



Level



Pressure



Flow



Temperature

Liquid  
Analysis

Registration

Systems  
Components

Services

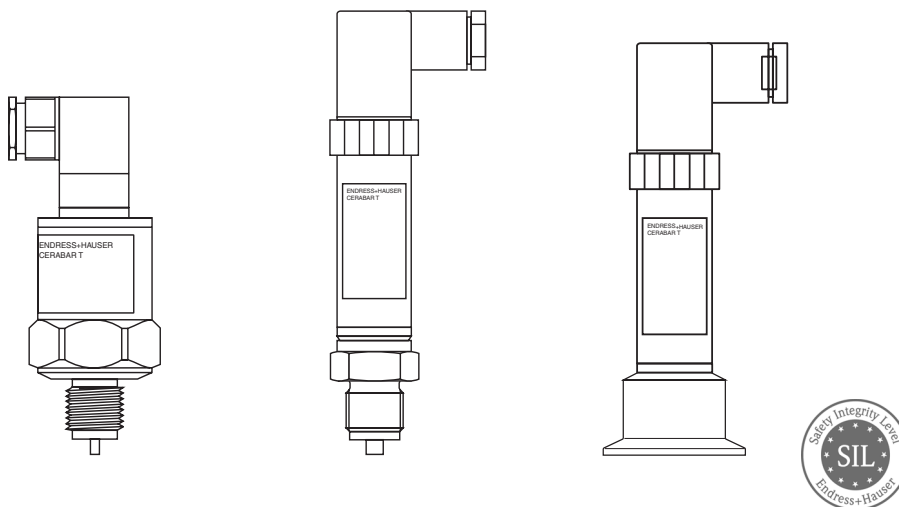


Solutions

## Functional Safety Manual

# Cerabar T PMP131, PMC131, PMP135

Pressure Transducer with 4...20 mA output signal



### Application

Pressure measurements (e.g. limit pressure monitoring) to satisfy particular safety systems requirements as per IEC 61508/ IEC 61511-1.

The measuring device fulfils the requirements concerning

- Functional safety as per IEC 61508/IEC 61511-1
- Explosion protection (depending on the version)
- Electromagnetic compatibility as per EN 61326

### Your benefits

- Used for limit pressure monitoring up to SIL 2, independently evaluated (Functional Assessment) by TÜV Rheinland as per IEC 61508/ IEC 61511-1
- Continuous measurement
- Easy commissioning

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# SIL declaration of conformity

## SIL-Konformitätserklärung

SIL-03004c/00/a2

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**



Level



Pressure



Flow



Temperature



Liquid Analysis



Registration



Systems Components



Services



Solutions

erklärt als Hersteller, dass die Drucktransducer  
declares as manufacturer, that the pressure transducer

### Cerabar T PMP131, PMP135, PMC131 (4...20 mA)

für den Einsatz in Schutzeinrichtungen entsprechend der 61511-1 geeignet ist, wenn die  
Sicherheitshinweise und nachfolgende Parameter beachtet werden:


is suitable for the use in safety-instrumented systems according to IEC 61511-1, if the safety  
instructions and following parameters are observed:

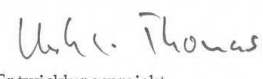
Gerät/Product	Cerabar T PMP131 / PMP135	Cerabar T PMC131 <sup>4)</sup>
SIL	2	
Prüfintervall/Proof test interval	≤ 1 Jahr/year	
Gerätetyp/Device type	A	B
HFT <sup>1)</sup>	0 (einkanale Verwendung/single channel use)	
SFF	81,5 %	89,7 %
PFD <sub>av</sub> <sup>2)</sup>	2,58 x 10 <sup>-5</sup>	1,10 x 10 <sup>-4</sup>
λ <sub>du</sub>	5,9 FIT	25,2 FIT
λ <sub>dd</sub> + λ <sub>safe</sub>	25,9 FIT	220,7 FIT
MTBF <sub>tot</sub> <sup>3)</sup>	> 150 Jahre/years	
<sup>1)</sup> gemäß Absatz/according to clause 11.4.4 of IEC 61511-1 <sup>2)</sup> die Werte entsprechen SIL 2 nach ISA S84.01/ the values comply with SIL2 according to ISA S84.01. <sup>3)</sup> gemäß Siemens SN29500, einschließlich Fehlern, die außerhalb der Sicherheitsfunktion liegen according to Siemens SN29500, including faults outside the safety function <sup>4)</sup> Gültigkeit der SIL-Bewertung: Auslieferdatum September 1997 bis März 2006 validity of the SIL-evaluation: for devices delivered from september 1997 to march 2006		

Das Gerät einschließlich Änderungsprozess wurde auf Basis der Betriebsbewährung bewertet.  
The device including the modification process was assessed on the basis of prior use.

