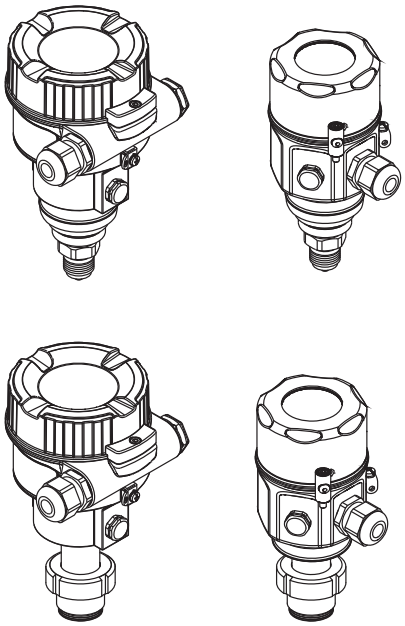
Pressure Transmitter LHC-M51, PPC-M51, LHCR-51, LHCS-51

Process Pressure
Hydrostatic



SIL2

Application

Operating minimum, maximum and range monitoring of gases, vapors 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 SIL2
  - 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

With regard to the supply of products, the current issue of the following document is applicable: The General Terms of Delivery for Products and Services of the Electrical Industry, published by the Central Association of the Electrical Industry (Zentralverband Elektrotechnik und Elektroindustrie (ZVEI) e.V.) in its most recent version as well as the supplementary clause: "Expanded reservation of proprietorship".

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SIL Declaration of Conformity

SIL declaration of conformity / *SIL-Konformitätserklärung* **en/de**

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No. / *Nr.*: MDEC-1139
Date / *Datum*: 2013-11-28

PEPPERL+FUCHS

SIL Declaration of Conformity / *SIL Konformitätserklärung*

We, Pepperl+Fuchs GmbH declare under our sole responsibility that the products listed below are is suitable for the use in safety-instrumented systems according to IEC 61508 Edition2.0/IEC 61511, if the functional safety manual and the safety characteristic values are observed.

Die Pepperl+Fuchs GmbH erklärt hiermit in alleiniger Verantwortung, dass die unten gelisteten Produkte für den Einsatz in Schutzeinrichtungen der IEC 61508 Edition 2.0/IEC 61511 geeignet ist, wenn das Handbuch zur Funktionalen Sicherheit und die Sicherheitskennwerte beachtet werden.

Products / *Produkte*

Product / *Produkt*	Item number / Teilenummer	Description / *Beschreibung*
LHC-M51	T163049	Pressure Transmitter / Drucktransmitter (4 – 20 mA HART)
PPC-M51	T163050	Pressure Transmitter / Drucktransmitter (4 – 20 mA HART)
LHCR-51	T163862	Pressure Transmitter Rod Version / Drucktransmitter Stabversion (4 – 20 mA HART)
LHCS-51	T163865	Pressure Transmitter Cable Version / Drucktransmitter Seilversion (4 – 20 mA HART)

Safety Characteristic Values / *Sicherheitskennwerte*

Product / *Produkt*	LHC-M51	PPC-M51	LHCR-51 / LHCS-51
Functional safety manual / Handbuch zur funktionalen Sicherheit	SD00347O		
Recommended proof test interval / Empfohlenes Intervall für Wiederholungsprüfungen	1 year/Jahr		
SIL [4]	2		
HFT	0		
Device Type / Gerätetyp	B		
Safety function / Sicherheitsfunktion	MIN, MAX, Bereich / Range		
$MTBF_{tot}$ [3]	139 years/Jahre	129 years/Jahre	95 years/Jahre
SFF	86.7%	85.9%	79.4%

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Safety Characteristic Values (cont'd) / *Sicherheitskennwerte (Forts.)*

