting:** OFF Test sequence: 1. Start the test by selecting ON. 2. All pixels of the main line and additional line are darkened for at least 0.75 seconds. 3. The main line and additional line show an "8" in each field for at least 0.75 seconds. 4. The main line and additional line show a "0" in each field for at least 0.75 seconds. 5. The main line and additional line show nothing (blank display) for at least 0.75 seconds. When the test completes the local display returns to its initial state and the setting changes to OFF. **Custody transfer mode:** In custody transfer mode, you can also start the display test using the status input (auxiliary input). This also resets any errors which have occurred.

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7   Group TOTALIZER 1/2

Function description TOTALIZER 1/2	
👆 Caution! ■ Only totalizer 1, and not totalizer 2, is suitable for custody transfer measurement. ■ In the custody transfer mode, it is not possible to occupy both lines of the local display (see Page 14) with the two totalizers 1 and 2: – By entering the custody transfer code, the ASSIGN LINE 1 function is automatically switched to VOLUME FLOW if TOTALIZER 1 or TOTALIZER 2 is set for the ASSIGN LINE 1 function. – Although the ASSIGN LINE 1 function (see Page 14) is not locked in custody transfer mode, assignment with TOTALIZER 1 or TOTALIZER 2 is no longer possible.	
ASSIGN TOTALIZER	Use this function to assign a measured variable (volume flow) to the totalizer. **Custody transfer mode:** In custody transfer mode, this function is only locked for totalizer 1 but not for totalizer 2. **Options:** OFF VOLUME FLOW **Factory setting:** VOLUME FLOW ✎ Note! The totalizer is reset to "0" as soon as the selection is changed.
SUM	The total for the totalizer's measured variable aggregated since measuring commenced appears on the display. This value can be positive or negative, depending on the direction of flow. **User interface:** max. 6-digit floating–point number, including sign and unit (e.g. 96,845.7 dm^3) ✎ Note! The totalizer's response to faults is defined in the function "FAILSAFE MODE", (see Page 19).
OVERFLOW	The total for the totalizer's overflow aggregated since measuring commenced appears on the display. Total flow quantity is represented by a floating–point number consisting of max. 6 digits. You can use this function to view higher numerical values (>999,999) as overflows. The effective quantity is thus the total of the function OVERFLOW plus the value displayed in the function SUM. Example: Reading for 2 overflows: 2 E6 dm^3 (= 2,000,000 dm^3) The value displayed in the function "SUM" = 96,845.7 dm^3 Effective total quantity = 2,096,845.7 dm^3 **User interface:** Integer with exponent, including sign and unit, e.g. 2 E6 dm^3

Function description TOTALIZER 1/2	
UNIT TOTALIZER	Use this function to define the unit for the totalizer.
	Custody transfer mode:
	■ In custody transfer mode, the "m^3" unit is permanently allocated to the totalizer 1.
	■ In custody transfer mode, this function is only locked for totalizer 1 but not for totalizer 2.
	Options:
	■ Metric → cm^3; dm^3; m^3; ml; l; hl; Ml Mega
	■ US → cc; af; ft^3; oz f; gal; Kgal; Mgal; bbl (normal fluids); bbl (beer); bbl (petrochemicals); bbl (filling tanks)
	■ Imperial → gal; Mgal; bbl (beer); bbl (petrochemicals)
	Factory setting:
	Depends on nominal diameter and country (see Page 61 ff., "Totalizer")
TOTALIZER MODE	Use this function to define how the flow components are to be totalised.
	Custody transfer mode:
	■ In custody transfer mode, the totalizer mode is permanently set to "BALANCE".
	■ In custody transfer mode, this function is only locked for totalizer 1 but not for totalizer 2.
	Options:
	BALANCE
	Positive and negative flow components. The positive and negative flow components are balanced. In other words, net flow in the flow direction is registered.
	FORWARD
	Positive flow components only
	REVERSE
	Negative flow components only
	Factory setting:
	Totalizer 1 = BALANCE
	Totalizer 2 = FORWARD
RESET TOTALIZER	Use this function to reset the sum and the overflow of the corresponding totalizer to "zero" (= RESET).
	Custody transfer mode:
	■ In custody transfer mode, this function is only locked for totalizer 1 but not for totalizer 2.
	■ In custody transfer mode, you cannot reset the totalizer 1, not even via the status input.
	■ In "Non Custody Transfer Mode", you can send a pulse via the status input to reset the totalizer. Therefore, set the status input to "RESET TOTALIZER".
	Options:
	NO
	YES
	Factory setting:
	NO

8   Group HANDLING TOTALIZER

Function description HANDLING TOTALIZER	
RESET ALL TOTALIZERS	Use this function to reset the totals (including all overflows) of the totalizers (1...2) to "zero".
	Custody transfer mode:
	■ In custody transfer mode, you cannot reset the totalizers, not even via the status input. In custody transfer mode, the function RESET ALL TOTALIZERS is therefore permanently set to "NO".
	■ In "Non Custody Transfer Mode", you can send a pulse via the status input to reset the totalizers. Therefore, set the status input to "RESET ALL TOTALIZERS".
	Options: NO YES
	Factory setting: NO
	✎ Note! If the device has a status input and if it is appropriately configured, a reset for the totalizer (1...2) can also be triggered by a pulse (see the ASSIGN STATUS INPUT function on Page 36).
FAILSAFE MODE	Use this function to define the response of the totalizer to fault.
	Custody transfer mode: In custody transfer mode, the error response of the totalizer is permanently set to "STOP".
	Options: STOP The totalizer is paused until the fault is rectified.
	ACTUAL VALUE The totalizer continues to count on the basis of the current flow measuring value. The fault is ignored.
	HOLD VALUE The totalizer continues to count the flow on the basis of the last valid flow measuring value (before the fault occurred).
	Factory setting: STOP

9   Group CURRENT OUTPUT

Function description CURRENT OUTPUT	
ASSIGN CURRENT OUTPUT	Use this function to assign a measured variable to the current output. **Options:** OFF VOLUME FLOW **Factory setting:** VOLUME FLOW ✎ Note! If you select OFF, the only function shown in this group is the function (ASSIGN CURRENT OUTPUT).

Function description CURRENT OUTPUT	
CURRENT SPAN	Use this function to define the current span. The selection specifies the operational range and the lower and upper signal on alarm. For the current output the option HART can be defined additionally. **Options:** 0–20 mA 4–20 mA 4–20 mA HART 4–20 mA NAMUR 4–20 mA HART NAMUR 4–20 mA US 4–20 mA HART US 0–20 mA (25 mA) 4–20 mA (25 mA) 4–20 mA (25 mA) HART **Factory setting:** 4–20 mA HART NAMUR **Current span, operational range and signal on alarm level**

a	1	2	3
0-20 mA	0 - 20.5 mA	0	22
4-20 mA	4 - 20.5 mA	2	22
4-20 mA HART	4 - 20.5 mA	2	22
4-20 mA NAMUR	3.8 - 20.5 mA	3.5	22.6
4-20 mA HART NAMUR	3.8 - 20.5 mA	3.5	22.6
4-20 mA US	3.9 - 20.8 mA	3.75	22.6
4-20 mA HART US	3.9 - 20.8 mA	3.75	22.6
0-20 mA (25 mA)	0 - 24 mA	0	25
4-20 mA (25 mA)	4 - 24 mA	2	25
4-20 mA (25 mA) HART	4 - 24 mA	2	25

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a = Current span
1 = Operational range (measuring information)
2 = Lower signal on alarm level
3 = Upper signal on alarm level

✎ Note!
- When switching the hardware from an active (factory setting) to a passive output signal select a current span of 4–20 mA.
- If the measured value exceeds the measuring range a notice message is generated (#351...354, current span).
- In case of a fault the behaviour of the current output is according to the selected option in the function FAILSAFE MODE (see Page 22). Change the error category in the function ASSIGN SYSTEM ERROR (see Page 56) to generate a fault message instead of a notice message.
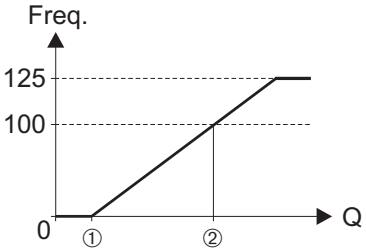
Function description CURRENT OUTPUT	
VALUE 20 mA	Use this function to assign the 20 mA current a full scale value. Positive and negative values are permissible. The required measuring range is defined by defining the 20 mA value. In the SYMMETRY measuring mode (see Page 51), the value assigned applies to both flow directions; in the STANDARD measuring mode it applies only to the flow direction selected. **User input:** 5-digit floating-point number, with sign **Factory setting:** Depends on nominal diameter and country (see Page 61 ff., "Full scale value") ✎ Note! ▪ The appropriate unit is taken from the group SYSTEM UNITS (see Page 8). ▪ The value for 0 or 4 mA always corresponds to the zero flow. This value is fixed and cannot be edited.
TIME CONSTANT	Use this function to enter a time constant defining how the current output signal reacts to severely fluctuating measured variables, either very quickly (enter a low time constant) or with damping (enter a high time constant). **User input:** fixed-point number: 0.01...100.00 s **Factory setting:** 3.00 s
FAILSAFE MODE	For safety reasons it is advisable to ensure that the current output assumes a predefined state in the event of a fault. The setting you select here affects only the current output. The failsafe mode of other outputs and the totalizers is defined in the corresponding function groups. **Options:** MIN. CURRENT The current output adopts the value of the lower signal on alarm level (as defined in the function CURRENT SPAN). MAX. CURRENT The current output adopts the value of the upper signal on alarm level (as defined in the function CURRENT SPAN). HOLD VALUE (**not recommended**) Measuring value output is based on the last measuring value saved before the error occurred . ACTUAL VALUE Measured value output is based on the current flow measurement. The fault is ignored . **Factory setting:** MIN. CURRENT
ACTUAL CURRENT	Use this function to view the computed actual value of the output current. **User interface:** 0.00...25.00 mA

