# Functional Safety Manual Cerabar S PMC71

Process pressure and level measurement with 4-20 mA output signal



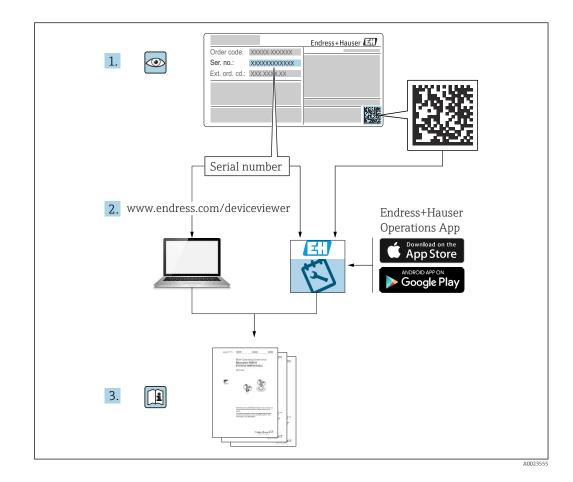
FY01047P/00/EN/01.21

02.00.zz (Device firmware)

71543535 2021-08-02







## Table of contents

1	Decla	ration of Conformity	4
1.1	Safety-	related characteristic values	. 5
2	About	t this document	10
2.1		ent function	10
2.2	5	s used	10
	2.2.1	Safety symbols	10
	2.2.2	Symbols for certain types of	
	- ·	information and graphics	10
2.3		mentary device documentation	11
	2.3.1 2.3.2	Further applicable documents	11 11
	2.3.3	Technical Information (TI) Operating Instructions (BA)	11
	2.3.5	Brief Operating Instructions (KA)	11
	2.3.5	Certificate	11
	2.2.2		11
3		n	11
3.1	Permit	ted device types	11
	3.1.1	Order codes	12
3.2		cation marking	12
3.3		function	12
	3.3.1	Safety-related output signal	13
	3.3.2	Redundant configuration of multiple	10
3.4	Pagia	sensors	13
J.4		tions	13
	3.4.1	Safety-related failures according to	1)
	21112	IEC / EN 61508	14
	3.4.2	Safety measured error	14
	3.4.3	Restrictions for safety-related	
		operation	15
3.5		ous undetected failures in this	
		0	15
3.6	Useful	lifetime of electric components	15
4	Comn	nissioning (installation and	
	config	juration)	15
4.1		ements for personnel	15
4.2		tion	16
4.3		ssioning	16
4.4	-	ion	16
4.5		configuration for safety-related	10
	4.5.1	tions Calibration of the measuring point	16 16
	4.5.2	51	16
	4.5.3	Locking/unlocking a SIL device	28
4.6		eters and default settings for SIL	20
	mode.	5	29
	4.6.1	"Increased security during parameter	-
		entry" method	29
	4.6.2	"Standard device configuration"	
		method	29
	4.6.3	Permitted parameter settings	29

	4.6.4	Check	30
5	Opera	ation	31
5.1	Device	behavior during power-up	31
5.2		or of device in the event of an alarm	
	and wa	arnings	31
5.3	Alarm	and warning messages	31
	5.3.1	List of alarm and warning messages	31
	5.3.2	Device response in event of	
		overranging	32
6	Proof	testing	33
6.1	Test se	equence A	33
6.2		equence B	34
6.3		ation criterion	34
7	Repai	ir and error handling	34
7.1	Mainte	enance	34
7.2	Repair		35
7.3		cation	35
7.4		missioning	35
7.5	Dispos	al	35
8	Appe	ndix	36
8.1	Structu	are of the measuring system	36
	8.1.1	System components	36
	8.1.2	Description of use as a protective	
		system	36
	8.1.3	Installation conditions	36
0.0	8.1.4	Measurement function	36
8.2		issioning or proof test report	37
	8.2.1	Pressure device parameter configuration form	38
	8.2.2	Level device parameter configuration	50
	0.2.2	form	40
8.3	Param	eter description	42
	8.3.1	Parameter description of the SAFETY	
		CONFIRM. group - "Pressure"	
		measuring mode	42
8.4	Versio	n history	45

## **1** Declaration of Conformity

SIL\_00456\_01.21

Endress + Hauser

## **Declaration of Conformity**

Functional Safety according to IEC 61508 Based on NE 130 Form B.1

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

being the manufacturer, declares that the product

## Cerabar S PMC71

is suitable for the use in safety-instrumented systems according to IEC 61508. The instructions of the corresponding functional safety manual must be followed.

This declaration of compliance is exclusively valid for the listed products and accessories in delivery status.

Maulburg, 07/19/2021 Endress+Hauser SE+Co. KG

i. V. MSS

Marc Schlachter Dept. Man. R&D Devices Pressure Research & Development

i. V.

Manfred Hammer Dept. Man. R&D Quality Management/FSM Research & Development

Template: D050-3\_Declaration of Conformity (SIL).docx, E+H LP Version 2.0 (DWP), Valid from 23.03.2021

## 1.1 Safety-related characteristic values

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

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

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

Depending on the configuration profile selected for the messages, different parameters must be considered when assessing the facility:

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

Parameter profiles A and B depend on the alarm settings and not on the firmware version. For firmware versions up to and including firmware version 02.20.04, message E727 was set, as a rule, to "Alarm" for SIL locking with increased security during parameter entry. With firmware version 02.30.zz and higher, the settings for message E727 remain unchanged.

SIL\_00456\_01.21

## Endress+Hauser 🖽

People for Process Automation

afety-related output signal ault signal	PMC71-x y # ## # ## # E # x = A,E,H,IJ,R,S,U,X,Z,1,2,3,6,7,8 y = A,B,C,D,E PMC71-x y # ## # # # # E x = A,E,H,IJ,R,S,U,X,Z,1,2,3,6,7,8 y = A,B,C,D,E Non Ex, Ex i, Parameter profile A with message E727 (pressure overrange) configured as an alarm				
	420 mA				
	≤ 3,6 mA	; ≥ 21,0 mA			
rocess variable/function	Process pro	essure and level r	neasu	rement	
afety function(s)	MIN, MAX	, RANGE			
evice type acc. to IEC 61508-2	Type A			Type B	
perating mode	Low De	mand Mode	Пн	igh Demand Mode	Continuous Mode
alid hardware version	As of 02.00	0			
alid software version	As of 02.0	y; 02.30.zz recom	nmend	ed	
afety manual	FY01047P				
		FMEDA and ch	nange	valuation parallel to d request acc. to IEC 61	
pe of evaluation				acc. to IEC 61508-2, 3	
heck only <u>one</u> box)				N field data to verify "	
		Evaluation by	FMED	A acc. to IEC 61508-2	for devices w/o softwar
aluation through – report/certificate no.	TÜV SÜD R	ail GmbH Z10 02	20351	0010	
est documents	Developme	Development documents Test reports		Data sheets	
IL - Integrity					
stematic safety integrity				SIL 2 capable	SIL 3 capable
	Single char	nnel use (HFT = 0	0) SIL 2 capable		SIL 3 capable
ardware safety integrity	Multi chan	nel use (HFT $\geq 1$ )	)	SIL 2 capable	SIL 3 capable
MEDA	and the second second	Section and section of			an and the state
fety function	MIN		MAX		RANGE
U <sup>2),3)</sup>	78 FIT		78 FI	T	78 FIT
D 2),3)	375 FIT		50 FI	т	0 FIT
2),3)	394 FIT		394 F	FIT	394 FIT
2),3)	50 FIT		375 F	FIT	425 FIT
F	91 %		91 %	,	91 %
$D_{avg}$ (T <sub>1</sub> = 1 year) <sup>3)</sup> (single channel architecture)	3.4 × 10 <sup>-4</sup>		3.4 ×	10-4	3.4 × 10 <sup>-4</sup>
Ή	7.8 × 10 <sup>-8</sup>	1/h	7.8 × 10 <sup>-8</sup> 1/h		7.8 × 10 <sup>-8</sup> 1/h
°C <sup>4)</sup>	A: 50 % /	B: 99 %	A: 50 % / B: 99 %		A: 50 % / B: 99 %
tal <sup>2,3)</sup>	897 FIT		897 FIT		897 FIT
agnostic test interval <sup>5)</sup>	5 min (RA/ 1 s (Measu	irement)	5 min (RAM,ROM), 1 s (Measurement)		5 min (RAM,ROM), 1 s (Measurement)
ult reaction time <sup>6)</sup>		5 min (RAM,ROM), 10 s (Measurement)		n (RAM,ROM), (Measurement)	5 min (RAM,ROM), 10 s (Measurement)
omments	align barrelle a			and the second second	AND STREET, DIS 1.
eclaration	1.5		-		
Our internal company quality managem	ent system ensur	es information of	n safet	ty-related systematic f	faults which become
evident in the future					
l order codes and order code exclusions are maintained Failure In Time, number of failures per 10 <sup>9</sup> h I for average ambient temperature up to +40 °C (+104 's continuous operation at ambient temperature close to -	F)				

Template: D050-3\_Declaration of Conformity (SIL).docx, E+H LP Version 2.0 (DWP), Valid from 23.03.2021