Maulburg, 10.10.2006

Endress+Hauser GmbH+Co. KG

i.V.   
Leitung Zertifizierungsstelle  
Management Certification Department

i.A.   
Leitung Entwicklungsprojekt  
Management R&D Project

**Endress+Hauser**   
People for Process Automation

## General



### Note!

For general information about SIL please refer to: [www.de.endress.com/sil](http://www.de.endress.com/sil) and in the Competence Brochure CP002Z: "Safety in the Process Industry – reducing risks with SIL"

## Safety function with Cerabar T

### Sicherheitsfunktion zur Grenzdrucküberwachung

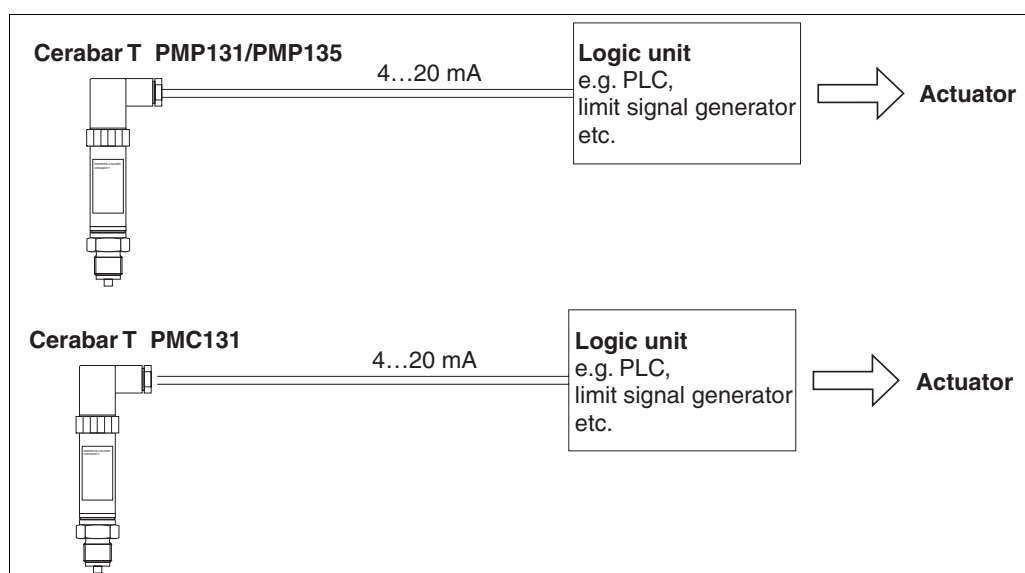


Fig. 2: Safety function (e.g. for limit pressure monitoring) with Cerabar T as sub-system

The Cerabar T transmitter generates an analogue signal (4...20 mA) proportional to the pressure. The analogue signal is fed to a downstream logic unit, such as a PLC or limit signal generator, and there it is monitored to determine whether it exceeds a maximum value. In order to monitor for faults, the logic unit must be able to detect both HI-alarms > 20 mA and LO-alarms < 3.6 mA.

### Safety function data

#### Caution!

The data for the safety functions are listed in the "Safety-related parameters" chapter.

For the rise time of the transmitter see Technical Information TI415P.

#### Note!

MTTR is set at eight hours.

Safety-related systems without a self-locking function must be monitored or set to an otherwise safe state after carrying out the safety function within MTTR.

#### Cerabar T PMC131

The SIL assessment of PMC131 is valid from delivery date September 1997 to March 2006.

#### Cerabar T PMP135

The TÜV certificate is also valid for PMP135 because it is identical in construction to PMP131. They differ only in the process connections.

