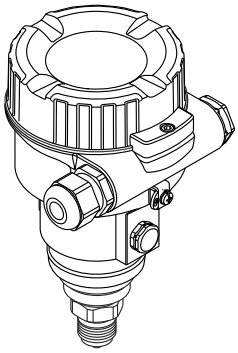
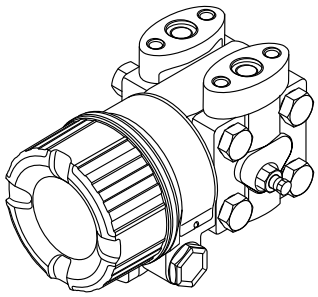
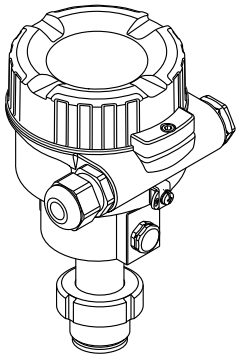
Functional Safety Manual
Cerabar M PMC51, PMP51/55
Deltabar M PMD55
Deltapilot M FMB50/51/52/53

Process pressure / Differential pressure, Flow / Hydrostatic

Application
Operating minimum, maximum and range monitoring of gases, vapours and liquids in systems to satisfy particular safety systems requirements as per IEC 61508 Edition 2.0 and IEC 61511.

The measuring device fulfils the requirements concerning
- Functional safety as per IEC 61508 Edition 2.0 and IEC 61511
- Explosion protection (depending on the version)
- Electromagnetic compatibility as per EN 61326 and NAMUR recommendation NE 21
- Electrical safety as per IEC/EN 61010-1

Your benefits
- Used for pressure, level and flow monitoring (MIN, MAX, Range) up to SIL 2
  - Independently assessed and certified by TÜV NORD CERT as per IEC 61508 Edition 2.0 and IEC 61511
- Permanent self-monitoring
- Continuous measurement
- Easy commissioning

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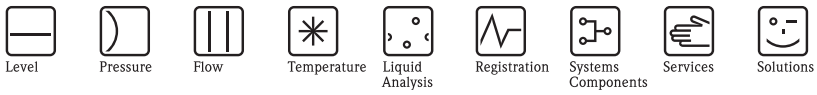

SIL-11044a/00/A2

SIL-Konformitätserklärung

Funktionale Sicherheit nach IEC 61508 / IEC 61511

SIL Declaration of Conformity

Functional safety according to IEC 61508 / IEC 61511

Endress+Hauser GmbH+Co. KG, Hauptstraße 1, 79689 Maulburg
erklärt als Hersteller, dass das Gerät
declares as manufacturer, that the device

Cerabar M PMC51, PMP51, PMP55 (4-20 mA HART)

für den Einsatz in Schutzeinrichtungen entsprechend der IEC 61508 Edition 2.0/IEC 61511 geeignet ist, wenn das Handbuch zur Funktionalen Sicherheit und die Kenngrößen in der folgenden Tabelle beachtet werden:
is suitable for the use in safety-instrumented systems according to IEC 61508 Edition 2.0/IEC 61511, if the functional safety manual and the characteristics specified in the following table are observed:

Gerät/Product	PMC51	PMC51 (Hygiene)	PMP51/55
Handbuch zur Funktionalen Sicherheit/ Functional safety manual	SD00347P		
Empfohlenes Intervall für Wiederholungsprüfungen/ recommended proof test interval	T_1 = 1 Jahr/year		
SIL [4]	2		
HFT	0		
Gerätetyp/Device type	B		
Sicherheitsfunktion/Safety function	MIN , MAX , Bereich/Range		
$MTBF_{tot}$ [3]	129 Jahre/years	129 Jahre/years	139 Jahre/years
SFF	85.9 %	86.1 %	86.7 %
PFD_{avg} *[1] T_1 = 1 Jahr/year	5.0×10^{-4}	5.0×10^{-4}	4.3×10^{-4}
PFH	1.1×10^{-7} 1/h	1.1×10^{-7} 1/h	9.9×10^{-8} 1/h
λ_{sd} [2]	193 FIT	193 FIT	194 FIT
λ_{su} [2]	412 FIT	418 FIT	334 FIT
λ_{dd} [2]	92 FIT	98 FIT	120 FIT
λ_{du} [2]	114 FIT	114 FIT	99 FIT

[1] Die Werte entsprechen SIL 2 nach ISA S84.01. PFD_{avg}-Werte für andere T_1-Werte siehe Handbuch zur Funktionalen Sicherheit./ The values comply with SIL 2 according to ISA S84.01. PFD_{avg} values for other T_1-values see Functional Safety Manual.
[2] Gemäß Siemens SN 29500 / According to Siemens SN 29500
[3] Gemäß Siemens SN 29500, einschließlich Fehlern, die außerhalb der Sicherheitsfunktion liegen./ According to Siemens SN 29500, including faults outside the safety function.
[4] Betrachtung gemäß IEC 61511-1 Abschnitt 11.4.4./ Consideration according to IEC 61511-1 clause 11.4.4.

Das Gerät einschließlich Software und Änderungsprozess wurde auf Basis der Betriebsbewährung bewertet.
The device including the software and the modification process was assessed on the basis of proven-in-use.

Maulburg, 30.08.2011

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SIL Declaration of Conformity - Deltabar M


Level


Pressure


Flow


Temperature


Liquid Analysis


Registration


Systems Components


Services


Solutions

SIL-11045a/00/A2

SIL-Konformitätserklärung

Funktionale Sicherheit nach IEC 61508 / IEC 61511

SIL Declaration of Conformity

Functional safety according to IEC 61508 / IEC 61511

Endress+Hauser GmbH+Co. KG, Hauptstraße 1, 79689 Maulburg
erklärt als Hersteller, dass das Gerät
declares as manufacturer, that the device

Deltabar M PMD55 (4-20 mA HART)

für den Einsatz in Schutzeinrichtungen entsprechend der IEC 61508 Edition 2.0/IEC 61511 geeignet ist, wenn das Handbuch zur Funktionalen Sicherheit und die Kenngrößen in der folgenden Tabelle beachtet werden:
is suitable for the use in safety-instrumented systems according to IEC 61508 Edition 2.0/IEC 61511, if the functional safety manual and the characteristics specified in the following table are observed:

Gerät/Product	PMD55
Handbuch zur Funktionalen Sicherheit/ Functional safety manual	SD00347P
Empfohlenes Intervall für Wiederholungsprüfungen/ recommended proof test interval	T_1 = 1 Jahr/year
SIL [4]	2
HFT	0
Gerätetyp/Device type	B
Sicherheitsfunktion/Safety function	MIN , MAX , Bereich/Range
$MTBF_{tot}$ [3]	159 Jahre/years
SFF	80.1 %
PFD_{avg} *1 T_1 = 1 Jahr/year	5.6×10^{-4}
PFH	1.3×10^{-7} 1/h
λ_{sd} [2]	194 FIT
λ_{su} [2]	203 FIT
λ_{dd} [2]	120 FIT
λ_{du} [2]	128 FIT

[1] Die Werte entsprechen SIL 2 nach ISA S84.01. PFD_{avg}-Werte für andere T_1-Werte siehe Handbuch zur Funktionalen Sicherheit./ The values comply with SIL 2 according to ISA S84.01. PFD_{avg} values for other T_1-values see Functional Safety Manual.
[2] Gemäß Siemens SN 29500 / According to Siemens SN 29500
[3] Gemäß Siemens SN 29500, einschließlich Fehlern, die außerhalb der Sicherheitsfunktion liegen./ According to Siemens SN 29500, including faults outside the safety function.
[4] Betrachtung gemäß IEC 61511-1 Abschnitt 11.4.4./ Consideration according to IEC 61511-1 clause 11.4.4.