2/5

Valid hardware versionAs of 02.00Valid software versionAs of 02.0y; 02.30.zz recommendedSafety manualFY01047PType of evaluationComplete HW/SW evaluation parallel to development incl. FMEDA and change request acc. to IEC 61508-2, 3Type of evaluationEvaluation of "proven in use" performance for HW/SW incl. FA and change request acc. to IEC 61508-2, 3(check only one box)Evaluation of HW/SW field data to verify aprior use" acc. to IEC 61501Evaluation of HW/SW field data to verify aprior use" acc. to IEC 61501Evaluation through - report/certificate no.TÜV SÜD Rall GmbH Z10 020351 0010Test documentsDevelopment documentsSystematic safety integritySingle channel use (HFT = 0)Systematic safety integritySingle channel use (HFT = 1)Safety functionMINMaxRANGESafety functionMINMay 23382 FITAge 243182 FITAge 243382 FITAge 2433394 FITAge 2433394 FITAge 2433394 FITAge 243336 × 10-4Seff (T1 = 1 year) 31 (single channel architecture)3.6 × 10-43.6 × 10-43.6 × 10-4PFL- evaluationSin (RAM,ROM),Smin (RAM,ROM), 1 S (Measurement)10 s (Measurement)Jagonostic test interval 59Sin (RAM,ROM), 1 S min (RAM,ROM),Smin (RAM,ROM), 10 s (Measurement)10 s (Measurement)Law 20Sin (RAM,ROM), 10 s (Measurement)Law 20Sin (RAM,ROM),	Device designation and permissible types <sup>1)</sup>	DMC71-M				
Device designation and permissible types <sup>11</sup> PMC71-x'y # ## ## # E       x = A, E, H, J, R, S, U, X, Z, I, Z, S, G, Z = Y, = K, S, Non, EX, EX, I, Parameter profile B with message E727 (pressure overrange) configured as a warning         Safety-related output signal       420 mA         Process variable/function       Process pressure and level measurement         Safety function(s)       MIN, MAX, RANGE         Device type act to IEC 61508-2       Type A         Operating mode       Ø Low Demand Mode         Valid ontrave version       As of 02.00         Valid andware version       As of 02.00         Valid software version       As of 02.00         Valid softwa			v######F#	x=AFHIIRSIIX	7123	678 V=ABC
Safety-related output signal       420 mA         Fault signal       \$ 3,6 mA ; ≥ 21,0 mA         Process variable/function       Process pressure and level measurement         Safety function(s)       MIN, MAX, RANCE         Device type acc. to IEC 61508-2       □ Type A       ☑ Type B         Operating mode       Ø Low Demand Mode       □ High Demand Mode       □ Continuous MU         Valid hardware version       As of 02.00       Valid software version       As of 02.00         Valid software version       As of 02.00, 02.30 zz recommended       Evaluation of proven in use" performance for HW/SW incl. FN and change request acc. to IEC 61508-2, 3         Type of evaluation       Complete HW/SW evaluation parallel to development incl. FMEDA and change request acc. to IEC 61508-2, 3         I       Evaluation of "proven in use" performance for HW/SW incl. FN and change request acc. to IEC 61508-2, 3         I       Evaluation of W/SW incl Ed data to verify prior use" acc. to IEC 61508-2, 1         I       Evaluation of W/SW incl Ed data to verify prior use" acc. to IEC 61508-2, 1         I       Evaluation of W/SW PMEDA acc. to IEC 61508-2, 3         Evaluation through - report/certificate no.       TÜV SÜD Rail GmbH Z10 020351 0010         Test documents       Test reports       Data sheets         SIL 1 Integrity       Sing channel use (HFT = 0)       SiL 2 capable	Safety-related output signal	PMC71-x Non Ex, E	y # ## # ## # # E k i, Parameter pro	x = A, E, H, I, J, R, S, U, X	,Z,1,2,3	,6,7,8 y = A,B,C,
Fault signal       ≤ 3,6 mA; ≥ 21,0 mA         Process variable/function       Process pressure and level measurement         Safety function(s)       MIN, MAX, RANGE         Device type act to IEC 61508-2       Type A         Operating mode       As of 02.00         Valid hardware version       As of 02.00         Valid software version       As of 02.00         Safety manual       FY01047P         Complete HW/SW evaluation parallel to development incl. FMEDA and change request act. to IEC 61508-2.3         Type of evaluation       Complete HW/SW evaluation parallel to development incl. FMEDA and change request act. to IEC 61508-2.3         Image request act. to IEC 61508-2.3       Image request act. to IEC 61508-2.3         Image request act. to IEC 61508-2.3       Image request act. to IEC 61508-2.3         Image request act. to IEC 61508-2.3       Image request act. to IEC 61508-2.3         Image request act. to IEC 61508-2.3       Image request act. to IEC 61508-2.3         Image request act. to IEC 61508-2.3       Image request act. to IEC 61508-2.3         Image request act. to IEC 61508-2.3       Image request act. to IEC 61508-2.3         Image request act. to IEC 61508-2       Image request act. to IEC 61508-2         Image request act. to IEC 61508-2       Image request act. to IEC 61508-2         Image request act. to IEC 61508-2       Image request						
Process variable/function       Process pressure and level measurement         Safety function(s)       MIN, MAX, RANGE         Device type acc. to IEC 61508-2       □ Type A       ☑ Type B         Operating mode       ☑ Low Demand Mode       □ High Demand Mode       □ Continuous Mi         Valid hardware version       As of 02.00       Valid software version       As of 02.00         Valid software version       As of 02.00; 02.30.zz recommended       □       Evaluation of "proven in use" performance for HW/SW incl. FA         Safety manual       FY01047P       □       Evaluation of "proven in use" performance for HW/SW incl. FA         Type of evaluation       (check only <u>one</u> box)       □       Evaluation of HW/SW field data to verify prior use" acc. to IEC 61508-2, 3         □       Evaluation of proven in use" performance for HW/SW incl. FA       and change request acc. to IEC 61508-2, 3         □       Evaluation of PMEDA acc. to IEC 61508-2, 3       □         □       Evaluation of PMEDA acc. to IEC 61508-2 for devices w/o soft         Evaluation through – report/certificate no.       TUV SÜD Rail GmbH Z10 020351 0010         Test documents       Development documents       Test reports       Data sheets         SIL - Integrity       Single channel use (HFT = 0)       Sil 2 capable       Sil 3 cap         Hardware safety integrity						
Device type acc. to IEC 61508-2       □ Type A       ☑ Type B         Operating mode       ☑ Low Demand Mode       □ High Demand Mode       □ Continuous Mu         Valid hardware version       As of 02.00       02.30.zz recommended       □ Continuous Mu         Safety manual       FY01047P       ☑       □ Complete HW/SW evaluation parallel to development incl. IN         Type of evaluation       (Check only one box)       ☑       □       Evaluation of "proven in use" performance for HW/SW incl. FN         ICheck only one box)       ☑       Evaluation of MX/SW field data to verify prior use" acc. to IEC 61508-2, 3       □         Evaluation of moments       ☑       Evaluation of MX/SW field data to verify prior use" acc. to IEC 61508-2       □         Evaluation through – report/certificate no.       TÜV SÜD Rail GmbH Z10 020351 0010       □       □         Test documents       □	Process variable/function	-		neasurement		
Operating mode       ⊠ Low Demand Mode       High Demand Mode       Continuous Mu         Valid bardware version       As of 02.00       As of 02.00       Continuous Mu         Valid software version       As of 02.0y, 02.30.zz recommended       Evaluation of recommended       FV01047P         Safety manual       FV01047P       Complete HW/SW evaluation parallel to development incl. FMEDA and change request acc. to IEC 61508-2, 3       Evaluation of Froven in use" performance for HW/SW incl. FA and change request acc. to IEC 61508-2, 3         Type of evaluation       Evaluation of FW/SW evaluation of FW/SW incl. FA and change request acc. to IEC 61508-2, 3       Evaluation of FW/SW incl. FA and change request acc. to IEC 61508-2, 3         Evaluation through – report/certificate no.       TÜV SÜD Rail GmBH Z10 020351 0010       Evaluation of FW/SW incl. FA and change request acc. to IEC 61508-2 for devices w/o soft         Evaluation through – report/certificate no.       TÜV SÜD Rail GmBH Z10 020351 0010       Evaluation of FW/SW incl. FA and change request acc. to IEC 61508-2 for devices w/o soft         Systematic safety integrity       Single channel use (HFT = 0)       SIL 2 capable       SIL 3 cap         Hardware safety integrity       Single channel use (HFT ≥ 1)       SIL 2 capable       SIL 3 cap         Hardware safety function       MIN       MAX       RANGE         Aug <sup>23,31</sup> 327 IFI       50 FIT       371 FIT       50 FIT	Safety function(s)	MIN, MA	K, RANGE			
Valid hardware version       As of 02.00         Valid software version       As of 02.0y; 02.30.zz recommended         Safety manual       FY01047P         Complete HW/SW evaluation parallel to development ind.       FMEDA and change request acc. to IEC 01508-2, 3         Type of evaluation (check only one box)       Evaluation of "proven in use" performance for HW/SW incl. FM and change request acc. to IEC 61508-2, 3         Evaluation of FMEDA and change request acc. to IEC 61508-2, 3       Evaluation of HW/SW field data to verify prior use" acc. to IEC 61511         Evaluation through – report/certificate no.       TÜV SÜD Rail GmbH Z10 020351 0010         Test documents       Development documents       Test reports       Data sheets         SIL - Integrity       Single channel use (HFT = 0)       Sill 2 capable       Sill 3 cap         Multi channel use (HFT = 1)       Sill 2 capable       Sill 3 cap         Multi channel use (HFT = 1)       Sill 2 capable       Sill 3 cap         Multi channel use (HFT = 1)       Sill 2 capable       Sill 3 cap         Multi channel use (HFT = 1)       Sill 2 capable       Sill 3 cap         Multi channel use (HFT = 1)       Sill 2 capable       Sill 3 cap         Safety function       MiN       MAX       RANGE         Mage 2J.3)       82 FIT       82 FIT       82 FIT <td< td=""><td>Device type acc. to IEC 61508-2</td><td>Type A</td><td></td><td>🛛 Туре</td><td>В</td><td></td></td<>	Device type acc. to IEC 61508-2	Type A		🛛 Туре	В	
Valid software version       As of 02.0y, 02.30.zz recommended         Safety manual       FY01047P         Safety manual       FV01047P         Type of evaluation (check only one box)       Complete HW/SW evaluation parallel to development incl. FMEDA and change request acc. to IEC 61508-2, 3         Check only one box)       Evaluation of "proven in use" performance for HW/SW incl. FA and change request acc. to IEC 61508-2, 3         Evaluation of the V/SW field data to verify aprior use" acc. to IEC 61511       Evaluation of "Proven in use" performance for HW/SW incl. FA and change request acc. to IEC 61508-2, 3         Evaluation through - report/certificate no.       TÜV SÜD Rall GmBH Z10 020351 0010       Test documents         Test documents       Development documents       Test reports       Data sheets         SIL - Integrity       Single channel use (HFT = 0)       Sill 2 capable       Sill 3 cap         Hardware safety integrity       Single channel use (HFT = 1)       Sill 2 capable       Sill 3 cap         Multi channel use (HFT = 1)       Sill 2 capable       Sill 3 cap         Multi channel use (HFT = 1)       Sill 2 capable       Sill 3 cap         Multi channel use (HFT = 1)       Sill 2 capable       Sill 3 cap         Multi channel use (HFT ≥ 1)       Sill 2 capable       Sill 3 cap         Safety function       MIN       MAX       RANGE	Operating mode	Low De	emand Mode	High Demand Mod	le [	Continuous Mod
Safety manualFY01047PType of evaluation (check only one box) $\boxed{\square}$ Complete HW/SW evaluation parallel to development incl. FMEDA and change request acc. to IEC 61508-2, 3 Evaluation of Proven in use" performance for HW/SW field data to verifyprior use" acc. to IEC 61511 $\square$ Evaluation of HW/SW field data to verifyprior use" acc. to IEC 61511 $\square$ Evaluation of HW/SW field data to verifyprior use" acc. to IEC 61511 $\square$ Evaluation by FMEDA acc. to IEC 61508-2, 3 $\square$ Evaluation by FMEDA acc. to IEC 61508-2 for devices w/o softEvaluation through - report/certificate no. $\square$ VS $\square$ Data IGmbH Z10 020351 0010Test documentsDevelopment documentsTest reportsSystematic safety integrityDevelopment documentsTest reportsSystematic safety integritySingle channel use (HFT = 0)Sill 2 capableSill 3 cap Multi channel use (HFT = 1)Sill 2 capableSill 3 capSafety functionMINMAXRANGE $\lambda_{00}$ $^{2,30}$ 371 FIT82 FIT82 FIT $\lambda_{00}$ $^{2,31}$ 394 FIT394 FIT394 FIT $\lambda_{00}$ $^{2,30}$ S0 FIT371 FIT91 % $\lambda_{00}$ $^{2,31}$ S0 FIT371 FIT82 × 10° 1/h $\lambda_{00}$ $^{2,31}$ S0 FIT371 FIT82 × 10° 1/h $\lambda_{00}$ $^{2,33}$ 394 FIT394 KIT394 FIT $\lambda_{00}$ $^{2,33}$ S0 FIT91 %91 %PFDevg (T_1 = 1 year) <sup>31</sup> (single channel architecture) $3.6 \times 10^4$ $3.6 \times 10^4$ $A \leq 10^8$ $A \leq 0.9^8$ $A \leq$	Valid hardware version	As of 02.0	0			
Type of evaluation (check only one box)Complete HW/SW evaluation parallel to development incl. FMEDA and change request acc. to IEC 61508-2, 3 Evaluation of Proven in use" performance for HW/SW incl. FA and change request acc. to IEC 61508-2, 3 Evaluation of HW/SW field data to verify prior use" acc. to IEC 61511 Evaluation of HW/SW field data to verify prior use" acc. to IEC 61511 Evaluation of HW/SW field data to verify prior use" acc. to IEC 61511 Evaluation of HW/SW field data to verify prior use" acc. to IEC 61511 Evaluation by FMEDA acc. to IEC 61508-2 for devices w/o soft Evaluation through - report/certificate no.TÜV SÜD Rail GmbH Z10 020351 0010 Test documentsDevelopment documentsTest reportsData sheetsSIL - IntegritySingle channel use (HFT = 0) Multi channel use (HFT = 0)Sill 2 capableSill 3 cap Sill 2 capableSystematic safety integritySingle channel use (HFT = 0) Multi channel use (HFT ≥ 1)Sill 2 capableSill 3 cap Sill 2 capableFMEDASafety functionMINMAX MAXRANGE $\lambda_{02}^{23,31}$ 371 FIT50 FIT0 FIT 394 FIT $\lambda_{02}^{23,31}$ 372 FIT394 FIT 394 FIT394 FIT 394 FIT $\lambda_{02}^{23,31}$ 50 FIT371 FIT 36.6 × 10.43.6 × 10.4 3.6 × 10.4PFDewg (T1 = 1 year) <sup>31</sup> (single channel architecture) 3 usi 2.3897 FIT 397 FIT 397 FIT897 FIT 897 FIT 897 FIT 897 FIT 897 FIT 897 FIT 	Valid software version			mended		
Image: Type of evaluation (check only one box)Image: FMEDA and change request acc. to IEC 61508-2, 3 Evaluation of "proven in use" performance for HW/SW Incl. FA and change request acc. to IEC 61508-2, 3Image: Check only one box)Image: Check only one boxImage: Check only one box)Image: Check one boxImage: Check only one box)Image: Check one boxImage: Check only one box)Image: Check one boxImage: Check one box<	Safety manual	FY01047F				
Type of evaluation (check only one box)         Image request acc. to IEC 61508-2, 3 Evaluation of HWVSW field data to verify ,prior us" acc. to IEC 61511           Image request acc. to IEC 61508-2, 3 Umail GmbH Z10 020351         Evaluation of HWVSW field data to verify ,prior us" acc. to IEC 61511           Evaluation through - report/certificate no.         TÜV SÜD Rail GmbH Z10 020351 0010         Test reports           Test documents         Development documents         Test reports         Data sheets           SIL - Integrity         Image request acc. to IEC 61508-2, 3         Mata sheets           Systematic safety integrity         Development documents         Test reports         Data sheets           Systematic safety integrity         Image request acc. to IEC 61508-2, 3         Data sheets           Systematic safety integrity         Image request acc. to IEC 61508-2, 3         Data sheets           Systematic safety integrity         Image request acc. to IEC 61508-2, 3         Data sheets           Sill a capable         Image request acc. to IEC 61508-2, 3         Data sheets           Systematic safety integrity         Image request acc. to IEC 61508-2, 3         Data sheets           Sill a capable         Image request acc. to IEC 61508-2, 3         Data sheets           Safety function         MIN         MAX         RANGE           And thange request acc. to IEC 61508-2 for device acc. to IE			FMEDA and ch	ange request acc. to IE	C 61508	3-2, 3
$\begin{tabular}{ c                                   $			and change re	quest acc. to IEC 61508	-2, 3	
Evaluation through - report/certificate no.TÜV SÜD Rail GmbH Z10 020351 0010Test documentsTest reportsData sheetsSIL - IntegrityImage: Sill and Sill	(check only <u>one</u> box)			HW/SW field data to ve	rify "pric	or use" acc. to
Test documentsDevelopment documentsTest reportsData sheetsSIL - Integrity $\Box$ SIL 2 capableSIL 3 capHardware safety integritySingle channel use (HFT = 0)SIL 2 capableSIL 3 capHardware safety integrityMulti channel use (HFT ≥ 1)SIL 2 capableSIL 3 capFMEDASafety functionMINMAXRANGESafety functionMINMAXRANGE $\lambda_{00}^{23,3}$ 82 FIT82 FIT82 FIT $\lambda_{02}^{23,3}$ 371 FIT50 FIT0 FIT $\lambda_{02}^{23,3}$ 394 FIT394 FIT $\lambda_{02}^{23,3}$ 50 FIT371 FIT421 FITSFF91 %91 %91 %PFD <sub>avg</sub> (T1 = 1 year) <sup>31</sup> (single channel architecture)3.6 × 10 <sup>-4</sup> 3.6 × 10 <sup>-4</sup> BC 43.0 % / B: 99 %A: 50 % / B: 99 %A: 50 % / B: 99 %Autur <sup>2,3)</sup> 897 FIT897 FIT897 FITDiagnostic test interval <sup>51</sup> 5 min (RAM,ROM), 1 s (Measurement)5 min (RAM,ROM), 1 s (Measurement)5 min (RAM,ROM), 10 s (Measurement)10 s (Measurement)10 s (Measurement)			Evaluation by	FMEDA acc. to IEC 615	08-2 for	devices w/o softw
SIL - IntegritySystematic safety integritySingle channel use (HFT = 0)SIL 2 capableSIL 3 capHardware safety integritySingle channel use (HFT = 0)SIL 2 capableSIL 3 capMulti channel use (HFT > 1)SIL 2 capableSIL 3 capFMEDASafety functionMINMAXRANGE $\lambda_{0u}^{21,3}$ 82 FIT82 FIT82 FIT82 FIT $\lambda_{0u}^{21,3}$ 371 FIT50 FIT0 FIT0 FIT $\lambda_{50}^{21,3}$ 394 FIT394 FIT394 FIT394 FIT $\lambda_{50}^{21,3}$ 50 FIT371 FIT421 FITSFF91 %91 %91 %PFD_avg (T_1 = 1 year) <sup>3</sup> ) (single channel architecture)3.6 × 10 <sup>-4</sup> 3.6 × 10 <sup>-4</sup> $\lambda_{50}^{21,3}$ 897 FIT897 FIT897 FITDiagnostic test interval <sup>50</sup> S min (RAM,ROM), 1 s (Measurement)1 s (Measurement)1 s (Measurement)Fault reaction time <sup>60</sup> 5 min (RAM,ROM), 10 s (Measurement)5 min (RAM,ROM), 10 s (Measurement)5 min (RAM,ROM), 10 s (Measurement)5 min (RAM,ROM), 10 s (Measurement)	Evaluation through – report/certificate no.	TÜV SÜD F	Rail GmbH Z10 02	0351 0010		
Systematic safety integrity $\Box$ Sill 2 capableSIL 2 capableSIL 3 capHardware safety integritySingle channel use (HFT = 0)SIL 2 capableSIL 3 capMulti channel use (HFT ≥ 1)SIL 2 capableSIL 3 capFMEDASafety functionMINMAXRANGE $\lambda_{00}^{21,30}$ 82 FIT82 FIT82 FIT82 FIT $\lambda_{00}^{21,30}$ 371 FIT50 FIT0 FIT $\lambda_{00}^{21,30}$ 394 FIT394 FIT394 FIT $\lambda_{00}^{21,30}$ 50 FIT371 FIT421 FITSFF91 %91 %91 %PFDavg (T_1 = 1 year) <sup>31</sup> (single channel architecture) $3.6 \times 10^{-4}$ $3.6 \times 10^{-4}$ $A: 50 \% / B: 99 \%$ $\lambda_{10tat}^{2,30}$ 897 FIT897 FIT897 FITDiagnostic test interval <sup>51</sup> 5 min (RAM,ROM), 1 s (Measurement)5 min (RAM,ROM), 1 s (Measurement)5 min (RAM,ROM), 1 0 s (Measurement)5 min (RAM,ROM), 10 s (Measurement)5 min (RAM,ROM), 10 s (Measurement)Comments	Test documents	Developm	ent documents	Test reports		Data sheets
Hardware safety integritySingle channel use (HFT = 0) $\square$ SIL 2 capable $\square$ SIL 3 capFMEDASafety functionMAXRANGEJournal 2013B2 FITB2 FITB2 FITB2 FITAbul 21.33B2 FITB2 FITB2 FITB2 FITAbul 21.33B3 FITSIL 2 capable $\square$ SIL 3 capAbul 21.33B2 FITB2 FITB2 FITB2 FITAbul 21.33B3 FITB3 FITAbul 21.31SO FITST FITB3 FITB3 FITA21 FITSA FITSA FITB3 FITB3 FITB3 FITB3 FITAbul 21.51ST FITST FITB3 FITB3 FITB3 FITB3 FITB3 FITB3 FITB3 FIT <td>SIL - Integrity</td> <td>West of the</td> <td></td> <td>No Spinster Co</td> <td>1.21</td> <td>1</td>	SIL - Integrity	West of the		No Spinster Co	1.21	1
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	Systematic safety integrity			SIL 2 capa	ble	SIL 3 capal
Multi channel use (HFT $\geq 1$ ) $\  \  \  \  \  \  \  \  \  \  \  \  \  $	11-1	Single cha	nnel use (HFT = 0			SIL 3 capal
Safety function         MIN         MAX         RANGE $\lambda_{01}^{21,30}$ 82 FIT         82 FIT         82 FIT         82 FIT $\lambda_{00}^{21,30}$ 371 FIT         50 FIT         0 FIT $\lambda_{00}^{21,30}$ 394 FIT         394 FIT         394 FIT $\lambda_{00}^{21,30}$ 50 FIT         371 FIT         421 FIT $\lambda_{00}^{21,30}$ 50 FIT         371 FIT         421 FIT           SFF         91 %         91 %         91 %           PFD <sub>avg</sub> (T <sub>1</sub> = 1 year) <sup>31</sup> (single channel architecture)         3.6 × 10 <sup>-4</sup> 3.6 × 10 <sup>-4</sup> 3.6 × 10 <sup>-4</sup> 8.2 × 10 <sup>-8</sup> 1/h           PFL         8.2 × 10 <sup>-9</sup> 1/h           PTC <sup>4)</sup> A: 50 % / B: 99 %           Diagnostic test interval <sup>5)</sup> 5 min (RAM,ROM),         5 min (RAM,ROM),         5 min (RAM,ROM),         1 s (Measurement)         1 s (Measurement)           Fault reaction time <sup>6)</sup> 5 min (RAM,ROM.	Hardware safety integrity	Multi char	nel use (HFT $\geq$ 1)	SIL 2 capa	ble	SIL 3 capat
Appu 21,33         82 FIT         82 FIT         82 FIT         82 FIT           App 21,33         371 FIT         50 FIT         0 FIT           Agg 21,33         394 FIT         394 FIT         394 FIT           Agg 21,33         50 FIT         371 FIT         421 FIT           SFF         91 %         91 %         91 %           PFD <sub>avg</sub> (T <sub>1</sub> = 1 year) <sup>3</sup> (single channel architecture)         3.6 × 10 <sup>-4</sup> 3.6 × 10 <sup>-4</sup> 3.6 × 10 <sup>-4</sup> 8.2 × 10 <sup>-8</sup> 1/h         8.2 × 10 <sup>-9</sup> 1/h           PFH         8.2 × 10 <sup>-8</sup> 1/h         8.2 × 10 <sup>-9</sup> 1/h         8.2 × 10 <sup>-9</sup> 1/h         8.2 × 10 <sup>-9</sup> 1/h           PTC <sup>4</sup> A: 50 % / B: 99 %           A <sub>1</sub> tract <sup>1</sup> /h         5 min (RAM,ROM),           Diagnostic test interval <sup>5</sup> )         5 min (RAM,ROM),         5 min (RAM,ROM),         5 min (RAM,ROM),         1 s (Measurement)         1 s (Measurement)           Fault reaction time <sup>6</sup> )         5 min (RAM,ROM),         5 min (RAM,ROM),         10 s (Measurement)         10 s (Measurement)	FMEDA			the second part		A State States
App 2/3)         371 FIT         50 FIT         0 FIT           Agu 2/3)         394 FIT         394 FIT         394 FIT         394 FIT           Agu 2/3)         394 FIT         394 FIT         394 FIT         394 FIT           Agu 2/3)         50 FIT         371 FIT         421 FIT           SFF         91 %         91 %         91 %           PFDewg (T1 = 1 year) 3) (single channel architecture)         3.6 × 10 <sup>-4</sup> 3.6 × 10 <sup>-4</sup> 3.6 × 10 <sup>-4</sup> 82 × 10 <sup>-8</sup> 1/h         8.2 × 10 <sup>-9</sup> 1/h           PFC         421 FIT         897 FIT         897 FIT         897 FIT         897 FIT           Diagnostic test interval <sup>5</sup> )         5 min (RAM,ROM), 1 s (Measurement)         5 min (RAM,ROM), 1 s (Measurement)         5 min (RAM,ROM), 1 s (Measurement)         5 min (RAM,ROM), 10 s (Measurement)         5 min (RAM,ROM), 10 s (Measurement)         5 min (RAM,ROM), 10 s (Measurement)	Safety function	MIN		MAX	R	ANGE
Ass         23.3         394 FIT         394 FIT         394 FIT         394 FIT           Ass         23.3         50 FIT         371 FIT         421 FIT         50 FIT         371 FIT         421 FIT         421 FIT           SFF         91 %         91 %         91 %         91 %         91 %           PFDavg (T1 = 1 year) <sup>31</sup> (single channel architecture)         3.6 × 10 <sup>-4</sup> 3.6 × 10 <sup>-4</sup> 3.6 × 10 <sup>-4</sup> 8.2 × 10 <sup>-8</sup> 1/h           PFH         8.2 × 10 <sup>-8</sup> 1/h           PTC <sup>4)</sup> A: 50 % / B: 99 %           A <sub>botal</sub> <sup>2,3)</sup> 897 FIT         897 FIT         897 FIT         897 FIT           Diagnostic test interval <sup>5)</sup> 5 min (RAM,ROM), 1 s (Measurement)         1 s (Measurement)         1 s (Measurement)         1 s (Measurement)           Fault reaction time <sup>6)</sup> 5 min (RAM,ROM), 10 s (Measurement)         5 min (RAM,ROM), 10 s (Measurement)         10 s (Measurement)         10 s (Measurement)	λ <sub>DU</sub> <sup>2),3)</sup>	82 FIT		82 FIT	8	2 FIT
Aso         21,30         50 FIT         371 FIT         421 FIT           SFF         91 %         91 %         91 %         91 %           PFDavg (T1 = 1 year) <sup>31</sup> (single channel architecture)         3.6 × 10 <sup>-4</sup> 3.6 × 10 <sup>-4</sup> 3.6 × 10 <sup>-4</sup> BFH         8.2 × 10 <sup>-8</sup> 1/h           PTC <sup>4)</sup> A: 50 % / B: 99 %           Autal <sup>2,3)</sup> 897 FIT         897 FIT         897 FIT         897 FIT           Diagnostic test interval <sup>5)</sup> 5 min (RAM,ROM), 1 s (Measurement)         1 s (Measurement)         1 s (Measurement)           Fault reaction time <sup>6)</sup> 5 min (RAM,ROM), 10 s (Measurement)         5 min (RAM,ROM), 10 s (Measurement)         5 min (RAM,ROM), 10 s (Measurement)         10 s (Measurement)	λ <sub>DD</sub> <sup>2],3)</sup>	371 FIT		50 FIT	0	FIT
SFF         91 %         91 %         91 %           PFD <sub>avg</sub> (T <sub>1</sub> = 1 year) <sup>3</sup> ) (single channel architecture)         3.6 × 10 <sup>-4</sup> 3.6 × 10 <sup>-4</sup> 3.6 × 10 <sup>-4</sup> PFH         8.2 × 10 <sup>-8</sup> 1/h         8.2 × 10 <sup>-8</sup> 1/h         8.2 × 10 <sup>-8</sup> 1/h         8.2 × 10 <sup>-9</sup> 1/h           PTC <sup>4</sup> A: 50 % / B: 99 %           A <sub>1</sub> otal <sup>2,3)</sup> 897 FIT         897 FIT         897 FIT         897 FIT           Diagnostic test interval <sup>5</sup> )         5 min (RAM,ROM), 1 s (Measurement)         5 min (RAM,ROM), 1 s (Measurement)         5 min (RAM,ROM), 1 s (Measurement)         5 min (RAM,ROM), 10 s (Measurement)	λsu <sup>2),3)</sup>	394 FIT		394 FIT	3	94 FIT
PFD <sub>avg</sub> (T <sub>1</sub> = 1 year) <sup>3</sup> ) (single channel architecture)         3.6 × 10 <sup>-4</sup> 3.6 × 10 <sup>-4</sup> 3.6 × 10 <sup>-4</sup> PFH         8.2 × 10 <sup>-8</sup> 1/h           PTC <sup>4</sup> )         A: 50 % / B: 99 %           A <sub>1</sub> otal <sup>2,3)</sup> 897 FIT         897 FIT         897 FIT         897 FIT           Diagnostic test interval <sup>5</sup> )         5 min (RAM,ROM), 1 s (Measurement)         5 min (RAM,ROM), 1 s (Measurement)         5 min (RAM,ROM), 1 s (Measurement)         5 min (RAM,ROM), 1 0 s (Measurement)         5 min (RAM,ROM), 10 s (Measurement)         5 min (RAM,ROM), 10 s (Measurement)	λsp <sup>2],3]</sup>	50 FIT		371 FIT	42	21 FIT
PFH         8.2 × 10 <sup>-8</sup> 1/h           PTC <sup>4</sup> )         A: 50 % / B: 99 %         A	SFF	91 %		91 %	9	1%
PTC <sup>6</sup> )         A: 50 % / B: 99 %         A: 50 % / B: 99 %         A: 50 % / B: 99 %           λ <sub>lotal</sub> <sup>2,3)</sup> 897 FIT         897 FIT         897 FIT         897 FIT           Diagnostic test interval <sup>5</sup> )         5 min (RAM,ROM), 1 s (Measurement)         5 min (RAM,ROM), 10 s (Measurement)	$PFD_{avg}$ (T <sub>1</sub> = 1 year) <sup>3)</sup> (single channel architecture)	3.6 × 10 <sup>-4</sup>		3.6 × 10 <sup>-4</sup>	3.	.6 × 10 <sup>-4</sup>
λ <sub>total</sub> <sup>2,3)</sup> 897 FIT         897 FIT         897 FIT           Diagnostic test interval <sup>5)</sup> 5 min (RAM,ROM), 1 s (Measurement)         5 min (RAM,ROM), 1 0 s (Measur						
Diagnostic test interval <sup>5)</sup> 5 min (RAM,ROM), 1 s (Measurement)     <		A: 50 % /	B: 99 %			
Diagnostic test interval */       1 s (Measurement)       1 s (Measurement)       1 s (Measurement)         Fault reaction time <sup>6</sup> )       5 min (RAM,ROM), 10 s (Measurement)	PTC <sup>4)</sup>			897 FIT	_	
Fault reaction time 6)     5 min (RAM,ROM), 10 s (Measurement)	PTC <sup>4)</sup>	_			5	
Comments	PTC 4) Atotal 2,3)	5 min (RA			1	5 (measurement)
-	PTC <sup>4)</sup> A <sub>total</sub> <sup>2,3)</sup> Diagnostic test interval <sup>5)</sup>	5 min (RA 1 s (Measu 5 min (RA	M,ROM),	1 s (Measurement) 5 min (RAM,ROM),	5	min (RAM,ROM)
	PTC <sup>4)</sup> λ <sub>lotal</sub> <sup>2,3)</sup> Diagnostic test interval <sup>5)</sup> Fault reaction time <sup>6)</sup>	5 min (RA 1 s (Measu 5 min (RA	M,ROM),	1 s (Measurement) 5 min (RAM,ROM),	5	min (RAM,ROM)
Declaration	PTC <sup>4)</sup> λ <sub>lotal</sub> <sup>2,3)</sup> Diagnostic test interval <sup>5)</sup> Fault reaction time <sup>6)</sup>	5 min (RA 1 s (Measu 5 min (RA	M,ROM),	1 s (Measurement) 5 min (RAM,ROM),	5	min (RAM,ROM)

