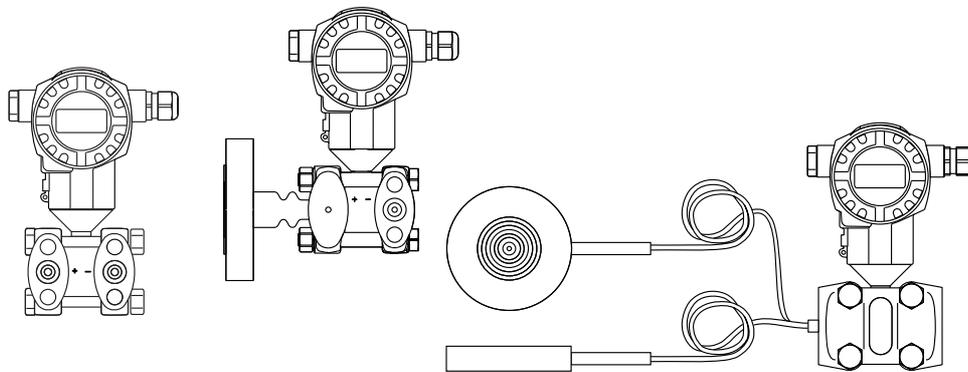


# Special Documentation

## **Deltabar S**

### **PMD75, FMD77, FMD78**

#### Functional Safety Manual



Pressure, differential pressure, level and flow measurement with 4 to 20 mA output signal

## Table of contents

<b>SIL declaration of conformity</b> .....	3	<b>Form for device configuration – Pressure</b> .....	33
Safety-related parameters .....	4	<b>Form for device configuration – Level</b> .....	35
Useful lifetime of electric components .....	5	<b>Form for device configuration – Flow</b> .....	37
<b>Certificate</b> .....	6		
<b>About this document</b> .....	7		
Document purpose .....	7		
Symbols used .....	7		
Supplementary device documentation .....	8		
<b>Permitted devices types</b> .....	9		
SIL label on the nameplate .....	10		
<b>Safety function</b> .....	11		
Definition of the safety function .....	11		
Safety-related signal .....	11		
Restrictions for use in safety-related applications .....	11		
<b>Use in protective systems</b> .....	13		
Device behavior during operation .....	13		
Confirmation and locking methods .....	15		
Increased security during parameter entry via onsite display, Field Communicator or FieldCare/DeviceCare .....	16		
Standard parameter entry via onsite display, Field Communicator or FieldCare/DeviceCare .....	20		
Conditions for safe measuring mode .....	21		
Checks .....	22		
Locking/unlocking .....	23		
Proof-test .....	23		
<b>Life cycle</b> .....	25		
Requirements for personnel .....	25		
Installation .....	25		
Commissioning .....	25		
Operation .....	25		
Maintenance .....	25		
Repair .....	25		
Modification .....	26		
Decommissioning .....	26		
<b>Appendix</b> .....	27		
Measuring system design .....	27		
Notes on the redundant connection of multiple sensors for SIL 3 .....	27		
Additional information .....	27		
Change history .....	28		
<b>Parameter description</b> .....	29		
Parameter description of the SAFETY CONFIRM. group – "Pressure" operating mode .....	29		

## SIL declaration of conformity

The binding document forms part of the scope of delivery when the Deltabar S is ordered with the "SIL 2/SIL 3 IEC 61508 Declaration of Conformity" option.



### SIL Declaration of Conformity

Functional Safety according to IEC 61508 / 61511  
Supplement 1 / NE130 Form B.1 and IGR 49-02-15 Datasheet 1

Endress+Hauser SE+Co. KG, Hauptstraße 1, 79689 Maulburg

being the manufacturer, declares that the product stated below

Deltabar S PMD75 - \*[A,B,C,D,E,F]\*\*\*\*\*EE  
Deltabar S FMD77 - \*[A,B,C,D,E,F]\*\*\*\*\*EE  
Deltabar S FMD78 - \*[A,B,C,D,E,F]\*\*\*\*\*EE

is suitable for the use in safety-instrumented systems according to IEC61508, if the safety instructions and following parameters are observed.

This declaration of compliance is exclusively valid for the customer listed in the cover letter of the respective Endress+Hauser sales center and for the listed products and accessories in delivery status.

Maulburg, 23-January-2018  
Endress+Hauser GmbH+Co. KG

i. V. Manfred Hammer  
Dep. Manager R&D Quality Management  
Research & Development

i. V. Marc Schlachter  
Dept. Manager Pressure  
Research & Development

**Safety-related parameters**

In various applications, the operation of pressure or differential pressure transmitters at overpressure (outside the measuring range, < MWP) or low pressure is not critical.

The state of the processes must be assessed and the various parameters must be taken into consideration.

- Low pressure or overpressure not dangerous → message E727 pressure overrange = Warning
- Low pressure or overpressure dangerous → message E727 pressure overrange = Alarm

Depending on the configuration profile selected for the messages (Table → 14) different parameters must be considered when assessing the facility:

- Message E727 pressure overrange = Alarm → parameter profile A applies
- Message E727 pressure overrange = Warning → parameter profile B applies

Parameter profiles A and B depend on the alarm settings and not on the firmware version.

For firmware versions up to and including firmware version 02.20.04, message E727 was set, as a rule, to "Alarm" for SIL locking with increased security during parameter entry.

With firmware version 02.30.zz and higher, the settings for message E727 remain unchanged, Table → 14.

**Parameter profile A with message E727 (pressure overrange) configured as an alarm**

Parameters according to IEC 61508	Value		
Safety functions	MIN, MAX, Range		
SIL (hardware)	<ul style="list-style-type: none"> <li>■ 2 (single-channel),</li> <li>■ 3 (with use of a SIL 3 capable coincidence logic)</li> </ul>		
SIL (software)	3		
Device type	B		
Operating mode	Low demand mode		
Safety functions	MIN	MAX	Range
$\lambda_{sd}$	52 FIT	396 FIT	448 FIT
$\lambda_{su}$	440 FIT	440 FIT	440 FIT
$\lambda_{dd}$	396 FIT	52 FIT	0 FIT
$\lambda_{du}$	69 FIT	69 FIT	69 FIT
$\lambda_{tot}$ <sup>1)</sup>	1194 FIT		
MTBF <sub>tot</sub> <sup>1)</sup>	96 years		
SFF	92.8 %		
PFD <sub>avg</sub> for T <sub>1</sub> = 1 year (single-channel) <sup>2)</sup>	$3.02 \times 10^{-04}$		
Diagnostic test interval <sup>3)</sup>	5 min (RAM, ROM, ...), 1 s (Measurement)		
Fault reaction time <sup>4)</sup>	5 min (RAM, ROM, ...), 10 s (Measurement)		
Settling time <sup>5)</sup>	→ Technical Information TI00382P/00/EN, "Dead time, time constant (T <sub>63</sub> )" section		

- 1) According to Siemens SN29500. This value takes into account all failure types.
- 2) If the average temperature during continuous operation is in the region of +50 °C (+122 °F), a factor of 1.3 should be taken into account.
- 3) During this time, all diagnostic functions are executed at least once.
- 4) Time between fault detection and fault reaction.
- 5) Step response time as per DIN EN 61298-2.

**Parameter profile B with message E727 (pressure overrange) configured as a warning**

Parameters according to IEC 61508	Value		
Safety functions	MIN, MAX, Range		
SIL (hardware)	<ul style="list-style-type: none"> <li>■ 2 (single-channel),</li> <li>■ 3 (with use of a SIL 3 capable coincidence logic)</li> </ul>		
SIL (software)	3		
Device type	B		
Operating mode	Low demand mode		
Safety functions	MIN	MAX	Range
$\lambda_{sd}$	50 FIT	347 FIT	397 FIT
$\lambda_{su}$	427 FIT	427 FIT	427 FIT
$\lambda_{dd}$	347 FIT	50 FIT	0 FIT
$\lambda_{du}$	76 FIT	76 FIT	76 FIT
$\lambda_{tot}^{1)}$	1136 FIT		
MTBF <sub>tot</sub> <sup>1)</sup>	101 years		
SFF	91%		
FPD <sub>avg</sub> for T <sub>1</sub> = 1 year (single-channel) <sup>2)</sup>	$3,32 \times 10^{-04}$		
Diagnostic test interval <sup>3)</sup>	5 min (RAM, ROM, ...), 1 s (Measurement)		
Fault reaction time <sup>4)</sup>	5 min (RAM, ROM, ...), 10 s (Measurement)		
Settling time <sup>5)</sup>	→ Technical Information TI00382P/00/EN, "Dead time, time constant (T <sub>63</sub> )" section		

- 1) According to Siemens SN29500. This value takes into account all failure types.
- 2) If the average temperature during continuous operation is in the region of +50 °C (+122 °F), a factor of 1.3 should be taken into account.
- 3) During this time, all diagnostic functions are executed at least once.
- 4) Time between fault detection and fault reaction.
- 5) Step response time as per DIN EN 61298-2.

**Useful lifetime of electric components**

The established failure rates of electrical components apply within the useful lifetime as per IEC 61508-2: 2010 section 7.4.9.5 note 3. According to DIN EN 61508-2:2011 section 7.4.9.5 national footnote N3 appropriate measures taken by the manufacturer and operator can extend the useful lifetime.

# Certificate

ZERTIFIKAT ◆ CERTIFICATE ◆ CERTIFICADO ◆ CERTIFICAT ◆ 認証証書 ◆



Product Service

## CERTIFICATE

No. Z10 16 09 20351 005

**Holder of Certificate:** Endress+Hauser GmbH+Co. KG  
 Hauptstr. 1  
 79689 Maulburg  
 GERMANY

**Factory(ies):** 20351

**Certification Mark:** 

**Product:** Pressure Meters

**Model(s):** Pressure Transmitter  
S-Class Evolution

**Parameters:**

Software:	SIL3
Structure-SIL:	1oo1 – SIL2
Output:	4 ... 20mA
Error current:	<=3,6mA or >=21,0mA
Protection class:	IP66/67

The report and the user documentation in the current valid revision are mandatory part of this certificate. The product complies with the following safety requirements only if the specifications documentent in the currently valid Revision of this report are met. The certified components are listed in report EM64891C-A in the current valid revision.

**Tested according to:**

- IEC 61508-1(ed.2)
- IEC 61508-2(ed.2)
- IEC 61508-3(ed.2)
- IEC 61508-4(ed.2)

The product was tested on a voluntary basis and complies with the essential requirements. The certification mark shown above can be affixed on the product. It is not permitted to alter the certification mark in any way. In addition the certification holder must not transfer the certificate to third parties. See also notes overleaf.

**Test report no.:** EM64891C

**Valid until:** 2021-09-11

Date, 2016-09-12



( Peter Weiss )



Page 1 of 1

A1 / 04\_11

TÜV SÜD Product Service GmbH · Zertifizierstelle · Ridlerstraße 65 · 80339 München · Germany



TUEV\_EN

## About this document

### Document purpose

The document is part of the Operating Instructions and serves as a reference for application-specific parameters and notes.