Function description CURRENT OUTPUT	
SIMULATION CURRENT	Use this function to activate simulation of the current output. ✎ Note! ▪ The "SIMULATION CURRENT OUTPUT" notice message indicates that simulation is active. ▪ The measuring device continues to measure while simulation is in progress, i.e. the current measuring values are output correctly via the other outputs. **Custody transfer mode:** Simulation is not possible in custody transfer mode. The function is permanently set to "OFF". **Options:** OFF ON **Factory setting:** OFF ☞ Caution! The setting (OFF – ON) is not saved if the power supply fails.
VALUE SIMULATION CURRENT	✎ Note! This function is not available unless the function SIMULATION CURRENT is active, i.e. is switched on (ON). Use this function to define a selectable value (e.g. 12 mA) to be output at the current output. This value is used to test downstream devices and the measuring device itself. **User input:** Floating-point number: 0.00...25.00 mA **Factory setting:** 0.00 mA ☞ Caution! The setting is not saved if the power supply fails.

10   Group PULSE/FREQUENCY OUTPUT

Function description PULSE/FREQUENCY OUTPUT	
OPERATION MODE	✎ Note! This function is only disabled in custody transfer mode if "YES" was selected in the "PULSE CT APPROVAL" function (see Page 13). Use this function to configure the output as a pulse output or frequency output. The functions available in this function group vary, depending on which option you select here. **Options:** PULSE FREQUENCY ✎ Note! You cannot select "FREQUENCY" if "YES" (pulse output = suitable for custody transfer) was selected in the "PULSE CT APPROVAL" function (see Page 13). **Factory setting:** PULSE
ASSIGN FREQUENCY	✎ Note! This function is not available unless the FREQUENCY setting was selected in the function OPERATION MODE. Use this function to assign a measured variable to the frequency output. **Options:** OFF VOLUME FLOW **Factory setting:** VOLUME FLOW ✎ Note! If you select OFF, the only functions shown in this function group are the functions ASSIGN FREQUENCY and OPERATION MODE.

Function description PULSE/FREQUENCY OUTPUT	
END VALUE FREQUENCY	✎ Note! This function is not available unless the FREQUENCY setting was selected in the function OPERATION MODE. Use this function to define a full scale frequency for the frequency output. You define the associated measured value of the measuring range in the function VALUE f HIGH (see Page 25). **User input:** 4-digit fixed-point number 2...1250 Hz **Factory setting:** 1000 Hz Example: ■ VALUE f HIGH = 1000 l/h, end frequency = 1000 Hz: i.e. at a flow of 1000 l/h, a frequency of 1000 Hz is output. ■ VALUE f HIGH = 3600 l/h, end frequency = 1000 Hz: i.e. at a flow of 3600 l/h, a frequency of 1000 Hz is output. ✎ Note! ■ In the FREQUENCY operating mode the output signal is symmetrical (on/off ratio = 1:1). At low frequencies the pulse duration is limited to a maximum of 2 seconds, i.e. the on/off ratio is no longer symmetrical. ■ The initial frequency is always 0 Hz. This value is fixed and cannot be edited.
VALUE f HIGH	✎ Note! This function is not available unless the FREQUENCY setting was selected in the function OPERATION MODE. Use this function to assign a value to the end value frequency. Positive and negative values are permissible. The required measuring range is defined by defining the VALUE f HIGH. In the SYMMETRY measuring mode (see Page 51), the value assigned applies to both flow directions; in the STANDARD measuring mode it applies only to the flow direction selected. **User input:** 5-digit floating-point number **Factory setting:** Depends on nominal diameter and country (see Page 61 ff., "Full scale value") A0001279 ① = VALUE f HIGH, ② = Measuring range Q = Flow (positive / negative) ✎ Note! ■ The appropriate unit is taken from the group SYSTEM UNITS (see Page 8). ■ The value f-min. for the initial frequency always corresponds to the zero flow (0 [unit]). This value is fixed and cannot be edited.

Function description PULSE/FREQUENCY OUTPUT

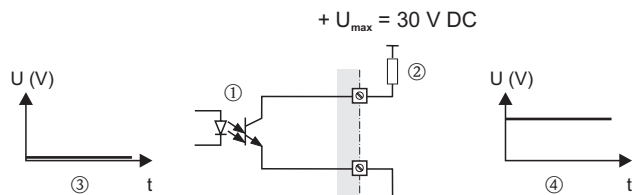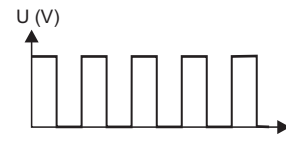| OUTPUT SIGNAL	✎ Note! Function is not available unless the FREQUENCY setting was selected in the OPERATION MODE function. For selecting the output configuration of the frequency output. **Options:** PASSIVE – POSITIVE PASSIVE – NEGATIVE **Factory setting:** PASSIVE – POSITIVE **Explanation** PASSIVE = power is supplied to the frequency output by means of an external power supply. Configuring the output signal level (POSITIVE or NEGATIVE) determines the quiescent behaviour (at zero flow) of the frequency output. The internal transistor is activated as follows: ■ If POSITIVE is selected, the internal transistor is activated with a **positive** signal level. ■ If NEGATIVE is selected, the internal transistor is activated with a **negative** signal level (0 V). ✎ Note! With the passive output configuration, the output signal levels of the frequency output depend on the external circuit (see examples). **Example for passive output circuit (PASSIVE)** If PASSIVE is selected, the frequency output is configured as an open collector. ① = Open collector ② = External power supply ✎ Note! For continuous currents up to 25 mA (I_{max} = 250 mA / 20 ms). **Example for output configuration PASSIVE–POSITIVE:** Output configuration with an external pull-up resistance. In the quiescent state (at zero flow), the output signal level at the terminals is 0 V. ① = Open collector ② = Pull-up resistance ③ = Transistor activation in "POSITIVE" quiescent state (at zero flow) ④ = Output signal level in quiescent state (at zero flow) In the operating status (flow present), the output signal level changes from 0 V to a positive voltage level. (continued on next page)

Function description PULSE/FREQUENCY OUTPUT

Example for output configuration PASSIVE-POSITIVE:
Output configuration with an external pull-down resistance.
In the quiescent state (at zero flow), a positive voltage level is measured via the pull-down resistance.

F06-xxxxxxxx-04-xx-xx-xx-001

① = *Open collector*
② = *Pull-down resistance*
③ = *Transistor activation in "POSITIVE" quiescent state (at zero flow)*
④ = *Output signal level in quiescent state (at zero flow)*

In the operating status (flow present), the output signal level changes from a positive voltage level to 0 V.
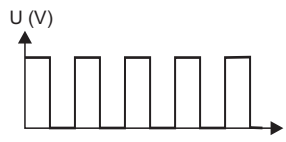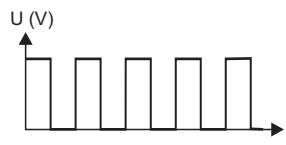
A0001972

Example for output configuration PASSIVE-NEGATIVE:
Output configuration with an external pull-up resistance.
In the quiescent state (at zero flow), the output signal level at the terminals is at a positive voltage level.