SIL\_00456\_01.21

## Endress + Hauser

Device designation and permissible types 1)	PMC71-x y # ## # # # # # # # # x = B,G,L,M,P,T,V,5 y = A,B,C,D,E,F PMC71-x y # ## # # # # E x = B,G,L,M,P,T,V,5 y = A,B,C,D,E,F Ex d[ia], Parameter profile A with message E727 (pressure overrange) configured as an alarm				
Safety-related output signal	420 mA				
Fault signal		; ≥ 21,0 mA			
Process variable/function		ressure and level i	measurement		
Safety function(s)		X , RANGE			
Device type acc. to IEC 61508-2	Type A		🛛 Ту	pe B	
Operating mode		emand Mode	High Demand M		Continuous Mode
Valid hardware version	As of 02.0	0			
Valid software version	As of 02.0	y; 02.30.zz recom	mended		
Safety manual	FY01047	>			
			/SW evaluation paral lange request acc. to		
Type of evaluation					or HW/SW incl. FMEDA
(check only <u>one</u> box)			quest acc. to IEC 615 HW/SW field data to		ior use" acc. to
		IEC 61511		· • • • • • • • • • • • • • • • • • • •	
				L508-2 fo	r devices w/o software
Evaluation through – report/certificate no.	cate no. TÜV SÜD Rail GmbH Z10 020351 0010				
Test documents	Development documents Test reports				Data sheets
SIL - Integrity					and an and the set
Systematic safety integrity			SIL 2 ca	pable	SIL 3 capable
Hardware safety integrity	Single channel use (HFT =		= 0) SIL 2 capable		SIL 3 capable
nationale safety integrity	Multi channel use (HFT ≥ 1) SIL 2 capabl		pable	SIL 3 capable	
FMEDA				Sales and	The second
Safety function	MIN		MAX	F	RANGE
λ <sub>DU</sub> <sup>2),3)</sup>	83 FIT		83 FIT	8	33 FIT
λ <sub>DD</sub> <sup>2),3)</sup>	451 FIT		50 FIT	0	) FIT
λsu <sup>2),3)</sup>	452 FIT		452 FIT	4	52 FIT
λsp <sup>2),3)</sup>	50 FIT		451 FIT	5	501 FIT
SFF	92 %		92 %	9	92 %
$PFD_{avg}$ (T <sub>1</sub> = 1 year) <sup>3</sup> (single channel architecture)	3.6 × 10 <sup>-4</sup>		3.6 × 10 <sup>-4</sup>	3	3.6 × 10 <sup>-4</sup>
PFH	8.3 × 10 <sup>-8</sup>	1/h	8.3 × 10 <sup>-8</sup> 1/h		3.3 × 10 <sup>-8</sup> 1/h
PTC 4)	A: 50 % / B: 99 %		A: 50 % / B: 99 %		A: 50 % / B: 99 %
λ <sub>total</sub> 2,3)	1036 FIT		1036 FIT		.036 FIT
Diagnostic test interval <sup>5)</sup>	5 min (RAM,ROM), 1 s (Measurement)		5 min (RAM,ROM), 1 s (Measurement)		min (RAM,ROM), s (Measurement)
Fault reaction time <sup>6)</sup>	5 min (RAM,ROM), 10 s (Measurement)		5 min (RAM,ROM) 10 s (Measurement)		min (RAM,ROM), 0 s (Measurement)
Comments	and the second second				Service Services
-					
Declaration	No.		STIC STREET		A Street Press
Our internal company quality management evident in the future	system ensur	es information or	safety-related syste	matic faul	lts which become
lid order codes and order code exclusions are maintained in t T = Failure In Time, number of failures per 10 <sup>9</sup> h lid for average ambient temperature up to +40 °C (+104 °F) or continuous operation at ambient temperature close to +60 (C = Proof Test Coverage I diagnostic functions are performed at least once within the <i>i</i> aximum time between error recognition and error response	°C (+140 °F), a	factor of 2.1 should	be applied		

Template: D050-3\_Declaration of Conformity (SIL).docx, E+H LP Version 2.0 (DWP), Valid from 23.03.2021