- General information about functional safety: SIL
- General information about SIL is available:

In the Download Area of the Endress+Hauser Internet site: [www.de.endress.com](http://www.de.endress.com) → Search → Functional safety

### Symbols used

#### Safety symbols

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

#### Symbols for certain types of information

Symbol	Meaning
 A0011193	<b>Tip</b> Indicates additional information.
 A0028659	Reference to page.
1, 2, 3, 4, ...	Series of steps

#### Symbols in graphics

Symbol	Meaning
1, 2, 3, 4, ...	Numbering of main items

#### Symbols on the device

Symbol	Meaning
 A0019159	<b>Safety</b> Observe the safety instructions contained in the Operating Instructions associated with the device.

**Supplementary device  
documentation**

Documentation	Contents	Note
Brief Operating Instructions: KA01018P/00	<ul style="list-style-type: none"> <li>▪ Installation</li> <li>▪ Wiring</li> <li>▪ Operation</li> <li>▪ Commissioning</li> </ul>	<ul style="list-style-type: none"> <li>▪ The documentation is provided with the device.</li> <li>▪ The documentation is available on the Internet at → <a href="http://www.de.endress.com">www.de.endress.com</a></li> </ul>
Technical Information: TI00382P/00	Technical data	The documentation is available on the Internet at → <a href="http://www.de.endress.com">www.de.endress.com</a>
Operating Instructions: BA00270P/00	<ul style="list-style-type: none"> <li>▪ Identification</li> <li>▪ Installation</li> <li>▪ Wiring</li> <li>▪ Operation</li> <li>▪ Commissioning, description of the Quick Setup menu</li> <li>▪ Maintenance</li> <li>▪ Trouble-shooting incl. spare parts</li> <li>▪ Appendix: diagram of menus</li> </ul>	The documentation is available on the Internet at → <a href="http://www.de.endress.com">www.de.endress.com</a>
Operating Instructions: BA00274P/00 (Description of Device Functions)	<ul style="list-style-type: none"> <li>▪ Configuration examples for pressure, level and flow measurement</li> <li>▪ Parameter description</li> <li>▪ Trouble-shooting</li> <li>▪ Appendix: diagram of menus</li> </ul>	The documentation is available on the Internet at → <a href="http://www.de.endress.com">www.de.endress.com</a>
Compact Instructions: KA00218P/00	<ul style="list-style-type: none"> <li>▪ Wiring</li> <li>▪ Operation without display</li> <li>▪ Description of the Quick Setup menu</li> <li>▪ HistoROM®/M-DAT operation</li> </ul>	The documentation is provided with the device. → Cover of connection compartment
Safety Instructions, Control Drawings or Certificates	Safety, mounting and operating instructions for devices suitable for use in hazardous areas or as overflow prevention (German Water Resources Act).	Select the desired explosion protection or approval by means of feature 10 "Approval" in the order code. The corresponding documentation is provided with the device.

## Permitted devices types

The details pertaining to functional safety in this manual relate to the device versions listed below and are valid as of the specified software and hardware version. Unless otherwise specified, all subsequent versions can also be used for safety functions. A modification process according to IEC 61508 is applied for device changes.

*Device versions valid for use in safety-related applications: PMD75*

Ordering feature		Option
010	Approval	all
020	Output; Operation	A 4-20 mA HART; extern. + LCD B 4-20 mA HART; inside + LCD C 4-20 mA HART; inside D 4-20 mA HART; Li = 0; extern. + LCD E 4-20 mA HART; Li = 0; inside + LCD F 4-20 mA HART; Li = 0; inside
030	Housing; Cover Sealing; Cable Entry	all
040	Nominal Range; Cell Material; PN	all
050	Calibration; Unit	all
060	Membrane Material	all
070	Process Connection	all
080	Seal	all
100	Additional Option 1	E SIL Declaration of Conformity
or		
110	Additional Option 2	E SIL Declaration of Conformity

*Device versions valid for use in safety-related applications: FMD77 with diaphragm seal*

Ordering feature		Option
010	Approval	all
020	Output; Operation	A 4-20 mA HART; extern. + LCD B 4-20 mA HART; inside + LCD C 4-20 mA HART; inside D 4-20 mA HART; Li = 0; extern. + LCD E 4-20 mA HART; Li = 0; inside + LCD F 4-20 mA HART; Li = 0; inside
030	Housing; Cover Sealing; Cable Entry	all
040	Nominal Range; Cell Material; PN	all
050	Calibration; Unit	all
060	Membrane Material	all
070	Process connection; LP Side; Seal	all
080	Process Connection; High Pressure Side	all (see the following "Warning" → 10)
090	Fill Fluid	all
100	Additional Option 1	E SIL Declaration of Conformity
or		
110	Additional Option 2	E SIL Declaration of Conformity

Device versions valid for use in safety-related applications: FMD78 with diaphragm seal

Ordering feature		Option
010	Approval	all
020	Output; Operation	A 4-20 mA HART, extern. + LCD B 4-20 mA HART; inside + LCD C 4-20 mA HART; inside D 4-20 mA HART; Li = 0; extern. + LCD E 4-20 mA HART; Li = 0; inside + LCD F 4-20 mA HART; Li = 0; inside
030	Housing; Cover Sealing; Cable Entry	all
040	Nominal Range; Cell Material; PN	all
050	Calibration; Unit	all
060	Membrane Material	all
080	Process Connection	all
090	Transmitter Mounting; Fill Fluid	all (see the following "Warning" → 10)
100	Additional Option 1	E SIL Declaration of Conformity

or

110	Additional Option 2	E SIL Declaration of Conformity
-----	---------------------	---------------------------------

Valid firmware version: 02.0x and higher; 02.30.zz recommended

Valid hardware version (electronics): 02.00 and higher

In the event of device modifications, a modification process compliant with IEC 61508 is applied.

Devices with a firmware version 02.0x and higher which are already in use can still be operated if the suitable DTM or DD is used.

An operating program is included in the scope of delivery for devices with the "HistoROM/M-DAT" option (select the following in the product structure: feature 100 "Additional options 1", option N "HistoROM/M-DAT Setup/diagnostic software included" or feature 110 "Additional options 2", option N "HistoROM/M-DAT Setup/diagnostic software included").

#### **▲ WARNING**

**The functional safety assessment of the devices includes the basic unit with the main electronics, sensor electronics and sensor up to the sensor membrane and the process connection mounted directly. Process adapters, diaphragm seals and mounted/enclosed accessories were not taken into account in the rating.**

The operator is responsible for assessing the suitability of the overall system for safety-related operation.

The additional use of diaphragm seal systems, primary devices (orifice plates, probes, etc.) and accessories (e.g. impulse lines) has an impact on the overall accuracy of the measuring transmission and the settling time.

- ▶ The planning instructions in the conventional standards has to be observed (e.g. ISO6167, AGA 3) for flow measurements with primary devices
- ▶ Observe the Technical Information ("Supplementary device documentation", → 8)

SIL label on the nameplate



SIL certified devices bear the following symbol on the nameplate:

## Safety function

### Definition of the safety function

The device's safety functions are:

- Minimum and/or maximum differential pressure monitoring; absolute and gauge pressure (dp-gauge)
- Flow monitoring (via primary device)
- Level monitoring

### Safety-related signal

The safety-related signal of the Deltabar S is the analogue output signal 4 to 20 mA.

All safety functions solely refer to this output. In addition, the Deltabar S communicates via HART and contains all HART features with additional diagnostics information.

The behavior of the output current in the event of an error depends on the settings for the messages (Table →  14).

The safety-related output signal is fed to a downstream logic unit, e.g. a programmable logic controller or a limit signal transmitter where it is monitored for the following:

- Exceeding and/or undershooting of a specific limit value.
- The occurrence of a fault, e.g. error current ( $\leq 3.6$  mA,  $\geq 21.0$  mA, signal cable open circuit or short-circuit).



In the event of an error, it must be ensured that the facility to be monitored remains in a safe state or is set to a safe state.

The following dangerous undetected failures can occur in the devices:

- An incorrect output signal which deviates from the real measured value by more than 1%, with the output signal remaining within the 4 to 20 mA or 3.8 to 20.5 mA range.
- A settling time that is delayed by more than the specified settling time plus tolerance.

For fault monitoring, the logic unit must be able to detect HI alarms ( $\geq 21$  mA) and LO alarms ( $\leq 3.6$  mA).

The transmitter output is not safety-oriented during the following activities:

- Changes to the configuration
- Multidrop
  - with software version  $< 02.20$ , if the parameter "bus address" (345) is set  $\neq 0$ .
  - with software version  $\geq 02.20$ , if the parameter "current mode" (052) is set to "fixed" (onsite display and FieldCare) or "disabled" (HART handheld terminal).
- Simulation
- Proof-test

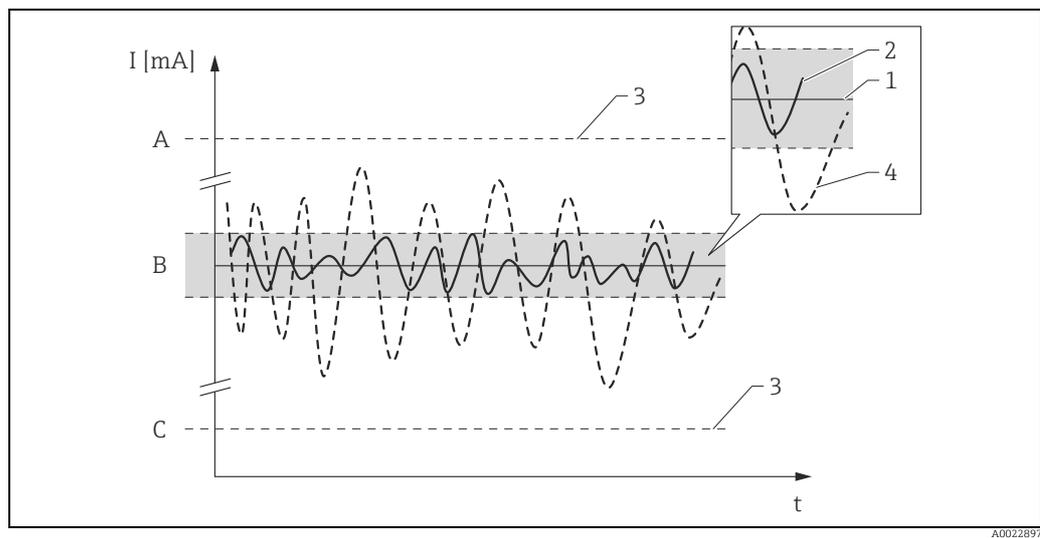
While configuring the transmitter and performing maintenance work on Deltabar S, alternative measures must be taken to ensure the process safety.