F06-xxxxxxxx-04-xx-xx-xx-002

① = *Open collector*
② = *Pull-up resistance*
③ = *Transistor activation in "NEGATIVE" quiescent state (at zero flow)*
④ = *Output signal level in quiescent state (at zero flow)*

In the operating status (flow present), the output signal level changes from a positive voltage level to 0 V.
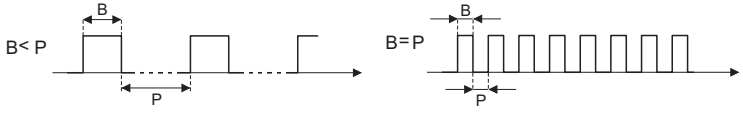
A0001972

Function description PULSE/FREQUENCY OUTPUT

TIME CONSTANT	✎ Note! This function is not available unless the FREQUENCY setting was selected in the function OPERATION MODE. Use this function to enter a time constant defining how the frequency output signal reacts to severely fluctuating measured variables, either very quickly (enter a low time constant) or with damping (enter a high time constant). **User input:** Floating-point number 0.00...100.00 s **Factory setting:** 0.00 s
FAILSAFE MODE	✎ Note! This function is not available unless the FREQUENCY setting was selected in the function OPERATION MODE. For safety reasons it is advisable to ensure that the frequency output assumes a predefined state in the event of a fault. Use this function to define this state. The setting you select here affects only the frequency output. It has no effect on other outputs and the display (e.g. totalizers). **Options:** FALLBACK VALUE Output is 0 Hz. FAILSAFE LEVEL Output is the frequency specified in the FAILSAFE VALUE function. HOLD VALUE Measuring value output is based on the last measuring value saved before the error occurred. ACTUAL VALUE Measuring value output is based on the current flow measurement. The fault is ignored. **Factory setting:** FALLBACK VALUE
FAILSAFE VALUE	✎ Note! This function is not available unless FREQUENCY was selected in the OPERATION MODE function and FAILSAFE LEVEL was selected in the function FAILSAFE MODE. Use this function to define the frequency that the measuring device should output in the event of a fault. **User input:** max. 4-digit number: 0...1250 Hz **Factory setting:** 1250 Hz

Function description PULSE/FREQUENCY OUTPUT	
ACTUAL FREQUENCY	✎ Note! This function is not available unless the FREQUENCY setting was selected in the function OPERATION MODE. Use this function to view the computed value of the output frequency. **User interface:** 0...1250 Hz
SIMULATION FREQUENCY	✎ Note! This function is not available unless the FREQUENCY setting was selected in the OPERATION MODE function (see Page 24). Use this function to activate simulation of the frequency output. **Custody transfer mode:** Simulation is not possible in custody transfer mode. The function is permanently set to "OFF". **Options:** OFF ON **Factory setting:** OFF ✎ Note! ▪ The "SIMULATION FREQUENCY OUTPUT" notice message indicates that simulation is active. ▪ The measuring device continues to measure while simulation is in progress, i.e. the current measuring values are output correctly via the other outputs. ▪ The setting (OFF – ON) is not saved if the power supply fails.
VALUE SIMULATION FREQUENCY	✎ Note! This function is not available unless FREQUENCY was selected in the OPERATION MODE function and the function VALUE SIMULATION FREQUENCY is active (= ON). Use this function to define a selectable frequency value (e.g. 500 Hz) to be output at the frequency output. This value is used to test downstream devices and the measuring device itself. **User input:** 0...1250 Hz **Factory setting:** 0 Hz ☞ Caution! The setting is not saved if the power supply fails.

Function description PULSE/FREQUENCY OUTPUT	
ASSIGN PULSE	✎ Note! ■ This function is not available unless the PULSE setting was selected in the OPERATION MODE function. ■ This function is only disabled in custody transfer mode if "YES" was selected in the "PULSE CT APPROVAL" function (see Page 13). Use this function to assign a measured variable to the pulse output. **Options:** OFF VOLUME FLOW ✎ Note! If you select OFF, the only functions shown in this function group are the functions ASSIGN PULSE and OPERATION MODE. **Factory setting:** VOLUME FLOW
PULSE VALUE	✎ Note! ■ This function is not available unless the PULSE setting was selected in the OPERATION MODE function. ■ This function is only disabled in custody transfer mode if "YES" was selected in the "PULSE CT APPROVAL" function (see Page 13). Use this function to define the flow at which a pulse is triggered. These pulses can be totalled by an external totalizer and in this way the total flow since measuring commenced can be registered. **User input:** 5-digit floating-point number, [unit] **Factory setting:** Depends on nominal diameter and country (see Page 61 ff., "Pulse value") ✎ Note! The appropriate unit is taken from the group SYSTEM UNITS (see Page 8).

Function description PULSE/FREQUENCY OUTPUT	
PULSE WIDTH	✎ Note! This function is not available unless the PULSE setting was selected in the OPERATION MODE function. Use this function to enter the maximum pulse width of the output pulses. **User input:** 0.5...2000 ms **Factory setting:** 100 ms Pulse output is **always** with the pulse width (B) entered in this function. The intervals (P) between the individual pulses are automatically configured. However, they must at least correspond to the pulse width (B = P). A0001233 B = Pulse width entered (the illustration applies to positive pulses) P = Intervals between the individual pulses ✎ Note! When entering the pulse width, select a value that can still be processed by an external totalizer (e.g. mechanical totalizer, PLC, etc.). ☞ Caution! If the pulse number or frequency resulting from the pulse value entered (see PULSE VALUE function, Page 30), and from the current flow is too large to maintain the pulse width selected (interval P is smaller than the pulse width B entered), a system error message (pulse range) is generated after buffering/balancing time.

Function description PULSE/FREQUENCY OUTPUT

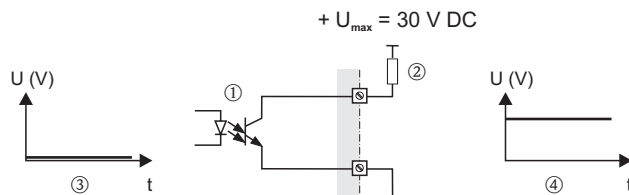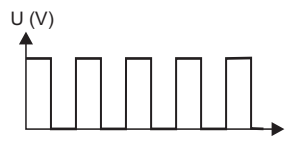| OUTPUT SIGNAL	✎ Note! Function is not available unless the FREQUENCY setting was selected in the OPERATION MODE function. Use this function to configure the output in such a way that it matches an external counter, for example. Depending on the application, you can select the direction of the pulses here. **Options:** PASSIVE – POSITIVE PASSIVE – NEGATIVE **Factory setting:** PASSIVE – POSITIVE **Explanation** PASSIVE = power is supplied to the pulse output by means of an external power supply. Configuring the output signal level (POSITIVE or NEGATIVE) determines the quiescent behaviour (at zero flow) of the pulse output. The internal transistor is activated as follows: ▪ If POSITIVE is selected, the internal transistor is activated with a **positive** signal level. ▪ If NEGATIVE is selected, the internal transistor is activated with a **negative** signal level (0 V). ✎ Note! With the passive output configuration, the output signal levels of the pulse output depend on the external circuit (see examples). **Example for passive output circuit (PASSIVE)** If PASSIVE is selected, the pulse output is configured as an open collector. A0001225 ① = Open collector ② = External power supply ✎ Note! For continuous currents up to 25 mA (I_{max} = 250 mA / 20 ms). **Example for output configuration PASSIVE-POSITIVE:** Output configuration with an external pull-up resistance. In the quiescent state (at zero flow), the output signal level at the terminals is 0 V. F06-xxxxxxxx-04-xx-xx-xx-000 ① = Open collector ② = Pull-up resistance ③ = Transistor activation in "POSITIVE" quiescent state (at zero flow) ④ = Output signal level in quiescent state (at zero flow) In the operating status (flow present), the output signal level changes from 0 V to a positive voltage level. A0001967 (continued on next page)

Function description PULSE/FREQUENCY OUTPUT
Example for output configuration PASSIVE-POSITIVE: Output configuration with an external pull-down resistance. In the quiescent state (at zero flow), a positive voltage level is measured via the pull-down resistance. $+ U_{max} = 30$ V DC F06-xxxxxxxx-04-xx-xx-xx-001 ① = *Open collector* ② = *Pull-down resistance* ③ = *Transistor activation in "POSITIVE" quiescent state (at zero flow)* ④ = *Output signal level in quiescent state (at zero flow)* In the operating status (flow present), the output signal level changes from a positive voltage level to 0 V. A0001972 **Example for output configuration PASSIVE-NEGATIVE:** Output configuration with an external pull-up resistance. In the quiescent state (at zero flow), the output signal level at the terminals is at a positive voltage level. $+ U_{max} = 30$ V DC F06-xxxxxxxx-04-xx-xx-xx-002 ① = *Open collector* ② = *Pull-up resistance* ③ = *Transistor activation in "NEGATIVE" quiescent state (at zero flow)* ④ = *Output signal level in quiescent state (at zero flow)* In the operating status (flow present), the output signal level changes from a positive voltage level to 0 V. A0001972

Function description PULSE/FREQUENCY OUTPUT	
FAILSAFE MODE	✎ Note! ■ This function is not available unless the PULSE setting was selected in the function OPERATION MODE. ■ This function is only disabled in custody transfer mode if "YES" was selected in the "PULSE CT APPROVAL" function (see Page 13). For safety reasons it is advisable to ensure that the pulse output assumes a predefined state in the event of a fault. Use this function to define this state. The setting you select here affects only the pulse output. It has no effect on other outputs and the display (e.g. totalizers). **Custody transfer mode:** When using a pulse output suitable for custody transfer (see Page 13), the error response is permanently set to "FALLBACK VALUE". **Options:** FALLBACK VALUE Output is 0 pulse. ACTUAL VALUE Measuring value output is based on the current flow measurement. The fault is ignored. **Factory setting:** FALLBACK VALUE
SIMULATION PULSE	✎ Note! This function is not available unless the PULSE option was selected in the OPERATION MODE function. Use this function to activate simulation of the pulse output. **Options:** OFF COUNTDOWN The pulses specified in the VALUE SIMULATION PULSE function are output. CONTINUOUSLY Pulses are continuously output with the pulse width specified in the PULSE WIDTH function. Simulation is started once the CONTINUOUSLY option is confirmed with the ᴇ key. ✎ Note! Simulation is started by confirming the CONTINUOUSLY option with the ᴇ key. The simulation can be switched off again via the SIMULATION PULSE function. **Factory setting:** OFF ✎ Note! ■ The notice message #631 "SIM. PULSE" indicates that simulation is active. ■ The on/off ratio is 1:1 for both types of simulation. ■ The measuring device continues to measure while simulation is in progress, i.e. the current measured values are output correctly via the other outputs. ☞ Caution! The setting is not saved if the power supply fails.