4/5

Device designation and permissible types 1)       PMC71-x y ###### # # x = B,G,L,M,P,T,V,5 y = A,B,C,D,E,F         Safety-related output signal       420 mA         Fault signal       ≤ 3,6 mA ; ≥ 21,0 mA         Process variable/function       Process pressure and level measurement         Safety-related output signal       ≤ 3,6 mA ; ≥ 21,0 mA         Process variable/function       Process pressure and level measurement         Safety function(s)       MIN, MAX, RANGE         Device type acc. to IEC 61508-2       Type A         Operating mode       ⊠ Low Demand Mode       High Demand Mode         Valid hardware version       As of 02.00       Valid software version         Valid software version       As of 02.00       Valid software version         Valid software version       As of 02.00       Valid software version         (check only one box)       Evaluation of "proven in use" performance for HW/SW lind. Fi         and change request acc. to IEC 61508-2, 3       Evaluation of the W/SW field data to verify prior use" acc. to IEC 61508-2, 3         Evaluation through - report/certificate no.       TÜV SÜD Rail GmbH Z10 020351 0010         Test documents       Development documents       Test reports         Systematic safety integrity       Single channel use (HFT = 0)       Sill 2 capable       Sill 3 ca         Hardware saf	General	100 m 100 m 100				1	
Device designation and permissible types <sup>11</sup> EX (1a), Parameter profile B with message E727 (pressure overrange) cor as a warning         Safety-related output signal       420 mA         Process variable/function       Process pressure and level measurement         Safety function(s)       MIN, MAX, RANGE         Device type acc. to IEC 61508-2       □ Type A         Quertaing mode       QL ow Demand Mode         Valid bardware version       As of 02.00; 02.30.zz recommended         Safety maual       FY01047P         Valid software version       As of 02.00; 02.30.zz recommended         Safety maual       FY01047P         Type of evaluation       FW1047P         Complete HW/SW evaluation parallel to development incl. FMEDA and change request acc. to IEC 61508-2, 3         I change request acc. to IEC 61508-2, 0         I change request acc. to IEC 61508-2, 3	General	DMC71 w		<b>F</b> #	- BCI MBTUS		1.0.0.0.0
Safety-related output signal       420 mA         Fault signal       \$3,6 mA; $\geq$ 21,0 mA         Process variable/function       Process pressure and level measurement         Safety function(s)       MIN, MAX, RANGE         Device type acc. to IEC 61508-2       Type A         Valid bardware version       As of 02.00         Valid bardware version       As of 02.00, C2.30.2z recommended         Safety manual       FY01047P         Type of evaluation       FMEDA and change request acc. to IEC 61508-2, 3         Complete HW/SW evaluation parallel to development incl. FMEDA and change request acc. to IEC 61508-2, 3         Check only one box)       Evaluation of 'proven in use" performance for HW/SW field data to verify, prior use" acc. to IEC 61508-2, 3         Evaluation through - report/certificate no.       TÜV SÜD Rail GmbH Z10 020351 0010         Test documents       Development documents       Test reports       Data sheets         SIL - Integrity       Single channel use (HFT = 0)       SiL 2 capable       SiL 3 ca         Systematic safety integrity       Single channel use (HFT = 0)       SiL 2 capable       SiL 3 ca         Hardware safety function       MIN       MAX       RANGE         Aga <sup>2,3,3</sup> 62 FIT       452 FIT       452 FIT         Aga <sup>2,3,3</sup> 62 FIT       452 FIT </th <th>Device designation and permissible types <sup>1)</sup></th> <th>PMC71-x Ex d[ia], l</th> <th>y # ## # ## # Parameter pro</th> <th># E</th> <th>x = B,G,L,M,P,T,V,5</th> <th>v</th> <th>= A, B, C, D, E, F</th>	Device designation and permissible types <sup>1)</sup>	PMC71-x Ex d[ia], l	y # ## # ## # Parameter pro	# E	x = B,G,L,M,P,T,V,5	v	= A, B, C, D, E, F
Process variable/function       Process pressure and level measurement         Safety function(s)       MIN, MAX, RANGE         Device type acc. to IEC 61508-2       □ Type A       ⊠ Type B         Operating mode       ≥ Low Demand Mode       □ Iflye B         Valid hardware version       As of 02.00       □ Type A       □ Continuous M         Valid software version       As of 02.00       □ Complete HW/SW evaluation parallel to development Incl. FMEDA and change request acc. to IEC 61508-2, 3         Type of evaluation (check only one box)       □       Evaluation of "proven in use" performance for HW/SW ind. FI and change request acc. to IEC 61508-2, 3         Evaluation through – report/certificate no.       TÜV SÜD Rail GmbH Z10 020351 0010         Test documents       Development documents       Test reports       Data sheets         Systematic safety integrity       Single channel use (HFT ≥ 0)       ⊠ SIL 2 capable       SIL 3 ca         Hardware safety integrity       Single channel use (HFT ≥ 1)       ⊡ SIL 2 capable       SIL 3 ca         Safety function       MIN       MAX       RANGE         Augr <sup>2,31</sup> 447 FIT       B7 FIT       87 FIT         Augr <sup>2,31</sup> 442 FIT       50 FIT       452 FIT         Augr <sup>2,31</sup> 452 FIT       452 FIT       452 FIT         Augr	Safety-related output signal						
Process variable/function         Process pressure and level measurement           Safety function(s)         MIN, MAX, RANGE           Device type acc. to IEC 61508-2         □ Type A         ⊠ Type B           Operating mode         ⊠ Low Demand Mode         □ High Demand Mode         □ Continuous M           Valid hardware version         As of 02.00         As of 02.00;         0.00           Valid software version         As of 02.00; 02.30.zz recommended         □ Complete HW/SW evaluation parallel to development incl. FMEDA and change request acc. to IEC 61508-2, 3           Type of evaluation (check only gne box)         □         Evaluation of "proven in use" performance for HW/SW field data to verify.prior use" acc. to IEC 615108-2, 3           □         Evaluation of HW/SW field data to verify.prior use" acc. to IEC 61508-2, 3         □           □         Evaluation of Proven in use" performance for HW/SW field data to verify.prior use" acc. to IEC 615108-2         □           □         Evaluation by FMEDA acc. to IEC 61508-2, 3         □           □         Evaluation by FMEDA acc. to IEC 61508-2, 3         □           □         Evaluation by FMEDA acc. to IEC 61508-2, 3         □           □         Evaluation by FMEDA acc. to IEC 61508-2, 3         □           □         Evaluation by FMEDA acc. to IEC 61508-2         0           Evaluation through - report/certificate	Fault signal	≤ 3,6 mA	; ≥ 21,0 mA				
Device type acc. to IEC 61508-2       □ Type A       ☑ Type B         Operating mode       ☑ Low Demand Mode       □ High Demand Mode       □ Continuous M         Valid hardware version       As of 02.00         Continuous M         Safety manual       FY01047P         Complete HW/SW evaluation parallel to development incl. FMEDA and change request acc. to IEC 61508-2, 3       □       Evaluation of Fromen in use" performance for HW/SW incl. Fi and change request acc. to IEC 61508-2, 3         □       Evaluation of HW/SW field data to verify ,prior use" acc. to IEC 61508-2, 3       □       Evaluation of HW/SW field data to verify ,prior use" acc. to IEC 61508-2, 3         □       Evaluation of HW/SW field data to verify ,prior use" acc. to IEC 61508-2, 3       □       Evaluation through - report/certificate no.         TÜV SÜD Rail GmBH Z10 020351 0010         Evaluation by FMEDA acc. to IEC 61508-2 for devices w/o sof         SilL - Integrity        □       Evaluation by FMEDA acc. to IEC 61508-2 for devices w/o sof         Systematic safety integrity        □       Sill 2 capable       Sill 3 ca         Hardware safety integrity        □       Sill 2 capable       Sill 3 ca         Safety function       MIN       MAX       RANGE         Augu 23.0       47 FIT       87 FIT       87 FI	Process variable/function			vel measu	rement		
Operating mode         ⊠ Low Demand Mode         High Demand Mode         Continuous M           Valid hardware version         As of 02.00         As of 02.00;         Valid software version         Valid software version         Valid software version         As of 02.00;         Valid software version         Valid softwar	Safety function(s)						
Operating mode         ⊠ Low Demand Mode         High Demand Mode         Continuous M           Valid hardware version         As of 02.00 <td>Device type acc. to IEC 61508-2</td> <td>Type A</td> <td>4</td> <td></td> <td>Type B</td> <td></td> <td></td>	Device type acc. to IEC 61508-2	Type A	4		Type B		
Valid software version       As of 02.0y; 02.30.zz recommended         Safety manual       FY01047P         Type of evaluation (check only one box)       Complete HW/SW evaluation parallel to development incl. FMEDA and change request acc. to IEC 61508-2, 3         L       Complete HW/SW evaluation of "proven in use" performance for HW/SW incl. FI and change request acc. to IEC 61508-2, 3         L       Evaluation of "proven in use" performance for HW/SW incl. FI and change request acc. to IEC 61508-2, 3         L       Evaluation of "BW/SW field data to verify prior use" acc. to IEC 61511         L       Evaluation by FMEDA acc. to IEC 61508-2, 3         Evaluation through – report/certificate no.       TÜV SÜD Rail GmbH Z10 020351 0010         Test documents       Test reports       Data sheets         SIL 2 capable       SIL 3 ca         Hardware safety integrity       Single channel use (HFT ≥ 0)       SIL 2 capable       SIL 3 ca         Hardware safety function       MIN       MAX       RANGE         Aou <sup>23,3</sup> 447 FIT       SO FIT       0 FIT         Aou <sup>23,3</sup> 452 FIT       452 FIT       452 FIT         SFF       92 %       92 %       92 %       92 %         PFDwg (T <sub>1</sub> = 1 year) <sup>31</sup> (single channel architecture)       3.8 × 10 <sup>4</sup> 3.8 × 10 <sup>4</sup> 3.8 × 10 <sup>4</sup> SFF	Operating mode	Low D	emand Mode				Continuous Mod
Safety manualFY01047PType of evaluation (check only one box)Complete HW/SW evaluation parallel to development incl. FMEDA and change request acc. to IEC 61508-2, 3Check only one box)Evaluation of "proven in use" performance for HW/SW wild. Fi and change request acc. to IEC 61508-2, 3Check only one box)Evaluation of HW/SW field data to verify prior use" acc. to IEC 61511Check only one box)Evaluation of HW/SW field data to verify prior use" acc. to IEC 61511Check only one box)TüV SÜD Rail GmbH Z10 020351 0010Test documentsDevelopment documentsSystematic safety integritySingle channel use (HFT = 0)Systematic safety integritySingle channel use (HFT = 0)Safety functionMINMulti channel use (HFT ≥ 1)SIL 2 capableSafety functionMINMou <sup>21,3)</sup> 87 FITApo <sup>21,3)</sup> S0 FITApo <sup>21,3)</sup> 442 FITApo <sup>21,3)</sup> S0 FITApo <sup>21,4)</sup> S.8 × 1	Valid hardware version						
Safety manual       FY01047P         Type of evaluation (check only one box)       Image: Complete HW/SW evaluation parallel to development incl. FMEDA and change request acc. to IEC 61508-2, 3         Image: Complete HW/SW field data to verify _prior use" performance of HW/SW lind. Fl and change request acc. to IEC 61508-2, 3         Image: Complete HW/SW field data to verify _prior use" acc. to IEC 61508-2, 3         Image: Complete HW/SW field data to verify _prior use" acc. to IEC 61508-2, 3         Image: Complete HW/SW field data to verify _prior use" acc. to IEC 61508-2, 3         Image: Complete HW/SW field data to verify _prior use" acc. to IEC 61508-2, 3         Image: Complete HW/SW field data to verify _prior use" acc. to IEC 61508-2, 3         Image: Complete HW/SW field data to verify _prior use" acc. to IEC 61508-2, 5         Evaluation through - report/certificate no.       TÜV SÜD Rail GmbH Z10 020351 0010         Test documents       Development documents       Test reports       Data sheets         SIL - Integrity       Single channel use (HFT = 0)       Image: SIL 2 capable       Image: SIL 3 ca         Hardware safety integrity       Single channel use (HFT ≥ 1)       Image: SIL 2 capable       Image: SIL 3 ca         Multi channel use (HFT ≥ 1)       Image: SIL 2 capable       Image: SIL 3 ca         Mod <sup>21,31</sup> 87 FIT       B7 FIT       B7 FIT       SIL 3 ca         Anoge <sup>21,31</sup> 87 FIT	Valid software version	As of 02.0	Dy; 02.30.zz re	comment	led		
Type of evaluation (check only one box)Example FMEDA and change request acc. to IEC 61508-2, 3 Evaluation of "proven in use" performance for HW/SW incl. Fl and change request acc. to IEC 61508-2, 3CEvaluation of HW/SW field data to verify prior use" acc. to IEC 61511CEvaluation by FMEDA acc. to IEC 61508-2, 3Evaluation through - report/certificate no.TÜV SÜD Rail GmbH Z10 020351 0010Test documentsDevelopment documentsTest reportsSIL - IntegrityImage: second s	Safety manual						
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$			FMEDA an	d change	request acc. to IEC 6	1508-	2, 3
$\begin{tabular}{ c c c c c } \hline  c c c c c c c c c c c c c c c c c c $			and change Evaluation	e request of HW/S	acc. to IEC 61508-2,	3	
Test documentsDevelopment documentsTest reportsData sheetsSIL - IntegritySystematic safety integrity $\Box$ SIL 2 capable $\Box$ SIL 3 caHardware safety integritySingle channel use (HFT = 0) $\Box$ SIL 2 capable $\Box$ SIL 3 caMulti channel use (HFT ≥ 1) $\Box$ SIL 2 capable $\Box$ SIL 3 caFMEDASafety functionMINMAXRANGESafety functionMINMAXRANGE $\Lambda_{00}$ $^{21,31}$ 87 FIT87 FIT87 FIT $\Lambda_{00}$ $^{21,31}$ 447 FIT50 FIT0 FIT $\Lambda_{50}$ $^{21,33}$ 50 FIT447 FIT452 FITSFF92 %92 %92 %PFDwg (T1 = 1 year) <sup>31</sup> (single channel architecture) $3.8 \times 10^{-4}$ $3.8 \times 10^{-4}$ $\Lambda_{104}$ $\lambda_{23}$ 1036 FIT1036 FIT1036 FITDiagnostic test interval <sup>50</sup> $S$ min (RAM,ROM), 1 s (Measurement)5 min (RAM,ROM), 10 s (Measurement)5 min (RAM,ROM), 10 s (Measurement)			Evaluation	by FMED		2 for o	devices w/o softwa
SIL - IntegrityInterpretData sine isSystematic safety integritySingle channel use (HFT = 0)SIL 2 capableSIL 3 caHardware safety integritySingle channel use (HFT = 0)SIL 2 capableSIL 3 caMulti channel use (HFT = 1)SIL 2 capableSIL 3 caFMEDASafety functionMINMAXRANSESafety functionMINMAXRANSESafety functionMINMAXRANSESafety functionMINMAXRANSESafety functionMINMAXRANSESafety functionMINMAXRANSESafety functionMINMAXRANSESafety functionMINMAXRANSEAge 2 %PSTPSTPSTPSTPSTPSTPSTPSTPSTPSTPSTPSTPSTPSTPSTPSTPSTPSTPST <td></td> <td>TÜV SÜD I</td> <td>Rail GmbH Z10</td> <td>020351</td> <td>0010</td> <td></td> <td></td>		TÜV SÜD I	Rail GmbH Z10	020351	0010		
Systematic safety integrity $\Box$ SIL 2 capable $\boxtimes$ SIL 3 caHardware safety integritySingle channel use (HFT = 0) $\boxtimes$ SIL 2 capable $\Box$ SIL 3 ca <b>FMEDA</b> $\Box$ MINMAXRANGESafety functionMINMAXRANGE $\lambda_{00}$ 2 <sup>1,3)</sup> 87 FIT87 FIT87 FIT $\lambda_{00}$ 2 <sup>1,3)</sup> 447 FIT50 FIT0 FIT $\lambda_{00}$ 2 <sup>1,3)</sup> 447 FIT50 FIT452 FIT $\lambda_{00}$ 2 <sup>1,3)</sup> 50 FIT447 FIT452 FIT $\lambda_{50}$ 2 <sup>1,3)</sup> 50 FIT447 FIT497 FITSFF92 %92 %92 %PFDavg (T1 = 1 year) <sup>31</sup> (single channel architecture) $3.8 \times 10^{-4}$ $3.8 \times 10^{-4}$ $\lambda_{104}$ 2 <sup>3,3)</sup> 1036 FIT1036 FIT1036 FITDiagnostic test interval <sup>50</sup> $5$ min (RAM,ROM), 1 s (Measurement)5 min (RAM,ROM), 10 s (Measurement)5 min (RAM,ROM), 10 s (Measurement)5 min (RAM,ROM), 10 s (Measurement)		Developm	ent document	s	Test reports		Data sheets
Label of the constraint of the constr	SIL - Integrity		Contraction of				
Hardware safety integrityMulti channel use (HFT $\geq 1$ )SIL 2 capableSIL 2 capableSIL 3 caFMEDASafety functionMAXRANGE $\lambda_{00}^{23,3}$ 87 FIT87 FIT87 FIT87 FIT $\lambda_{00}^{23,3}$ 60 FIT60 FIT60 FIT $\lambda_{00}^{23,3}$ 447 FIT50 FIT452 FIT452 FIT $\lambda_{50}^{23,3}$ 50 FIT447 FIT497 FITSFF92 %92 %PFDavg (T1 = 1 year) <sup>3</sup> ) (single channel architecture)3.8 × 10-43.8 × 10-43.8 × 10-4A:so $2^{3,3}$ 50 FIT447 FIT492 %PFDavg (T1 = 1 year) <sup>3</sup> ) (single channel architecture)3.8 × 10-43.8 × 10-43.8 × 10-43.8 × 10-43.8 × 10-43.8 × 10-4A:so $3^{2}$ (T1 = 1 year) <sup>3</sup> ) (single channel architecture)3.8 × 10-43.8 × 10-4A:so $3^{2}$ (T1 = 1 year) <sup>3</sup> )10:36 FIT10:36 FIT10:36 FITDiagnostic test interval <sup>50</sup> S min (RAM,ROM), 1 S (Measurement)S min (RAM,ROM), 1 S (Measurement)S min (RAM,ROM), <br< td=""><td>Systematic safety integrity</td><td></td><td></td><td></td><td>SIL 2 capable</td><td>2</td><td>🛛 SIL 3 capab</td></br<>	Systematic safety integrity				SIL 2 capable	2	🛛 SIL 3 capab
Multi channel use (HFT ≥ 1)         SIL 2 capable         SIL 3 ca           FMEDA         Safety function         MIN         MAX         RANGE $\lambda_{0u}^{21,3}$ 87 FIT         87 FIT         87 FIT         87 FIT $\lambda_{0u}^{21,3}$ 447 FIT         50 FIT         0 FIT $\lambda_{50}^{21,3}$ 452 FIT         452 FIT         452 FIT $\lambda_{50}^{21,3}$ 50 FIT         447 FIT         497 FIT           SFF         92 %         92 %         92 %           PFD <sub>avg</sub> (T <sub>1</sub> = 1 year) <sup>3</sup> (single channel architecture)         3.8 × 10 <sup>-4</sup> 3.8 × 10 <sup>-4</sup> 3.8 × 10 <sup>-4</sup> PFH         8.7 × 10 <sup>-6</sup> 1/h           PTC <sup>4</sup> A: 50 % / B: 99 %           Autor <sup>2,3</sup> 1036 FIT         1036 FIT         1036 FIT         1036 FIT         1036 FIT           Diagnostic test interval <sup>50</sup> 1 s (Measurement)         1 s (Measurement)         1 s (Measurement)         1 s (Measurement)           Fault reaction time <sup>61</sup> 5 min (RAM,ROM),         5 min (RAM,ROM),         5 min (RAM,ROM),         5 min (RAM,R	Hardware safety integrity	Single cha	nnel use (HFT	= 0)	🔀 SIL 2 capable	2	🔲 SIL 3 capab
Safety function         MIN         MAX         RANGE $\lambda_{00}^{21,30}$ 87 FIT         87 FIT         87 FIT         87 FIT $\lambda_{00}^{21,30}$ 447 FIT         50 FIT         0 FIT $\lambda_{00}^{21,30}$ 447 FIT         50 FIT         452 FIT $\lambda_{50}^{21,30}$ 452 FIT         452 FIT         452 FIT $\lambda_{50}^{21,30}$ 50 FIT         447 FIT         497 FIT           SFF         92 %         92 %         92 %           PFD <sub>avg</sub> (T <sub>1</sub> = 1 year) <sup>3</sup> (single channel architecture)         3.8 × 10 <sup>-4</sup> 3.8 × 10 <sup>-4</sup> 3.8 × 10 <sup>-4</sup> PFH         8.7 × 10 <sup>-8</sup> 1/h         8.7 × 10 <sup>-9</sup> 1/h         8.7 × 10 <sup>-9</sup> 1/h         8.7 × 10 <sup>-9</sup> 1/h           PTC <sup>41</sup> A: 50 % / B: 99 %         A: 50 % / B: 99 %         A: 50 % / B: 99 %         A: 50 % / B: 99 % $\lambda_{total}^{2,30}$ 1036 FIT         1036 FIT         1036 FIT         1036 FIT           Diagnostic test interval <sup>50</sup> 1 s (Measurement)         1 s (Measurement)         1 s (Measurement)         1 s (Measurement)           Fault reaction time <sup>61</sup> 5 min (RAM,ROM),         5 min (RAM,ROM),         5 min (RAM,ROM),         5 min (RAM,ROM),		Multi char	nnel use (HFT :	≥1)	SIL 2 capable	:	🛛 SIL 3 capab
April 21,33         B7 FIT         B7 FIT         B7 FIT         B7 FIT           Apple 21,33         447 FIT         50 FIT         0 FIT         0 FIT           Apple 21,33         447 FIT         50 FIT         0 FIT         452 FIT           Apple 21,33         452 FIT         452 FIT         452 FIT         452 FIT           Apple 21,33         50 FIT         447 FIT         497 FIT           SFF         92 %         92 %         92 %           PFD <sub>avg</sub> (T <sub>1</sub> = 1 year) <sup>3</sup> (single channel architecture)         3.8 × 10 <sup>-4</sup> 3.8 × 10 <sup>-4</sup> 3.8 × 10 <sup>-4</sup> PFH         8.7 × 10 <sup>-8</sup> 1/h         8.7 × 10 <sup>-9</sup> 1/h         8.7 × 10 <sup>-9</sup> 1/h         8.7 × 10 <sup>-9</sup> 1/h           PTC <sup>4</sup> A: 50 % / B: 99 %           A <sub>butal</sub> <sup>2,33</sup> 1036 FIT         1036 FIT         1036 FIT         1036 FIT           Diagnostic test interval <sup>50</sup> 1 s (Measurement)         1 s (Measurement)         1 s (Measurement)         1 s (Measurement)           Fault reaction time <sup>6</sup> 5 min (RAM,ROM), 10 s (Measurement)	FMEDA						
App 23,31         A47 FIT         50 FIT         0 FIT           Asy 23,31         447 FIT         50 FIT         0 FIT           Asy 23,31         452 FIT         452 FIT         452 FIT           Asy 23,31         50 FIT         447 FIT         452 FIT           Asy 23,31         50 FIT         447 FIT         497 FIT           SFF         92 %         92 %         92 %           PFD <sub>avg</sub> (T <sub>1</sub> = 1 year) 3) (single channel architecture)         3.8 × 10 <sup>-4</sup> 3.8 × 10 <sup>-4</sup> 3.8 × 10 <sup>-4</sup> PFH         8.7 × 10 <sup>-8</sup> 1/h         8.7 × 10 <sup>-9</sup> 1/h         8.7 × 10 <sup>-9</sup> 1/h         8.7 × 10 <sup>-9</sup> 1/h           PTC 4 <sup>1</sup> A: 50 % / B: 99 %           A <sub>1041</sub> <sup>2,3)</sup> 1036 FIT         1036 FIT         1036 FIT         1036 FIT           Diagnostic test interval <sup>50</sup> 1 s (Measurement)         1 s (Measurement)         1 s (Measurement)         1 s (Measurement)           Fault reaction time <sup>60</sup> 5 min (RAM,ROM), 10 s (Measurement)	Safety function	MIN		MAX		RA	NGE
Asu 21.3)         452 FIT         452 FIT         452 FIT         452 FIT           Aso 21.3)         50 FIT         447 FIT         497 FIT           SFF         92 %         92 %         92 %           PFDavg (T1 = 1 year) <sup>3</sup> ) (single channel architecture)         3.8 × 10 <sup>-4</sup> 3.8 × 10 <sup>-4</sup> 3.8 × 10 <sup>-4</sup> PFH         8.7 × 10 <sup>-6</sup> 1/h           PTC <sup>4</sup> )         A: 50 % / B: 99 %           A <sub>total</sub> <sup>2,3)</sup> 1036 FIT         1036 FIT         1036 FIT         1036 FIT           Diagnostic test interval <sup>50</sup> 5 min (RAM,ROM), 1 s (Measurement)         5 min (RAM,ROM), 1 s (Measurement)         5 min (RAM,ROM), 10 s (Measurement)         5 min (RAM,ROM), 10 s (Measurement)	λ <sub>DU</sub> <sup>2),3)</sup>	87 FIT		87 FI	т	87	FIT
λ <sub>SD</sub> 21.3)         50 FIT         447 FIT         497 FIT           SFF         92 %         92 %         92 %           PFD <sub>avg</sub> (T <sub>1</sub> = 1 year) <sup>3</sup> ) (single channel architecture)         3.8 × 10 <sup>-4</sup> 3.8 × 10 <sup>-4</sup> 3.8 × 10 <sup>-4</sup> PFH         8.7 × 10 <sup>-8</sup> 1/h         8.7 × 10 <sup>-9</sup> 1/h         8.7 × 10 <sup>-9</sup> 1/h         8.7 × 10 <sup>-9</sup> 1/h           PTC <sup>4</sup> A: 50 % / B: 99 %           https://table.com/		447 FIT		50 FI	Т	OF	IT
SFF         92 %         92 %         92 %           PFD <sub>avg</sub> (T <sub>1</sub> = 1 year) <sup>3</sup> ) (single channel architecture)         3.8 × 10 <sup>-4</sup> 3.8 × 10 <sup>-4</sup> 3.8 × 10 <sup>-4</sup> PFH         8.7 × 10 <sup>-8</sup> 1/h           PTC <sup>4</sup> )         A: 50 % / B: 99 %           A <sub>1004</sub> <sup>2,33</sup> 1036 FIT         1036 FIT         1036 FIT         1036 FIT           Diagnostic test interval <sup>50</sup> 5 min (RAM,ROM), 1 s (Measurement)         5 min (RAM,ROM), 1 s (Measurement)         5 min (RAM,ROM), 10 s (Measurement)         5 min (RAM,ROM), 10 s (Measurement)						45	2 FIT
PFD <sub>avg</sub> (T <sub>1</sub> = 1 year) <sup>3</sup> ) (single channel architecture)         3.8 × 10 <sup>-4</sup> 3.8 × 10 <sup>-4</sup> 3.8 × 10 <sup>-4</sup> PFH         8.7 × 10 <sup>-8</sup> 1/h         8.7 × 10 <sup>-9</sup> 1/h         8.7 × 10 <sup>-9</sup> 1/h         8.7 × 10 <sup>-9</sup> 1/h           PTC <sup>4</sup> )         A: 50 % / B: 99 %         A: 50 % / B: 99 %         A: 50 % / B: 99 %         A: 50 % / B: 99 % $\lambda_{total}$ <sup>2,3)</sup> 1036 FIT         1036 FIT         1036 FIT         1036 FIT           Diagnostic test interval <sup>5</sup> )         5 min (RAM,ROM), 1 s (Measurement)         5 min (RAM,ROM), 1 s (Measurement)         5 min (RAM,ROM), 10 s (Measurement)         5 min (RAM,ROM), 10 s (Measurement)		50 FIT		447	FIT	49	7 FIT
PFH         8.7 × 10 <sup>-6</sup> 1/h           PTC <sup>4</sup> )         A: 50 % / B: 99 %         A: 50 % / B: 90 %         A: 50 % / B: 90 %         A: 50 % / B: 90 %		92 %		92 %		92	%
PTC 4)         A: 50 % / B: 99 %         A: 50 % / B: 99 %         A: 50 % / B: 99 %           λ <sub>total</sub> 2.3)         1036 FIT         1036 FIT         1036 FIT         1036 FIT           Diagnostic test interval <sup>5</sup> )         5 min (RAM,ROM), 1 s (Measurement)         5 min (RAM,ROM), 10 s (Measurement)         5 min (RAM,ROM), 10 s (Measurement)	$PFD_{avg}$ (T <sub>1</sub> = 1 year) <sup>3</sup> (single channel architecture)	3.8 × 10 <sup>-4</sup>		3.8 ×	10-4	3.8	3 × 10 <sup>-4</sup>
λ <sub>total</sub> 2.3)         1036 FIT         1036 FIT         1036 FIT         1036 FIT         1036 FIT           Diagnostic test interval <sup>5</sup> )         5 min (RAM,ROM), 1 s (Measurement)         5 min (RAM,ROM), 10 s (Measurement)         5 min (R		8.7 × 10 <sup>-8</sup>	1/h	8.7 ×	10 <sup>-8</sup> 1/h	8.7	× 10 <sup>-8</sup> 1/h
Diagnostic test interval <sup>5</sup> )     5 min (RAM,ROM), 1 s (Measurement)       Fault reaction time <sup>6</sup> )     5 min (RAM,ROM), 10 s (Measurement)		A: 50 % /	B: 99 %	A: 50	% / B: 99 %	A:	50 % / B: 99 %
Diagnosuc test interval */     1 s (Measurement)     1 s (Measurement)     1 s (Measurement)       Fault reaction time */     5 min (RAM,ROM), 10 s (Measurement)	Atotal 2,3)			_			
10 s (Measurement) 10 s (Measurement) 10 s (Measurement)		1 s (Measu	urement)	1 s (M	Aeasurement)	1 s	(Measurement)
Comments	ault reaction time						
connicito	Comments						all and the factor
-							
Declaration	Declaration		A Contraction				al al subsection of
Our internal company quality management system ensures information on safety-related systematic faults which become	Our internal company quality managemer	nt system ensu	res information	n on safet	y-related systematic	faults	which become