Product / *Produkt*	LHC-M51	PPC-M51	LHCR-51 / LHCS-51
PFD $_{avg}$ (1 Jahr / year) [1]	4.3 x 10^{-4}	5.0 x 10^{-4}	1.0 x 10^{-3}
PFH	9.9 x 10^{-8} 1/h	1.1 x 10^{-7} 1/h	2.3 x 10^{-7} 1/h
λsd [2]	194 FIT	193 FIT	292 FIT
λsu [2]	334 FIT	412 FIT	466 FIT
λdd [2]	120 FIT	92 FIT	138 FIT
λdu [2]	99 FIT	114 FIT	231 FIT

[1] The values comply with SIL 2 according to ISA S84.01. PFD values for other proof test intervals see Functional Safety Manual. / Die Werte entsprechen SIL 2 nach ISA S84.01. PFD - Werte für andere Wiederholungsprüfintervalle siehe Handbuch zur Funktionalen Sicherheit.
[2] According to Siemens SN 29500 / Gemäß Siemens SN 29500.
[3] According to Siemens SN 29500, including faults outside the safety function. / Gemäß Siemens SN 29500, einschließlich Fehlern, die außerhalb der Sicherheitsfunktion liegen.
[4] Considerations according to IEC 61511-1 clause11.4.4. / Betrachtung gemäß IEC 61511-1 Abschnitt11.4.4.

This Declaration of Conformity is only valid in connection with the valid datasheet of Pepperl+Fuchs, the valid instruction of Pepperl+Fuchs and the 'Handbook for functional safety'.
Diese Konformitätserklärung gilt nur in Zusammenhang mit dem gültigen Pepperl+Fuchs Datenblatt, der gültigen Pepperl+Fuchs Betriebsanleitung und dem ‚Handbuch zur Funktionalen Sicherheit'.

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

Signatures / *Unterschriften*

Mannheim, 2013-11-28

ppa. Lutz Liebers
Vice President Sales

i.V. Michael Kindermann
Functional Safety Manager

MDEC-1139 / 2013-11-28

2/2

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PEPPERL+FUCHS

Introduction

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

Symbols Used

Safety symbols

Symbol	Meaning
DANGER P0011189-EN	**DANGER!** This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.
WARNING P0011190-EN	**WARNING!** This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.
CAUTION P0011191-EN	**CAUTION!** This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.
NOTICE P0011192-EN	**NOTE!** This symbol contains information on procedures and other facts which do not result in personal injury.

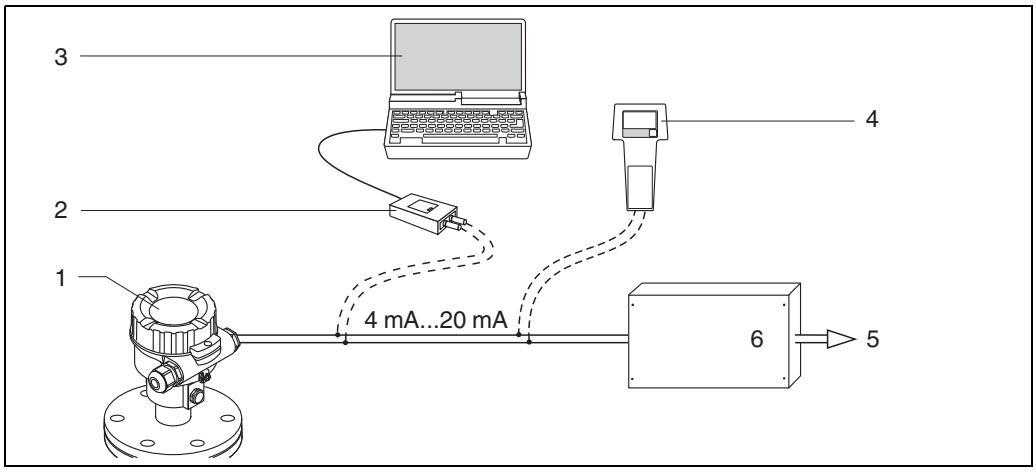
Symbols for certain types of information

Symbol	Meaning
P0011193	**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 Modem
3 Computer with operating program, e. g. **PACT*ware*™**
4 HART handheld terminal
5 Actuator
6 Logic unit, e. g. PLC, trip amplifier, ...