Das Gerät einschließlich Software und Änderungsprozess wurde auf Basis der Betriebsbewährung bewertet.
The device including the software and the modification process was assessed on the basis of proven-in-use.

Maulburg, 30.08.2011

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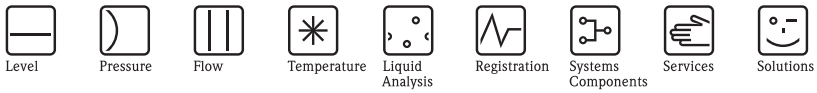
SIL Declaration of Conformity - Deltapilot M



SIL-11046a/00/A2

SIL-Konformitätserklärung

Funktionale Sicherheit nach IEC 61508 / IEC 61511

SIL Declaration of Conformity

Functional safety according to IEC 61508 / IEC 61511

Endress+Hauser GmbH+Co. KG, Hauptstraße 1, 79689 Maulburg
erklärt als Hersteller, dass das Gerät
declares as manufacturer, that the device

Deltapilot M FMB50, FMB51, FMB52, FMB53 (4-20 mA HART)

für den Einsatz in Schutzeinrichtungen entsprechend der IEC 61508 Edition 2.0/IEC 61511 geeignet ist, wenn das Handbuch zur Funktionalen Sicherheit und die Kenngrößen in der folgenden Tabelle beachtet werden:
is suitable for the use in safety-instrumented systems according to IEC 61508 Edition 2.0/IEC 61511, if the functional safety manual and the characteristics specified in the following table are observed:

Gerät/Product	FMB50 (kompakt / compact)	FMB51/52/53 (Stab/Seil / rod/cable)
Handbuch zur Funktionalen Sicherheit/ Functional safety manual	SD00347P	
Empfohlenes Intervall für Wiederholungsprüfungen/ recommended proof test interval	T_1 = 1 Jahr/year	
SIL [4]	2	
HFT	0	
Gerätetyp/Device type	B	
Sicherheitsfunktion/Safety function	MIN , MAX , Bereich/Range	
$MTBF_{tot}$ [3]	140 Jahre/years	95 Jahre/years
SFF	86.6 %	79.4 %
PFD_{avg} *[1] T_1 = 1 Jahr/year	4.3×10^{-4}	1.0×10^{-3}
PFH	9.9×10^{-8} 1/h	2.3×10^{-7} 1/h
λ_{sd} [2]	194 FIT	292 FIT
λ_{su} [2]	330 FIT	466 FIT
λ_{dd} [2]	118 FIT	138 FIT
λ_{du} [2]	99 FIT	231 FIT

[1] Die Werte entsprechen SIL 2 nach ISA S84.01. PFD_{avg}-Werte für andere T_1-Werte siehe Handbuch zur Funktionalen Sicherheit./ The values comply with SIL 2 according to ISA S84.01. PFD_{avg} values for other T_1-values see Functional Safety Manual.
[2] Gemäß Siemens SN 29500 / According to Siemens SN 29500
[3] Gemäß Siemens SN 29500, einschließlich Fehlern, die außerhalb der Sicherheitsfunktion liegen./ According to Siemens SN 29500, including faults outside the safety function.
[4] Betrachtung gemäß IEC 61511-1 Abschnitt 11.4.4./ Consideration according to IEC 61511-1 clause 11.4.4.

Das Gerät einschließlich Software und Änderungsprozess wurde auf Basis der Betriebsbewährung bewertet.
The device including the software and the modification process was assessed on the basis of proven-in-use.

Maulburg, 30.08.2011

i.V. Arno Götz
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Leitung Zertifizierung/
Manager Certification

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(Udo Grittke)
Leitung Entwicklungsprojekt/
Management R&D Projekt

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SIL_11046a

Introduction

General information on functional safety (SIL) is available at: www.de.endress.com/SIL (German) or www.endress.com/SIL (English) and in Competence Brochure CP01008Z/11/EN "Functional Safety in the Process Industry - Risk Reduction with Safety Instrumented Systems".

Safety symbols

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

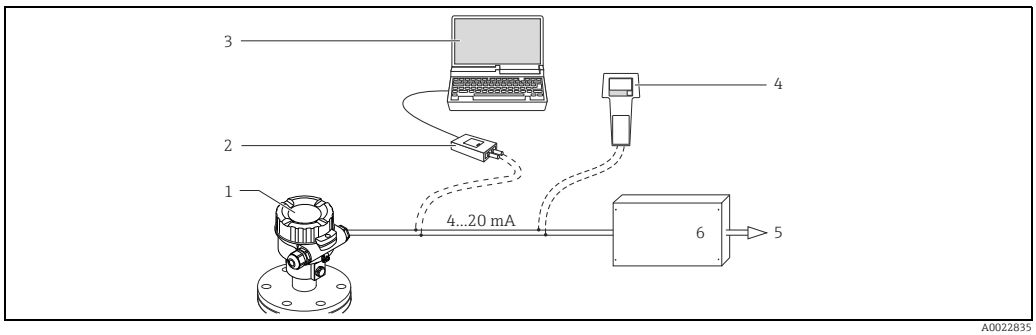
Symbols for certain types of information

Symbol	Meaning
 A0011193	**Tip** Indicates additional information.

Structure of the measuring system

System components

The measuring system's devices are displayed in the following diagram (example).



1 Pressure measuring device
2 Commubox FXA195
3 Computer with operating program, e.g. FieldCare
4 HART handheld terminal, e.g. Field Communicator 375, 475
5 Actuator
6 Logic unit, e.g. PLC, limit signal generator, ...

The device generates an analogue signal (≥ 3.8 to ≤ 20.5 mA) that is proportional to the pressure. This signal is sent to a logic unit located downstream, e.g. programmable logic controller or a limit signal transmitter, and monitored there to establish if:
- A specified value for the "Pressure", "Level" or "Flow" (Deltabar only) operating modes has been overshot or undershot.
- A range to be monitored for the "Pressure", "Level" or "Flow" (Deltabar only) operating modes has been violated.
- A fault has occurred (e.g. sensor error, sensor cable disconnection or short-circuit, supply voltage failure).

For failure monitoring, the logic unit must recognize both HI-alarms (≥ 21,0 mA) and LO-alarms (≤ 3,6 mA).