## 2 About this document

## 2.1 Document function

This supplementary Safety Manual applies in addition to the Operating Instructions, Technical Information and ATEX Safety Instructions. The supplementary device documentation must be observed during installation, commissioning and operation. The requirements specific for the protection function are described in this Safety Manual.

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

www.endress.com/SIL

WP01032F, Whitepaper "Functional Safety in practice"

## 2.2 Symbols used

#### 2.2.1 Safety symbols

#### **DANGER**

This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.

#### **WARNING**

This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.

#### **A**CAUTION

This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.

#### NOTICE

This symbol contains information on procedures and other facts which do not result in personal injury.

#### 2.2.2 Symbols for certain types of information and graphics

#### 🚹 Tip

Indicates additional information

#### 

Reference to documentation

#### 

Reference to graphic

#### 

Notice or individual step to be observed

#### 1., 2., 3.

Series of steps

#### 

Result of a step

**1, 2, 3, ...** Item numbers

**A, B, C, ...** Views

## 2.3 Supplementary device documentation

For an overview of the scope of the associated Technical Documentation, refer to the following:

- W@M Device Viewer (www.endress.com/deviceviewer): Enter the serial number from the nameplate
- *Endress+Hauser Operations App*: Enter the serial number from the nameplate or scan the matrix code on the nameplate

The following document types are available in the Downloads section of the Endress+Hauser website (www.endress.com/downloads):

#### 2.3.1 Further applicable documents

- TI00383P
- BA00271P
- KA00218P
- KA01019P
- BA00274P (Description of Device Functions)

#### 2.3.2 Technical Information (TI)

#### Planning aid

The document contains all the technical data on the device and provides an overview of the accessories and other products that can be ordered for the device.

#### 2.3.3 Operating Instructions (BA)

#### Your reference guide

These Operating Instructions contain all the information that is required in various phases of the life cycle of the device: from product identification, incoming acceptance and storage, to mounting, connection, operation and commissioning through to troubleshooting, maintenance and disposal.

#### 2.3.4 Brief Operating Instructions (KA)

#### Guide that takes you quickly to the 1st measured value

The Brief Operating Instructions contain all the essential information from incoming acceptance to initial commissioning.

#### 2.3.5 Certificate

The associated certificate is available in the Endress+Hauser W@M Device Viewer or can be found in the declaration of conformity of the applicable Functional Safety Manual. This certificate must be valid at the time of delivery of the device.

## 3 Design

## 3.1 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 firmware and hardware versions.

Unless otherwise specified, all subsequent versions can also be used for safety functions.

A modification process according to IEC 61508 is applied for any device modifications.

Any exemptions from possible combinations of features are saved in the Endress +Hauser ordering system.

Valid device versions for safety-related use:

#### 3.1.1 Order codes

Cerabar S PMC71

Feature: 010 "Approval" Version: all

## Feature: 020 "Output; Operation" Version:

- A: 4-20mA HART; extern. + LCD
- B: 4-20mA HART; inside + LCD
- C: 4-20mA HART; inside
- D: 4-20mA HART; Li=0 extern. + LCD
- E: 4-20mA HART; Li=0 inside + LCD
- F: 4-20mA HART; Li=0 inside

Feature: 030 "Housing; Cover sealing; Cable entry" Version: all

Feature: 040 "Sensor range; Sensor overload limit" Version: all

Feature: 050 "Calibration; unit" Version: all

Feature: 070 "Process connection" Version: all

Feature: 080 "Seal" Version: all

**Feature: 100 "Additional option 1"** Version: E; SIL

#### or

#### Feature: 110 "Additional option 2"

Version: E; SIL

Valid firmware version: as of 02.00.zz ( $\rightarrow$  nameplate of the device)

Valid hardware version (electronics): from 02.00.ww ( $\rightarrow$  device nameplate)

## 3.2 Identification marking

SIL-certified devices are marked with the SIL logo  $\textcircled{\sc subscript{on}}$  on the nameplate.

## 3.3 Safety function

The device's safety functions are:

- Minimum, maximum or range monitoring
- Absolute pressure measurement
- Gauge pressure measurement

The assessment of the functional safety of a device includes the basic unit with the main electronics, sensor electronics and sensor up to the sensor diaphragm and the process connection mounted directly on the device. The process adapter and mounted/enclosed accessories were not taken into account in the rating.

#### 3.3.1 Safety-related output signal

The device's safety-related signal is the 4 to 20 mA analog output signal as per NAMUR NE43. All safety measures refer to this signal exclusively. The device additionally communicates for information only via HART and contains all HART features with additional device information. HART communication is not part of the safety function. The behavior of the output current in the event of a fault depends on the settings for the alarms and warnings. The safety-related output signal is fed to a downstream logic unit, e.g. a programmable logic controller or a limit signal transmitter, where it is monitored to determine whether:

- it exceeds and/or drops below a predefined limit value
- a fault has occurred, e.g. failure current (≤3.6 mA, ≥21.0 mA, signal cable open circuit or short-circuit).

#### NOTICE

#### In an alarm condition

• Ensure that the equipment under control achieves or maintains a safe state.

The following dangerous undetected failures can occur in the devices:

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

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

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

- Configuration changes
- Multidrop
  - with SW version < 02.20 if the "Bus address (345)" parameter is set to ≠ "0".</p>
  - with SW version ≥ 02.20 if the "Current mode (052)" parameter is set to "Fixed" (local display and FieldCare) or "Disabled" (HART handheld terminal).
- Simulation
- Proof testing

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

#### 3.3.2 Redundant configuration of multiple sensors

With redundant configuration with HFT = 1 (e.g. 1002 or 2003 architecture), the device meets the requirements for SIL 3.

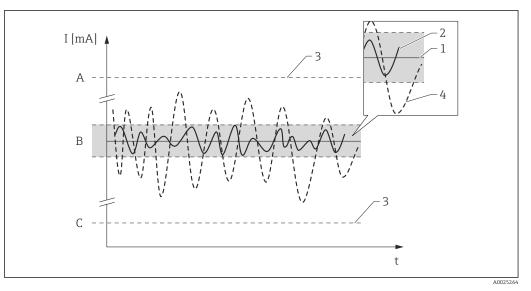
The common cause factors ß and  $\beta_D$  indicated in the table below are minimum values for the device. These values should be used when calculating the failure probability of redundantly connected devices according to IEC 61508-6. The plant-specific assessment can return higher values depending on the particular installation and the use of other components (e.g. Ex barrier).

	Minimum value ß with homogeneous redundant use	5 %
[	Minimum value $\ensuremath{\mathtt{B}}_D$ with homogeneous redundant use	2 %

## 3.4 Basic conditions 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 in the Operating Instructions and the Technical Information must not be exceeded.

3.4.1 Safety-related failures according to IEC / EN 61508							
Safety-related error	Explanation	Implications for the safety related output signal		ations for measuring uncertainty (see item number in c below)			
No device error	Safe: SD No error	None	1	Is within the specification (see TI, BA,)			
$\lambda_{S}$	Safe failure	Causes the output signal to signal the failsafe mode	3	No implications			
$\lambda_{S}$	Safe failure	Is within the defined error range	2	May be outside specifications			
λ <sub>DD</sub>	Dangerous detected: Dangerous failure which can be detected (diagnostic at the device)	Causes the output signal to signal the failsafe mode	3	No implications			
$\lambda_{DU}$	Dangerous undetected: Dangerous failure which cannot be detected	May be outside the defined error range	4	May be outside the defined error range			



- Α Hi- $Alarm \ge 21 mA$
- Error range ± 1 % В
- Lo-Alarm ≤ 3.6 mA С

#### 3.4.2 Safety measured error

The total deviations with regard to the safety-related current output are composed of:

- Measured errors under reference operating conditions: as per Technical Information
- Measured errors due to process/installation/ambient conditions: as per Technical Information
- Measured errors due to ambient conditions (EMC): ±0.5 % based on the span of the safety-related current output

Strong, pulse-like EMC interference on the power supply line can result in transient (< 1 s) deviations in the output signal ( $\geq \pm 1$  % based on the span of the safety related current output). Therefore, filtering with a time constant  $\geq 1$  s should be performed in the downstream logic unit.

• Measured errors due to random component failures (SIL error range): ±1 % based on the span of the safety-related current output

#### 3.4.3 Restrictions for safety-related operation

- Device warm-up time: after device warm-up, the safety functions are available after a 30 Sekunden initialization period.
- If the device is operated locally without a display and without an operating tool or without a HART communicator, it cannot be safely configured because the user cannot perform a visual check. In both these situations, communication via HART alone is not sufficient.
- The device must be locked after parameter configuration.
- When the device is used as a subsystem of a safety function, the "Hold measured value" setting in the "Output fail mode (388)" parameter and the Multidrop mode may not be selected as this option does not guarantee a failsafe alarm.
- A complete function test of the safety-related functions must be carried out during commissioning.
- The maximum interval for proof testing (proof test interval) is 5 Jahre.
- Faulty devices must be replaced as soon as possible to minimize the possibility of multiple errors occurring. The failure probabilities indicated in this Functional Safety Manual are based on a medium time to repair (MTTR) of 8 Stunden.

## 3.5 Dangerous undetected failures in this scenario

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

## 3.6 Useful lifetime of electric components

The established failure rates of electrical components apply within the useful lifetime as per IEC 61508-2:2010 section 7.4.9.5 note 3.

According to DIN EN 61508-2:2011 section 7.4.9.5 (national footnote N3) appropriate measures taken by the operator can extend the useful lifetime.

## 4 Commissioning (installation and configuration)

## 4.1 Requirements for personnel

The personnel for installation, commissioning, diagnostics and maintenance must fulfill the following requirements:

- Trained, qualified specialists must have a relevant qualification for this specific function and task.
- ▶ Personnel must be authorized by the plant owner/operator.
- Be familiar with federal/national regulations.
- Before starting work: personnel must read and understand the instructions in the manual and supplementary documentation as well as the certificates (depending on the application).
- ► Personnel must follow instructions and comply with general policies.

The operating personnel must fulfill the following requirements:

- Personnel are instructed and authorized according to the requirements of the task by the facility's owner-operator.
- Personnel follow the instructions in this manual.

## 4.2 Installation

The mounting and wiring of the device and the permitted orientations are described in the Operating Instructions pertaining to the device.



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

## 4.3 Commissioning

The commissioning of the device is described in the Operating Instructions pertaining to the device.

Prior to operating the device in a safety instrumented system, verification must be performed by carrying out a test sequence as described in Section **6 Proof testing**.

## 4.4 Operation

The operation of the device is described in the Operating Instructions pertaining to the device.

## 4.5 Device configuration for safety-related applications

#### 4.5.1 Calibration of the measuring point

🖪 For more information, see the Operating Instructions.

## 4.5.2 Configuration methods

#### Increased security during parameter entry

The following conditions are permitted and recommended for devices without a local display that are to be used in process control safety systems:

- Via the FieldCare/DeviceCare operating program and DTM with firmware version ≥ 02.10
- Via the Field Communicator handheld terminal and Device Description with device revision  $\geq 21$

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

Parameter configuration via local display

- 1. Reset parameters to factory setting: reset code "7864" (see the associated Operating Instructions, "Resetting to factory setting (reset)" section). Check default values, number formats and parameter descriptions with the "Device parameter configuration report".
- 2. Configure the device.
- 3. Enter the settings for the following parameters according to the report, since these settings are queried for safe device configuration.