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" or "Level" operating modes has been overshot or undershot.
- A range to be monitored for the "Pressure" or "Level" 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

LHC-M51, PPC-M51

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)

LHCR-51, LHCS-51

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 (page 11).

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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:

PPC-M51

Designation	Version
Approval	all
Output	IH (4 mA to 20 mA SMART electronics, HART protocol)
Display; Operation	all
Housing	all
Electrical Connection	all
Sensor Range	all
Reference Accuracy	all
Calibration; Unit	all
Process Connection	all
Seal	all
Service	all
Other Approvals	H (SIL)
Separate Housing	not permitted
Accessory Mounted	not permitted

LHC-M51

Designation	Version
Approval	all
Output	IH (4 mA to 20 mA SMART electronics, HART protocol)
Display; Operation	all
Housing	all
Electrical Connection	all
Sensor Range	all
Reference Accuracy	all
Calibration; Unit	all
Process Connection	all
Membrane Material	all, except A (rhodium > gold > 316L)
Fill Fluid	all
Service	all
Other Approvals	H (SIL)
Separate Housing	not permitted
Accessory Mounted	not permitted

LHCR-51, LHCS-51

Designation	Version
Approval	all
Output	H (4 mA to 20 mA SMART electronics, HART protocol)
Display; Operation	all
Housing	all
Electrical Connection	all
Sensor Range	all
Reference Accuracy	all
Calibration; Unit	all
Probe Connection	all
Process Connection	all
Membrane Material	all, except 5 (rhodium > gold > AlloyC), 6 (gold > platinum > AlloyC)
Fill Fluid	all
Seal	all
Service	all, except IB
Other Approvals	H (SIL)
Separate Housing	not permitted
Accessory Mounted	not permitted

The following controls are permitted for devices without an on-site display that are to be used in process control protection equipment:

- DTM, e. g. can be operated with the **PACT*ware*™** operating program or
- Handheld terminal.

⚠ 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 systems, 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 has to be observed (page 11).

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Supplementary Device Documentation

Documentation	Contents	Comment
Technical Information TI00436O (PPC-M51, LHC-M51) TI00437O (LHCR-51, LHCS-51)	• Technical data	• The documentation is supplied with the device. • The documentation is also available on the Internet. see www.pepperl-fuchs.com.
Operating Instructions BA00382O (PPC-M51, LHC-M51, LHCR-51, LHCS-51)	• Identification • Installation • Wiring • Operation • Commissioning • Maintenance • Troubleshooting • Appendix	• The documentation is supplied with the device. • The documentation is also available on the Internet. see www.pepperl-fuchs.com.
Brief Operating Instructions KA01030O (PPC-M51, LHC-M51) KA01033O (LHCR-51, LHCS-51)	• Installation • Wiring • Operation • Commissioning	• The documentation is provided with the device. • The documentation is also available on the Internet. see www.pepperl-fuchs.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 (SI, 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 page 14.

The measuring system's reaction time is ≤ 5 s.

Safety-related signal

The safety-related signal is the 4 mA to 20 mA analog output signal.

All safety measures refer to this signal exclusively. The device additionally communicates via HART and contains all HART features with additional diagnostics information.

NOTICE

During the following activities the transmitter outputs 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 mA 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.
- The accuracy of the 4 mA to 20 mA safety-related output signal is ±2 %.
- Device start-up time: after device start-up, the safety functions are available after a 5-second initialization period.
- 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.