Description of use as a protective system

Cerabar M

The pressure transmitter is used for the following measuring tasks:
- Absolute pressure and gauge pressure measurement in gases, steams or liquids in all areas of process engineering and process measurement technology
- Level, volume or mass measurements in liquids
- High process temperature
  - without diaphragm seals up to 130 °C (266 °F)
  - with diaphragm seals up to 400 °C (752 °F)
- High pressure up to 400 bar (6000 psi)

Deltabar M

The differential pressure transmitter is used for the following measuring tasks:
- Flow measurement (volume flow or mass flow) in conjunction with primary devices in gases, steams and liquids
- Level, volume or mass measurement in liquids
- Differential pressure monitoring, e.g. of filters and pumps
- Gauge pressure measurement in gases, steams or liquids in all areas of process engineering and process measurement technology

Deltapilot M

The hydrostatic pressure sensor is used for the following measuring tasks:
- Hydrostatic pressure measurement in liquids and paste-like media in all areas of process engineering, process measuring technology, pharmaceuticals and the food industry
- Level, volume or mass measurements in liquids

NOTICE

Correct installation is a prerequisite for safe operation of the device.

▸ Installation examples → see respective Technical Information → 11, "Supplementary device documentation".

Permitted device 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.

Valid software version: as of 01.00.01
Valid hardware version: as of 02.00.00

A modification process according to IEC 61508 is applied for device changes.
Unless otherwise specified, all subsequent versions can also be used for safety instrumented systems.

Valid device versions for safety-related use:

Cerabar M PMC51

Feature	Designation	Option model
010	Approval	all
020	Output	2 4-20 mA HART
030	Display; Operation	all
040	Housing	all
050	Electrical Connection	all
070	Sensor Range	all
080	Reference Accuracy	all
090	Calibration; Unit	all
110	Process Connection	all
190	Seal	all
570	Service	all, except IB
590	Additional Approval	LA SIL
600	Separate Housing	not permitted

Cerabar M PMP51

Feature	Designation	Option model
010	Approval	all
020	Output	2 4-20 mA HART
030	Display; Operation	all
040	Housing	all
050	Electrical Connection	all
070	Sensor Range	all
080	Reference Accuracy	all
090	Calibration; Unit	all
110	Process Connection	all
170	Membrane Material	all, except M
180	Fill Fluid	all
570	Service	all, except IB
590	Additional Approval	LA SIL
600	Separate Housing	not permitted

Cerabar M PMP55

Feature	Designation	Option model
010	Approval	all
020	Output	2 4-20 mA HART
030	Display; Operation	all
040	Housing	all
050	Electrical Connection	all
070	Sensor Range	all
080	Reference Accuracy	all
090	Calibration; Unit	all
110	Process Connection	all
170	Membrane Material	all, except M
180	Fill Fluid	all
200	Diaphragm Seal Connection	all
570	Service	all, except IB
590	Additional Approval	LA SIL
600	Separate Housing	not permitted
610	Accessory Mounted	not permitted

Deltabar M PMD55

Feature	Designation	Option model
010	Approval	all
020	Output	2 4-20 mA HART
030	Display; Operation	all
040	Housing	all
050	Electrical Connection	all
060	Nominal Pressure PN	all
070	Sensor Nominal Value	all
080	Reference Accuracy	all
090	Calibration; Unit	all
110	Process Connection	all
170	Membrane Material	all
180	Fill Fluid	all
190	Seal	all
570	Service	all, except IB
590	Additional Approval	LA SIL

Deltapilot M FMB50

Feature	Designation	Option model
010	Approval	all
020	Output	2 4-20 mA HART
030	Display; Operation	all
040	Housing	all
050	Electrical Connection	all
070	Sensor Range	all
080	Reference Accuracy	all
090	Calibration; Unit	all
110	Process Connection	all
170	Membrane Material	all, except L
180	Fill Fluid	all
190	Seal	all
570	Service	all, except IB
590	Additional Approval	LA SIL
600	Separate Housing	not permitted
610	Accessory Mounted	not permitted

Deltapilot M FMB51, FMB52, FMB53

Feature	Designation	Option model
010	Approval	all
020	Output	2 4-20 mA HART
030	Display; Operation	all
040	Housing	all
050	Electrical Connection	all
070	Sensor Range	all
080	Reference Accuracy	all
090	Calibration; Unit	all
100	Probe Connection	all
110	Process Connection	all
170	Membrane Material	all, except L, N
180	Fill Fluid	all
190	Seal	all
570	Service	all, except IB
590	Additional Approval	LA SIL
600*	Separate Housing	not permitted
610	Accessory Mounted	not permitted

* Not for FMB53

The following controls are permitted for devices without an on-site display that are to be used in process control protection equipment:
- Via the FieldCare operating program and DTM for Cerabar M, Deltabar M or Deltapilot M with software version 01.00.xx, or
- Via Handheld terminal Field Communicator 375, 475 and Device Description for Cerabar M, Deltabar M or Deltapilot M with device revision 01.

⚠ 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 are not taken into account in the rating.

Assessing the suitability of the overall system, for safety-related operation is the responsibility of the operator.

The additional use of diaphragm seal system, primary devices (orifice plates, probes, etc.) and accessories (e.g. impulse piping) 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
- ▸ The technical information ("Supplementary device documentation", → 11) has to be observed

Supplementary device documentation

Documentation	Contents	Comment
Technical Information: ▪ TI00436P (PMC51, PMP51/55) ▪ TI00434P (PMD55) ▪ TI00437P (FMB50/51/52/53)	▪ Technical data	The documentation is available on the Internet. → www.endress.com.
Operating Instructions: BA00382P (PMC51, PMP51/55, PMD55, FMB50/51/52/53)	▪ Identification ▪ Installation ▪ Wiring ▪ Operation ▪ Commissioning ▪ Maintenance ▪ Troubleshooting ▪ Appendix	The documentation is available on the Internet. → www.endress.com.
Brief Operating Instructions: ▪ KA01030P (PMC51, PMP51/55) ▪ KA01027P (PMD55) ▪ KA01033P (FMB50/51/52/53)	▪ Installation ▪ Wiring ▪ Operation ▪ Commissioning	▪ The documentation is provided with the device. ▪ The documentation is available on the Internet. → www.endress.com.
Safety instructions depending on the selected version "Approval"	Safety, installation and operating instructions for devices, which are suitable for use in potentially explosive atmospheres or as overfill protection (WHG, German Water Resources Act).	Additional safety instructions (XA, ZE, ZD) are supplied with certified device versions. Please refer to the nameplate for the relevant safety instructions.

Description of the safety requirements and boundary conditions

Safety function

The mandatory settings and safety function data emanate from the descriptions from → 16.
The measuring system's reaction time is ≤ 5 s.

Safety-related signal

The safety-related signal is the 4 to 20 mA analog output signal. All safety functions solely refer to this output. The device additionally communicates via HART and contains all HART features with additional diagnostics information.

NOTICE

During the following activities the transmitter outputis not safety-oriented:
Changes of the configuration, Multidrop, Simulation, Proof-test.

- Before one of these activities will be started, the application has to be set to safe state.

Internal errors (e.g. measuring range violations) generate an error current at the analog output.