**Supplementary device documentation PMP131/PMP135**

Depending on the version, the following documentation must be available for the pressure transducer PMP131/PMP135:

Explosion protection/ Certificates	Operating Instructions	Other Ex-Documentation
none	KA103P	none
ATEX II 1/2 G EEx ib IIC T6	KA103P	Safety Instructions XA142P
ATEX II 2 G EEx ib IIC T6	KA103P	Safety Instructions XA142P
ATEX II 3 G EEx nA II T6	KA103P	Safety Instructions XA191P

**Caution!**

- The installation and setting instructions, and the technical limit values must be observed in accordance with the Operating Instructions (KA103P).
- For devices which are used in explosion-hazardous, the supplementary documentation (XA) must also be used in accordance with the table.

**Cerabar T PMP131/PMP135 supplementary documentation**

For further information, see Technical Information TI415P.

**Supplementary device documentation PMC131**

Depending on the version, the following documentation must be available for the pressure transducer PMC131:

Explosion protection/ Certificates	Operating Instructions	Other Ex-Documentation
none	KA 085P	none
ATEX II 3 G EEx nA II T4	KA 085P	Safety Instructions XA 191P

**Caution!**

- The installation and setting instructions, and the technical limit values must be observed in accordance with the Operating Instructions (KA085P).
- For devices which are used in explosion-hazardous, the supplementary documentation (XA) must also be used in accordance with the table.

**Cerabar T PMC131 supplementary documentation**

For further information, see Technical Information TI415P.

## Iterative tests

**Using the Cerabar T for continuous measurements**

The operability of the measuring device must be tested at appropriate time intervals. We recommend carrying out the test at least once a year. It is the responsibility of the user to select the type of check and the intervals in the specified time frame.

## Settings

**Settings**

The zero point can be set for the Cerabar T. If you use the Cerabar T as a sub-system of a safety function, the zero point must not be adjusted during operation.

## Safety-related parameters

### Specific safety-related parameters for Cerabar T

The table displays the specific safety-related parameters for the Cerabar T.

	PMP131/PMP135 (Type A)	PMC131 (Type B)
SIL	SIL 2 as per IEC 61508	SIL 2 as per IEC 61511
HFT	0	0
SFF	81.5 %	89.7 %
$PFD_{av}$	$2.58 \times 10^{-5}$	$1.10 \times 10^{-4}$
TI <sup>1)</sup>	annual	annual

1) Complete function test

### $PFD_{av}$ dependent on selected maintenance interval

The following diagram presents the dependence of the  $PFD_{av}$  on the maintenance interval. The  $PFD_{av}$  increases as the maintenance interval increases.