Function description PULSE/FREQUENCY OUTPUT
VALUE SIMULATION PULSE ✎ Note! This function is not available unless the COUNTDOWN option was selected in the SIMULATION PULSE function. Use this function to specify the number of pulses (e.g. 50) which are output during the simulation. This value is used to test downstream devices and the measuring device itself. The pulses are output with the pulse width specified in the PULSE WIDTH function. The on/off ratio is 1:1. Simulation is started once the specified value is confirmed with the ⧉ key. The display remains at "0" if the specified pulses have been output. **User input:** 0...10000 **Factory setting:** 0 ✎ Note! Simulation is started by confirming the simulation value with the ⧉ key. The simulation can be switched off again via the SIMULATION PULSE function. ☝ Caution! The setting is not saved if the power supply fails.

11   Group STATUS OUTPUT

Function description STATUS OUTPUT	
This group is not available unless the measuring device is equipped with a status output.	
ASSIGN STATUS OUTPUT	Use this function to assign a switching function to the status output. **Options:** OFF ON (operation) FAULT MESSAGE NOTICE MESSAGE FAULT & NOTICE EPD or OED (Empty Pipe Detection/Open Electrode Detection; only if active) FLOW DIRECTION LIMIT VOLUME FLOW **Factory setting:** FAULT MESSAGE Caution! In custody transfer mode, Promag 51 always classifies and treats "Notice messages" as "Fault messages". If the status output, in contrast to the factory setting (= FAULT MESSAGE), is set to "NOTICE MESSAGE", the status output no longer switches in the event of notice/fault messages. Note! • The behaviour of the status output is a normally closed behaviour, in other words the output is closed (transistor conductive) when normal, error-free measuring is in progress. • It is very important to read and comply with the information on the switching characteristics of the status output (see Page 39 ff.). • If you select OFF, the only function shown in this function group is the function ASSIGN STATUS OUTPUT.
ON-VALUE	Note! This function is not available unless LIMIT VOL. FLOW or FLOW DIRECTION was selected in the function ASSIGN STATUS OUTPUT. Use this function to assign a value to the switch-on point (status output pulls up). The value can be equal to, greater than or less than the switch-off point. Positive and negative values are permissible. **User input:** 5-digit floating-point number, [unit] **Factory setting:** 0 [unit] Note! • The appropriate unit is taken from the group SYSTEM UNITS (see Page 8). • Only the switch-on point is available for flow direction output (no switch-off point). If you enter a value not equal to the zero flow, e.g. 5, the difference between the zero flow and the value entered corresponds to half the switchover hysteresis.

Function description STATUS OUTPUT	
This group is not available unless the measuring device is equipped with a status output.	
OFF-VALUE	✎ Note! This function is not available unless LIMIT VALUE was selected in the function ASSIGN STATUS OUTPUT. Use this function to assign a value to the switch-off point (status output drops out). The value can be equal to, greater than or less than the switch-on point. Positive and negative values are permissible. **User input:** 5-digit floating-point number, [unit] **Factory setting:** 0 [unit] ✎ Note! ▪ The appropriate unit is taken from the group SYSTEM UNITS (see Page 8). ▪ If SYMMETRY is selected in the function MEASURING MODE (see Page 51) and values with different signs are entered for the switch-on and switch-off points, the notice message "INPUT RANGE EXCEEDED" appears.
TIME CONSTANT	Use this function to enter a time constant defining how the measuring signal reacts to severely fluctuating measured variables, either very quickly (enter a low time constant) or with damping (enter a high time constant). The purpose of damping, therefore, is to prevent the status output changing state continuously in response to fluctuations in flow. **User input:** fixed-point number 0.00...100.00 s **Factory setting:** 0.00 s
ACTUAL STATUS OUTPUT	Use this function to check the current status of the status output. **User interface:** NOT CONDUCTIVE CONDUCTIVE
SIMULATION SWITCH POINT	Use this function to activate simulation of the status output. ✎ Note! ▪ The "SIMULATION STATUS OUTPUT" message indicates that simulation is active. ▪ The measuring device continues to measure while simulation is in progress, i.e. the current measuring values are output correctly via the other outputs. **Options:** OFF ON **Factory setting:** OFF ☝ Caution! The setting (OFF – ON) is not saved if the power supply fails.

Function description STATUS OUTPUT
This group is not available unless the measuring device is equipped with a status output.

| VALUE SIMULATION SWITCH POINT | ✎   Note!
This function is not available unless the function SIMULATION SWITCH POINT is active (= ON).

Use this function to define the switching response of the status output during the simulation. This value is used to test downstream devices and the measuring device itself.

Custody transfer mode:
Simulation is not possible in custody transfer mode.

Options:
NOT CONDUCTIVE
CONDUCTIVE

Factory setting:
NOT CONDUCTIVE

🖑   Caution!
The setting (NOT CONDUCTIVE – CONDUCTIVE) is not saved if the power supply fails. |

11.1 Response of the status output

General

If you have configured the status output for "LIMIT VALUE" or "FLOW DIRECTION", you can configure the requisite switch points in the functions ON-VALUE and OFF-VALUE. When the measured variable in question reaches these predefined values, the status output switches as shown in the illustrations below.

Status output configured for "Limit flow value"

The status output switches as soon as the measured variable undershoots or overshoots a defined switch point.
Application: Monitoring flow or process-related boundary conditions.
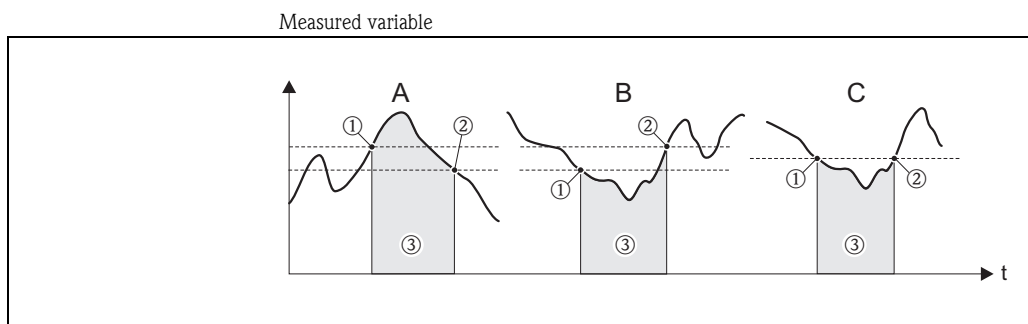
A = Maximum safety → ① SWITCH-OFF POINT > ② SWITCH-ON POINT
B = Maximum safety → ① SWITCH-OFF POINT < ② SWITCH-ON POINT
C = Maximum safety → ① SWITCH-OFF POINT = ② SWITCH-ON POINT (this configuration is to avoid)
③ = Status output switched off (not conductive)

Status output configured for "Flow direction"

The value entered in the function SWITCH-ON POINT defines the switch point for the positive and negative directions of flow. If, for example, the switch point entered is = 1 m^3/h, the status output switches off at −1 m^3/h (not conductive) and switches on again at +1 m^3/h (conductive). Set the switch point to 0 if your process calls for direct switchover (no switching hysteresis). If low flow cut off is used, it is advisable to set hysteresis to a value greater than or equal to the low flow cut off rate.
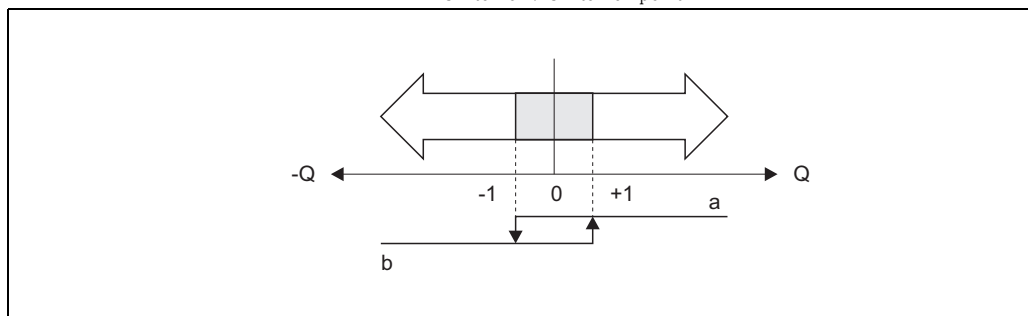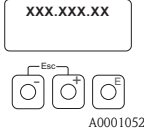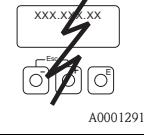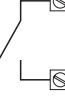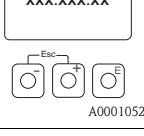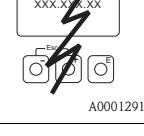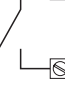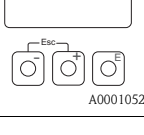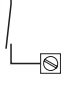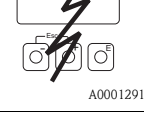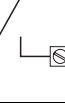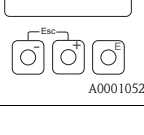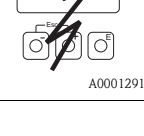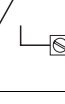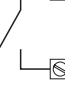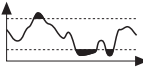
a = Status output conductive
b = Status output not conductive