Depending on the settings/order specifications the error current can be set to HI-alarm (21 to 23 mA) or LO-alarm (3.6 mA).

Additionally, there is the "Hold" option for the behavior of the output current, i.e. the present value of the current is kept in case of an error. As a further option the current output can be fixed to 4 mA by selecting the "Fixed" option in the "Current mode" parameter.

⚠ CAUTION

The following settings don't generate an alarm to initiate a fail-safe state:
- "Output fail mode" = "Hold"
(Menu path: Expert > Output > Current output > Output fail mode) and
- "Current mode" = "Fixed"
(Menu path: Expert > Communication > HART config. > Current mode)

- These settings are not allowed for safety-related use!

Restrictions for use in safety-related applications

- The measuring system must be used correctly for the specific application, taking into account the medium properties and ambient conditions. Carefully follow instructions pertaining to critical process situations and installation conditions from the Operating Instructions.
- The application-specific limits must be observed.
- The specifications from the Operating Instructions must not be exceeded.
- Device start-up time: after device start-up, the safety functions are available after a 5-second initialization period.
- During the calculation of SFF a tolerance range of ±2 % for the deviation of output current in case of a failure of a safety relevant component had been taken into account. The ±2 % deviation refers to the actual measured, real value of the output current. If pressure transmitters shall be operated in safety relevant applications, it is recommended to increase the total performance failure shown in the Technical Information (TI) by this value.
- In the case of local operation 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 these cases, communication via HART alone is not sufficient.
- The device must be locked following parameterization.
- During commissioning, a complete function test of the safety-related functions must be performed.

Functional safety figures

The following tables show specific indicators for functional safety.

Cerabar M

Characteristic as per IEC 61508	PMC51	PMC51 (hygiene)	PMP51, PMP55
Safety functions	MIN, MAX, Range		
SIL	2		
HFT	0		
Device type	B		
Mode of operation	Low demand mode, High demand mode		
MTTR	8 h		
Recommended time interval for proof-testing T_1	1 year		
SFF	85.9%	86.1%	86.7%
λ_{sd}	193 FIT	193 FIT	194 FIT
λ_{su}	412 FIT	418 FIT	334 FIT
λ_{dd}	92 FIT	98 FIT	120 FIT
λ_{du}	114 FIT	114 FIT	99 FIT
λ_{tot} [1)*1]	883 FIT	883 FIT	819 FIT
PFD_{avg} for T_1 = 1 year [2)]	5.0×10^{-4}	5.0×10^{-4}	4.3×10^{-4}
PFH [3)]	1.1×10^{-7} 1/h	1.1×10^{-7} 1/h	9.9×10^{-8} 1/h
MTBF [1)]	129 years	129 years	139 years
Diagnostic test interval [4)]	5 min (RAM, ROM, ...), 1 s (Measurement)		
Fault reaction time [5)]	5 min (RAM, ROM, ...), 10 s (Measurement)		
Settling time [6)]	→ Technical Information TI00436P/00/EN, "Dynamic behavior: current output " section		

1) According to Siemens SN 29500, including faults outside the safety function.

2) The following factors must be taken into account in case of permanently increased operation temperatures:
Temperature range: +40 °C...+50 °C (104 °F...122 °F) with factor 1.3
Temperature range: +50 °C...+60 °C (122 °F...140 °F) with factor 1.8
Temperature range: +60 °C...+85 °C (140 °F...185 °F) with factor 3.5

3) Under the assumption that the sensor switches into the safe state on every detected breakdown, a calculation of the characteristic value PFH according to IEC 61508-6:2010, B.3.3.2.1 for the 1oo1 configuration results in: PFH = λ_{du}.

4) During this time, all diagnostic functions are executed at least once.

5) Time between fault detection and fault reaction.

6) Step response time as per DIN EN 61298-2.

Deltabar M

Characteristic as per IEC 61508	PMD55
Safety functions	MIN, MAX, Range
SIL	2
HFT	0
Device type	B
Mode of operation	Low demand mode, High demand mode
MTTR	8 h
Recommended time interval for proof-testing T_1	1 year
SFF	80.1%
λ_{sd}	194 FIT
λ_{su}	203 FIT
λ_{dd}	120 FIT
λ_{du}	128 FIT
λ_{tot} [1)]*	717 FIT
PFD_{avg} for T_1 = 1 year [2)]	5.6×10^{-4}
PFH [3)]	1.3×10^{-7} 1/h
MTBF [1)]	159 years
Diagnostic test interval [4)]	5 min (RAM, ROM, ...), 1 s (Measurement)
Fault reaction time [5)]	5 min (RAM, ROM, ...), 10 s (Measurement)
Settling time [6)]	→ Technical Information TI00434P/00/EN, "Dynamic behavior: current output " section

1) According to Siemens SN 29500, including faults outside the safety function.

2) The following factors must be taken into account in case of permanently increased operation temperatures:
Temperature range: +40 °C...+50 °C (104 °F...122 °F) with factor 1.3
Temperature range: +50 °C...+60 °C (122 °F...140 °F) with factor 1.8
Temperature range: +60 °C...+85 °C (140 °F...185 °F) with factor 3.5

3) Under the assumption that the sensor switches into the safe state on every detected breakdown, a calculation of the characteristic value PFH according to IEC 61508-6:2010, B.3.3.2.1 for the 1oo1 configuration results in: PFH = λ_{du}.

4) During this time, all diagnostic functions are executed at least once.

5) Time between fault detection and fault reaction.

6) Step response time as per DIN EN 61298-2.

Deltapilot M

Characteristic as per IEC 61508	FMB50 (compact)	FMB51/52/53 (rod/cable)
Safety functions	MIN, MAX, Range	
SIL	2	
HFT	0	
Device type	B	
Mode of operation	Low demand mode, High demand mode	
MTTR	8 h	
Recommended time interval for proof-testing T_1	1 year	
SFF	86.6%	79.4%
λ_{sd}	194 FIT	292 FIT
λ_{su}	330 FIT	466 FIT
λ_{dd}	118 FIT	138 FIT
λ_{du}	99 FIT	231 FIT
λ_{tot} [1]*	813 FIT	1204 FIT
PFD_{avg} for T_1 = 1 year [2]	4.3×10^{-4}	1.0×10^{-3}
PFH [3]	9.9×10^{-8} 1/h	2.3×10^{-7} 1/h
MTBF [1]	140 years	95 years
Diagnostic test interval [4]	5 min (RAM, ROM, ...), 1 s (Measurement)	
Fault reaction time [5]	5 min (RAM, ROM, ...), 10 s (Measurement)	
Settling time [6]	→ Technical Information TI00437P/00/EN, "Dynamic behavior: current output " section	

1) According to Siemens SN 29500, including faults outside the safety function.