### Restrictions for use in safety-related applications

- Device warmup time: after device warmup, the safety functions are available after a 30-second initialization period.
- With regard to the calculation of the SFF, a tolerance range of  $\pm 1$  % was established for the deviation of the output current in the event of a failure of a safety-related component in the pressure transmitter. If the pressure transmitter is operated in safety-related applications, it is recommended to increase the total performance failure, as indicated in the Technical Information (TI), by this value.
- In the case of local operation of the Deltabar S without a display and without an operating tool or without a HART communicator, the device cannot be safely configured because the user cannot perform a visual check. In both these situations, communication via HART alone is not sufficient.
- The Deltabar S must be locked following configuration.
- When using the Deltabar S as a subsystem of a safety function, the "Hold meas. value" setting in the parameter "Output fail mode" (388) and also the Multidrop mode (→  11) may not be selected as this option does not provide failsafe alarming.
- During commissioning, a complete function test of the safety-related functions must be performed.
- The maximum interval for proof testing (Proof Test Interval) is 5 years.
- Faulty devices must be replaced as soon as possible to minimize the possibility of multiple errors occurring.

The failure probabilities indicated in this Safety Manual are based on a medium time to repair (MTTR) of 8 hours.

Safety related error	Explanation	Implications for the safety-related output signal	Implications for measuring uncertainty (position, see Fig. → 12)
No device error	Safe: SD No error	None	1 Is within the specification (see TI, BA, ...)
$\lambda_{SD}$	Safe detected: Safe failure which can be detected	Causes the output signal to signal the failsafe mode → 13	3 No implications
$\lambda_{SU}$	Safe undetected: Safe failure which cannot be detected	Is within the defined error range	2 May be outside specifications
$\lambda_{DD}$	Dangerous detected: Dangerous failure which can be detected (Diagnostic within the device)	Causes the output signal to signal the failsafe mode → 13	3 No implications
$\lambda_{DU}$	Dangerous undetected: Dangerous failure which cannot be detected	May be outside the defined error range	4 May be outside the defined error range



A HI-Alarm  $\geq 21$  mA  
 B Error range  $\pm 1\%$   
 C LO-Alarm  $\leq 3.6$  mA

**Dangerous undetected failures in this scenario**

An incorrect output signal that deviates from the real measured value by more than 1%, but is still in the 4-20 mA range, is considered a dangerous, undetected failure.

---

## Use in protective systems

---

### Device behavior during operation

#### Device behavior during power-up

Once switched on, the device runs through a diagnostic phase for approx. 30 seconds. The current output is set to approx. 12 mA, then 4 mA before going to the actual current. Communication via HART is not possible during the diagnostic phase.

#### Behavior of device in event of alarms

The output current on alarm can be set to a value of  $\leq 3.6$  mA or  $\geq 21.0$  mA.

In some cases (e.g. failure of power supply, a cable open circuit and faults in the current output itself, where the error current  $\geq 21.0$  mA cannot be reached), output currents  $\leq 3.6$  mA occur irrespective of the configured error current.

In some other cases (e.g. cabling short circuit), output currents  $\geq 21.0$  mA occur irrespective of the configured error current.

For alarm monitoring, the downstream logic unit must be able to recognize failure currents of the upper level for signal on alarm ( $\geq 21.0$  mA) and the lower level for signal on alarm ( $\leq 3.6$  mA).



The behavior during operation and in case of failure is described in Operating Instructions BA00270P/00/EN.

#### Alarm and warning messages

Additional information is provided by the alarm and warning messages in the form of error codes<sup>1)</sup> and associated clear text messages.

#### **▲ WARNING**

**In the case of devices with firmware version  $\leq 02.20.04$ , certain messages in the SAFETY CONFIRM. menu (increased security during parameter entry) are automatically set from warning to alarm, see Table → 14.**

Do not use the SAFETY CONFIRM. sequence if the device is operated outside the set current or measuring range in applications.

- ▶ Standard device configuration and software/hardware locking is recommended in such applications.

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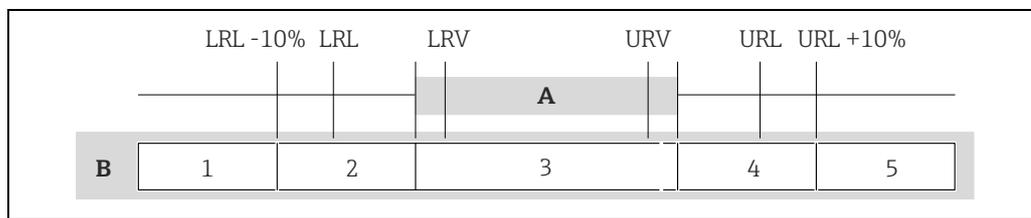
1) The error codes are listed in the Operating Instructions.

Alarm and warning messages

Message number/ parameter	Message/description	Factory setting		Parameterization method with increased security during parameter entry		
		with FW 02.20	with FW ≥ 02.30.zz	Permitted SIL setting	with FW ≤ 02.20 <sup>1)</sup>	with FW ≥ 02.30.zz
115	Sensor over pressure	Warning	Warning	Warning or alarm	Alarm	As per client setting (default: warning)
120	Sensor low pressure	Warning	Warning	Warning or alarm	Alarm	
620	Current output out of range	Warning	Warning	Warning or alarm	Alarm	
715	Sensor over temperature	Warning	Warning	Warning or alarm	Alarm	
720	Sensor under temperature	Warning	Warning	Warning or alarm	Alarm	
717	Transmitter over temp.	Warning	Warning	Warning or alarm	Alarm	
718	Transmitter under temp.	Warning	Warning	Warning or alarm	Alarm	
726	Sens. temp. error overrange	Warning	Alarm	Alarm	Alarm	Alarm
727	Sens. pres. error overrange <sup>2)</sup>	Warning	Warning	Warning or alarm	Alarm	As per client setting (default: warning)
Alarm current	Output Fail Mode	MAX	MAX	MIN or MAX	MAX	As per client setting (default: MAX)

- 1) Settings are automatically changed from warning to alarm via the parametrization method.
- 2) The setting influences the parameters for functional safety (Tables → 4)

Process pressure range



A0022894

- A** Range of current signal for measured value transmission (NE43) 3.8 to 20.5 mA
- B** Range of output current 3.6 to ≥21.0 mA
- LRL Lower range limit
- LRV Lower range value
- URV Upper range value
- URL Upper range limit

Process pressure range	Acting process pressure	Message <sup>1)</sup>
1	Process pressure below sensor measuring range limit	E120 (LRL -10 %)
		E727 (<< LRL -10 %)
2	Process pressure/current below set range limit	E620 < LRV
3	Process pressure within set measuring range	None (3.8 to 20.5 mA)
4	Process pressure/current above set range limit	E620 > URV
5	Process pressure above sensor measuring range limit	E115 (URL +10 %)
		E727 (>> URL +10 %)

- 1) The output current depends on the message setting as alarm or warning.

**Confirmation and locking methods**

The device is configured via the operating menu (see Operating Instructions BA00270P).

When using the devices in process control safety systems, the device configuration must meet two requirements:

- Confirmation concept:  
Proven independent checking of safety-related parameters entered.
  - Via increased security during parameter entry or
  - Manually via a checklist
- Locking concept:  
Device locked after configuration (required in accordance with IEC 61511-1 §11.6.4 and NE 79 §3).
  - SIL locking via increased security during parameter entry and/or
  - Hardware locking via DIP switch on electronics; software locking

Two methods are available for commissioning the devices in process control safety systems:

- Standard device configuration and hardware/software locking
- Increased security during parameter entry



Due to the increased configuration security, the use of the "Increased security during parameter entry" method is recommended.

**Task**

**Select locking method**

SIL locking with increased security during parameter entry (SAFETY CONFIRM. menu)	SW locking with standard configuration / HW locking via DIP switch
---	--

**Configuration (e.g. LRV, URV, damping)**

Via Quick Setup/operating menu	Via Quick Setup/operating menu
--------------------------------	--------------------------------

Firmware ≤ 02.20.04 <sup>1)</sup>	Firmware ≥ 02.30.zz	Firmware ≤ 02.20.04	Firmware ≥ 02.30.zz
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**Configuration Alarm settings/messages**

Message automatically switched to alarm Table → 14	If required (e.g. E727 pressure over-range) <sup>2)</sup>	E726 manually switched to alarm, Table → 14	If required (e.g. E727 pressure over-range) <sup>2)</sup>
---	---	---	---

**Set current output/alarm response**

Automatic changeover (e.g. to MAX alarm/ 22 mA), Table → 14	If required MIN or MAX (default)	MIN or MAX (default)	
---	----------------------------------	----------------------	--

**Confirm plausibility and correctness of parameter settings**

Automatically via SAFETY CONFIRM. menu	Manually via checklist
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**Lock**

Automatically via SAFETY CONFIRM. menu Additionally recommended: HW locking via DIP switch	SW locking with standard configuration and/or HW locking via DIP switch
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**Operation**

FieldCare / DeviceCare	Onsite display	FieldCommunicator	FieldCare / DeviceCare	Onsite display	FieldCommunicator
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**Document**

DTM pdf	Form → 33ff	DTM pdf	Form → 33ff
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- 1) In the case of devices with firmware version ≤ 02.20.04, certain messages in the SAFETY CONFIRM. menu (increased security during parameter entry) are automatically set from warning to alarm.  
Do not use the SAFETY CONFIRM. sequence if the device is operated outside the set current or measuring range in applications, table → 14.
- 2) Configuring E727 as a warning or alarm affects the SIL parameters, Table → 4 ff.

### Increased security during parameter entry via onsite display, Field Communicator or FieldCare/DeviceCare

The following controls are permitted and recommended for devices without an onsite display that are to be used in process control safety systems:

- Via the FieldCare/DeviceCare operating program and DTM for Deltabar S with firmware version  $\geq 02.10$
- Via Field Communicator handheld terminal and Device Description for Deltabar S with Device Revision  $\geq 21$ .

Description of the safety-related parameters, → [39 ff](#) "Parameter description of the SAFETY CONFIRM. group" section.

This configuration method is a software function implemented in the device and comprising automated parameter confirmation and device locking.

#### Increased security during parameter entry via Field Communicator handheld terminal

- a. Select "Main Menu" > "Hart Communication", in "Hart application" > "Online".  
The device will automatically be found and opened online.  
Make sure that the bus address of the device is = 0.
- b. Make sure that the connection has been established to the correct device. This can be checked using the measuring point, extended order code or serial number parameters.

#### Increased security during parameter entry via the FieldCare/DeviceCare operating program

- a. The connection can be established in the following two ways:
  - Select the "HART communication" connection wizard. The device will automatically be found and opened online. Make sure that the bus address of the device is = 0.
  - In the navigation tree, select "Create projects" > "Add device" > "HART communication". Then select "Create network". The device is opened online. Make sure that the bus address of the device is = 0.
- b. Make sure that the connection has been established to the correct device. This can be checked using the measuring point, extended order code or serial number parameters.