Parameter	Available in the op	erating mode	Group
	Pressure	Level, level selection "Level easy pressure"	
ACK. ALARM MODE	Х	Х	MESSAGES
CALIB. OFFSET	Х	Х	POSITION ADJUST.

Parameter	Available in the op	erating mode	Group
	Pressure	Level, level selection "Level easy pressure"	
MEASURING MODE	Х	Х	MEASURING MODE
EMPTY PRESSURE		Х	BASIC SETUP
EMPTY CALIB.		Х	BASIC SETUP
FULL PRESSURE		Х	BASIC SETUP
FULL CALIB.		Х	BASIC SETUP
SET LRV	Х	Х	BASIC SETUP
SET URV	Х	Х	BASIC SETUP
DAMPING VALUE	Х	Х	BASIC SETUP
OUTPUT FAIL MODE 1)	Х	Х	OUTPUT
SET MIN. CURRENT <sup>1)</sup>	Х	Х	OUTPUT
SET MAX. ALARM <sup>1)</sup>	Х	Х	OUTPUT
E727 P.OVERRANGE 1)	Х	Х	OUTPUT

1) From firmware version  $\geq 2.30$ 

- The EMPTY PRESSURE and FULL PRESSURE parameters are only displayed for the "Dry" CALIBRATION MODE. If you have performed a wet calibration, you must subsequently select the "Dry" option via the CALIBRATION MODE parameter. You can read out the corresponding values for the EMPTY PRESSURE and FULL PRESSURE parameters here.
- 4. Switch the device off and then on again. This ensures that the parameter settings are saved.
- 5. Check the safety function.
- 6. Select the "SAFETY CONFIRM." group (menu path: (GROUP SELECTION→) OPERATING MENU → SAFETY CONFIRM.)
- 7. Select the "Lock" option. Select the "Lock" option via the SAFETY LOCK parameter. The status "Locked" or "Unlocked" is indicated on the fourth line of the display.
- 8. Enter the password via the SAFETY PASSWORD parameter (password: 7452)

#### For firmware version ≤02.20.04

- If the correct password is entered, the following parameters are reset to the factory values (→ Step 10 for factory values):
  - CURRENT CHARACT.
  - OUTPUT FAIL MODE
  - ALT. CURR. OUTPUT
  - SET MAX. ALARM
  - SET MIN. CURRENT
  - SIMULATION
  - ALARM DELAY
  - ALARM DISPLAY TIME
  - SELECT ALARM TYPE
- Any simulation which may be running is ended
- The configurable messages ("Error"-type messages) 115, 120, 620, 715, 716, 717, 718, 720, 726 and 727 are automatically set to "Alarm" ("Messages" section of the relevant Operating Instructions)

#### For firmware version ≥02.30.zz

- Any simulation which may be running is ended
- No parameters are reset

Log the following confirmed settings according to the "Device parameter configuration report".

- 9. Via the DIGIT SETS parameter, the user can check whether the characters and digits are displayed correctly on the user interface. "0123456789.-" is shown if everything is displayed correctly. Options: Valid: Select this option if the string of characters and digits is displayed correctly. Not valid: Select this option if the string of characters and digits is not displayed correctly. In this case, operation in the safe measuring mode is not possible. The confirmation sequence is cancelled.
- Only for firmware version ≤02.20.04: Via the OUTPUT CURRENT parameter, the user can check whether the following parameters are correctly reset to the factory values. If reset correctly, the OUTPUT CURRENT parameter displays "LinMaxNorm/22/3.8/0s".

Factory values:

- CURRENT CHARACT.: Linear
- OUTPUT FAIL MODE: Max. alarm
- ALT. CURR. OUTPUT: Normal
- SET MAX. ALARM: 22 mA
- SET MIN. CURRENT: 3.8 mA
- ALARM DELAY: 0.0 s
- ALARM DISPLAY TIME: 0.0 s

Options:

- Valid: Select this option if the factory values displayed correspond to the desired values. The device continues to interrogate the safety-related parameters.
- Not valid: Select this option if the factory values displayed do not correspond to the desired values. In this case, operation in the safe measuring mode is not possible. The SAFETY LOCK parameter displays the status "Unlocked". The confirmation sequence is cancelled.

**11.** Depending on the selected operating mode, the following parameters must be confirmed:

#### For firmware version ≤02.20.04

- ACK. ALARM MODE
- CALIB. OFFSET
- MEASURING MODE
- EMPTY PRESSURE (only Level operating mode)
- EMPTY CALIB. (only Level operating mode)
- FULL PRESSURE (only Level operating mode)
- FULL CALIB. (only Level operating mode)
- SET LRV
- SET URV
- DAMPING VALUE

#### For firmware version $\geq 02.30.zz$

- ACK. ALARM MODE
- CALIB. OFFSET
- MEASURING MODE
- EMPTY PRESSURE (only Level operating mode)
- EMPTY CALIB. (only Level operating mode)
- FULL PRESSURE (only Level operating mode)
- FULL CALIB. (only Level operating mode)
- SET LRV
- SET URV
- DAMPING VALUE

- OUTPUT FAIL MODE
- SET MIN. CURRENT
- SET MAX. ALARM
- E727 P.OVERRANGE

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

Options:

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

Parameter configuration via Field Communicator 375/475 handheld terminal

- Go to "Main Menu" → "HART Communication" → "HART-Application" → "Online". The device is then found automatically and opened online. Ensure that the device bus address = 0.
- 2. Ensure that the connection has been made with the correct device. This can be done using the "Measuring point" parameter, the extended order number or the serial number.
- **3.** Reset parameters to factory setting: reset code "7864" (see the associated Operating Instructions, "Resetting to factory setting (reset)" section). Check default values, number formats and parameter descriptions with the "Device parameter configuration report".
- 4. Configure the device.
- 5. Enter the settings for the following parameters according to the report, since these settings are queried for safe device configuration.

Parameter	Available in the op	erating mode	Group
	Pressure	Level, level selection "Level easy pressure"	
ACK. ALARM MODE	Х	Х	MESSAGES
CALIB. OFFSET	Х	Х	POSITION ADJUST.
MEASURING MODE	Х	Х	MEASURING MODE
EMPTY PRESSURE		Х	BASIC SETUP
EMPTY CALIB.		Х	BASIC SETUP
FULL PRESSURE		Х	BASIC SETUP
FULL CALIB.		Х	BASIC SETUP
SET LRV	Х	Х	BASIC SETUP
SET URV	Х	Х	BASIC SETUP
DAMPING VALUE	Х	Х	BASIC SETUP
OUTPUT FAIL MODE 1)	Х	Х	OUTPUT
SET MIN. CURRENT 1)	Х	Х	OUTPUT

Parameter	Available in the op	erating mode	Group
	Pressure	Level, level selection "Level easy pressure"	
SET MAX. ALARM <sup>1)</sup>	Х	Х	OUTPUT
E727 P.OVERRANGE 1)	Х	Х	OUTPUT

#### 1) From firmware version $\geq 2.30$

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

- 6. Switch the device off and then on again. This ensures that the parameter settings are saved.
- 7. Check the safety function.
- 8. Close the Field Communicator 375/475 handheld terminal. Then connect to the device again.
- **9.** Select the "SAFETY CONFIRM." group (menu path: (GROUP SELECTION→) OPERATING MENU → SAFETY CONFIRM.)
- 10. Select the "Lock" option. Select the "Lock" option via the SAFETY LOCK parameter. The status "Locked" or "Unlocked" is indicated on the fourth line of the display.
- 11. Enter the password via the SAFETY PASSWORD parameter (password: 7452)

#### For firmware version ≤02.20.04

- If the correct password is entered, the following parameters are reset to the factory values (→ Step 10 for factory values):
  - CURRENT CHARACT.
  - OUTPUT FAIL MODE
  - ALT. CURR. OUTPUT
  - SET MAX. ALARM
  - SET MIN. CURRENT
  - SIMULATION
  - ALARM DELAY
  - ALARM DISPLAY TIME
  - SELECT ALARM TYPE
- Any simulation which may be running is ended
- The configurable messages ("Error"-type messages) 115, 120, 620, 715, 716, 717, 718, 720, 726 and 727 are automatically set to "Alarm" ("Messages" section of the relevant Operating Instructions)

#### For firmware version ≥02.30.zz

- Any simulation which may be running is ended
- No parameters are reset

Log the following confirmed settings according to the "Device parameter configuration report".

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

 Only for firmware version ≤02.20.04: Via the OUTPUT CURRENT parameter, the user can check whether the following parameters are correctly reset to the factory values. If reset correctly, the OUTPUT CURRENT parameter displays "LinMaxNorm/22/3.8/0s".

Factory values:

- CURRENT CHARACT.: Linear
- OUTPUT FAIL MODE: Max. alarm
- ALT. CURR. OUTPUT: Normal
- SET MAX. ALARM: 22 mA
- SET MIN. CURRENT: 3.8 mA
- ALARM DELAY: 0.0 s
- ALARM DISPLAY TIME: 0.0 s

Options:

- Valid: Select this option if the factory values displayed correspond to the desired values. The device continues to interrogate the safety-related parameters.
- Not valid: Select this option if the factory values displayed do not correspond to the desired values. In this case, operation in the safe measuring mode is not possible. The SAFETY LOCK parameter displays the status "Unlocked". The confirmation sequence is cancelled.
- **14.** Depending on the selected operating mode, the following parameters must be confirmed:

#### For firmware version ≤02.20.04

- ACK. ALARM MODE
- CALIB. OFFSET
- MEASURING MODE
- EMPTY PRESSURE (only Level operating mode)
- EMPTY CALIB. (only Level operating mode)
- FULL PRESSURE (only Level operating mode)
- FULL CALIB. (only Level operating mode)
- SET LRV
- SET URV
- DAMPING VALUE

#### For firmware version ≥02.30.zz

- ACK. ALARM MODE
- CALIB. OFFSET
- MEASURING MODE
- EMPTY PRESSURE (only Level operating mode)
- EMPTY CALIB. (only Level operating mode)
- FULL PRESSURE (only Level operating mode)
- FULL CALIB. (only Level operating mode)
- SET LRV
- SET URV
- DAMPING VALUE
- OUTPUT FAIL MODE
- SET MIN. CURRENT
- SET MAX. ALARM
- E727 P.OVERRANGE

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

Options:

- Valid: Select this option if the entered value or the desired value is displayed. The device continues to interrogate the safety-related parameters.
- Not valid: Select this option if an incorrect value or a value that was not entered is displayed. In this case, operation in the safe measuring mode is not possible. The SAFETY LOCK parameter displays the status "Unlocked". The confirmation sequence is cancelled.

- **15.** Once the safety-related parameters have been successfully interrogated, the password "7452" must be entered again via the CONF. PASSWORD parameter. Afterwards, the device is locked for the safe measuring mode. The SAFETY LOCK parameter displays the status "Locked". This locking has the highest priority and can only be disabled via the SAFETY LOCK and SAFETY PASSWORD parameters.
- **16.** Switch the device off and then on again. This ensures that the parameter settings for the current output, alarm response and locking are saved. Read out the parameters again and compare them to the data recorded in the "Device parameter configuration report".
- The "Offline" operating function is not permitted for the configuration of an application with functional safety. Please ensure that no messages (e.g. Device disconnected) are displayed during the parameter configuration.

#### Parameter configuration via FieldCare operating program

- The connection can be established in the following two ways: 1) Select the "HART Communication" connection wizard. The device will then be found automatically and opened online. Ensure that the device bus address = 0. 2) In the tree structure, select "Create projects" → "Add device" → "HART communication" and then select "Create network". The device is opened online. Ensure that the device bus address = 0.
- 2. Ensure that the connection has been made with the correct device. This can be done using the "Measuring point" parameter, the extended order number or the serial number.
- **3.** Reset parameters to factory setting: reset code "7864" (see the associated Operating Instructions, "Resetting to factory setting (reset)" section). Check default values, number formats and parameter descriptions with the "Device parameter configuration report".
- 4. Configure the device.
- 5. Enter the settings for the following parameters according to the report, since these settings are queried for safe device configuration.

Parameter	Available in the op	erating mode	Group	
	Pressure	Level, level selection "Level easy pressure"	_	
ACK. ALARM MODE	Х	Х	MESSAGES	
CALIB. OFFSET	Х	Х	POSITION ADJUST.	
MEASURING MODE	Х	Х	MEASURING MODE	
EMPTY PRESSURE		Х	BASIC SETUP	
EMPTY CALIB.		Х	BASIC SETUP	
FULL PRESSURE		Х	BASIC SETUP	
FULL CALIB.		Х	BASIC SETUP	
SET LRV	Х	Х	BASIC SETUP	
SET URV	Х	Х	BASIC SETUP	
DAMPING VALUE	Х	Х	BASIC SETUP	
OUTPUT FAIL MODE 1)	Х	Х	OUTPUT	
SET MIN. CURRENT <sup>1)</sup>	Х	Х	OUTPUT	

Parameter	Available in the op	erating mode	Group
	Pressure Level, level selection "Level easy pressure"		
SET MAX. ALARM <sup>1)</sup>	Х	Х	OUTPUT
E727 P.OVERRANGE 1)	Х	Х	OUTPUT

#### 1) From firmware version $\geq 2.30$

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

- 6. Switch the device off and then on again. This ensures that the parameter settings are saved.
- 7. Check the safety function.
- 8. Close FieldCare. Then connect to the device again.
- 9. Select the "SAFETY CONFIRM." group (menu path: (GROUP SELECTION→) OPERATING MENU → SAFETY CONFIRM.)
- 10. Select the "Lock" option. Select the "Lock" option via the SAFETY LOCK parameter. The status "Locked" or "Unlocked" is indicated on the fourth line of the display.
- **11.** Enter the password via the SAFETY PASSWORD parameter (password: 7452)

#### For firmware version ≤02.20.04

- If the correct password is entered, the following parameters are reset to the factory values (→ Step 10 for factory values):
  - CURRENT CHARACT.
  - OUTPUT FAIL MODE
  - ALT. CURR. OUTPUT
  - SET MAX. ALARM
  - SET MIN. CURRENT
  - SIMULATION
  - ALARM DELAY
  - ALARM DISPLAY TIME
  - SELECT ALARM TYPE
- Any simulation which may be running is ended
- The configurable messages ("Error"-type messages) 115, 120, 620, 715, 716, 717, 718, 720, 726 and 727 are automatically set to "Alarm" ("Messages" section of the relevant Operating Instructions)

#### For firmware version $\geq 02.30.zz$

- Any simulation which may be running is ended
- No parameters are reset

Log the following confirmed settings according to the "Device parameter configuration report".

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

 Only for firmware version ≤02.20.04: Via the OUTPUT CURRENT parameter, the user can check whether the following parameters are correctly reset to the factory values. If reset correctly, the OUTPUT CURRENT parameter displays "LinMaxNorm/22/3.8/0s".

Factory values:

- CURRENT CHARACT.: Linear
- OUTPUT FAIL MODE: Max. alarm
- ALT. CURR. OUTPUT: Normal
- SET MAX. ALARM: 22 mA
- SET MIN. CURRENT: 3.8 mA
- ALARM DELAY: 0.0 s
- ALARM DISPLAY TIME: 0.0 s

Options:

- Valid: Select this option if the factory values displayed correspond to the desired values. The device continues to interrogate the safety-related parameters.
- Not valid: Select this option if the factory values displayed do not correspond to the desired values. In this case, operation in the safe measuring mode is not possible. The SAFETY LOCK parameter displays the status "Unlocked". The confirmation sequence is cancelled.
- **14.** Depending on the selected operating mode, the following parameters must be confirmed:

#### For firmware version ≤02.20.04

- ACK. ALARM MODE
- CALIB. OFFSET
- MEASURING MODE
- EMPTY PRESSURE (only Level operating mode)
- EMPTY CALIB. (only Level operating mode)
- FULL PRESSURE (only Level operating mode)
- FULL CALIB. (only Level operating mode)
- SET LRV
- SET URV
- DAMPING VALUE

#### For firmware version ≥02.30.zz

- ACK. ALARM MODE
- CALIB. OFFSET
- MEASURING MODE
- EMPTY PRESSURE (only Level operating mode)
- EMPTY CALIB. (only Level operating mode)
- FULL PRESSURE (only Level operating mode)
- FULL CALIB. (only Level operating mode)
- SET LRV
- SET URV
- DAMPING VALUE
- OUTPUT FAIL MODE
- SET MIN. CURRENT
- SET MAX. ALARM
- E727 P.OVERRANGE

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

#### Options:

- Valid: Select this option if the entered value or the desired value is displayed. The device continues to interrogate the safety-related parameters.
- Not valid: Select this option if an incorrect value or a value that was not entered is displayed. In this case, operation in the safe measuring mode is not possible. The SAFETY LOCK parameter displays the status "Unlocked". The confirmation sequence is cancelled.

- **15.** Once the safety-related parameters have been successfully interrogated, the password "7452" must be entered again via the CONF. PASSWORD parameter. Afterwards, the device is locked for the safe measuring mode. The SAFETY LOCK parameter displays the status "Locked". This locking has the highest priority and can only be disabled via the SAFETY LOCK and SAFETY PASSWORD parameters.
- **16.** Switch the device off and then on again. This ensures that the parameter settings for the current output, alarm response and locking are saved. Read out the parameters again and compare them to the data recorded in the "Device parameter configuration report".
- The "Offline" operating function and FDT-Up-Download are not permitted for the configuration of an application with functional safety.
  - Note the status during entry and display of the parameters. This is indicated by icons/symbols and refers to possible errors during parameter entry, when updating parameters and when connecting to the device. More information can be found in the FieldCare help.