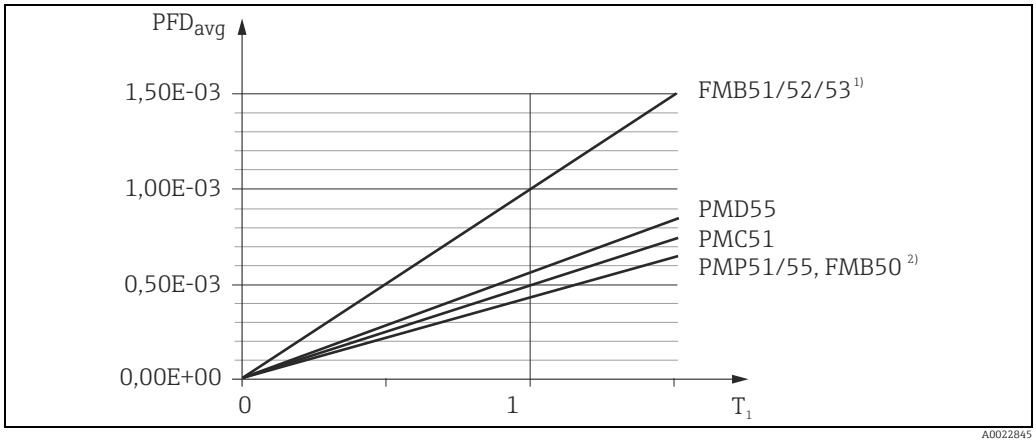
2) The following factors must be taken into account in case of permanently increased operation temperatures:
Temperature range: +40 °C...+50 °C (104 °F...122 °F) with factor 1.3
Temperature range: +50 °C...+60 °C (122 °F...140 °F) with factor 1.8
Temperature range: +60 °C...+85 °C (140 °F...185 °F) with factor 3.5.

3) Under the assumption that the sensor switches into the safe state on every detected breakdown, a calculation of the characteristic value PFH according to IEC 61508-6:2010, B.3.3.2.1 for the 1oo1 configuration results in: PFH = λ_{du}.

4) During this time, all diagnostic functions are executed at least once.

5) Time between fault detection and fault reaction.

6) Step response time as per DIN EN 61298-2.



Proof-test interval

1) Rod/Cable version
2) Compact version

Dangerous undetected failures in this scenario:

The following is considered a dangerous undetected failure:
- An incorrect output signal which deviates from the real measured value by more than 2%, with the output signal remaining within the 4 to 20 mA range.
- A settling time that is delayed by more than the specified settling time plus tolerance.
- Other deviations from specified safety-related properties.

Useful lifetime of electrical 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.

In accordance with DIN EN 61508-2:2011, Note NA4, appropriate measures taken by the manufacturer and operator can extend the useful lifetime.

Behavior of device during operation and in case of error

The behavior during operation and in case of failures is described in the Operating Instructions BA00382P/00/EN.

Installation

Installation, wiring and commissioning

The mounting, wiring and commissioning of the Deltabar S is described in the Operating Instructions BA00382P/00/EN.

Operation

Alarm response and current output

Configure the current output for an alarm condition via the parameters "Output Fail Mode" (default value: Max. Alarm) and "Set Max Alarm" (default value: 22 mA). These parameters can be set to the following values:

Output fail mode 1)*1	Current value in case of error
Min. alarm (LO alarm)	3.6 mA
Max. alarm (HI alarm) 2)*2	Can be set via "Set Max Alarm" = 22 mA

1) Can alternatively be set via DIP switch 3 "SW/alarm min"

2) DIP switch 3 "SW/alarm min" must be in the "SW" position

⚠ WARNING

The following settings don't generate an alarm to initiate a fail-safe state:
- "Output fail mode" = "Hold"
(Menu path: Expert → Output → Current output → Output fail mode) and
- "Current mode" = "Fixed"
(Menu path: Expert → Communication → HART config. → Current mode)
▸ These settings are not allowed for safety-related use!

- The selected alarm current cannot be guaranteed for all possible fault situations (e.g. cable open circuit). However, failure reaction in accordance with NE 43 (≤ 3.6 mA or ≥ 21 mA) is always ensured.
- In cases such as power failure or circuit break, output currents can be ≤ 3,6 mA (independent of the selected current value in case of error).
- In cases such as short-circuit, output currents can be ≥ 23 mA (independent of the selected current value).
- After an error or a fault has been removed, the 4 to 20 mA output signal can be considered to be safe after 10 seconds.

Device configuration

When using the devices in process control protection equipment, the device configuration must meet two requirements:

1. Confirmation concept:
   proven independent checking of safety-relevant parameters input
2. Locking concept:
   device locked after configuration (required in accordance with IEC 61511-1 §11.6.4 and NE 79 §3)

Procedure for device configuration via local operation

1. Reset the parameters to their factory setting: with the "7864" reset code (→ Operating Instructions BA00382P/00/EN, section "Resetting to factory settings (reset)").
   Check default values, number formats and parameter designations using the "Form for device configuration" (column "Factory settings", → 27ff).

   The following operating steps may no longer be performed after this reset:
   - Position adjustment or setting the measuring range on site without using the on-site display
   - Download
   - Reset apart from reset code "7864"
   - Current trim
   - Sensor trim ("Note", → 21)
   - Set the parameters "Measuring mode" = "Level" and "Level selection" = "In height".
   - Set the parameters "Output fail mode" = "Hold", "Current mode" = "Fixed" and "Bus address" ≠ "0".
2. Configure the device and log settings manually.
   For the configuration → Operating Instructions BA00382P/00/EN.
   Switch the device off and on to make sure that the parameter settings are stored.

   Observe the prescribed parameters in accordance with the "Form for device configuration":
   - for "Pressure" → 27
   - for "Level" → 28
   - for "Flow" → 29

   Additionally, the allowed parameter settings given in the following table (→ 20) must be taken into account.
3. Check safety functions if necessary ("Checks", → 22)
4. Read out the specified parameters and compare it to the "Form for device configuration", → 27ff.
5. Lock the device via software and/or hardware for the safe measuring mode
   → Operating Instructions BA00382P/00/EN, section "Locking/unlocking operation".
6. Read out and log the "Config. counter" parameter.
   (Menu path: Expert → Diagnosis → Config. counter)

Procedure for device configuration via handheld terminal Field Communicator 375, 475

When the connection to the handheld terminal has been established, proceed as follows:

1. Select "Main Menu" > "Hart communication" > "Hart application" > "Online", The device will automatically be found and opened online. Make sure that the bus address of the device is = 0.
2. Make sure the connection has been established to the correct device. This can be checked using the: measuring point, extended order code or serial number parameters.
3. Reset the parameters to their factory setting: with the "7864" reset code (→ Operating Instructions BA00382P/00/EN, section "Resetting to factory settings (reset)").
   Check default values, number formats and parameter designations using the "Form for device configuration" (column "Factory settings", → 27ff).

   The following operating steps may no longer be performed after this reset:
   - Position adjustment or setting the measuring range on site without using the on-site display
   - Download
   - Reset apart from reset code "7864"
   - Current trim
   - Sensor trim ("Note", → 21)
   - Set the parameters "Measuring mode" = "Level" and "Level selection" = "In height".
   - Set the parameters "Output fail mode" = "Hold", "Current mode" = "Fixed" and "Bus address" ≠ "0".
4. Configure the device and log settings manually.
   For the configuration → Operating Instructions BA00382P/00/EN.
   Switch the device off and on to make sure that parameter settings are stored. Close the application on the handheld terminal. After switchin off and on reestablish the connection between the device and the handheld terminal (see step 1).