For increased security during parameter entry via onsite display, Field Communicator or FieldCare/DeviceCare, perform the following steps:

1. Reset the parameters to their factory setting: reset code "7864"  
(→ Operating Instructions BA00270P/00/EN, "Factory setting (reset)" section).  
Check default values, number formats and parameter designations using the "Form for device configuration" (column "Factory settings", → [33ff](#)).
2. Configure device. → Operating Instructions BA00270P/00/EN and BA00274P/00/EN.  
Observe the "Conditions for safe measuring mode" section, → [21](#).
3. Note the settings of the following parameters according to the form (column "Specified value", → [33ff](#)) since these settings are queried for safe device configuration:

Parameters	Available in the operating mode			Group
	Pressure	Level, "Level Easy Pressure" level selection	Flow <sup>1)</sup>	
ACK. ALARM MODE	X	X	X	MESSAGES
CALIB. OFFSET	X	X	X	POSITION ADJUSTMENT
MEASURING MODE	X	X	X	MEASURING MODE
PRESSURE EMPTY		X		BASIC SETUP
EMPTY CALIB.		X		BASIC SETUP
PRESSURE FULL		X		BASIC SETUP
FULL CALIB.		X		BASIC SETUP
MAX. FLOW			X	BASIC SETUP
MAX. PRESS. FLOW			X	BASIC SETUP
LOW FLOW CUT-OFF			X	EXTENDED SETUP
SET. L. FL. CUT-OFF			X	EXTENDED SETUP
LINEAR/SQROOT			X	EXTENDED SETUP

Parameters	Available in the operating mode			Group
	Pressure	Level, "Level Easy Pressure" level selection	Flow <sup>1)</sup>	
SET LRV	X	X	X	BASIC SETUP
SET URV	X	X	X	BASIC SETUP
DAMPING VALUE	X	X	X	BASIC SETUP
OUTPUT FAIL MODE <sup>2)</sup>	X	X	X	OUTPUT
SET MIN. CURRENT <sup>2)</sup>	X	X	X	OUTPUT
SET MAX. ALARM <sup>2)</sup>	X	X	X	OUTPUT
E727 P.OVERRANGE <sup>2)</sup>	X	X	X	OUTPUT

- 1) Not for options with 160/250 bar measuring range (2320/3625 psi)
- 2) From firmware version ≥ 2.30



The PRESSURE EMPTY and PRESSURE FULL parameters are only displayed for the "Dry" CALIBRATION MODE. If you have performed a wet calibration, you subsequently have to select the "Dry" option by means of the CALIBRATION MODE parameter. You can read out the corresponding values for the PRESSURE EMPTY and PRESSURE FULL parameters here.

4. Switch the device off and on again. This ensures that the parameter settings are saved.
5. Check safety functions ("Checks", → 22).  
Restart FieldCare/DeviceCare or Handheld FieldCommunicator and reconnect device.
6. Select the "SAFETY CONFIRM." group.  
(Menu path: (GROUP SELECTION →) OPERATING MENU → SAFETY CONFIRM.).
7. Select the "Lock" option.  
Select the "Lock" option via the SAFETY LOCK parameter. The status "Locked" or "Unlocked" is indicated on the fourth line on the display.
8. Enter the password via the SAFETY PASSWORD parameter (password: 7452).

For firmware version ≤ 02.20.04

- If the correct password is entered, the following parameters are reset to the factory values:  
CURR. CHARACT., OUTPUT FAIL MODE, ALT. CURR. OUTPUT., SET MAX. ALARM, SET MIN. CURRENT, SIMULATION MODE, ALARM DELAY, ALARM DISPL. TIME and SELECT ALARMTYPE (→ Point 10 for factory values).
- Any simulation running is terminated.
- The configurable messages ("Error"-type messages) 115, 120, 620, 715, 717, 718, 720, 726, 727 are automatically set to "Alarm".  
→ Operating Instructions BA00270P/00/EN, "Messages" section.

For firmware version ≥ 02.30.zz

- Any simulation running is terminated.
- No parameters are reset.

Record the following confirmed settings according to the "Form for device configuration" (column "Read-out actual value", → 33ff).

9. By means of the DIGIT SETS parameter, the user checks whether the characters and digits are displayed correctly on the user interface. "0123456789.-" is displayed if everything is displayed correctly.  
Options:
  - Valid: Select this option if the string of characters and digits is displayed correctly.
  - Not valid: Select this option if the string of characters and digits is not displayed correctly. In this case, operation in the safe measuring mode is not possible. The confirmation sequence is aborted.

10. Only for firmware versions  $\leq 02.20.04$   
 By means of the OUTPUT CURRENT parameter, the user can check whether the following parameters are correctly reset to the factory values. If reset correctly, the OUTPUT CURRENT parameter displays "LinMaxNorm/22/3.8/0s". Factory values:
- CURR. CHARACT.: linear
  - OUTPUT FAIL MODE: max. alarm
  - ALT. CURR. OUTPUT: normal
  - SET MAX. ALARM: 22 mA
  - SET MIN. CURRENT: 3.8 mA
  - ALARM DELAY: 0.0 s
  - ALARM DISPLAY TIME: 0.0 s
- Options:
- Valid: Select this option if the factory values displayed correspond to the desired values. The system continues to interrogate the safety-related parameters.
  - Not valid: Select this option if the factory values displayed do not correspond to the desired values. In this case, operation in the safe measuring mode is not possible. The SAFETY LOCK parameter displays the status "Unlocked". The confirmation sequence is aborted.
11. The following parameters have to be confirmed depending on the operating mode selected:

For firmware version  $\leq 02.20.04$

- ACK. ALARM MODE
- CALIB. OFFSET
- MEASURING MODE
- PRESSURE EMPTY (only Level operating mode)
- EMPTY CALIB. (only Level operating mode)
- PRESSURE FULL (only Level operating mode)
- FULL CALIB. (only Level operating mode)
- MAX. FLOW (only Flow operating mode)
- MAX. PRESS. FLOW (only Flow operating mode)
- LOW FLOW CUT-OFF (only Flow operating mode)
- SET. L. FL. CUT-OFF (only Flow operating mode)
- LINEAR/SQROOT (only Flow operating mode)
- SET LRV
- SET URV
- DAMPING VALUE

For firmware version  $\geq 02.30.zz$

- ACK. ALARM MODE
- CALIB. OFFSET
- MEASURING MODE
- PRESSURE EMPTY (only Level operating mode)
- EMPTY CALIB. (only Level operating mode)
- PRESSURE FULL (only Level operating mode)
- FULL CALIB. (only Level operating mode)
- MAX. FLOW (only Flow operating mode)
- MAX. PRESS. FLOW (only Flow operating mode)
- LOW FLOW CUT-OFF (only Flow operating mode)
- SET. L. FL. CUT-OFF (only Flow operating mode)
- LINEAR/SQROOT (only Flow operating mode)
- SET LRV
- SET URV
- DAMPING VALUE
- OUPUT FAIL MODE
- SET MIN. CURRENT
- SET MAX. ALARM
- E727 P.OVERRANGE

The value saved is indicated on the fourth line of the onsite display.

- Options:
- Valid: Select this option if the value entered or the desired value is displayed. The system continues to interrogate the safety-related parameters.
  - Not valid: Select this option if an incorrect value or a value that was not entered is displayed. In this case, operation in the safe measuring mode is not possible. The SAFETY LOCK parameter displays the status "Unlocked". The confirmation sequence is aborted.
12. Once the safety-related parameters have been successfully interrogated, the password "7452" must be entered again via the CONF. PASSWORD parameter. Afterwards, the device is locked for the safe measuring mode. The SAFETY LOCK parameter displays the status "Locked". This locking has the highest priority and can only be disabled via the SAFETY LOCK and SAFETY PASSWORD parameters. →  23, "Locking/unlocking" section.

*For increased security during parameter entry via the FieldCare/DeviceCare operating program, perform the following steps:*

Perform steps 1 to 12, see →  16 ff

13. Switch the device off and on again. This makes sure that parameter settings for the current output, the alarm behavior and locking have been stored. Read the parameters out again and compare them to the "Form for device configuration" (→  33ff).



The "Offline" and "FDT-Up-Download" operating options are not allowed for functional safety options.



Observe the status when entering or reading parameters. The status is represented by icons or symbols and may indicate possible errors concerning the data input, the updating of parameters or the connection to the device.

For further information, refer to the FieldCare help.

*For increased security during parameter entry via the Field Communicator handheld terminal, perform the following steps:*

Perform steps 1 to 12, see →  16 ff

13. Switch the device off and on again. This makes sure that parameter settings for the current output, the alarm behavior and locking have been stored. Read the parameters out again and compare them to the "Form for device configuration" (→  33ff).



The "Offline" operating option is not allowed for functional safety applications. Make sure that no messages such as "Device disconnected" occur during the configuration.

**Standard parameter entry  
via onsite display,  
Field Communicator or  
FieldCare/DeviceCare**

**Standard device configuration via Field Communicator handheld terminal**

- a. Select "Main Menu" → "HART Communication", in "Hart application" select → "Online". The device will automatically be found and opened online. Make sure that the bus address of the device is = 0.
- b. Make sure that the connection has been established to the correct device. This can be checked using the measuring point, extended order code or serial number parameters.

**Standard device configuration via the FieldCare/DeviceCare operating program**

- a. The connection can be established in the following two ways:
  - Select the "HART communication" connection wizard. The device will automatically be found and opened online. Make sure that the bus address of the device is = 0
  - In the navigation tree, select "Create projects", then select "Add device" → "HART communication".  
Then select "Create network". The device is opened online.  
Make sure that the bus address of the device is = 0.
- b. Make sure that the connection has been established to the correct device. This can be checked using the measuring point, extended order code or serial number parameters.

*In the case of device configuration via the onsite display, Field Communicator or FieldCare/DeviceCare, perform the following steps:*

1. Reset the parameters to their factory setting: with the "7864" reset code.  
(→ Operating Instructions BA00270P/00/EN, "Factory setting (reset)" section).  
Check default values, number formats and parameter designations using the "Form for device configuration" (column "factory settings", → 33ff).