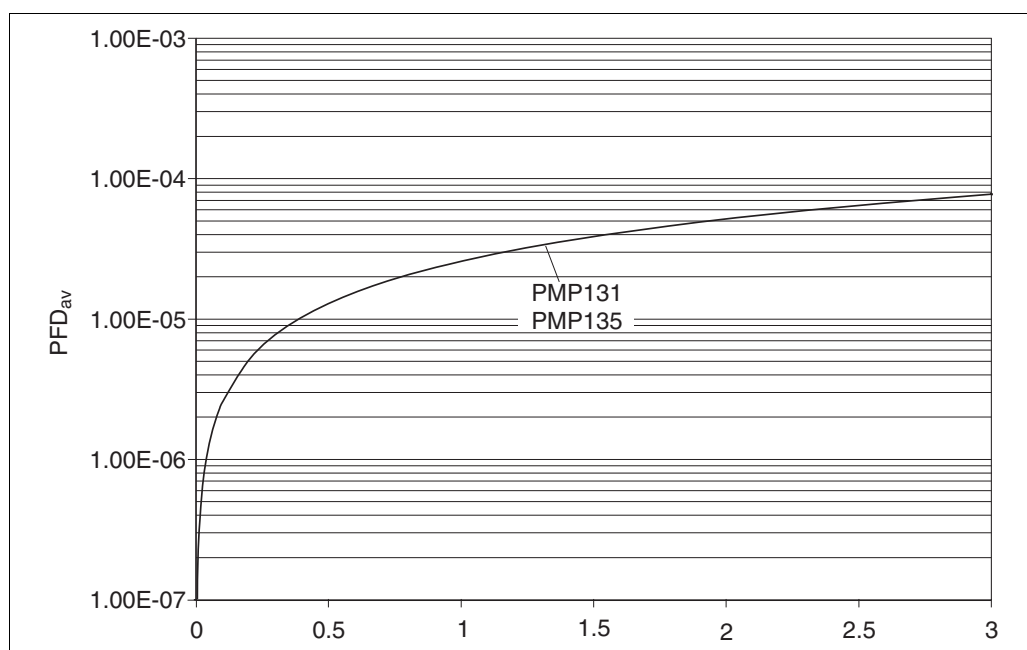



Fig. 4: "Average Probability of Failure on Demand" ( $PFD_{av}$ ) dependent on the selected maintenance interval

### Repair

When device components are replaced, the SIL declaration of conformity becomes invalid. If a SIL-marked device that has been operated in a functional safety application fails, the "Declaration of Hazardous Material and De-Contamination" form containing the appropriate information "Used as a SIL device in a Safety Instrumented System" must be enclosed with the defective device when it is returned.

# TÜV Management Summary



TÜV Rheinland  
Berlin Brandenburg

2003-01-27

**5. Summary**

Based on the submitted manufacturer documents an assessment of safety relevant parameters (failure rates, PFD<sub>av</sub>, HFT and SFF) has been carried out for different pressure sensors, manufactured by the Endress+Hauser company. The assessment, that covers the pressure instruments type Cerabar S, Deltabar S, and Cerabar T, was carried out in compliance with the requirements of IEC 61508 and IEC 61511 (FDIS).

The assessment showed the following results:

**Type A component: Cerabar T PMP131**

The safety relevant parameters PFD<sub>av</sub>, HFT and SFF are in compliance with the corresponding requirements for **SIL 2** according to IEC 61508.

**Type B components: Cerabar S, Deltabar S, Cerabar T PMC131**

The safety relevant parameter PFD<sub>av</sub> is in compliance with the corresponding requirements for **SIL 2** according to IEC 61508.

The safety relevant parameters HFT and SFF are in compliance with the corresponding requirements for **SIL 1** according to IEC 61508.

The safety relevant parameters HFT and SFF are in compliance with the corresponding requirements for **SIL 2** according to IEC 61511(FDIS).

The user should consider, that the hardware fault tolerance of all inspected devices is zero and that a single fault can lead to a dangerous failure.

**NOTES:**


The assessment results described in this report only refer to the safety-related parameters PFD<sub>av</sub>, HFT and SFF according to IEC 61508 and IEC 61511 (FDIS).

This report does not make any statements, that the manufacturer meets all other requirements of the above cited standards for hardware, software, documentation, management of functional safety, verification and validation.

This report does not imply that the examined pressure sensors have been certified for functional safety by the assessor according to IEC 61508 or any other standards.

The pressure sensors are only one part of a complete safety function. It is at the responsibility of the end-user to prepare and to apply an extensive reliability model, that brings out the complete safety function and that meets all requirements of the claimed SIL level according to IEC 61508.


Cologne, 2003-01-27  
AS/Kst. 968 ja-nle

The inspector  
  
Dipl.-Phys. Erich Janoschek

Report-No.: 968/EL 193.00/03

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TÜV Rheinland  
Berlin Brandenburg

2003-01-27

**Automation, Software and Information Technology**

**Test report about the determination of safety-related parameters according to IEC 61508 and IEC 61511 (FDIS) for the Endress+Hauser smart pressure transmitters Cerabar S, smart differential pressure transmitters Deltabar S and pressure transducers Cerabar T**

Report-No.: 968/EL 193.00/03  
Date: 2003-01-27

Report-No.: 968/EL 193.00/03

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**Instruments International**

Endress+Hauser  
Instruments International AG  
Kaegenstrasse 2  
4153 Reinach  
Switzerland

Tel. +41 61 715 81 00  
Fax +41 61 715 25 00  
[www.endress.com](http://www.endress.com)  
[info@ii.endress.com](mailto:info@ii.endress.com)

**Endress+Hauser**   
People for Process Automation