   Observe the prescribed parameters in accordance with the "Form for device configuration":
   - for "Pressure" → 27
   - for "Level" → 28
   - for "Flow" → 29

   Additionally, the allowed parameter settings given in the following table (→ 20) must be taken into account.
5. Check safety functions if necessary ("Checks", → 22)
6. Read out the specified parameters and compare it to the "Form for device configuration", → 27ff.
7. Lock the device via software and/or hardware for the safe measuring mode (→ Operating Instructions BA00382P/00/EN, section "Locking/unlocking operation").
8. Read out and log the "Config. counter" parameter.
   (Menu path: Expert → Diagnosis → Config. counter)

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

Procedure for device configuration via the FieldCare operating program

When the connection to FieldCare has been established, proceed as follows:

1. There are the following two ways to established the connection:
   – Select the "HART communication" connection wizard. The device will automatically been found and opened online. Make sure that the bus address of the device is = 0.
   – Go to the tree structure and select "Create projects" > "Add device" > "HART communication", before selecting " "Create network". The device is opened online. Make sure that the bus address of the device is = 0.
2. Make sure the connection has been established to the correct device. This can be checked using the: measuring point, extended order code or serial number parameters parameters.
3. Reset the parameters to their factory setting: with the "7864" reset code (→ Operating Instructions BA00382P/00/EN, section "Resetting to factory settings (reset)").
   Check default values, number formats and parameter designations using the device configuration form (column "factory settings").

   The following operating steps may no longer be performed after this reset:
   - Position adjustment or setting the measuring range on site without using the on-site display
   - Download
   - Reset apart from reset code "7864"
   - Current trim
   - Sensor trim ("Note", → 21)
   - Set the parameters "Measuring mode" = "Level" and "Level selection" = "In height".
   - Set the parameters "Output fail mode" = "Hold", "Current mode" = "Fixed" and "Bus address" ≠ "0".
4. Configure the device and log settings manually.
   For the configuration → Operating Instructions BA00382P/00/EN.
   Switch the device off and on to make sure that parameter settings are stored. Close FieldCare. After switching the device off and on and after closing FieldCare, reestablished the connection between the device and FieldCare (see step 1).

   Observe the prescribed parameters in accordance with the form:
   - for "Pressure" → 27
   - for "Level" → 28
   - for "Flow" → 29

   Additionally, the allowed parameter settings given in the following table (→ 20) must be taken into account.
5. Check safety functions if necessary ("Checks", → 22)
6. Read out the specified parameters and compare against the log, → 27ff.
7. Lock the device via software and/or hardware for the safe measuring mode (→ Operating Instructions BA00382P/00/EN, section "Locking/unlocking operation").
8. Read out and log the "Config. counter" parameter.
   (Menu path: Expert → Diagnosis → Config. counter)

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.

Permitted parameter setting

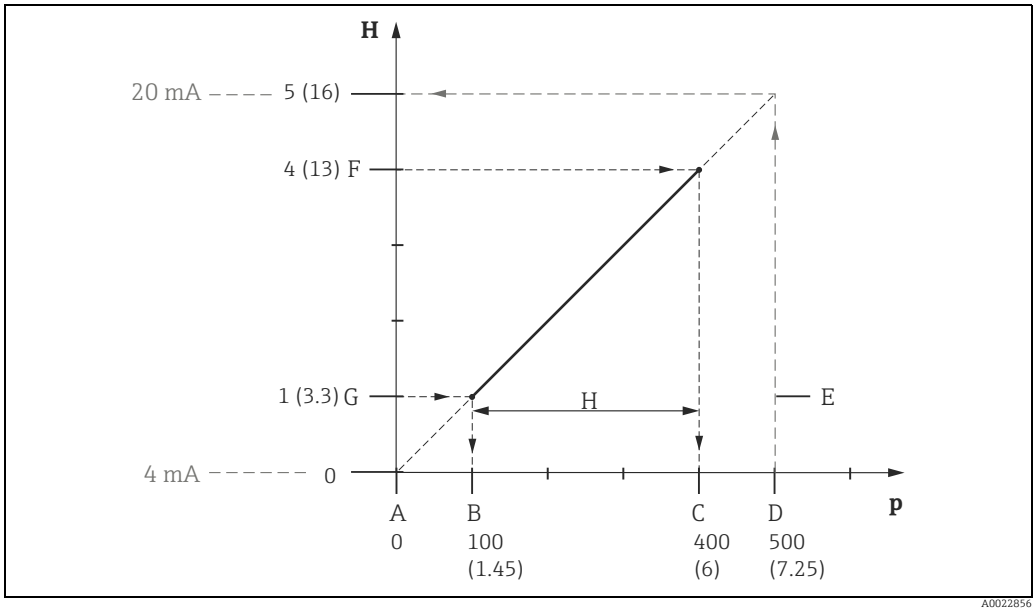
Only certain settings are possible for some parameters. If a setting that is not permitted has been selected for one of these parameters, safe operation is no longer guaranteed.

Functional group (menu path)	Parameter and setting
Expert → Output → Current output	▪ Output fail mode = Max. alarm or Min. alarm [1)] ▪ Alarm behav. P = alarm ▪ High alarm curr. = 22 mA ▪ Set min. current = < 3.8 mA ▪ Start current = 12 mA
Expert → Communication → HART config.	▪ Current mode = signaling ▪ Bus address = 0
Expert → Diagnosis → Simulation	▪ Simulation mode = none
Expert → Measurement → Level "Level" operating mode, "In pressure" level selection: The "Empty pressure", "Full pressure", "Empty calib." and "Full calib." parameters must meet the following conditions	▪ The pressure values for "Empty pressure" and "Full pressure" must be within the sensor measuring range. → following graphic, F + G. ▪ The turndown, which is determined by the difference between the pressure values for "Empty pressure" and "Full pressure", must not be larger than the maximum recommended turndown of 10:1. This equals 10% of the nominal range of the sensor. → following graphic, B + C.
"Level" operating mode, "In pressure" level selection: "Adjust density" (034) Expert → Measurement → Level	▪ Same value as "Process density" (035)

1) "Min. alarm" can also be selected via the DIP switch. In this case the "SW" option is no longer possible.

Example of 500 mbar (7.25 psi) measuring cell

The calibration was performed correctly.



The conditions A, B, C and D are met.

A *Pressure value for 4 mA = "LRL sensor"*
B *"Empty pressure"*
C *"Full pressure"*
D *Pressure value for 20 mA = "URL sensor"*
E *Measuring range of the sensor*
F *"Full calib."*
G *"Empty calib."*
H *Set span*

Y *Height in m (ft)*
X *Pressure in mbar (psi)*

- 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.
- A sensor trim should only be performed by the Endress+Hauser service. All parameters, except the parameters for a sensor trim, are reset with the "7864" reset code.
  Therefore, the parameters have to be checked prior to locking.