**NOTICE**

**The following operating steps may no longer be performed after this reset:**

- ▶ Position adjustment or setting the measuring range on site without using the onsite display
  - ▶ Download
  - ▶ Configuration backup using HistoROM®/M-DAT
  - ▶ Reset apart from reset code "7864"
  - ▶ Current trimming
  - ▶ Sensor recalibration ("note" → 21)
2. By means of the DIGIT SETS parameter, check whether the characters and digits are displayed correctly on the user interface. "0123456789.-" is displayed if everything is displayed correctly.  
Menu path: (GROUP SELECTION) → OPERATING MENU → DISPLAY
  3. Configure the device and log settings manually.  
For the configuration → Operating Instructions BA00270P/00/EN and BA00274P/00/EN.  
Switch the device off and on again. This ensures that the parameter settings have been saved.
    -  Observe the prescribed parameters in accordance with the "Form for device configuration":
      - For "Pressure", → 33
      - For "Level" ("Level Easy Pressure" level selection) → 35
      - For "Flow", → 37

In addition, the permitted parameter settings → 21 must be taken into consideration.
  4. Check safety functions ("Checks" → 22).  
Restart FieldCare/DeviceCare or Handheld FieldCommunicator and reconnect device.
  5. Read out the specified parameters and compare them to the "Form for device configuration" → 33ff.
  6. Lock the device via software and/or hardware.  
→ Operating Instructions BA00270P/00/EN, "Locking/unlocking operation" section.
  7. Read out and log the CONFIG. COUNTER parameter.  
Menu path: (GROUP SELECTION →) OPERATING MENU → TRANSMITTER INFO → TRANSMITTER DATA



- If the device has assumed a fault condition, i.e. an alarm is output and the current output assumes the set value, the cause of the fault must first be eliminated.
- "Level" operating mode, "Level Easy Pressure" level selection: The PRESSURE EMPTY and PRESSURE FULL parameters are only displayed for the "Dry" CALIBRATION MODE. If you have performed a wet calibration, you subsequently have to select the "Dry" option by means of the CALIBRATION MODE parameter. You can read out the corresponding values for the PRESSURE EMPTY and PRESSURE FULL parameters here.
- The sensor can only be recalibrated by Endress+Hauser Service. All parameters, except the parameters for a sensor recalibration, are reset with the "7864" reset code. Therefore, the parameters have to be checked prior to locking via the SAFETY CONFIRM. menu.

**Conditions for safe measuring mode**

"Increased security during parameter entry" method:

The device checks whether certain operating steps have been performed beforehand or whether impermissible parameters have been configured.

The "Increased security during parameter entry" method is no longer possible after the following operating steps:

- Position adjustment performed or measuring range set on site without using the onsite display.
- Following a download
- After a configuration backup using HistoROM®/M-DAT
- After a reset, apart from after the reset code "7864"
- After performing sensor recalibration (observe note, → 22.)
- Following current trimming
- For the "LEVEL SELECTION" parameter, the "Level Easy Height" or "Level Standard" option was selected (permitted setting for LEVEL SELECTION is "Level Easy Pressure").

The "Increased security during parameter entry" method is only possible again if a reset (code "7864") is performed, thereby resetting all the parameters to the as-delivered state.

The reset (code "7864") must be performed to use the "Standard device configuration" method.

**Permitted parameter setting**

Only certain settings are possible for some parameters. If a setting that is not permitted has been selected for one of these parameters, the "Increased security during parameter entry" method is not possible. This method is possible once more as soon as the permitted setting is selected for the parameter.

Parameter and menu path	Permitted settings
<ul style="list-style-type: none"> <li>▪ BUS ADDRESS (345)</li> <li>▪ CURRENT MODE (052)<sup>1)</sup></li> </ul> <p>Menu path: (GROUP SELECTION →) OPERATING MENU → TRANSMITTER INFO → HART PARAMETER</p>	<ul style="list-style-type: none"> <li>▪ 0</li> <li>▪ Signaling (onsite display and FieldCare) or enabled (HART handheld terminal)</li> </ul>
<p>"Pressure" MEASURING MODE:</p> <ul style="list-style-type: none"> <li>▪ PRESS. ENG. UNIT (060)</li> </ul> <p>Menu path: (GROUP SELECTION →) OPERATING MENU → SETTINGS → BASIC SETUP or configuration with FieldCare via the Quick Setup</p>	All units, apart from "User unit"
<p>"Flow" MEASURING MODE<sup>2)</sup>:</p> <ul style="list-style-type: none"> <li>▪ UNIT FLOW (391)</li> <li>▪ NORM FLOW UNIT (661)</li> <li>▪ STD. FLOW UNIT (660)</li> <li>▪ MASS FLOW UNIT (571)</li> </ul> <p>Menu path: (GROUP SELECTION →) OPERATING MENU → SETTINGS → BASIC SETUP or configuration with FieldCare via the Quick Setup</p>	All units, apart from "User unit"

Parameter and menu path	Permitted settings
"Level" MEASURING MODE, "Level Easy Pressure" LEVEL SELECTION: <ul style="list-style-type: none"> <li>▪ EMPTY PRESSURE,</li> <li>▪ PRESSURE FULL</li> <li>▪ EMPTY CALIB.</li> <li>▪ FULL CALIB.</li> <li>▪ SET LRV</li> <li>▪ SET URV</li> </ul> Menu path: (GROUP SELECTION →) OPERATING MENU → SETTINGS → BASIC SETUP or configuration with FieldCare via the Quick Setup	The parameters must meet the following requirements: <ul style="list-style-type: none"> <li>▪ The pressure values for SET LRV and SET URV must be within the sensor measuring range. → following graphics, point 1.</li> <li>▪ The turndown, which is determined by the difference between the pressure values for SET LRV and SET URV, must not be larger than the maximum turndown (100:1 at factory). → following graphics, point 2.</li> <li>▪ The value for PRESSURE FULL – PRESSURE EMPTY must not fall below the minimum span (1% of sensor measuring range). → following graphics, point 3.</li> </ul>
"Level" MEASURING MODE, "Level Easy Pressure" LEVEL SELECTION: <ul style="list-style-type: none"> <li>▪ ADJUST DENSITY (007)</li> </ul> Menu path: (GROUP SELECTION →) OPERATING MENU → SETTINGS → EXTENDED SETUP	Same value as PROCESS DENSITY (025)
<ul style="list-style-type: none"> <li>▪ CURRENT CHARACT. (694), (695), (696), 764<sup>3)</sup></li> <li>▪ OUTPUT FAIL MODE (388)<sup>3)</sup></li> <li>▪ SET MAX. ALARM (342)</li> <li>▪ SET MIN. CURRENT (343)</li> <li>▪ ALT. CURR.OUTPUT (597)<sup>3)</sup></li> </ul> Menu path: (GROUP SELECTION →) OPERATING MENU → OUTPUT	<ul style="list-style-type: none"> <li>▪ Linear</li> <li>▪ Max. alarm (110 %): can be set between 21 and 23 mA or Min. alarm<sup>4)</sup> (-10 %): 3.6 mA</li> <li>▪ 22 mA<sup>3)</sup> or 21 to 23 mA</li> <li>▪ 3.8 mA<sup>3)</sup> or 4 mA</li> <li>▪ Normal/NE43</li> </ul>
<ul style="list-style-type: none"> <li>▪ ALARM DELAY (336)<sup>3)</sup></li> <li>▪ ALARM DISPL.TIME (480)<sup>3)</sup></li> </ul> Menu path: (GROUP SELECTION →) OPERATING MENU → DIAGNOSIS MESSAGES	<ul style="list-style-type: none"> <li>▪ 0.0 s</li> <li>▪ 0.0 s</li> </ul>
<ul style="list-style-type: none"> <li>▪ SIMULATION (413)</li> </ul> Menu path: (GROUP SELECTION →) OPERATING MENU → SIMULATION	SIMULATION = none <sup>5)</sup>

1) Only from firmware version ≥ 02.20

2) Not for options with measuring range, e.g. 160/250 bar [2320/3625 psi])

3) For firmware versions ≤ 02.20.04, settings are reset to permitted default values once the SIL password is entered (heed "Warning" notice → 13)

4) For firmware versions ≤ 02.20.04, the "Min. alarm" setting is only possible with the "Standard device configuration" method.

5) With the "Increased security during parameter entry" method, any simulation running is terminated automatically once the correct password has been entered.



- If the device has assumed a fault condition, i.e. an alarm is output and the current output assumes the set value, the cause of the fault must first be eliminated.
- When operating via the DTM, locking via the SAFETY LOCK menu is only possible in the online mode.
- The sensor can only be recalibrated by Endress+Hauser Service.  
All parameters, except the parameters for a sensor recalibration, are reset with the "7864" reset code. Therefore, the parameters have to be checked prior to locking via the SAFETY CONFIRM. menu.

## Checks

After entering all the parameters, check the safety function prior to the locking sequence by means of the SIMULATION MODE parameter or by approaching the limit pressure, for example.

(→ Operating Instructions BA00274P/00/EN SIMULATION MODE parameter description.)

The entire safety function should be checked after each change to the Deltabar S as part of a safety function, e.g. a change to the orientation of the device or the configuration.

## Locking/unlocking

### **WARNING**

Changes to the measuring system or parameters can affect the safety function.

- ▶ After entering all the parameters and checking the safety function, the operation of the device must be locked.

### Increased security during parameter entry

#### Locking

With the "Increased security during parameter entry" method, the device is locked by a password at the end of the locking sequence.

- Via local operation or via the Field Communicator 375, 475 handheld terminal → [16ff](#)
- Via the operating tool → [16ff](#)



Locking by password has the highest priority and can only be disabled via the SAFETY LOCK and SAFETY PASSWORD parameters.

#### Unlocking

1. Select the "SAFETY CONFIRM." group.  
(Menu path: (GROUP SELECTION →) OPERATING MENU → SAFETY CONFIRM.).
2. Select the "Unlock" option via the SAFETY LOCK parameter.
3. Enter the password "7452" via the SAFETY PASSWORD parameter. If the password entered is correct, the SAFETY LOCK or SAFETY LOCKSTATE parameter displays the status "Unlocked".

### Standard device configuration

If you are using the "Standard device configuration" method (→ [20](#)), the device has to be locked via the software and/or the hardware.

→ Operating Instructions BA00270P/00/EN, "Locking/unlocking operation" section.



The damping setting via DIP switch 2 (damping on/off) is independent of software locking and/or hardware locking. Therefore the switch setting must be used as per the factory setting: on (damping on). The damping value can be set to 0 s where needed.

#### Unlocking a SIL device

When SIL locking is active on a device, the device is protected against unauthorized operation by means of a locking code and, as an additional option, by means of a hardware write protection switch. The device must be unlocked in order to change the configuration, to perform proof-tests and to reset self-holding diagnostic messages.

## Proof-test

Safety functions must be tested at appropriate intervals to ensure that they are functioning correctly and are safe. The operator must determine the time intervals. The test must be carried out in such a way that it is proven that the protective system functions perfectly in interaction with all the components.

The following section describes two possible procedures for proof testing to uncover dangerous undetected device failures. They differ in terms of the percentage rate of detection.



If the device has assumed a fault condition, i.e. an alarm is output and the current output assumes the set value, the cause of the fault must first be eliminated.

### Proof-test 1:

This test detects approx. 50% of the possible dangerous undetected device failures.