#### Standard parameter configuration

Parameter configuration via local display

- 1. Reset parameters to factory setting: reset code "7864" (see the associated Operating Instructions, "Resetting to factory setting (reset)" section). Check default values, number formats and parameter descriptions with the "Device parameter configuration report".
- After this reset, the following operating steps may no longer be performed:
  - Position adjustment or onsite configuration of measuring range without local display
  - Download
  - Configuration backup with HistoROM<sup>®</sup>/M-DAT
  - Reset, except for reset code "7864"
  - Current trim
  - Sensor recalibration
- **2.** Via the DIGIT SETS parameter, check whether the characters and digits are displayed correctly on the user interface. "0123456789.-" is shown if everything is displayed correctly. Menu path: (GROUP SELECTION  $\rightarrow$ ) OPERATING MENU  $\rightarrow$  DISPLAY
- **3.** Configure the device parameters and keep a manual log of the settings. For parameter configuration, see the associated Operating Instructions. Switch the device off and then on again. This ensures that the parameter settings have been saved.
- Observe the prescribed parameters in accordance with the "Device parameter configuration form". The permitted parameter settings must also be taken into consideration.
- 4. Check the safety function.
- 5. Read out the prescribed parameters and compare them to the "Device parameter configuration report".
- 6. Lock the device via the software and/or hardware (see the associated Operating Instructions).

- 7. Read out and keep a record of the CONFIG RECORDER parameter. Menu path: (GROUP SELECTION  $\rightarrow$ ) OPERATING MENU  $\rightarrow$  TRANSMITTER INFO  $\rightarrow$ TRANSMITTER DATA
- If the device is in a fault state, i.e. an alarm is output and the current output adopts the set value, the cause of the fault must first be eliminated.
  - "Level" operating mode, "Level easy pressure" level selection: The EMPTY PRESSURE and FULL PRESSURE parameters are only displayed for the "Dry" CALIBRATION MODE.

If you have performed a wet calibration, you must subsequently select the "Dry" option via the CALIBRATION MODE parameter. You can read out the corresponding values for the EMPTY PRESSURE and FULL PRESSURE parameters here.

• The sensor can only be recalibrated by Endress+Hauser Service. All parameters, except the parameters for a sensor recalibration, are reset by the "7864" reset code. Therefore, the parameters have to be checked prior to locking via the SAFETY CONFIRM. menu.

Parameter configuration via Field Communicator 375/475 handheld terminal

- Go to "Main Menu" → "HART Communication" → "HART-Application" → "Online". The device is then found automatically and opened online. Ensure that the device bus address = 0.
- 2. Ensure that the connection has been made with the correct device. This can be done using the "Measuring point" parameter, the extended order number or the serial number.
- **3.** Reset parameters to factory setting: reset code "7864" (see the associated Operating Instructions, "Resetting to factory setting (reset)" section). Check default values, number formats and parameter descriptions with the "Device parameter configuration report".

After this reset, the following operating steps may no longer be performed:

- Position adjustment or onsite configuration of measuring range without local display
- Download
- Configuration backup with HistoROM<sup>®</sup>/M-DAT
- Reset, except for reset code "7864"
- Current trim
- Sensor recalibration
- 4. Via the DIGIT SETS parameter, check whether the characters and digits are displayed correctly on the user interface. "0123456789.-" is shown if everything is displayed correctly. Menu path: (GROUP SELECTION  $\rightarrow$ ) OPERATING MENU  $\rightarrow$  DISPLAY
- 5. Configure the device parameters and keep a manual log of the settings. For parameter configuration, see the associated Operating Instructions. Switch the device off and then on again. This ensures that the parameter settings have been saved.
- Observe the prescribed parameters in accordance with the "Device parameter configuration form". The permitted parameter settings must also be taken into consideration.
- 6. Check the safety function. Close the Field Communicator handheld terminal. Then connect to the device again.
- **7.** Read out the prescribed parameters and compare them to the "Device parameter configuration report".
- 8. Lock the device via the software and/or hardware (see the associated Operating Instructions).

- 9. Read out and keep a record of the CONFIG RECORDER parameter. Menu path: (GROUP SELECTION→) OPERATING MENU → TRANSMITTER INFO → TRANSMITTER DATA
- If the device is in a fault state, i.e. an alarm is output and the current output adopts the set value, the cause of the fault must first be eliminated.
  - "Level" operating mode, "Level easy pressure" level selection: The EMPTY PRESSURE and FULL PRESSURE parameters are only displayed for the "Dry" CALIBRATION MODE.
    - If you have performed a wet calibration, you must subsequently select the "Dry" option via the CALIBRATION MODE parameter. You can read out the corresponding values for the EMPTY PRESSURE and FULL PRESSURE parameters here.
  - The sensor can only be recalibrated by Endress+Hauser Service. All parameters, except the parameters for a sensor recalibration, are reset by the "7864" reset code. Therefore, the parameters have to be checked prior to locking via the SAFETY CONFIRM. menu.

#### Parameter configuration via FieldCare operating program

- The connection can be established in the following two ways: 1) Select the "HART Communication" connection wizard. The device will then be found automatically and opened online. Ensure that the device bus address = 0. 2) In the tree structure, select "Create projects" → "Add device" → "HART communication" and then select "Create network". The device is opened online. Ensure that the device bus address = 0.
- 2. Ensure that the connection has been made with the correct device. This can be done using the "Measuring point" parameter, the extended order number or the serial number.
- **3.** Reset parameters to factory setting: reset code "7864" (associated Operating Instructions, "Resetting to factory setting (reset)" section). Check default values, number formats and parameter descriptions with the "Device parameter configuration report".

After this reset, the following operating steps may no longer be performed:

- Position adjustment or onsite configuration of measuring range without local display
- Download
- Configuration backup with HistoROM<sup>®</sup>/M-DAT
- Reset, except for reset code "7864"
- Current trim
- Sensor recalibration
- 4. Via the DIGIT SETS parameter, check whether the characters and digits are displayed correctly on the user interface. "0123456789.-" is shown if everything is displayed correctly. Menu path: (GROUP SELECTION  $\rightarrow$ ) OPERATING MENU  $\rightarrow$  DISPLAY
- 5. Configure the device parameters and keep a manual log of the settings. For parameter configuration, see the associated Operating Instructions. Switch the device off and then on again. This ensures that the parameter settings have been saved.

Observe the prescribed parameters in accordance with the "Device parameter configuration form". The permitted parameter settings must also be taken into consideration.

- 6. Check the safety function. Close FieldCare. Then connect to the device again.
- **7.** Read out the prescribed parameters and compare them to the "Device parameter configuration report".
- 8. Lock the device via the software and/or hardware (see the associated Operating Instructions)

- 9. Read out and keep a record of the CONFIG RECORDER parameter. Menu path: (GROUP SELECTION→) OPERATING MENU → TRANSMITTER INFO → TRANSMITTER DATA
- If the device is in a fault state, i.e. an alarm is output and the current output adopts the set value, the cause of the fault must first be eliminated.
  - "Level" operating mode, "Level easy pressure" level selection: The EMPTY PRESSURE and FULL PRESSURE parameters are only displayed for the "Dry" CALIBRATION MODE.

If you have performed a wet calibration, you must subsequently select the "Dry" option via the CALIBRATION MODE parameter. You can read out the corresponding values for the EMPTY PRESSURE and FULL PRESSURE parameters here.

• The sensor can only be recalibrated by Endress+Hauser Service. All parameters, except the parameters for a sensor recalibration, are reset by the "7864" reset code. Therefore, the parameters have to be checked prior to locking via the SAFETY CONFIRM. menu.

#### 4.5.3 Locking/unlocking a SIL device

#### **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.

#### Procedure with increased security during parameter entry

#### Locking

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

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

#### Unlocking

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

#### Procedure for standard device configuration

If you are using the "Standard device configuration" method, the device must be locked via the software and/or hardware (see the associated Operating Instructions).

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

#### Unlocking a SIL device

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

## 4.6 Parameters and default settings for SIL mode

## 4.6.1 "Increased security during parameter entry" method

The device checks whether certain operating steps have been performed beforehand or whether invalid parameters have been configured. If this is the case, a message appears to this effect and this method is then no longer possible.

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

- Position adjustment performed or measuring range set on site without using the local display.
- Following a download
- After a configuration backup using HistoROM<sup>®</sup>/M-DAT
- After a reset, except after the reset code "7864"
- After performing sensor recalibration
- Following current trimming
- For the LEVEL SELECTION parameter, the "Level easy height" or "Level standard" option was selected (permitted setting for LEVEL SELECTION is "Level easy pressure").

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

## 4.6.2 "Standard device configuration" method

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

## 4.6.3 Permitted parameter settings

Only certain settings are permitted for some parameters. If one of these parameters is set to an invalid setting, the "Increased security during parameter entry" method is not possible. This method is possible again as soon as the parameter is set to the permitted setting.

Parameter and menu path	Permitted setting
<ul> <li>BUS ADDRESS (345)</li> <li>CURRENT MODE (052) <sup>1)</sup></li> <li>Menu path: (GROUP SELECTION →) OPERATING MENU → TRANSMITTER</li> </ul>	<ul> <li>0</li> <li>Signaling (local display and FieldCare) or enabled (HART handheld terminal)</li> </ul>
INFO → HART DATA "Pressure" MEASURING MODE:	All units, except "User unit".
PRESS. ENG. UNIT (060) Menu path: (GROUP SELECTION →) OPERATING MENU → SETTINGS → BASIC SETUP or configuration via FieldCare using the Quick Setup	
"Level" MEASURING MODE <sup>2)</sup> : • EMPTY PRESSURE • FULL PRESSURE • EMPTY CALIB. • FULL CALIB. • SET LRV • SET URV Menu path: (GROUP SELECTION →) OPERATING MENU → SETTINGS → BASIC SETUP or configuration via FieldCare using the Quick Setup	<ul> <li>The parameters must meet the following conditions:</li> <li>The pressure values for SET LRV and SET URV must be within the sensor measuring range.</li> <li>The turndown, determined by the difference between the pressure values for SET LRV and SET URV, may not be greater than the maximum turndown (factory setting 100:1).</li> <li>The value for FULL PRESSURE - EMPTY PRESSURE may not drop below the minimum span (1 % of sensor measuring range).</li> </ul>

Parameter and menu path	Permitted setting
"Level" MEASURING MODE <sup>2)</sup> , "Level easy pressure" LEVEL SELECTION: ADJUST DENSITY (007)	Same value as PROCESS DENSITY (025)
Menu path: (GROUP SELECTION $\rightarrow$ ) OPERATING MENU $\rightarrow$ SETTINGS $\rightarrow$ EXTENDED SETUP	
<ul> <li>CURRENT CHARACT. (694), (695), (696), (764)<sup>3)</sup></li> <li>OUTPUT FAIL MODE (388)<sup>3)</sup></li> <li>SET MAX. ALARM (342)</li> <li>SET MIN. CURRENT (343)</li> <li>ALT.CURR.OUTPUT (597)<sup>3)</sup></li> </ul>	<ul> <li>Linear</li> <li>Max. alarm (110 %): can be set from 21 to 23 mA or Min. alarm<sup>4)</sup> (-10 %): 3.6 mA</li> <li>22 mA<sup>3)</sup> or 21 to 23 mA</li> </ul>
Menu path: (GROUP SELECTION →) OPERATING MENU → OUTPUT	<ul> <li>3.8 mA<sup>3)</sup> or 4 mA</li> <li>Normal/NE43</li> </ul>
<ul> <li>ALARM DELAY (336) <sup>3)</sup></li> <li>ALARM DISPL. TIME (480) <sup>3)</sup></li> </ul>	<ul><li>0.0 s</li><li>0.0 s</li></ul>
Menu path: (GROUP SELECTION $\rightarrow$ ) OPERATING MENU $\rightarrow$ DIAGNOSIS MESSAGES	
SIMULATION (413) Menu path: (GROUP SELECTION $\rightarrow$ ) OPERATING MENU $\rightarrow$ SIMULATION	SIMULATION = None <sup>5)</sup>

1) Only from firmware version  $\geq 02.20$ 

- 2) Not for options with a measuring range, e.g. 16/250 bar [2320/3625 psi]
- 3) For firmware versions  $\leq 02.20.04$ , settings are reset to the default values once the SIL password is entered.
- 4) For firmware versions ≤02.20.04, the "Min. alarm" setting is only possible with the "Standard configuration" method.
- 5) With the "Increased security during parameter entry" method, any simulation running is terminated automatically once the correct password has been entered.
- If the device is in a fault state, i.e. an alarm is output and the current output adopts the set value, the cause of the fault must first be eliminated.
  - If operating via the DTM, it is only possible to lock via the SAFETY LOCK menu in the online mode.
  - The sensor can only be recalibrated by Endress+Hauser Service. All parameters, except the parameters for a sensor recalibration, are reset by the "7864" reset code. Therefore, the parameters have to be checked prior to locking via the SAFETY CONFIRM. menu.

#### 4.6.4 Check

#### **A**CAUTION

#### A change to the measuring system or parameters can affect the safety function.

- Once all of the parameters have been entered, the safety function must be checked before performing the locking sequence! This can be done, for example, via the "Simulation" parameter or by approaching the limit pressure (see the parameter description for "Simulation" in the associated Operating Instructions).
- When the device is part of a safety function, the entire safety function must be checked following any change to the device, e.g. a change in the orientation of the device or the parameter configuration.

## 5 Operation

## 5.1 Device behavior during power-up

Once switched on, the device runs through a diagnostic phase of approx. 30 s. During this time, the current output is first set to approx. 12 mA, then to 4 mA, before the current that is output actually corresponds to the current measured value. Communication via HART is not possible during the diagnostic phase.

## 5.2 Behavior of device in the event of an alarm and warnings

The output current on alarm can be set to a value of  $\leq$  3.6 mA or  $\geq$  21 mA.

#### **A**CAUTION

In some cases, (e.g. failure of power supply, a cable open circuit and faults in the current output itself, where the error current  $\geq 21$  mA cannot be reached), output currents  $\leq 3.6$  mA occur irrespective of the configured failure current. In some other cases, (e.g. cabling short circuit), output currents  $\geq 21.0$  mA occur irrespective of the configured failure current.

For alarm monitoring, the downstream logic unit must be able to recognize failure currents of the upper level for signal on alarm (≥ 21 mA) and the lower level for signal on alarm (≤ 3.6 mA).

## 5.3 Alarm and warning messages

#### 5.3.1 List of alarm and warning messages

Additional information is provided by the alarm and warning messages in the form of error codes and associated plain text messages.

Parameter	Parameter Description		tting	Parameterization method with increased security during parameter entry		
		FW 02.20	FW ≥ 02.30.zz	Permitted SIL setting	FW ≤ 02.20 <sup>1)</sup>	FW ≥ 02.30.zz
115	Sensor over pressure	Warning	Warning	Warning or alarm	Alarm	As per client setting (default: warning)
120	Sensor underpressure	Warning	Warning	Warning or alarm	Alarm	
620	Current output out of range	Warning	Warning	Warning or alarm	Alarm	
715	Sensor over temperature	Warning	Warning	Warning or alarm	Alarm	-
716	Proce. iso. diaphrg. broken (ceramic measuring cell)	Alarm	Alarm	Alarm	Alarm	_
720	Sensor under temperature	Warning	Warning	Warning or alarm	Alarm	_
717	Transmitter over temp.	Warning	Warning	Warning or alarm	Alarm	
718	Transmitter under temp.	Warning	Warning	Warning or alarm	Alarm	

Parameter	Description	Factory setting		Parameterization method with increased security during parameter entry		
		FW 02.20	FW ≥ 02.30.zz	Permitted SIL setting	FW ≤ 02.20 <sup>1)</sup>	FW ≥ 02.30.zz
726	Sens. temp. error overrange	Warning	Alarm	Alarm	Alarm	Alarm
727	Sens. pres. error overrange <sup>2)</sup>	Warning	Warning	Warning or alarm	Alarm	As per client setting (default: warning)
Alarm current	Output fail mode	MAX	MAX	MIN. or MAX	MAX	As per client setting (default: MAX.)

1) Settings are automatically changed from warning to alarm via the parameterization method

2) The setting influences the parameters for functional safety

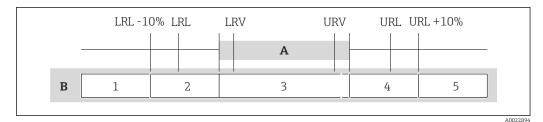
#### **WARNING**

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

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

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

#### 5.3.2 Device response in event of overranging



A Range of current signal for measured value transmission (NE43) 3.8 to 20.5 mA

B Output current range  $\leq$  3.6 to  $\geq$  21.0 mA

LRL Lower range limit

LRV Lower range value

URV Upper range value

URL Upper range limit

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

Process pressure range	Acting process pressure	Message <sup>1)</sup>	
5	r i i i i i i i i i i i i i i i i i i i	E115	(URL + 10%)
limit	sensor measuring range limit	E727	(>> URL + 10%)

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

## 6 Proof testing

The safety-related functionality of the device in the SIL mode must be verified during commissioning, when changes are made to safety-related parameters, and also at appropriate time intervals. This enables this functionality to be verified within the entire safety instrumented system. The time intervals must be specified by the operator.

#### **A**CAUTION

#### The safety function is not guaranteed during a proof test.

Suitable measures must be taken to guarantee process safety during the test.

- The safety-related output signal 4 to 20 mA must not be used for the protective system during the test.
- The operator specifies the testing interval and this must be taken into account when determining the probability of failure PFDavg of the sensor system.

The individual proof test coverages (PTC) that can be used for calculation are specified for the proof tests described below.

Two possible ways to perform proof tests to detect dangerous undetected failures are described below. They differ with regard to the percentage coverage rate.