Checks

⚠ CAUTION

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

- ▸ After entering all the parameters, check the safety function prior to the locking sequence! E.g. by means of the "Simulation mode" parameter or by approaching the limit pressure (→ Operating Instructions BA00382P/00/EN, "Simulation" parameter description).
- ▸ The entire safety function shall be checked after each change to the device as part of a safety function, e.g. a change to the orientation of the device or the configuration.

Locking

⚠ 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 (→ Operating Instructions BA00382P/00/EN, section "Locking/unlocking operation").

- 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.
- The alarm current setting via DIP switch 3 (alarm current: SW/Alarm min) is independent of software locking and/or hardware locking. Therefore the switch setting must be used as per the factory setting: SW.
- Only for Deltabar:
  - The output characteristic settings vis DIP switch 4 (Lin./SQRT: SW/Square root) is independent of software locking and/or hardware locking. Therefore the switch setting must be used as per the factory setting: SW.
  - The high-pressure side setting via DIP switch 5 (switch P1/P2: SW/P2-High) is independent of software locking and/or hardware locking. Therefore the switch setting must be used as per the factory setting: SW.

Maintenance

Please refer to the relevant Operating Instructions ("Supplementary device documentation", → 11) for instructions on maintenance and recalibration.
Alternative monitoring measures must be taken to ensure process safety during configuration, proof-testing and maintenance work on the device.

Proof-test

Proof-test

Safety functions must be tested at appropriate intervals to ensure that they are functioning correctly and are safe. The intervals have to be specified by the operator ("Proof-test interval" graphic, → 16). The test must be carried out in such a way that it is proven that the protection equipment functions perfectly in interaction with all the components.

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

Process for proof-testing

Test sequence A

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", → 22).
3. Set the current output of the transmitter to HI alarm via a HART command or by means of the on-site 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 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 on-site display and check whether the analog current signal reaches this value.
   - e.g. set the "Output fail mode" 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 recurrent test has been carried out, the results must be documented and stored in a suitable manner.

Test sequence B

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

1. Perform steps 1 to 4 outlined under recurrent 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 BA00382P/00/EN, parameter descriptions "Set LRV" and "Get LRV".
     For the 20 mA value, → Operating Instructions BA00382P/00/EN, parameter descriptions "Set URV" and "Get URV".
   - 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.

NOTICE

Regarding step 2 of test sequence B:
After this procedure, the current value is output correctly. The value displayed, e.g. on the on-site 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.

Repairs

Repairs

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 anybody 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
Display module	EA00015P/00/A2	Proof-test; test sequence A Proof-test; test sequence B (alternative)
Cover	EA01034F/00/A2	
	KA00620F/00/A2	
Set of gasket	EA00017P/00A2	
	EA01062F/00/A2	
	KA00620/00/A2	
Electronic[1)]	EA00016P/00/A2	
Flange	EA00017P/00/A2	
Housing filter	EA01062F/00/A2	
Bracket for the display module		
Cable	KA00671P/00/A2	
Cable entry		
Cable gland		
Protection cap of the diaphragm	EA01062F/00/A2	
Mounting kit CONTITE Sensor	EA00027P/00/A2	
	EA00033P/00/A2	
Mounting kit for the flange	EA00017P/00/A2	
O-ring	EA01020P/00/A2	
Profile seal	KA00096F/00/A3	
Sensor[1)]	EA00027P/00/A2	
Connector	KA00554P/00/A2	
Overpressure plug		

1) Proof-test 2 is applied.

The replaced components must be sent to Endress+Hauser for the purpose of fault analysis, if the device has been operated in protective system. Once the components have been replaced, a proof-test must be carried out as per test sequence A (→ 23) or test sequence B (→ 23).

In the event of failure of a SIL-labeled Endress+Hauser device, which has been operated in a protection function, the "Declaration of Contamination and Cleaning" with the corresponding note "Used as SIL device in protection system" must be enclosed when the defective device is returned. Please refer to the section "Return" in the Operating Instructions ("Supplementary device documentation", → 11).

If the device is equipped with new software, a reset must be carried out following download, and the device must be tested to ensure that it is functioning correctly and also recalibrated.

Certificate

TÜV NORD

ZERTIFIKAT
CERTIFICATE

Hiermit wird bescheinigt, dass das unten beschriebene Produkt der Firma
This certifies that the product mentioned below from company

Endress+Hauser GmbH+Co.KG
Hauptstraße 1
79689 Maulburg
Germany

die Anforderungen der folgenden Prüfunterlage(n) erfüllt.
fulfills the requirements of the following test regulations.

Geprüft nach *Tested in accordance with*	**IEC 61508:2010 (Parts 1-7) –SIL 2** **IEC 61511-1:2003 + Corr. 2004, Chapter 11.4**
Beschreibung des Produktes *(Details s. Anlage 1)* Description of product *(Details see Annex 1)*	**Drucktransmitter** *Pressure Transmitter*
Typenbezeichnung *Type Designation*	**Cerabar M PMC51, PMP51/55** **Deltabar M PMD55** **Deltapilot M FMB50/51/52/53**
Bemerkung *Remark*	**siehe Anhang 1** *see Annex 1*

Dieses Zertifikat bescheinigt das Ergebnis der Prüfung an dem vorgestellten Prüfgegenstand. Eine allgemein gültige Aussage über die Qualität der Produkte aus der laufenden Fertigung kann hieraus nicht abgeleitet werden.
This certifies the result of the examination of the product sample submitted by the manufacturer. A general statement concerning the quality of the products from the series manufacture cannot be derived there from.

Registrier-Nr. / *Registered No.* 44 799 13761310
Prüfbericht Nr. / *Test Report No.* 3517 5114
Aktenzeichen / *File reference* 8000456622

Gültigkeit / Validity
von / *from* 2016-08-23
bis / *until* 2021-08-22

Zertifizierungsstelle der
TÜV NORD CERT GmbH Essen

Essen, 2016-08-09

TÜV NORD CERT GmbH Langemarckstraße 20 45141 Essen www.tuev-nord-cert.de technology@tuev-nord.de

Bitte beachten Sie auch die umseitigen Hinweise
Please also pay attention to the information stated overleaf

TUEV_Nord_P1

ANLAGE
ANNEX

Anlage 1, Seite 1 von 1
Annex 1, page 1 of 1

zum Zertifikat Registrier-Nr. / *to Certificate Registration No.* 44 799 13761310

Allgemeine Angaben *General Information*	**Siehe auch Seite 1 des Zertifikats** *See also page 1 of the certificate*
Produktbeschreibung: *Product description:*	**Drucktransmitter** *Pressure Transmitter*
Typbezeichnung: *Type designation:*	**Cerabar M PMC51, PMP51/55** **Deltabar M PMD55** **Deltapilot M FMB50/51/52/53**
Technische Daten: *Technical data:*	**Rated voltage:** 11.5 ... 45 V **Rated current:** max. 23 mA **IP rating:** IP66/68 **Temperature:** -40 °C ... 85 °C

Sicherheitskennwerte:
Safety related data:

Safety related data according to IEC 61508
The given values are only valid for an ambient temperature of 40 °C. Hints regarding the calculation of values at ambient temperatures > 40 °C are given in the safety manual.