11.2   Switching response of the status output

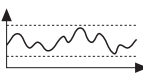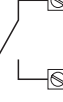| Function	Status		Open collector response (transistor)	
ON (operation)	System in measuring mode	XXX.XXX.XX Esc A0001052	conduc- tive	A0001237
	System not in measuring mode (power supply failed)	XXX.XXX.XX Esc A0001291	not conduc- tive	A0001238
Fault message	System OK	XXX.XXX.XX Esc A0001052	conduc- tive	A0001237
	(System or process error) Fault → Error response of out-puts/inputs and totalizer	XXX.XXX.XX Esc A0001291	not conduc- tive	A0001238
Notice message	System OK	XXX.XXX.XX Esc A0001052	conduc- tive	A0001237
	(System or process error) Fault → Continuation of meas-uring	XXX.XXX.XX Esc A0001291	not conduc- tive	A0001238
Fault message or notice message	System OK	XXX.XXX.XX Esc A0001052	conduc- tive	A0001237
	(System or process error) Fault → Response to error or Note → Continuation of meas-uring	XXX.XXX.XX Esc A0001291	not conduc- tive	A0001238
Empty Pipe Detec-tion (EPD) / **Open Electrode Detection (OED)**	Measuring tube full	A0001292	conduc- tive	A0001237
	Measuring tube partially filled / empty measuring tube	A0001293	not conduc- tive	A0001238

Function	Status		Open collector response (transistor)	
Flow direction	Forward	A0001241	conductive	A0001237
	Reverse	A0001242	not conductive	A0001238
Limit value Volume flow	Limit value not overshot or undershot	A0001243	conductive	A0001237
	Limit value overshot or undershot	A0001244	not conductive	A0001238

12 Group STATUS INPUT
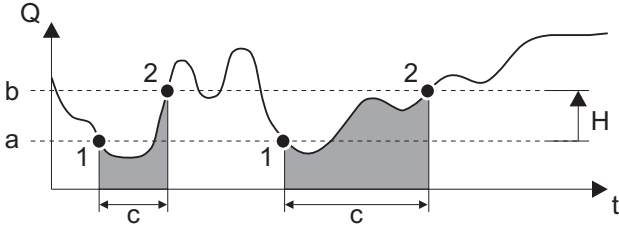
Function description STATUS INPUT	
ASSIGN STATUS INPUT	Use this function to assign a switching function to the status input.
	Custody transfer mode: In custody transfer mode, the status input is permanently set to "RESET FAULTMESSG (+ display test)".
	Options: OFF RESET TOTALIZER 1 POSITIVE ZERO RETURN RESET FAULTMESSG. (+ display test) RESET TOTALIZER 2 RESET ALL TOTALIZERS
	Factory setting: OFF
	✎ Note! Positive zero return is active as long as the active level is available at the status input (continuous signal). All other assignments react to a change in level (pulse) at the status input.
ACTIVE LEVEL	Use this function to define whether the assigned switch function (see function ASSIGN STATUS INPUT) is released or sustained when the level is present (HIGH) or not present (LOW).
	Options: HIGH LOW
	Factory setting: HIGH
MINIMUM PULSE WIDTH	Use this function to define a minimum pulse width which the input pulse must achieve in order to trigger the selected switching function.
	User input: 20...100 ms
	Factory setting: 50 ms

Function description STATUS INPUT	
SIMULATION STATUS INPUT	Use this function to activate simulation of the status input, i.e. to trigger the function assigned to the status input (see ASSIGN STATUS INPUT function, Page 36).
	✎ Note! ■ The "SIMULATION STATUS INPUT" notice message indicates that simulation is active. ■ The measuring device continues to measure while simulation is in progress, i.e. the current measuring values are output correctly via the outputs.
	Custody transfer mode: Simulation is not possible in custody transfer mode. The function is permanently set to "OFF".
	Options: OFF ON
	Factory setting: OFF
	✎ Note! The setting (OFF – ON) is not saved if the power supply fails.
VALUE SIMULATION STATUS INPUT	✎ Note! This function is not available unless the function SIMULATION STATUS INPUT is active, i.e. is switched on (ON).
	Use this function to select the level to be simulated at the status input.
	Custody transfer mode: Simulation is not possible in custody transfer mode.
	Options: HIGH LOW
	Factory setting: LOW
	☞ Caution! The setting (HIGH – LOW) is not saved if the power supply fails.

13 Group COMMUNICATION

Function description COMMUNICATION	
TAG NAME	Use this function to enter a tag name for the measuring device. You can edit and read this tag name at the local display or via the HART protocol. **User input:** max. 8-character text, permitted characters are: A–Z, 0–9, +, –, punctuation marks **Factory setting:** "_ _ _ _ _ _ _ _" (no text)
TAG DESCRIPTION	Use this function to enter a tag description for the measuring device. You can edit and read this tag description at the local display or via the HART protocol. **User input:** max. 16-character text, permitted characters are: A–Z, 0–9, +, –, punctuation marks **Factory setting:** "_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _" (No text)
BUS ADDRESS	Use this function to define the address for the exchange of data with the HART protocol. **User input:** 0...15 **Factory setting:** 0 ✎ Note! Addresses 1...15: a constant 4 mA current is applied.
HART PROTOCOL	Use this function to display if the HART protocol is active. **User interface:** OFF = HART protocol not active ON = HART protocol active ✎ Note! The HART protocol is activated by selecting 4–20 mA HART or 4–20 mA (25 mA) HART in the function CURRENT SPAN (see Page 21).
MANUFACTURER NO.	Use this function to view the manufacturer number in decimal numerical format. **User interface:** – Endress+Hauser – 17 ($\cong$ 11 hex) for Endress+Hauser
DEVICE Re	Use this function to view the device ID in hexadecimal numerical format. **User interface:** 43 hex ($\cong$ 67 dez) for Device functions Proline Promag 51
DEVICE REVISION	Use this function to view the device-specific revision at the HART-Command-interface. **User interface:** E.g.: 5

14   Group PROCESS PARAMETER

Function description PROCESS PARAMETER	
ASSIGN LOW FLOW CUT OFF	Use this function to assign the switch point for low flow cut off. **Custody transfer mode:** In custody transfer mode, the creepage is permanently set to "VOLUME FLOW". **Options:** OFF VOLUME FLOW **Factory setting:** VOLUME FLOW
ON-VALUE LOW FLOW CUT OFF	Use this function to enter the switch-on point for low flow cut off. Low flow cut off is active if the value entered is not equal to 0. The sign of the flow value is highlighted on the display to indicate that low flow cut off is active. **Custody transfer mode:** In custody transfer mode, the switch-on point is permanently set to a value at $v = 0.02$ m/s. On Page 61 ff. you can also find the equivalent values for non custody transfer mode at $v = 0.04$ m/s. **User input:** 5-digit floating-point number, [unit] **Factory setting:** Depends on nominal diameter and country (see Page 61 ff., "Low flow cut off") ✎ Note! The appropriate unit is taken from the group SYSTEM UNITS (see Page 8).
OFF-VALUE LOW FLOW CUT OFF	Use this function to enter the switch-off point for low flow cut off. Enter the switch-off point as a positive hysteresis value from the switch-on point. **Custody transfer mode:** In custody transfer mode, the switch-on point is permanently set to 100% (equivalent to $v = 0.04$ m/s). **User input:** Integer 0...100% **Factory setting:** 50% Example: A0001245 Q = Flow [volume/time], t = Time H = Hysteresis a = ON-VALUE LOW FLOW CUT OFF = 200 dm^3/h b = OFF-VALUE LOW FLOW CUT OFF = a + H (H = 10%) c = Low flow cut off active 1 = Low flow cut off is switched on at 200 dm^3/h 2 = Low flow cut off is switched off at 220 dm^3/h H= Hysteresis