1. Bypass safety PLC or take other suitable measures to prevent alarms from being triggered by mistake.
2. Disable locking ("Locking/unlocking" → [23](#)).

3. Set the current output of the transmitter to HI alarm via a HART command or by means of the onsite display and check whether the analog current signal reaches this value.
  - e.g. simulate an alarm by means of the SIMULATION MODE and SIM. ERROR NO. parameters. This test detects problems based on voltages that are not compliant with the standard, e.g. due to too low a current loop supply voltage or increased cable resistance, and checks possible faults in the transmitter electronics.
4. Set the current output of the transmitter to LO alarm via a HART command or by means of the onsite display and check whether the analog current signal reaches this value.
  - e.g. set the ALARM RESPONSE parameter to "Min. alarm".
  - Simulate an alarm by means of the SIMULATION MODE and SIM. ERROR NO. parameters. This test detects any problems in conjunction with quiescent currents.
5. Restore the complete operativeness of the current loop.
6. Disable safety PLC bypassing or restore normal operation in some other way.
7. Once the proof-test has been carried out, the results must be documented and stored in a suitable manner.

#### Proof-test 2:

This test detects approx. 99% of the possible dangerous undetected device failures.

1. Perform steps 1 to 4 outlined under proof-test 1.
2. Compare the pressure measured value displayed to the pressure present and check the current output.
 

During this test, suitable processes, measuring resources and references must be used.

  - For the lower-range value (4 mA value) and the upper-range value (20 mA value), compare the pressure present to the measured pressure.
  - If the measured pressure deviates from the pressure present at the device, the reference pressure present must be reassigned to the 4 mA value and the 20 mA value.  
 For the 4 mA value, → Operating Instructions BA00274P/00/EN, parameter descriptions for SET LRV (245) and GET LRV (309) for pressure measurement, SET LRV (013) for level measurement (LEVEL SELECTION "Level Easy Pressure") and SET LRV (637) for flow measurement.  
 For the 20 mA value, → Operating Instructions BA00274P/00/EN, parameter descriptions for SET URV (246) and GET URV (310) for pressure measurement, SET URV (012) for level measurement (LEVEL SELECTION "Level Easy Pressure") and SET URV (638) for flow measurement.
  - Compare the pressure measured value displayed to the pressure present and check the current output a second time. If there are any deviations, please contact Endress+Hauser Service.
3. Perform steps 5 to 7 outlined under proof-test 1.



Regarding step 2 of proof-test 2:

After this procedure, the current value is output correctly. The value displayed, e.g. on the onsite display, and the digital value via HART can deviate from the pressure actually present. If the display value and digital value are also to be corrected, please contact Endress+Hauser Service.

## Life cycle

**Requirements for personnel** Personnel involved in installation, commissioning, diagnostics, repair and maintenance must meet the following requirements:

- Trained, qualified specialists: must have a relevant qualification for this specific role and task
- Are authorized by the plant owner/operator
- Are familiar with federal/national regulations
- Before beginning work: must have read and understood the instructions in the manuals and supplementary documentation as well as in the certificates (depending on the application)
- Follow instructions and comply with basic conditions

The operating personnel must meet the following requirements:

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

**Installation** The installation of the device is described in the relevant Operating Instructions → 8.

**Commissioning** The commissioning of the device is described in the relevant Operating Instructions → 8.

**Operation** The operation of the device is described in the relevant Operating Instructions → 8.

**Maintenance** Please refer to the relevant Operating Instructions for information on maintenance and recalibration, → 8.

 Alternative monitoring measures must be taken to ensure process safety during configuration, proof-testing and maintenance work on the device.

**Repair**  Repair means a one-to-one replacement of components.

Repairs on the devices must always be carried out by Endress+Hauser. Safety functions cannot be guaranteed if repairs are carried out by anyone else.

Exceptions:  
Qualified personnel may replace the following components on the condition that original spare parts are used and the relevant Installation Instructions are observed:

Component	Installation Instructions	Checking the device after repair
Adapter	EA01021P/00/A2	Proof-test 1 Proof-test 2 (alternative)
Display module	KA00601P/00/A2	
Push buttons of the housing	KA00610P/00/A2	
Cover	EA01062F/00/A2	
Set of gaskets	EA01062F/00/A2	
Electronics <sup>1)</sup>	KA00678P/00/A2	
Vent valve		
Flange	EA01007P/00/A2	
	EA01011P/00/A2	
Housing	EA01013P/00/A2	
	EA01015P/00/A2	
Housing filter	EA01078P/00/A2	
	EA01062P/00/A2	
HistoROM	KA00599P/00/A2	
Cable	KA00671P/00/A2	
Cable entry	EA00006P/00/A2	

Component	Installation Instructions	Checking the device after repair
Cable gland	EA00006P/00/A2	Proof-test 1 Proof-test 2 (alternative)
Clamp	KA00602F/00/A2	
Measuring range tag		
Mounting kit	EA00005P/00/A2	
	EA01016P/00/A2	
	KA00649P/00/A2	
O-ring	EA00005P/00/A2	
Sensor <sup>1)</sup>	EA01007P/00/A2	
	EA01009P/00/A2	
	EA00005P/00/A2	
Connector	EA00006P/00/A2	

1) Proof-test 2 must be applied.

The replaced component must be sent to Endress+Hauser for the purpose of fault analysis if the device has been operated in a protective system.

In the event of the failure of a SIL-labeled Endress+Hauser device that has been operated in a protective function, the "Declaration of Contamination and Cleaning" with the corresponding note "Used as SIL device in protective system" must be enclosed when the defective device is returned. Please refer to the "Return" section in the Operating Instructions ("→ 8", Supplementary device documentation).

#### Modification

Modifications are changes to devices with SIL capability already delivered or installed.

- Modifications to devices with SIL capability are usually performed in the Endress+Hauser manufacturing center.
- Modifications to devices with SIL capability onsite at the user's plant are possible following approval by the Endress+Hauser manufacturing center. In this case, the modifications must be performed and documented by an Endress+Hauser service technician.
- Modifications to devices with SIL capability by the user are not permitted.

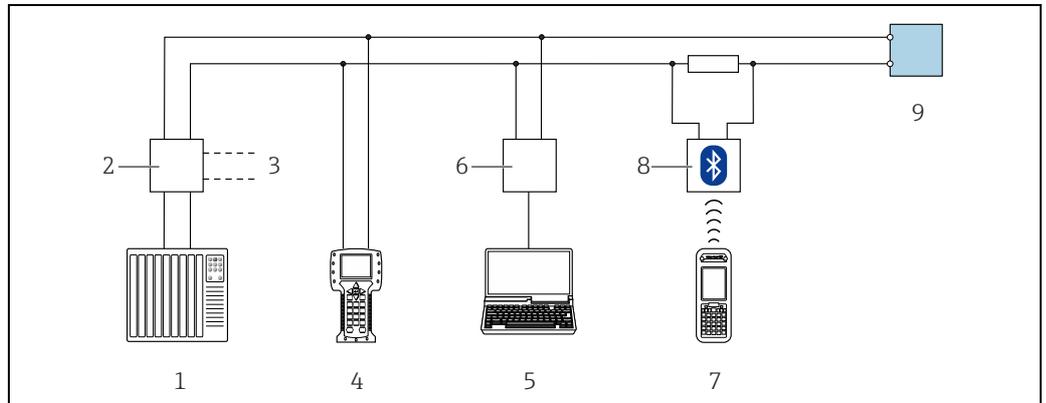
#### Decommissioning

When decommissioning, the requirements according to IEC 61508-1:2010 section 7.17 have to be observed.

## Appendix

### Measuring system design

### System components



- 1 SPS (programmable logic controller)
- 2 Transmitter power supply unit, e.g. RN221N (with communication resistor)
- 3 Connection for Commubox FXA191, FXA195 and Field Communicator
- 4 HART handheld terminal, e.g. Field Communicator
- 5 Computer with operating tool
- 6 Commubox FXA191 (RS232) or FXA195 (USB), FXA291
- 7 Field Xpert
- 8 VIATOR Bluetooth modem with connecting cable
- 9 Transmitter

A00287/46

An analog signal (4-20 mA) in proportion to the pressure is generated in the transmitter. This is sent to a downstream logic unit (e.g. PLC, limit signal transmitter, etc.) where it is monitored to determine whether it is below or above a specified limit value. For fault monitoring, the logic unit must recognize both HI-alarms ( $\geq 21.0$  mA) and LO-alarms ( $\leq 3.6$  mA).

### Notes on the redundant connection of multiple sensors for SIL 3

With redundant connection with HFT = 1 (e.g. 1oo2 or 2oo3 architecture), the Deltabar S meets the requirements for SIL 3.

The common cause factors  $\beta$  and  $\beta_D$  indicated in the table below are minimum values for the Deltabar S. These values should be used when calculating the failure probability of redundantly connected Deltabar S units as per IEC 61508-6.

The system-specific observation can return higher values depending on the actual installation and the use of other components (e.g. Ex barriers).

Minimum value $\beta$ with homogeneous redundant use	5 %
Minimum value $\beta_D$ with homogeneous redundant use	2 %

### Additional information



General information on functional safety (SIL) is available at:

[www.de.endress.com](http://www.de.endress.com) → Search → Functional safety and in the Competence Brochure CP01008Z/11 "Functional Safety in the Process Industry - Risk Reduction with Safety Instrumented Systems".

## Change history

Safety Manual version	Changes	Valid from firm-ware version	Valid from hardware version
SD00189P/00/EN/09.04	First edition	02.00	02.00
SD00189P/00/EN/07.06	New FW 02.10	02.00	02.00
SD00189P/00/EN/04.08	SW version with SIL3 changes regarding 700 bar	02.00	02.00
SD00189P/00/EN/13.13	New FW 02.11	02.00	02.00
SD00189P/00/EN/14.13	New FW 02.20	02.00	02.00
SD00189P/00/EN/15.16	Edition 2	02.00	02.00
SD00189P/00/EN/16.17	New FW 02.30.zz	02.00	02.00

## Parameter description

### Parameter description of the SAFETY CONFIRM. group – "Pressure" operating mode

For additional parameter descriptions, e.g. level and flow, see Operating Instructions BA00274P. The numbers in brackets indicate the ID numbers of the parameters on the onsite display.