Device	SFF [%]	PFD_{avg} [T_1=1 a]	PFH [1/h]	SIL
Cerabar M PMC51	85,9	$5,0 \times 10^{-4}$	$1,1 \times 10^{-7}$	2
Cerabar M PMC51 Hygiene	86,1	$5,0 \times 10^{-4}$	$1,1 \times 10^{-7}$	2
Cerabar M PMP51/55	86,7	$4,3 \times 10^{-4}$	$9,9 \times 10^{-8}$	2
Deltabar M PMD55	80,1	$5,6 \times 10^{-4}$	$1,3 \times 10^{-7}$	2
Deltapilot M FMB50/51/52/53	86,6	$4,3 \times 10^{-4}$	$9,9 \times 10^{-8}$	2
Deltapilot M FMB50/51/52/53	79,4	$1,0 \times 10^{-3}$	$2,3 \times 10^{-7}$	2

Zertifizierungsstelle der
TÜV NORD CERT GmbH Essen

Essen, 2016-08-09

TÜV NORD CERT GmbH Langemarckstraße 20 45141 Essen www.tuev-nord-cert.de technology@tuev-nord.de

TUEV_Nord_P2

Form for device configuration - Pressure

Operation via: Handheld terminal ☐ FieldCare ☐ On-Site display ☐
Extended order code: _____ Serial number: _____
Measuring point: _____ Upper range limit (URL Sensor): _____

Parameter name	Direct access	Menu path: Expert	Factory setting	Permitted settings	Specified value	Read-out actual value	Checked
Measuring mode	005	→ Measurement	as ordered		Pressure		
Calib. offset	008	→ Measurement → Basic setup	0.0	1)			
Damping value 2)	017		2.0 s or as ordered	0 to 999			
Press. eng. unit	125		mbar / bar or as ordered				
Set LRV	013	→ Measurement → Pressure	0 mbar / bar or as ordered	1)			
Set URV	014		Upper range limit or as ordered	1)			
High pressure side 2), 3)	006		P1 High	P1 High	P1 High		
Alarm behav. P	050	→ Output → Current output	Warning	Alarm	Alarm		
Outout fail mode 2)	190		Max. Alarm	Max. alarm Min. alarm			
High alarm curr.	052		22 mA	22 mA			
Set min. current	053		< 3.8 mA	< 3.8 mA			
Startcurrent	134		12 mA	12 mA			
Current mode	144	→ Communication → HART config.	Signaling	Signaling			
Bus address	145		0	0			
After locking: Config. counter	100	→ Diagnosis					
Simulation mode	112	→ Diagnosis → Simulation	None	None			

1) Within sensor range.

2) Observe position of the DIP switch.

3) Only present in Deltabar.

Company: _____ Date: _____ Signature: _____

Form for device configuration - Level

Operation via: Handheld terminal ☐ FieldCare ☐ On-Site display ☐
Extended order code: _____ Serial number: _____
Measuring point: _____ Upper range limit (URL Sensor): _____

Parameter name	Direct access	Menu path: Expert	Factory setting	Permitted settings	Specified value	Read-out actual value	Checked
Measuring mode	005	→ Measurement	as ordered		Level		
Calib. offset	008	→ Measurement → Basic setup	0.0	1)			
Damping value 2)	017		2.0 s or as ordered	0 to 999 s			
Press. eng. unit	125		mbar / bar or as ordered				
High pressure side 2), 3)	006		P1 High	P1 High	P1 High		
Level selection	024	→ Measurement → Level	In pressure	in Druck			
Empty calib.	028 / 011		0.0% or as ordered				
Empty pressure	029		0.0 or as ordered	1)			
Full calib.	031 / 012		100.0% or as ordered				
Full pressure	032		Upper range limit or as ordered	1)			
Adjust density	034		1.0 g/cm³	= Process density (035)			
Process density	035		1.0 g/cm³	= Adjust density (034)			
Output unit	025		% or as ordered				
Lin. mode	037	→ Measurement → Linearization	Linear	Linear			
Alarm behav. P	050	→ Output → Current output	Warning	Alarm	Alarm		
Output fail mode 2)	190		Max. alarm	Max. alarm / Min. alarm			
High alarm curr.	052		22 mA	22 mA			
Set min. current	053		< 3.8 mA	< 3.8 mA			
Set LRV	166		0.0% or as ordered				
Set URV	167		100.0% or as ordered				
Startcurrent	134		12 mA	12 mA			
Current mode	144	→ Communication → HART config.	Signaling	Signaling			
Bus address	145		0	0			
after locking: Config. counter	100	→ Diagnosis					
Simulation mode	112	→ Diagnosis → Simulation	None	None			

1) Within sensor range.

2) Observe position of the DIP switch.

3) Only available for Deltabar.

Company: _____ Date: _____ Signature: _____

Form for device configuration - Flow

Operation via: Handheld terminal ☐ FieldCare ☐ On-Site display ☐
Extended order code: _____ Serial number: _____
Measuring point: _____ Upper range limit (URL Sensor): _____

Parameter name	Direct access	Menu path: Expert	Factory setting	Permitted settings	Specified value	Read-out actual value	Checked
Measuring mode	005	→ Measurement	as ordered		Flow		
Calib. offset	192 / 008	→ Measurement → Basic setup	0.0	1)			
Dampin value 2)	017		2.0 s or as ordered	0 to 999 s			
Press. eng. unit	125		mbar / bar or as ordered				
High pressure side 2), 3)	006		P1 High	P1 High	P1 High		
Flow type	044	→ Measurement → Flow	Volume process cond. or as ordered				
Mass flow unit 4)	045		kg/s				
Norm. flow unit 4)	046		Nm^3/s				
Std. flow unit. 4)	047		Sm^3/s				
Flow unit 4)	048		m^3/h				
Max. flow	009		3600 m^3/h or as ordered				
Max. pressure flow	010		Upper range limit or as ordered	1)			
Set low-flow cut-off	049		5% or as ordered	0 to 50% of Max. flow			
Alarm behav. P	050	→ Output current → Current output	Warning	Alarm	Alarm		
Output fail mode 2)	190		Max. alarm	Max. alarm Min. alarm			
High alarm curr.	052		22 mA	22 mA			
Set min. current	053		< 3.8 mA	< 3.8 mA			
Linear / Sqroot 2), 3)	055		Square root or as ordered				
Set LRV 5)	056		0.0 or as ordered				
Set URV 5)	057		Max. flow or as ordered				
Curent mode	144	→ Communica-tion → HART Config.	Signaling	Signaling			
Bus address	145		0	0			
after locking: Config. counter	100	→ Diagnosis					
Simulation mode	112	→ Diagnosis → Simulation	None	None			

1) Within sensor range.

2) Observe position of the DIP switch.

3)Only available for Deltabar.

4) Only one value can be entered. Which one this is, is dependent on the "Flow type (044)" parameter.

5) Linear / Sqroot. = Square root

Company: _____ Date: _____ Signature: _____

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