Function description PROCESS PARAMETER	
EMPTY PIPE DETECTION	Flow cannot be measured correctly unless the measuring tube is full. This status can be monitored at all times with the Empty Pipe Detection function. Use this function to activate Empty Pipe Detection (EPD) or Open Electrode Detection (OED). ■ EPD = Empty Pipe Detection (with the help of an EPD electrode) ■ OED = Open Electrode Detection (empty pipe detection with the help of the measuring electrodes, if the sensor is not equipped with an EPD electrode or the orientation is not suitable for using EPD). **Options:** OFF – ON SPECIAL – OED – ON STANDARD OFF (neither EPD nor OED are active) ON SPECIAL: Switching on the Empty Pipe Detection (EPD) for devices in remote version (transmitter and sensor are installed separately). OED: Switching on the Open Electrode Detection (OED). ON STANDARD: Switching on the Empty Pipe Detection (EPD) for: – Devices in compact version (transmitter and sensor form a single mechanical unit). – Applications where a facing and coating of the fluid on the measuring tube line and measuring electrode accrues. **Factory setting:** OFF ✎ Note! ■ The options ON STANDARD and ON SPECIAL are not available unless the sensor is equipped with an EPD electrode. ■ The default setting for the EPD/OED functions when the device is delivered is OFF. The functions must be activated as required. ■ The devices are calibrated at the factory with water (approx. 500 μS/cm). If the conductivity of certain fluids deviates from this reference, empty pipe/full pipe adjustment must be performed again on site (see function EPD/OED ADJUSTMENT on page 48). ■ The adjustment coefficients must be valid before you can switch on the EPD or OED. If these coefficients are not available, the function EPD/OED ADJUSTMENT is displayed (see Page 47). ■ If there are problems with the adjustment, the following error messages appear on the screen: – ADJUSTMENT FULL = EMPTY: The adjustment values for empty pipe and full pipe are identical. In such instances, empty pipe adjustment/full pipe adjustment **must** be carried out **again**. – ADJUSTMENT NOT OK: Adjustment is not possible as the fluid conductivity values are outside the permitted range. ■ A plausibility check of the adjustment values will only be executed by activating the empty pipe detection. If an empty or full pipe adjustment is performed during the empty pipe detection is active, the empty pipe detection has to be de- and again activated, after finishing the adjustment, to start the plausibility check. (continued on next page)

Function description PROCESS PARAMETER

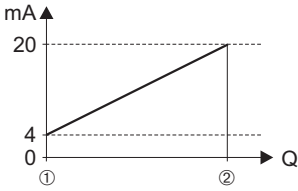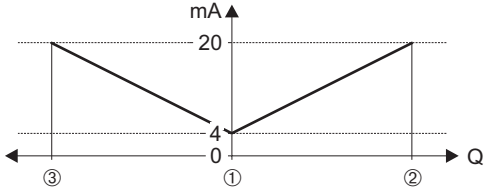| EMPTY PIPE DETECTION (continued) | **Notes on Open Electrode Detection (OED)**
Open Electrode Detection (OED) functions like Empty Pipe Detection (EPD). In contrast to EPD where the measuring device must be equipped with a separate (optional) electrode, OED detects partial filling by means of the two measuring electrodes which are present as standard (fluid no longer covers the measuring electrodes).
OED is especially used if:
■ The sensor does not have the optimum orientation for using EPD (optimum = mounted horizontally).
■ The sensor is not equipped with an additional (optional) EPD electrode.

✎   Note!
■ Cable connection length:
When mounting a remote version, please observe the maximum permissible cable length of 15 metres in order to keep the OED function.
■ OED empty pipe adjustment:
To achieve the best results for the open electrode detection, it is important to have the electrodes surface as dry as possible (no liquid film) while the empty-pipe adjustment is being made.
Even during normal operation, the OED function is only secured if there is no longer any liquid film present on the electrodes when the measuring pipe is empty.

Response to partially filled pipe
■ If the EPD/OED function is switched on and responds to a partially filled or empty pipe, the error message "EMPTY PIPE" appears on the local display. In custody transfer mode, this error message is also output via the status output.
■ An empty or partially filled pipe is a process error. A default factory setting defines that a "Notice message" is issued and that this process error has no effect on the outputs. Use the function ASSIGN PROCESS ERROR (see Page 57) to define whether a "Notice message" or "Fault message" should be triggered.
In custody transfer mode, all system and process errors are output as "Fault messages" via the status output.

If the pipe is partially empty and the EPD is **not** switched on, the response can vary in identically configured systems:
■ Flow reading fluctuates
■ Zero flow
■ Excessively high flow values |

Function description PROCESS PARAMETER	

EPD/OED ADJUSTMENT	Use this function to activate the EPD/OED adjustment for an empty or full measuring tube.
	
	✎ Note!
	A detailed description and other helpful hints for the empty-pipe/full-pipe adjustment procedure can be found on Page 47.
	
	Options:
	OFF
	FULL PIPE ADJUST
	EMPTY PIPE ADJUST
	OED FULL ADJUST
	OED EMPTY ADJUST
	
	Factory setting:
	OFF
	
	Procedure for EPD or OED empty-pipe / full-pipe adjustment
	1. Empty the piping. In case of an EPD adjustment, the wall of the measuring tube should be wetted with fluid for the adjustment procedure but this is not the case with an OED adjustment!
	2. Start empty-pipe adjustment: Select "EMPTY PIPE ADJUST" or "OED EMPTY ADJUST" and press ⒠ to confirm.
	3. After empty-pipe adjustment, fill the piping with fluid.
	4. Start full-pipe adjustment: Select "FULL PIPE ADJUST" or "OED FULL ADJUST" and press ⒠ to confirm.
	5. Having completed the adjustment, select the setting "OFF" and exit the function by pressing ⒠.
	6. Now select the "EMPTY PIPE DETECTION" function. Switch on Empty Pipe Detection by selecting the following settings:
	  – EPD → Select ON STANDARD or ON SPECIAL and press ⒠ to confirm.
	  – OED → Select OED and confirm with ⒠.
	
	☞ Caution!
	The adjustment coefficients must be valid before you can activate the EPD/OED function. If adjustment is incorrect the following messages might appear on the display:
	– FULL = EMPTY
	  The adjustment values for empty pipe and full pipe are identical. In cases of this nature you **must** repeat empty-pipe or full-pipe adjustment **again**!
	– ADJUSTMENT NOT OK
	  Adjustment is not possible because the fluid's conductivity is out of range.

Function description PROCESS PARAMETER

| EPD/OED RESPONSE TIME | ✎ Note!
The function is not available unless ON STANDARD, ON SPECIAL or OED was selected in the function EMPTY PIPE DETECTION.

Use this function to enter the time span for which the criteria for an "empty" pipe have to be satisfied without interruption before a notice message or fault message is generated. The setting defined here is used by the active empty pipe detection (EPD) or open electrode detection (OED).

User input:
fixed-point number 1.0...100 s

Factory setting:
1.0 s

✎ Note!
OED detection time:
The recognition of open electrodes is, in contrast to the empty pipe detection (EPD), very slow reacting (delay at least 25 seconds) and is only activated after an aditional delay from the programmed response time!
We recommend in most applications to use the empty pipe detection (EPD) which is an optimal solution for detecting partly filled measuring tubes. |

15　Group SYSTEM PARAMETERS

Function description SYSTEM PARAMETERS
INSTALLATION DIRECTION SENSOR   Use this function to reverse the sign of the flow quantity, if necessary.   **Options:**   NORMAL (FORWARD), flow as indicated by the arrow   INVERSE (REVERSE), flow opposite to direction indicated by the arrow   **Factory setting:**   NORMAL   ✎ Note!   Ascertain the actual direction of fluid flow with reference to the direction indicated by the arrow on the sensor (nameplate).

Function description SYSTEM PARAMETERS

MEASURING MODE (icon)	Use this function to select the measuring mode for all outputs. ✎ Note! This function is only disabled in custody transfer mode if "YES" was selected in the "PULSE CT APPROVAL" function (see Page 13). **Custody transfer mode:** In custody transfer mode, the measuring mode is permanently set to "SYMMETRY". **Options:** STANDARD – SYMMETRY **Factory setting:** STANDARD The responses of the individual outputs in each of the measuring modes are described in detail on the following pages: **Current output and frequency output** STANDARD Only the flow components for the selected flow direction are totalled (positive or negative full scale value ② = flow direction). Flow components in the opposite direction are not taken into account (suppression). Example for current output: A0001248 SYMMETRY The output signals of the current and frequency outputs are independent of the direction of flow (absolute amount of the measured variable). The "VALUE 20 mA" or "VALUE f HIGH" ③ (e.g. backflow) corresponds to the mirrored VALUE 20 mA or VALUE f HIGH ② (e.g. flow). Positive and negative flow components are taken into account. Example for current output: A0001249 ✎ Note! The direction of flow can be output via the configurable status output. (continued on next page)

Function description SYSTEM PARAMETERS

| MEASURING MODE (continued) | **Pulse output**

STANDARD
Only positive flow components are totalled. Negative components are not taken into account.

SYMMETRY
Positive and negative flow components are taken into account.

✎ Note!
The direction of flow can be output via the configurable status output.

Status output

✎ Note!
The information is only applicable if LIMIT VALUE was selected in the function ASSIGN STATUS OUTPUT.

STANDARD
The status output signal switches at the defined switch points.