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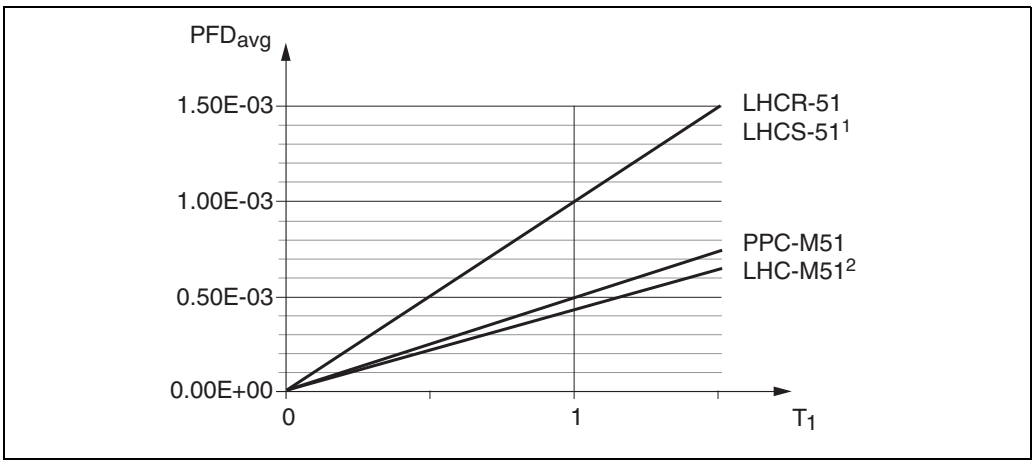
Functional Safety Figures

The following tables show specific indicators for functional safety.

Characteristic as per IEC 61508	PPC-M51	LHC-M51	LHCR-51, LHCS-51
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 %	86.7 %	79.4 %
λ_{sd}	193 FIT	194 FIT	292 FIT
λ_{su}	412 FIT	334 FIT	466 FIT
λ_{dd}	92 FIT	120 FIT	138 FIT
λ_{du}	114 FIT	99 FIT	231 FIT
λ_{tot} [1]	883 FIT	819 FIT	1204 FIT
PFD_{avg} for T_1 = 1 year [2]	5.0×10^{-4}	4.3×10^{-4}	1.0×10^{-3}
PFH [6]	1.1×10^{-7} 1/h	9.9×10^{-8} 1/h	2.3×10^{-7} 1/h
MTBF [1]	129 years	139 years	95 years
Diagnostic test interval [3]	5 min (RAM, ROM, ...), 1 s (Measurement)		
Fault reaction time [4]	5 min (RAM, ROM, …), 10 s (Measurement)		
Settling time [5]	see Technical Information TI00436O		TI00437O
	"Dynamic behavior: current output " section		

1 According to Siemens SN 29500, including faults outside the safety function.
2 Where the average temperature when in continuous use 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.
6 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}.



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 mA 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.

NOTICE 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 BA00382O.

Installation

Installation, wiring and commissioning

Installation, wiring and commissioning of the device is described in the Operating Instructions BA00382O.

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]	Current value in case of error
Min. alarm (LO alarm)	3.6 mA
Max. alarm (HI alarm) [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 mA 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)

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Procedure for device configuration

1. Reset the parameters to their factory setting: with the "7864" reset code (see Operating Instructions BA00382O, chapter "Resetting to factory settings (reset)").

   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 (page 16, "Notice")
   - 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 see Operating Instructions BA00382O.
   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" see page 20 or
   - for "Level" see page 21.

   Additionally, the allowed parameter settings given in the following table must be taken into account.
3. Check safety functions if necessary (page 16, "Checks")
4. Read out the specified parameters and compare against the log.
5. Lock the device via software and/or hardware for the safe measuring mode (see Operating Instructions BA00382O, chapter: "Locking/unlocking operation").
6. Read out and log the "Config. counter" parameter. (Menu path: Expert → Diagnosis → Config. counter)