MEASURING MODE = Pressure	
Parameter name	Description
SAFETY LOCKSTATE	<p>Displays the device status with regard to the safe measuring mode.</p> <p><b>Possibilities:</b></p> <ul style="list-style-type: none"> <li>■ Unlocked</li> <li>■ Locked</li> </ul> <p><b>Prerequisites:</b></p> <ul style="list-style-type: none"> <li>■ Operating tool or Field Communicator 375, 475 handheld terminal</li> </ul>
SAFETY LOCK (836)	<p>This parameter offers the following functions:</p> <ul style="list-style-type: none"> <li>■ Check and lock the device for the safe measuring mode. →  16ff for operation via onsite display, Field Communicator 375, 475 handheld terminal and operating tool.</li> <li>■ Remove lock for the safe measuring mode. →  23, "Locking/unlocking" section.</li> <li>■ Onsite display: Displays the device status with regard to the safe measuring mode.</li> </ul>
SAFETY PASSWORD (838)	<p>The password must be entered in the following situations:</p> <ul style="list-style-type: none"> <li>■ Prior to querying safety-related parameters: →  16ff for operation via the onsite display, Field Communicator 375, 475 handheld terminal and the operating tool.</li> <li>■ When unlocking the safe measuring mode →  23, "Locking/unlocking" section.</li> </ul>
DIGIT SETS (841)	<p>This parameter is used to check the correct display of characters and digits on the user interface. If the characters and digits are displayed correctly, this parameter displays the string "0123456789.-".</p> <p><b>Options:</b></p> <ul style="list-style-type: none"> <li>■ Valid: Select this option if the string of characters and digits is displayed correctly.</li> <li>■ Not valid: Select this option if the string of characters and digits is not displayed correctly. In this case, operation in the safe measuring mode is not possible.</li> </ul>
OUTPUT CURRENT (875)	<p>Only for firmware versions ≤2.20</p> <p>For displaying and querying the settings for the CURR. CHARACT., OUTPUT FAIL MODE, ALT. CURR. OUTPUT, SET MAX. ALARM, SET MIN. CURRENT, ALARM DELAY, ALARM DISPLAY TIME parameters.</p> <p>Once you have entered the password correctly for the SAFETY PASSWORD parameter, the following parameters - among others - are reset to the factory setting:</p> <ul style="list-style-type: none"> <li>■ CURR. CHARACT. = Linear</li> <li>■ OUTPUT FAIL MODE = Max. alarm</li> <li>■ ALT. CURR. OUTPUT. = Normal</li> <li>■ SET MAX. ALARM = 22 mA</li> <li>■ SET MIN. CURRENT = 3.8 mA</li> <li>■ ALARM DELAY = 0 s</li> <li>■ ALARM DISPLAY TIME = 0 s</li> </ul> <p>The OUTPUT CURRENT parameter displays these factory values as "LinMaxNorm22/3.8/0s".</p> <p><b>Options:</b></p> <ul style="list-style-type: none"> <li>■ Valid: Select this option if the factory values displayed correspond to the desired values.</li> <li>■ Not valid: Select this option if the factory values displayed do not correspond to the desired values. In this case, operation of the device in the safe measuring mode is not possible.</li> </ul>

MEASURING MODE = Pressure	
Parameter name	Description
OUTPUT FAIL MODE (57)	<p>Only if firmware version <math>\geq 2.30</math> For displaying and querying the set output fail mode.</p> <p><b>Possibilities:</b></p> <ul style="list-style-type: none"> <li>▪ Max. alarm (110 %)</li> <li>▪ Min. alarm (-10 %)</li> </ul> <p><b>Options:</b></p> <ul style="list-style-type: none"> <li>▪ Valid: Select this option if the selected and desired value is displayed.</li> <li>▪ Not valid: Select this option if an incorrect value or a value that was not selected is displayed. In this case, operation of the device in the safe measuring mode is not possible.</li> </ul>
SET MIN. CURRENT (56)	<p>Only if firmware version <math>\geq 2.30</math> For displaying and querying the lower current limit.</p> <p><b>Possibilities:</b></p> <ul style="list-style-type: none"> <li>▪ 3.8 mA</li> <li>▪ 4.0 mA</li> </ul> <p><b>Options:</b></p> <ul style="list-style-type: none"> <li>▪ Valid: Select this option if the selected and desired value is displayed.</li> <li>▪ Not valid: Select this option if an incorrect value or a value that was not selected is displayed. In this case, operation of the device in the safe measuring mode is not possible.</li> </ul>
SET MAX. ALARM (54)	<p>Only if firmware version <math>\geq 2.30</math> For displaying and querying the set current value for the maximum alarm current.</p> <p><b>Possibilities:</b></p> <ul style="list-style-type: none"> <li>▪ 21 to 23 mA</li> </ul> <p><b>Options:</b></p> <ul style="list-style-type: none"> <li>▪ Valid: Select this option if the selected and desired value is displayed.</li> <li>▪ Not valid: Select this option if an incorrect value or a value that was not selected is displayed. In this case, operation of the device in the safe measuring mode is not possible.</li> </ul>
E727 P.OVERRANGE (58)	<p>Only if firmware version <math>\geq 2.30</math> For displaying and querying the behavior in the event of this error. This setting affects the SIL characteristic values.</p> <p><b>Possibilities:</b></p> <ul style="list-style-type: none"> <li>▪ Alarm (A) output current adopts a defined value.</li> <li>▪ Warning (W): output current in saturation (3.8 mA or 20.5 mA).</li> </ul> <p><b>Options:</b></p> <ul style="list-style-type: none"> <li>▪ Valid: Select this option if the selected and desired value is displayed.</li> <li>▪ Not valid: Select this option if an incorrect value or a value that was not selected is displayed. In this case, operation of the device in the safe measuring mode is not possible.</li> </ul>

MEASURING MODE = Pressure	
Parameter name	Description
ACK. ALARM MODE (844)	<p>For displaying and querying the option selected for the ACK. ALARM MODE parameter (MESSAGES group).</p> <p><b>Possibilities:</b></p> <ul style="list-style-type: none"> <li>▪ On</li> <li>▪ Off</li> </ul> <p><b>Options:</b></p> <ul style="list-style-type: none"> <li>▪ Valid: Select this option if the selected and desired value is displayed.</li> <li>▪ Not valid: Select this option if an incorrect value or a value that was not selected is displayed. In this case, operation of the device in the safe measuring mode is not possible.</li> </ul> <p><b>NOTICE</b></p> <p><b>If you selected the "On" option for the ACK. ALARM MODE parameter and an alarm occurs, proceed as follows:</b></p> <ul style="list-style-type: none"> <li>▶ Rectify the cause of the alarm.</li> <li>▶ Unlock the device via the SAFETY LOCK and SAFETY PASSWORD parameters.</li> <li>▶ Acknowledge the alarm via the ACK. ALARM parameter.</li> <li>▶ Select the "Lock" option for the SAFETY LOCK parameter.</li> <li>▶ Enter the password for the SAFETY PASSWORD parameter.</li> <li>▶ Confirm the values and option selected for the parameters queried.</li> <li>▶ Lock the device via the password.</li> </ul>
CALIB. OFFSET (847)	<p>For displaying and querying the value entered or calculated for the CALIB. OFFSET parameter (POSITION ADJUSTMENT group).</p> <p><b>Options:</b></p> <ul style="list-style-type: none"> <li>▪ Valid: Select this option if the entered and desired value is displayed.</li> <li>▪ Not valid: Select this option if a value that was not entered or desired is displayed. In this case, operation of the device in the safe measuring mode is not possible.</li> </ul> <p> You can also perform position adjustment by means of the POS. ZERO ADJUST or POS. INPUT VALUE parameters. The CALIB. OFFSET parameter then displays the calculated value.</p>
MEASURING MODE (845)	<p>For displaying and querying the set measuring mode.</p> <p><b>Possibilities:</b></p> <ul style="list-style-type: none"> <li>▪ Pressure</li> <li>▪ Level</li> <li>▪ Flow</li> </ul> <p><b>Options:</b></p> <ul style="list-style-type: none"> <li>▪ Valid (for "Pressure" measuring mode): Select this option if the selected and desired value is displayed.</li> <li>▪ Not valid (for "Level" measuring mode and "Flow" measuring mode): Select this option if an incorrect value or a value that was not selected is displayed. In this case, operation of the device in the safe measuring mode is not possible.</li> </ul>
SET LRV (852)	<p>For displaying and querying the value entered or calculated for the SET LRV (BASIC SETUP or QUICK SETUP group).</p> <p><b>Options:</b></p> <ul style="list-style-type: none"> <li>▪ Valid: Select this option if the entered and desired value is displayed.</li> <li>▪ Not valid: Select this option if a value that was not entered or desired is displayed. In this case, operation of the device in the safe measuring mode is not possible.</li> </ul> <p> You can also configure the lower-range value via the GET LRV parameter and a pressure present at the device. The SET LRV parameter displays the pressure value that was assigned to the lower-range value.</p>

MEASURING MODE = Pressure	
Parameter name	Description
SET URV (853)	<p>For displaying and querying the value entered or calculated for the SET URV parameter (BASIC SETUP or QUICK SETUP group).</p> <p><b>Options:</b></p> <ul style="list-style-type: none"> <li>▪ Valid: Select this option if the entered and desired value is displayed.</li> <li>▪ Not valid: Select this option if a value that was not entered or desired is displayed. In this case, operation of the device in the safe measuring mode is not possible.</li> </ul> <p> You can also configure the upper-range value via the GET URV parameter and a pressure present at the device. The SET URV parameter displays the pressure value that was assigned to the upper-range value.</p>
DAMPING VALUE (855)	<p>For displaying and querying the value entered for the DAMPING VALUE parameter (BASIC SETUP or QUICK SETUP group).</p> <p><b>Options:</b></p> <ul style="list-style-type: none"> <li>▪ Valid: Select this option if the entered and desired value is displayed.</li> <li>▪ Not valid: Select this option if a value that was not entered or desired is displayed. In this case, operation of the device in the safe measuring mode is not possible.</li> </ul> <p> Changing the "Damping" DIP switch on the electronic insert does not have any effect on the damping time when operation for the safe measuring mode is locked via SAFETY LOCK (836), SAFETY PASSWORD (838) and CONF. PASSWORD (856). A change only takes effect once operation has been unlocked.</p>
CONF. PASSWORD (856)	<p>Once the safety-related parameters have been successfully interrogated, the password "7452" must be entered again via the CONF. PASSWORD parameter. Afterwards, the device is locked for the safe measuring mode. The SAFETY LOCKSTATE parameter displays the status "Locked".</p>

## Form for device configuration – Pressure

Operation via:      Handheld terminal       FieldCare/DeviceCare       Onsite display   
 Device designation: \_\_\_\_\_ Serial number: \_\_\_\_\_  
 Measuring point: \_\_\_\_\_ Upper range limit (URL Sensor): \_\_\_\_\_