SYMMETRY
The status output signal switches at the defined switch points, irrespective of the sign. In other words, if you define a switch point with a positive sign, the status output signal switches as soon as the value is reached in the negative direction (negative sign), (see illustration).

Example for the SYMMETRY measuring mode:
Switch-on point: Q = 4
Switch-off point: Q = 10

① = Status output switched on (conductive)
② = Status output switched off (not conductive) |
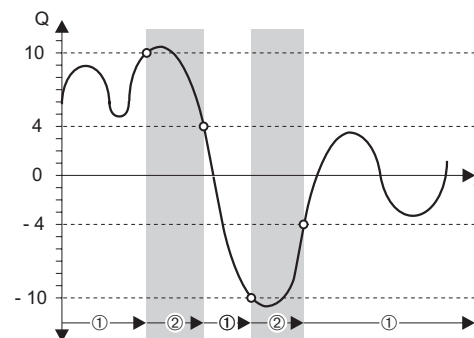
A0001247

| Function description SYSTEM PARAMETERS	
POSITIVE ZERO RETURN	Use this function to interrupt evaluation of measured variables. This is necessary when a piping system is being cleaned, for example. This setting acts on all function and outputs of the measuring device. **Custody transfer mode:** In custody transfer mode, positive zero return is not possible. The function is permanently set to "OFF". **Options:** OFF ON → Signal output is set to the "ZERO FLOW" value. **Factory setting:** OFF
SYSTEM DAMPING	Use this function to set the filter depth of the digital filter. This reduces the sensitivity of the measuring signal to interference peaks (e.g. high solids content, gas bubbles in the fluid, etc.). The system reaction time decreases with an increasing filter setting. **User input:** 0...15 **Factory setting:** 9 ✎ Note! The system damping acts on all functions and outputs of the measuring device.
INTEGRATION TIME	Use this function to set the integration time. Under normal circumstances it is not necessary to change the factory settings. **User input:** 3.3...65 ms **Factory setting:** 20 ms at 50 Hz → mains frequency (e.g. Europe) 16.7 ms at 60 Hz → mains frequency (e.g. USA) 👆 Caution! The integration time must not be selected with a greater value than the measuring period (see Page 55). ✎ Note! The integration time defines the duration of internal totaling of the induced voltage in the fluid (measured by the measuring electrode), i.e. the time in which the measuring device records the true flow (afterwards the magnetic field for the next integration is created from the opposite pole).

16   Group SENSOR DATA

Function description SENSOR DATA
All sensor data (calibration factors, zero point and nominal diameter etc.) are set at the factory and saved on the S–DAT sensor memory chip. ☝ Caution! Under normal circumstances you should not change the following parameter settings, because changes affect numerous functions of the entire measuring facility in general and the accuracy of the measuring system in particular. For this reason, the functions described below cannot be changed even when you enter your personal code. Contact the Endress+Hauser service organization if you have any questions about these functions.

K-FACTOR POSITIVE	Use this function to display the current calibration factor (positive flow direction) for the sensor. The calibration factor is determined and set at the factory. **User interface:** 5-digit fixed-point number: 0.5000...2.0000 **Factory setting:** Depends on nominal diameter and calibration ✎ Note! This value is also provided on the sensor nameplate.
K-FACTOR NEGATIVE	Use this function to display the current calibration factor (negative flow direction) for the sensor. The calibration factor is determined and set at the factory. **User interface:** 5-digit fixed-point number: 0.5000...2.0000 **Factory setting:** Depends on nominal diameter and calibration ✎ Note! This value is also provided on the sensor nameplate.
ZERO POINT	This function shows the current zero-point correction value for the sensor. Zero-point correction is determined and set at the factory. **User interface:** max. 4-digit number: −1000...+1000 **Factory setting:** Depends on nominal diameter and calibration ✎ Note! This value is also provided on the sensor nameplate.
NOMINAL DIAMETER	This function shows the nominal diameter for the sensor. The nominal diameter depends on the size of the sensor and is set at the factory. **User interface:** 2...2000 mm or 1/12...78" **Factory setting:** Depends on the size of the sensor ✎ Note! This value is also provided on the sensor nameplate.

Function description SENSOR DATA	
MEASURING PERIOD	Use this function to set the time for a full measuring period. The duration of the measuring period is calculated from the rise time of the magnetic field, the brief recovery time, the integration time (which can be set) and the empty pipe detection time. **User input:** 0.0...1000 ms **Factory setting:** Depends on nominal diameter ✎ Note! The system checks the time entered and sets the measuring period which is actually used internally to a plausible value. If you enter 0 ms, the system automatically computes the shortest time.
OVERVOLTAGE TIME	Use this function to specify the time in which overvoltage is applied to the coil circuit in order to build up the magnetic field as fast as possible. The overvoltage time is adjusted automatically while measuring is in progress. The overvoltage time depends on the sensor type and the nominal diameter and is set at the factory. **User interface:** 4–digit floating–point number: 0.0...100.0 ms **Factory setting:** Depends on nominal diameter
EPD ELECTRODE	Use this function to check whether the sensor is equipped with an EPD electrode. **User interface:** YES NO **Factory setting:** YES (electrode fitted as standard)

17 Group SUPERVISION

Function description SUPERVISION	
CURRENT SYSTEM CONDITION	Use this function to check the present system status. **User interface:** "SYSTEM OK" or the fault / notice message with the highest priority.
PREVIOUS SYSTEM CONDITIONS	Use this function to view the fifteen most recent fault and notice messages since measuring last started. **User interface:** The last 15 fault/notice messages appear on the display
ASSIGN SYSTEM ERROR	Use this function to view all system errors. By selecting a certain system error, its error category can be changed in the subsequent function ERROR CATEGORY. **Options:** CANCEL List of system errors ✎ Note! ▪ You can exit this function as follows: select "CANCEL" and confirm with Ⓔ. ▪ A list of possible system errors is provided in the Operating Instructions Promag 51, BA 080D/06/en.
ERROR CATEGORY	✎ Note! This function is only available if a system error has been selected in the function ASSIGN SYSTEM ERROR. Use this function to define whether a **system error** triggers a notice message or a fault message. If you select FAULT MESSAGES, all outputs respond to an error in accordance with their defined error response patterns. **Custody transfer mode:** ▪ In custody transfer mode, all system errors are treated as "Fault messages". ▪ In custody transfer mode, this function is read-only. **Options:** NOTICE MESSAGES (display only) FAULT MESSAGES (outputs and display) ✎ Note! Press the Ⓔ key twice to call up the ASSIGN SYSTEM ERROR function.

Function description SUPERVISION	
ASSIGN PROCESS ERROR	Use this function to view all process errors. By selecting a certain process error, its error category can be changed in the subsequent function ERROR CATEGORY. **Options:** CANCEL List of process errors ✎ **Note!** ■ You can exit this function as follows: select "CANCEL" and confirm with Ⓔ. ■ A list of possible process errors is provided in the Operating Instructions Promag 51, BA 080D/06/en.
ERROR CATEGORY	✎ **Note!** This function is only available if a **process error** has been selected in the function ASSIGN PROCESS ERROR. Use this function to define whether a process error triggers a notice message or a fault message. If you select FAULT MESSAGES, all outputs respond to an error in accordance with their defined error response patterns. **Eichbetrieb:** ■ In custody transfer mode, all process errors are treated as "Fault messages". ■ In custody transfer mode, this function is read-only. **Options:** NOTICE MESSAGES (display only) FAULT MESSAGES (outputs and display) ✎ **Note!** Press the Ⓔ key twice to call up the ASSIGN PROCESS ERROR function.
ALARM DELAY	Use this function to define a time span in which the criteria for an error have to be satisfied without interruption before an error or notice message is generated. Depending on the setting and the type of error, this suppression acts on: ■ Display ■ Status output ■ Current output ■ Frequency output **User input:** 0...100 s (in steps of one second) **Factory setting:** 0 s ☞ **Caution!** If this function is activated error and notice messages are delayed by the time corresponding to the setting before being forwarded to the higher-order controller (process controller, etc.). It is therefore imperative to check in advance in order to make sure whether a delay of this nature could affect the safety requirements of the process. If error and notice messages cannot be suppressed, a value of 0 seconds must be entered here.