Permitted parameter setting

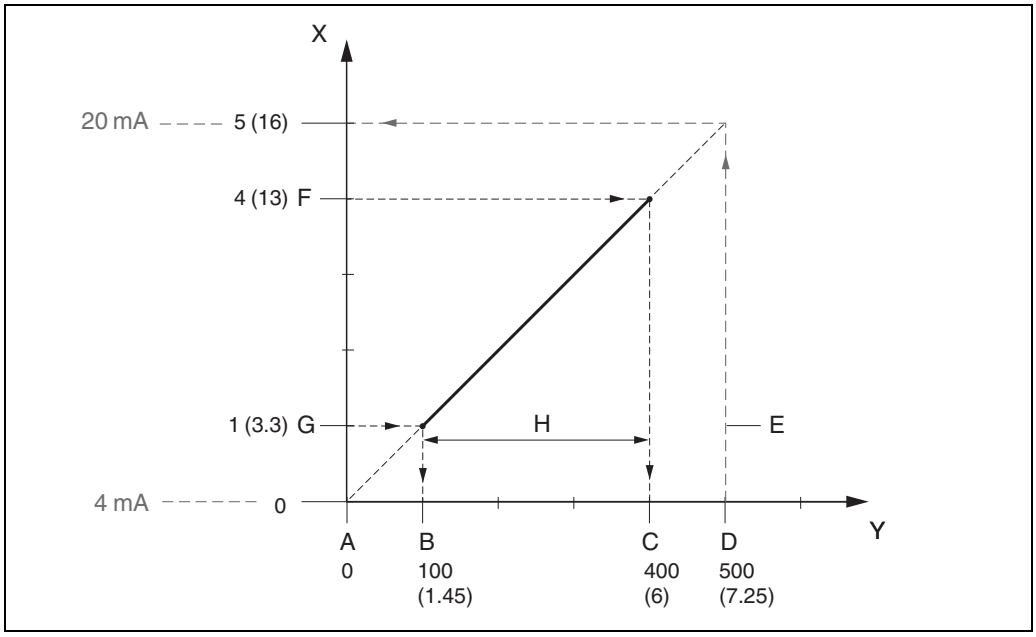
Only certain settings are possible for some parameters. If a setting that is not permitted has been selected for one of these parameters, safe operation is no longer guaranteed.

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. see 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. see 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
X	Height in m (ft)
Y	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 Pepperl+Fuchs 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 (see Operating Instructions BA00382O, "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 (see Operating Instructions BA00382O, chapter: "Locking/unlocking operation").

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- 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.

Maintenance

Please refer to the relevant Operating Instructions (see page 11, "Supplementary device documentation") 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

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", see page 13)

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", see page 16.
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 A.
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: see Operating Instructions, parameter descriptions "Set LRV" and "Get LRV".
   For the 20 mA value: see Operating Instructions, 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 Pepperl+Fuchs Service.
3. Perform steps 5 to 7 outlined under proof-test A.

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 Pepperl+Fuchs Service.

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Repairs

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

Repairs on the devices must always be carried out by Pepperl+Fuchs. 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	Checking the device after repair
Display module	Proof-test; test sequence A Proof-test; test sequence B (alternative)
Cover	
Set of gasket	
Electronic [1]	
Flange	
Housing filter	
Bracket for the display module	
Cable	
Cable entry	
Cable gland	
Protection cap of the diaphragm	
Mounting kit sensor	
Mounting kit for the flange	
O-Ring	
Profile seal	
Sensor [1]	
Connector	
Overpressure plug	

[1] Proof-test 2 is applied.

The replaced components must be sent to Pepperl+Fuchs 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 (page 18) or test sequence B (page 18).

In the event of failure of a SIL-labeled Pepperl+Fuchs 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", see page 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.

Form for Device Configuration – Pressure

Operation via: Handheld terminal ☐ PACTware ☐ On-Site display ☐
Extended or 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 [2]	017		2.0 s or as ordered	0 ... 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]			
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			
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.

Company: _____ Date: _____ Signature: _____

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Form for Device Configuration – Level

Operation via: Handheld terminal ☐ PACTware ☐ On-Site display ☐
Extended or 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 [2]	017		2.0 s or as ordered	0 s... 999 s			
Press. eng. unit	125		mbar/bar or as ordered				
Level selection	024	→ Measurement → Level	In pressure	In pressure			
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 ordfered				
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.

Company: _____ Date: _____ Signature: _____

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