Parameter name	Display ID	Group	Factory setting <sup>1)</sup>	Permitted settings	Specified value	Read-out actual value	Checked
Digits Set	840	→ Display			01234567890.-		
Calib. Offset	319	→ Position Adjustm.	0.0	<sup>2)</sup>			
Measuring Mode	389		Pressure		Pressure		
Set LRV	245	→ Quick Setup/ Basic Setup	0.0 <sup>3)</sup>	<sup>2)</sup>			
Set URV	246		URL Sensor <sup>3)</sup>	<sup>2)</sup>			
Damping Value	247		2.0 s	0 to 999 s			
Press Eng. Unit	060	→ Basic Setup	mbar / bar <sup>3),4)</sup>	all, except "User unit"			
Curr. Charact.	695	→ Output	Linear	Linear			
Output Fail Mode	388		Max. alarm	Max. alarm Min. alarm			
Alt. Current Output	597		Normal	Normal			
Max. Alarm Current	342		22 mA	21 to 23 mA			
Set Min. Current	343		3.8 mA	3.8 mA or 4.0 mA			
Simulation	413	→ Simulation	None	None			
Ack. Alarm Mode	401	→ Messages	Off	Off / On			
Error no., select alarm type The following messages must be set to "Alarm":	595 / 600						
115 Sensor over pressure		Warning	Alarm or Warning				
120 Sensor low pressure		Warning	Alarm or Warning				
715 Sensor over temperature		Warning	Alarm or Warning				
717 Transmitter over temp.		Warning	Alarm or Warning				
718 Transmitter under temp.		Warning	Alarm or Warning				
720 Sensor under temperature		Warning	Alarm or Warning				
726 Sens. temp. error overrange		Warning/ alarm <sup>5)</sup>	Alarm				
727 Sens. pres. error overrange <sup>6)</sup>	Warning	Alarm or Warning					
620 Current output out of range	Warning	Alarm or Warning					
Alarm Delay	336		0.0 s	0.0 s			
Alarm Displ. Time	480		0.0 s	0.0 s			

Parameter name	Display ID	Group	Factory setting <sup>1)</sup>	Permitted settings	Specified value	Read-out actual value	Checked
Current Mode <sup>7)</sup>	052	→ HART Data	Signaling <sup>8)</sup> or Enabled <sup>9)</sup>	Signaling <sup>8)</sup> or Enabled <sup>9)</sup>			
Bus Address	345		0	0			
After locking: Config. Recorder	352	→ Transmitter data					

- 1) After performing the reset with the reset code "7864"
- 2) Within sensor range
- 3) According to ordering specifications
- 4) Depending on the "Press. Sens. Hilim (485)" parameter
- 5) Alarm setting from firmware version  $\geq 02.30.zz$
- 6) Setting influences SFF
- 7) Only from firmware version  $\geq 02.20$
- 8) Onsite display and FieldCare
- 9) HART handheld terminal

Company: \_\_\_\_\_ Date: \_\_\_\_\_ Signature: \_\_\_\_\_

## Form for device configuration – Level\*

Operation via:      Handheld terminal       FieldCare/DeviceCare       Onsite display   
 Device designation: \_\_\_\_\_ Serial number: \_\_\_\_\_  
 Measuring point: \_\_\_\_\_ Upper range limit (URL Sensor): \_\_\_\_\_

Parameter name	Display ID	Group	Factory setting <sup>1)</sup>	Permitted settings	Specified value	Read-out actual value	Checked
Digits Set	840	→ Display			01234567890.-		
Calib. Offset	319	→ Position Adjustm.	0.0	<sup>2)</sup>			
Measuring Mode	389		Pressure		Level		
Level Selection	020		Level Easy Pressure	Level Easy Pressure			
Empty Calib.	010	→ Basic Setup	0.0% <sup>3)</sup>				
Empty Pressure	011		0.0% <sup>3)</sup>	<sup>2)</sup>			
Full Calib.	004		100.0% <sup>3)</sup>				
Full Pressure	005		URL Sensor <sup>3)</sup>	<sup>2)</sup>			
Set LRV	013		0.0% <sup>3)</sup>				
Set URV	012		100.0% <sup>3)</sup>				
Damping Value	247		2.0 s	0 to 999 s			
Press Eng. Unit	060		mbar / bar <sup>3),4)</sup>	all, except "User unit"			
Output Unit	023		% <sup>3)</sup>				
Adjust Density	007	→ Extended setup	1.0 kg/dm <sup>3</sup>	= Process Density (025)			
Curr. Charact.	695	→ Output	Linear	Linear			
Output Fail Mode	388		Max. alarm	Max. alarm Min. alarm			
Alt. Current Output	597		Normal	Normal			
Max. Alarm Current	342		22 mA	21 to 23 mA			
Set Min. Current	343		3.8 mA	3.8 mA or 4.0 mA			
Simulation	413		→ Simulation	None	None		

\*Not for options with measuring range, e.g. 160/250 bar [2320/3625 psi]

Parameter name	Display ID	Group	Factory setting <sup>1)</sup>	Permitted settings	Specified value	Read-out actual value	Checked
Ack. Alarm Mode	401	→ Messages	Off	Off / On			
Error No.	595 / 600						
115 Sensor over pressure			Warning	Alarm or Warning			
120 Sensor low pressure			Warning	Alarm or Warning			
715 Sensor over temperature			Warning	Alarm or Warning			
717 Transmitter over temp.			Warning	Alarm or Warning			
718 Transmitter under temp.			Warning	Alarm or Warning			
720 Sensor under temperature			Warning	Alarm or Warning			
726 Sens. temp. error overrange			Warning/ alarm <sup>5)</sup>	Alarm			
727 Sens. pres. error overrange <sup>6)</sup>			Warning	Alarm or Warning			
620 Current output out of range			Warning	Alarm or Warning			
Alarm Delay	336		0.0 s	0.0 s			
Alarm Displ. Time	480		0.0 s	0.0 s			
Current Mode <sup>7)</sup>	052	→ HART Data	Signaling <sup>8)</sup> or Enabled <sup>9)</sup>	Signaling <sup>8)</sup> or Enabled <sup>9)</sup>			
Bus Address	345		0	0			
After locking: Config. Recorder	352	→ Transmitter data					

- 1) After performing the reset with the reset code "7864"
- 2) Within sensor range
- 3) According to ordering specifications
- 4) Depending on the "Press. Sens. Hilim (485)" parameter
- 5) Alarm setting from firmware version  $\geq 02.30.zz$
- 6) Setting influences SFF
- 7) Only from firmware version  $\geq 02.20$
- 8) Onsite display and FieldCare
- 9) HART handheld terminal

Company: \_\_\_\_\_ Date: \_\_\_\_\_ Signature: \_\_\_\_\_

## Form for device configuration – Flow\*

Operation via:      Handheld terminal          FieldCare/DeviceCare          Onsite display      
 Device designation: \_\_\_\_\_ Serial number: \_\_\_\_\_  
 Measuring point: \_\_\_\_\_ Upper range limit (URL Sensor): \_\_\_\_\_

Parameter name	Display ID	Group	Factory setting <sup>1)</sup>	Permitted settings	Specified value	Read-out actual value	Checked
Digits Set	840	→ Display			01234567890.-		
Calib. Offset	319	→ Position Adjustm.	0.0	<sup>2)</sup>			
Measuring Mode	389		Pressure		Flow		
Max. Flow	311	→ Quick Setup / Basic Setup	1.0 <sup>3)</sup>				
Max. Press. Flow	634		URL Sensor <sup>3)</sup>	<sup>2)</sup>			
Damping Value	247		2.0 s	0 to 999 s			
Press Eng. Unit	060		mbar / bar <sup>3),4)</sup>	all, except "User unit"			
Flow-Meas. Type	640	→ Basic Setup	Volume p. cond. <sup>3)</sup>				
Unit Flow <sup>3),5)</sup>	391		m <sup>3</sup> /s	all, except "User unit"			
Norm Flow Unit <sup>3),5)</sup>	661		Nm <sup>3</sup> /s				
Std. Flow Unit <sup>3),5)</sup>	660		Sm <sup>3</sup> /s				
Mass Flow Unit <sup>3),5)</sup>	571		kg/s				
Low Flow Cut-Off	442	→ Quick Setup / Basic Setup / Extended Setup	Off	Off / On			
Set L. Fl. Cut-Off	323		5%	0 to 50% of Max. Flow			
Set LRV <sup>6)</sup>	637		0.0 <sup>3)</sup>				
Set URV <sup>6)</sup>	638		Max. Flow <sup>3)</sup>				
Set LRV <sup>7)</sup>	245		0.0 <sup>3)</sup>	<sup>2)</sup>			
Set URV <sup>7)</sup>	246		URL Sensor <sup>3)</sup>	<sup>2)</sup>			
Curr. Charact.	695	→ Output	Linear	Linear			
Output Fail Mode	388	→ Quick Setup / → Output	Max. Alarm	Max. Alarm Min. Alarm			
Alt. Current Output	597		Normal	Normal			
Max. Alarm Current	342	→ Output	22 mA	21 to 23 mA			
Set Min. Current	343	→ Quick Setup / → Output	3.8 mA	3.8 mA or 4.0 mA			
Linear/Sqroot.	390	→ Output	Flow (square root)	Differential pressure/ Flow (square root)			
Simulation	413	→ Simulation	None	None			

\*Not for options with measuring range, e.g. 160/250 bar [2320/3625 psi]

Parameter name	Display ID	Group	Factory setting <sup>1)</sup>	Permitted settings	Specified value	Read-out actual value	Checked
Ack. Alarm Mode	401	→ Messages	Off	Off / On			
Error No.	595 / 600						
115 Sensor over pressure			Warning	Alarm or Warning			
120 Sensor low pressure			Warning	Alarm or Warning			
715 Sensor over temperature			Warning	Alarm or Warning			
717 Transmitter over temp.			Warning	Alarm or Warning			
718 Transmitter under temp.			Warning	Alarm or Warning			
720 Sensor under temperature			Warning	Alarm or Warning			
726 Sens. temp. error overrange			Warning/ alarm <sup>8)</sup>	Alarm			
727 Sens. pres. error overrange <sup>9)</sup>			Warning	Alarm or Warning			
620 Current output out of range			Warning	Alarm or Warning			
Alarm Delay	336		0.0 s	0.0 s			
Alarm Displ. Time	480		0.0 s	0.0 s			
Current Mode <sup>10)</sup>	052	→ HART Data	Signaling <sup>11)</sup> or Enabled <sup>12)</sup>	Signaling <sup>11)</sup> or Enabled <sup>12)</sup>			
Bus address	345		0	0			
After locking: Config. Recorder	352	→ Transmitter data					

- 1) After performing the reset with the reset code "7864"
- 2) Within sensor range
- 3) According to ordering specifications
- 4) Depending on the "Press. Sens. Hilim (485)" parameter
- 5) Only one value can be entered. This depends on the "Flow Meas. Type (640)" parameter.
- 6) Linear / Sqrt. = Flow (square root)
- 7) Linear / Sqrt. = Differential pressure
- 8) Alarm setting from firmware version  $\geq 02.30.zz$
- 9) Setting influences SFF
- 10) Only for software version  $\geq 02.20$
- 11) Onsite display and FieldCare
- 12) HART handheld terminal

Company: \_\_\_\_\_ Date: \_\_\_\_\_ Signature: \_\_\_\_\_





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