Function description SUPERVISION	
SYSTEM RESET	Use this function to perform a reset of the measuring system. **Options:** NO RESTART SYSTEM (restart without interrupting power supply) **Factory setting:** NO
CUSTODY TRANSFER	The current custody transfer status is displayed in this function. **Display:** YES (device in custody transfer mode) NO (device not in custody transfer mode)
OPERATION HOURS	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 $\rightarrow$ display format = 0:00:00 (hr:min:sec) Hours of operation 10...10,000 hours $\rightarrow$ display format = 0000:00 (hr:min) Hours of operation > 10,000 hours $\rightarrow$ display format = 000000 (hr)

18   Group SIMULATION SYSTEM

Function description SIMULATION SYSTEM	
SIMULATION FAILSAFE MODE	Use this function to set all inputs, outputs and the totalizer to their defined failsafe modes, in order to check whether they respond correctly. During this time, the words "SIMULATION FAILSAFE MODE" appear on the display. **Custody transfer mode:** Simulation is not possible in custody transfer mode. The function is permanently set to "OFF". **Options:** ON OFF **Factory setting:** OFF
SIMULATION MEASURED VARIABLE	Use this function to set all inputs, outputs and the totalizer to their defined flow-response modes, in order to check whether they respond correctly. During this time, the words "SIMULATION MEASURAND" appear on the display. **Custody transfer mode:** Simulation is not possible in custody transfer mode. The function is permanently set to "OFF". **Options:** OFF VOLUME FLOW **Factory setting:** OFF ☞ Caution! ■ The measuring device cannot be used for measuring while this simulation is in progress. ■ The setting is not saved if the power supply fails.
VALUE SIMULATION MEASURED VARIABLE	✎ Note! This function is not available unless the SIMULATION MEASURED VARIABLE function is active (= VOLUME FLOW). Use this function to specify a selectable value (e.g. 12 m^3/s). This value is used to test downstream devices and the measuring device itself. **Custody transfer mode:** Simulation is not possible in custody transfer mode. **User input:** 5-digit floating-point number, [unit] **Factory setting:** 0 [unit] ☞ Caution! The setting is not saved if the power supply fails. ✎ Note! The appropriate unit is taken from the group SYSTEM UNITS (see Page 8)

19   Group SENSOR VERSION

Function description SENSOR VERSION	
SERIAL NUMBER	Use this function to view the serial number of the sensor.
SENSOR TYPE	Use this function to view the sensor type.
SOFTWARE REVISION NUMBER S-DAT	Use this function to view the software revision number of the software used to create the content of the S-DAT.

20   Group AMPLIFIER VERSION

Function description AMPLIFIER VERSION	
DEVICE SOFTWARE	Use this function to view the current software version.
SOFTWARE REVISION NUMBER AMPLIFIER	Use this function to view the software revision number of the amplifier.
LANGUAGE GROUP	Use this function to view the language group. The following language groups can be ordered: WEST EU / USA, EAST EU / SCAND., ASIA. **Display:** available language group ✎ Note! • The language options of the available language group are displayed in the LANGUAGE function. • You can change the language group via the configuration software ToF Tool – Fieldtool Package. Please do not hesitate to contact your Endress+Hauser sales office if you have any questions.
I/O MODULE TYPE	Use this function to view the configuration of the I/O module complete with terminal numbers.
SOFTWARE REVISION NUMBER I/O MODULE	Use this function to view the software revision number of the I/O module.

21   Factory settings

21.1   SI units (not for USA and Canada)

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

Nominal diameter		Low flow cut off		Full scale value		Pulse value		Totalizer
[mm]	[inch]	(v ~ 0.04 m/s)		(v ~ 2.5 m/s)		(approx. 2 pulses/s at v = 2.5 m/s)		
15	$^1/_2$"	0.5	dm³/min	25	dm³/min	0.20	dm³	dm³
25	1"	1	dm³/min	75	dm³/min	0.50	dm³	dm³
32	$1\,^1/_4$"	2	dm³/min	125	dm³/min	1.00	dm³	dm³
40	$1\,^1/_2$"	3	dm³/min	200	dm³/min	1.50	dm³	dm³
50	2"	5	dm³/min	300	dm³/min	2.50	dm³	dm³
65	$2\,^1/_2$"	8	dm³/min	500	dm³/min	5.00	dm³	dm³
80	3"	12	dm³/min	750	dm³/min	5.00	dm³	dm³
100	4"	20	dm³/min	1200	dm³/min	10.00	dm³	dm³
125	5"	30	dm³/min	1850	dm³/min	15.00	dm³	dm³
150	6"	2.5	m³/h	150	m³/h	0.025	m³	m³
200	8"	5.0	m³/h	300	m³/h	0.05	m³	m³
250	10"	7.5	m³/h	500	m³/h	0.05	m³	m³
300	12"	10	m³/h	750	m³/h	0.10	m³	m³
350	14"	15	m³/h	1000	m³/h	0.10	m³	m³
400	16"	20	m³/h	1200	m³/h	0.15	m³	m³
450	18"	25	m³/h	1500	m³/h	0.25	m³	m³
500	20"	30	m³/h	2000	m³/h	0.25	m³	m³
600	24"	40	m³/h	2500	m³/h	0.30	m³	m³
700	28"	50	m³/h	3500	m³/h	0.50	m³	m³
–	30"	60	m³/h	4000	m³/h	0.50	m³	m³
800	32"	75	m³/h	4500	m³/h	0.75	m³	m³
900	36"	100	m³/h	6000	m³/h	0.75	m³	m³
1000	40"	125	m³/h	7000	m³/h	1.00	m³	m³
–	42"	125	m³/h	8000	m³/h	1.00	m³	m³
1200	48"	150	m³/h	10000	m³/h	1.50	m³	m³
–	54"	200	m³/h	13000	m³/h	1.50	m³	m³
1400	–	225	m³/h	14000	m³/h	2.00	m³	m³
–	60"	250	m³/h	16000	m³/h	2.00	m³	m³
1600	–	300	m³/h	18000	m³/h	2.50	m³	m³
–	66"	325	m³/h	20500	m³/h	2.50	m³	m³
1800	72"	350	m³/h	23000	m³/h	3.00	m³	m³
–	78"	450	m³/h	28500	m³/h	3.50	m³	m³
2000	–	450	m³/h	28500	m³/h	3.50	m³	m³

✎ Note!
The above values are only valid for devices that are not in custody transfer mode.

Language

Country	Language
Australia	English
Austria	Deutsch
Belgium	English
Czech Republic	Czech
Denmark	English
England	English
Finland	Suomi
France	Francais
Germany	Deutsch
Hong Kong	English
Hungary	English
India	English
Indonesia	Bahasa Indonesia
Instruments International	English
Italy	Italiano
Japan	Japanese
Malaysia	English
Netherlands	Nederlands
Norway	Norsk
Poland	Polish
Portugal	Portuguese
Russia	Russian
Singapore	English
South Africa	English
Spain	Espanol
Sweden	Svenska
Switzerland	Deutsch
Thailand	English

21.2   US units (only for USA and Canada)

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

Nominal diameter		Low flow cut off		Full scale value		Pulse value		Totalizer
[inch]	[mm]	(v ~ 0.04 m/s)		(v ~ 2.5 m/s)		(approx. 2 pulses/s at v = 2.5 m/s)		
$^1/_2$"	15	0.10	gal/min	6	gal/min	0.05	gal	gal
1"	25	0.25	gal/min	18	gal/min	0.20	gal	gal
1 $^1/_4$"	32	0.50	gal/min	30	gal/min	0.20	gal	gal
1 $^1/_2$"	40	0.75	gal/min	50	gal/min	0.50	gal	gal
2"	50	1.25	gal/min	75	gal/min	0.50	gal	gal
2 $^1/_2$"	65	2.0	gal/min	130	gal/min	1	gal	gal
3"	80	2.5	gal/min	200	gal/min	2	gal	gal
4"	100	4.0	gal/min	300	gal/min	2	gal	gal
5"	125	7.0	gal/min	450	gal/min	5	gal	gal
6"	150	12	gal/min	600	gal/min	5	gal	gal
8"	200	15	gal/min	1200	gal/min	10	gal	gal
10"	250	30	gal/min	1500	gal/min	15	gal	gal
12"	300	45	gal/min	2400	gal/min	25	gal	gal
14"	350	60	gal/min	3600	gal/min	30	gal	gal
16"	400	60	gal/min	4800	gal/min	50	gal	gal
18"	450	90	gal/min	6000	gal/min	50	gal	gal
20"	500	120	gal/min	7500	gal/min	75	gal	gal
24"	600	180	gal/min	10500	gal/min	100	gal	gal
28"	700	210	gal/min	13500	gal/min	125	gal	gal
30"	–	270	gal/min	16500	gal/min	150	gal	gal
32"	800	300	gal/min	19500	gal/min	200	gal	gal
36"	900	360	gal/min	24000	gal/min	225	gal	gal
40"	1000	480	gal/min	30000	gal/min	250	gal	gal
42"	–	600	gal/min	33000	gal/min	250	gal	gal
48"	1200	600	gal/min	42000	gal/min	400	gal	gal
54"	–	1.3	Mgal/d	75	Mgal/d	0.0005	Mgal	Mgal
–	1400	1.3	Mgal/d	85	Mgal/d	0.0005	Mgal	Mgal
60"	–	1.3	Mgal/d	95	Mgal/d	0.0005	Mgal	Mgal
–	1600	1.7	Mgal/d	110	Mgal/d	0.0008	Mgal	Mgal
66"	–	2.2	Mgal/d	120	Mgal/d	0.0008	Mgal	Mgal
72"	1800	2.6	Mgal/d	140	Mgal/d	0.0008	Mgal	Mgal
78"	–	3.0	Mgal/d	175	Mgal/d	0.001	Mgal	Mgal
–	2000	3.0	Mgal/d	175	Mgal/d	0.001	Mgal	Mgal

✎ *Note!*
The above values are only valid for devices that are not in custody transfer mode.

Language

Country	Language
Canada	English
USA	English

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