## 6.1 Test sequence A

Proof testing procedure

- **1.** Bypass safety PLC or take other suitable measures to prevent alarms from being triggered in error.
- 2. Disable locking
- 3. Set the current output of the transmitter to HI alarm via a HART command or via the local display and check whether the analog current signal reaches this value (e.g. simulate an alarm via the "SIMULATION MODE" and SIM. ERROR NO. parameters). This test detects problems due to non-standard voltages (e.g. due to a loop current supply voltage that is too low or due to increased line resistance) and checks for possible failures in the transmitter electronics.
- 4. Set the current output of the transmitter to LO alarm via a HART command or via the local display and check whether the analog current signal reaches this value (e.g. set the ALARM RESPONSE parameter to "Min. alarm" or simulate an alarm via the "SIMULATION MODE" and "SIM. ERROR NO. parameters). This test detects any faults associated with quiescent currents.
- 5. Restore the full functionality of the current loops.
- 6. Remove the bypass for the safety PLC or restore normal operation by some other means.
- 7. After the proof test has been carried out, the results must be documented and retained in a suitable manner.

This check detects 50 % of the dangerous undetected failures.

## 6.2 Test sequence B

Proof testing procedure

- 1. Carry out steps 1 to 4 of test sequence A.
- 2. Compare displayed pressure measured value with applied pressure and check current output. Appropriate procedures, measuring equipment and references must be used for this test. For the lower range value (4 mA value) and upper range value (20 mA value), compare the applied pressure with the measured pressure. If the measured pressure differs from the pressure applied to 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 the corresponding Operating Instructions (BA), Description of Device Functions

- For pressure measurement: SET LRV (245) and GET LRV (309)
- For level measurement: SET LRV (013) ("Level easy pressure" level selection)

For the 20 mA value, see the corresponding Operating Instructions (BA), Description of Device Functions

- For pressure measurement: SET URV (246) and GET URV (310)
- For level measurement: SET URV (012) ("Level easy pressure" level selection)

Compare the displayed pressure measured value with the applied pressure again and check the current output. If there are any deviations, contact Endress+Hauser Service.

• Carry out steps 5 to 7 of test sequence A.

This check detects 99 % of the dangerous undetected failures.

#### NOTICE

Regarding test sequence B, Step 2: After this procedure, the current value is output correctly. The displayed value, e.g. on the local display, and the digital value via HART may differ from the actual pressure applied.

 If the display value and digital value are also to be corrected, please contact Endress +Hauser Service

## 6.3 Verification criterion

If one of the test criteria from the test sequences described above is not fulfilled, the device may no longer be used as part of a safety instrumented system.

- The purpose of proof-testing is to detect dangerous undetected device failures ( $\lambda_{DU}$ ).
- This test does not cover the impact of systematic faults on the safety function, which must be assessed separately.
- Systematic faults can be caused, for example, by process material properties, operating conditions, build-up or corrosion.
- As part of the visual inspection, for example, ensure that all of the seals and cable entries provide adequate sealing and that the device is not visibly damaged.

## 7 Repair and error handling

## 7.1 Maintenance

Maintenance instructions and instructions regarding recalibration may be found in the Operating Instructions pertaining to the device.

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

## 7.2 Repair

Repair means restoring functional integrity by replacing defective components.

#### Only original Endress+Hauser spare parts may be used here.

The repair must be documented. This includes:

- Serial number of the device
- Date of the repair
- Type of repair
- Person who performed the repair

Components may be repaired/replaced by the customer's specialist staff if original Endress +Hauser spare parts (which can be ordered by the end customer) are used, and if the relevant installation instructions are followed.



A proof test must always be performed after every repair.

Installation Instructions are supplied with the original spare part and can also be accessed in the Download Area at www.endress.com

Send in replaced components to Endress+Hauser for fault analysis.

When returning the defective component, always enclose the "Declaration of Hazardous Material and Decontamination" with the note "Used as SIL device in a safety instrumented system.

Information on returns: http://www.endress.com/support/return-material

## 7.3 Modification

- Modifications to SIL devices by the user are not permitted as they can impair the functional safety of the device
- Modifications to SIL devices on site at the user's plant are possible following approval by the Endress+Hauser manufacturing center
- Modifications to SIL devices must be performed by staff who have been authorized to perform this work by Endress+Hauser
- Only original spare parts from Endress+Hauser must be used for modifications
- All modifications must be documented in the Endress+Hauser W@M Device Viewer
- All modifications require a modification nameplate or the replacement of the original nameplate.

## 7.4 Decommissioning

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

## 7.5 Disposal

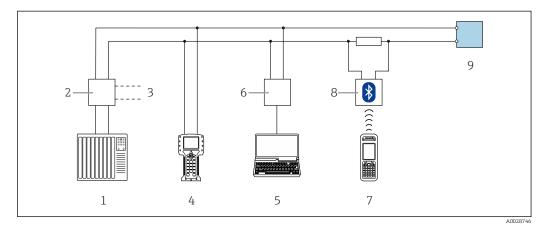
## X

If required by the Directive 2012/19/EU on waste electrical and electronic equipment (WEEE), the product is marked with the depicted symbol in order to minimize the disposal of WEEE as unsorted municipal waste. Do not dispose of products bearing this marking as unsorted municipal waste. Instead, return them to Endress+Hauser for disposal under the applicable conditions.

## 8 Appendix

## 8.1 Structure of the measuring system

#### 8.1.1 System components



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

An analog signal (4 to 20 mA) that is in proportion to the pressure is generated in the transmitter. This is sent to a downstream logic unit (e.g. PLC, limit signal transmitter, etc.) where it is monitored to determine whether it is below or above a specified limit value.

For fault monitoring, the logic unit must be able to detect both HI alarms ( $\geq$  21.0 mA) and LO alarms ( $\leq$  3.6 mA).

#### 8.1.2 Description of use as a protective system

The pressure transmitter is used for the following measuring tasks:

- Absolute pressure and overpressure measurement in gases, vapors or liquids in all areas
  of process engineering and process measurement technology
- Level, volume or mass measurements in liquids

#### 8.1.3 Installation conditions

The installation conditions for various measurements are described in the Technical Information for the device.

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

#### 8.1.4 Measurement function

The measuring principle and the measurement functions are described in the Technical Information for the device

# 8.2 Commissioning or proof test report

The following device-specific test report acts as a print/master template and can be replaced or supplemented any time by the customer's own SIL reporting and testing system.

8.2.1	Pressure	device	parameter	configu	ration	form

Operation via:

Handheld terminal

□ FieldCare/DeviceCare

🗆 On site

Device designation:

Serial number:

Measuring

point:

Upper range limit (URL sensor):

Factory setting<sup>1)</sup> Parameter name Direct Menu path: Permitted Specifie Actual Checked value settings d value access Expert 840 012345 Digit set → Display 67890.-2) Calib. offset 319 0.0  $\rightarrow$  Position adjustment Measuring mode 389 Pressure Pressure 2) Set LRV 245 → Quick Setup / 0.0 or as per order Basic Setup 2) Set URV 246 URL sensor or as per order 247 2 s 0 to 999 s Damping value Press. eng. unit 060 → Basic setup mbar/bar All or as per order  $^{\rm 3)}$ except "user unit" Current charact. 695 → Output Linear Linear Output fail mode 388 Max. alarm Max. alarm Min. alarm 597 Normal Normal Alt. curr. output Set max. alarm 22 mA 21 to 23 mA 342 Set min. current 343 3.8 mA 3.8 mA or 4 mA Simulation 413 → Simulation None None Off Off/On Ack. alarm mode 401 → Messages Error No. Select alarm 595/600 type The following messages must be set to "Alarm": 115 Sensor over pressure Warning Alarm o. warning 120 Sensor low pressure Warning Alarm o. warning 715 Sensor over Warning Alarm o. warning temperature 716 Proce. iso. diaphrg. Alarm Alarm broken 717 Transmitter over Warning Alarm o. warning temp. 718 Transmitter under Warning Alarm o. warning temp. 720 Sensor under Warning Alarm o. warning temperature Warning/alarm<sup>4)</sup> 726 Sens. temp. error Alarm overrange 727 Sens. pres. error Warning Alarm o. warning overrange 5) 620 Current output out Warning Alarm o. warning of range Alarm delay 336 0.0 s 0.0 s

Parameter name	Direct access	Menu path: Expert	Factory setting <sup>1)</sup>	Permitted settings	Specifie d value	Actual value	Checked
Alarm display time	480		0.0 s	0.0 s			
Current mode <sup>6)</sup>	052	→ HART Data	Signaling <sup>7)</sup> or Enabled <sup>8)</sup>	Signaling <sup>9)</sup> or Enabled <sup>10)</sup>			
Bus address	345		0	0			
After locking: Config. counter	352	→ Transmitter data					

1) After performing a reset with reset code "7864"

Within the lower and upper range limit 2)

Depending on the "Press. Sens Hilim (485)" parameter Alarm setting from firmware  $\geq 02.30.zz$ 3)

4)

5)

Influence on SFF Only from software version  $\ge 02.20$ Local display and FieldCare 6)

7)

8) HART handheld terminal

9) Local display and FieldCare

HART handheld terminal 10)

Date

Signature

Signature of tester

#### Level device parameter configuration form 8.2.2

Operation via:

Handheld terminal

□ FieldCare/DeviceCare

🗆 On site

Device designation:

Serial number:

Measuring

point:

Upper range limit (URL sensor):

Parameter name	Direct access	Menu path: Expert	Factory setting <sup>1)</sup>	Permitted settings	Specifie d value	Actual value	Checked
Digit set	840	→ Display			012345 67890		
Calib. offset	319	→ Position adjustment	0.0	2)			
Measuring mode	389		Pressure		Level		
Level selection	020		Level easy pressure	Level easy pressure			
Empty calib.	010	→ Basic setup	0.0 % or as per order				
Empty pressure	011	_	0.0 or as per order	2)			
Full calib.	004	_	100 % or as per order				
Full pressure	005	_	URL sensor or as per order	2)			
Set LRV	013	-	0.0 % or as per order				
Set URV	012	_	100 % or as per order				
Damping value	247	_	2 s	0 to 999 s			
Press. eng. unit	060		mbar/bar or as per order <sup>3)</sup>	All except "user unit"			
Output unit	023		% or as per order				
Adjust density	007	→ Extended setup	1.0 kg/dm <sup>3</sup>	= Process density (025)			
Current charact.	695	→ Output	Linear	Linear			
Output fail mode	388	_	Max. alarm	Max. alarm Min. alarm			
Alt. curr. output	597		Normal	Normal			
Set max. alarm	342		22 mA	22 mA			
Set min. current	343	_	3.8 mA	3.8 mA			
Simulation	413	→ Simulation	None	None			
Ack. alarm mode	401	→ Messages	Off	Off/On			
Error No. Select alarm type The following messages must be set to "Alarm":	595/600						
115 Sensor over pressure			Warning	Alarm o. warning			
120 Sensor low pressure	1		Warning	Alarm o. warning			
715 Sensor over temperature			Warning	Alarm o. warning			
716 Proce. iso. diaphrg. broken			Alarm	Alarm			
717 Transmitter over temp.			Warning	Alarm o. warning			
718 Transmitter under temp.			Warning	Alarm o. warning			

Parameter name	Direct access	Menu path: Expert	Factory setting <sup>1)</sup>	Permitted settings	Specifie d value	Actual value	Checked
720 Sensor under temperature			Warning	Alarm o. warning			
726 Sens. temp. error overrange			Warning/alarm <sup>4)</sup>	Alarm			
727 Sens. pres. error overrange <sup>5)</sup>			Warning	Alarm o. warning			
620 Current output out of range			Warning	Alarm o. warning			
Alarm delay	336		0.0 s	0.0 s			
Alarm display time	480	_	0.0 s	0.0 s			
Current mode <sup>6)</sup>	052	→ HART Data	Signaling <sup>7)</sup> or Enabled <sup>8)</sup>	Signaling <sup>9)</sup> or Enabled <sup>10)</sup>			
Bus address	345	_	0	0			
After locking: Config. counter	352	→ Transmitter data					

1)

2)

After performing a reset with reset code "7864" Within the lower and upper range limit Depending on the "Press. Sens Hilim (485)" parameter Alarm setting from firmware  $\geq 02.30.zz$ 3)

4)

5) Influence on SFF

6) Only from software version  $\geq 02.20$ 

7) Local display and FieldCare

HART handheld terminal 8)

Local display and FieldCare 9)

10) HART handheld terminal

Date

Signature

Signature of tester

## 8.3 Parameter description

### 8.3.1 Parameter description of the SAFETY CONFIRM. group -"Pressure" measuring mode

For other parameter descriptions, e.g. level, see the corresponding Operating Instructions.

The numbers in brackets indicate the identification numbers of the parameters on the local display.

Parameter name	Description
SAFETY LOCKSTATE	Displays the device status with regard to the safe measuring mode. Possibilities: • Unlocked • Lock Prerequisites: Operating tool or Field Communicator 375/475 handheld terminal
SAFETY LOCK (836)	<ul> <li>This parameter offers the following functions:</li> <li>Check and lock the device for the safe measuring mode</li> <li>Remove lock for the safe measuring mode</li> <li>Local display: Displays the device status with regard to the safe measuring mode.</li> </ul>
SAFETY PASSWORD (838)	The password must be entered in the following situations: <ul> <li>Prior to querying safety-related parameters</li> <li>When unlocking the safe measuring mode</li> </ul>
DIGITS SET (841)	This parameter is used to check whether the characters and digits are displayed correctly on the user interface. If the characters and digits are displayed correctly, this parameter displays the character string "0123456789".
	<ul> <li>Options:</li> <li>Valid Select this option if the string of characters and digits is displayed correctly.</li> <li>Not valid Select this option if the string of characters and digits is not displayed correctly. In this case, operation in the safe measuring mode is not possible.</li> </ul>
OUTPUT CURRENT (875)	Only for firmware version < 2.20 For displaying and querying the settings for the CURR. CHARACT., OUTPUT FAIL MODE, ALT. CURR. OUTPUT, SET MAX. ALARM, SET MIN. CURRENT, ALARM DELAY, ALARM DISPLAY TIME parameters.
	<ul> <li>Once you have entered the password correctly for the SAFETY PASSWORD parameter, the following parameters - among others - are reset to the factory setting:</li> <li>CURRENT CHARACT.= Linear</li> <li>OUTPUT FAIL MODE = Max. alarm</li> <li>ALT. CURR. OUTPUT = Normal</li> <li>SET MAX. ALARM = 22 mA</li> <li>SET MIN. CURRENT = 3.8 mA</li> <li>ALARM DELAY = 0 s</li> <li>ALARM DISPLAY TIME = 0 s</li> </ul>
	The OUTPUT CURRENT parameter displays these factory values as "LinMaxNorm22/3.8/0s".
	<ul> <li>Options:</li> <li>Valid Select this option if the factory values displayed correspond to the desired values.</li> <li>Not valid Select this option if the factory values displayed do not correspond to the desired values. In this case, operation in the safe measuring mode is not possible.</li> </ul>

Parameter name	Description
OUTPUT FAIL MODE (57)	Only for firmware version $\ge 2.30$ For displaying and querying the set output fail mode.
	Possibilities: • Max. alarm (110 %) • Min. alarm (-10 %)
	<ul> <li>Options:</li> <li>Valid Select this option if the selected and desired value is displayed</li> <li>Not valid Select this option if an incorrect value or a value that was not selected is displayed. In this case, operation in the safe measuring mode is not possible.</li> </ul>
SET MIN. CURRENT (56)	Only for firmware version ≥ 2.30 For displaying and querying the lower current limit. Possibilities: • 3.8 mA
	<ul> <li>4 mA</li> <li>Options:</li> <li>Valid Select this option if the selected and desired value is displayed</li> <li>Not valid Select this option if an incorrect value or a value that was not selected is displayed. In this case, operation in the safe measuring mode is not possible.</li> </ul>
SET MAX. ALARM (54)	Only for firmware version $\ge 2.30$ For displaying and querying the set current value for the maximum alarm current.
	Possibilities: 21 to 23 mA
	<ul> <li>Options:</li> <li>Valid Select this option if the selected and desired value is displayed</li> <li>Not valid Select this option if an incorrect value or a value that was not selected is displayed. In this case, operation in the safe measuring mode is not possible.</li> </ul>
E727 P.OVERRANGE (58)	Only for firmware version $\ge 2.30$ For displaying and querying the set behavior in the event of this error. This setting affects the SIL characteristic values.
	<ul> <li>Possibilities:</li> <li>Alarm (A): output current adopts a defined value</li> <li>Warning (W): output current in saturation (3.8 or 20.5 mA)</li> </ul>
	<ul> <li>Options:</li> <li>Valid Select this option if the selected and desired value is displayed</li> <li>Not valid Select this option if an incorrect value or a value that was not selected is displayed. In this case, operation in the safe measuring mode is not possible.</li> </ul>

Parameter name	Description
ACK. ALARM MODE (844)	<ul> <li>For displaying and querying the option selected for the ACK. ALARM MODE parameter (MESSAGES group).</li> <li>Possibilities: <ul> <li>On</li> <li>Off</li> </ul> </li> <li>Options: <ul> <li>Valid</li> <li>Select this option if the selected and desired value is displayed</li> <li>Not valid</li> <li>Select this option if an incorrect value or a value that was not selected is displayed. In this case, operation in the safe measuring mode is not possible.</li> </ul> </li> </ul>
	<ul> <li>NOTICE</li> <li>If you selected the "On" option for the ACK. ALARM MODE parameter and an alarm occurs, proceed as follows: <ul> <li>Rectify the cause of the alarm.</li> <li>Unlock the device via the SAFETY LOCK and SAFETY PASSWORD parameters.</li> <li>Acknowledge the alarm via the ACK. ALARM parameter.</li> <li>Select the "Lock" option for the SAFETY LOCK parameter.</li> <li>Enter the password for the SAFETY PASSWORD parameter.</li> <li>Confirm the values and option selected for the parameters queried.</li> <li>Lock the device via the password.</li> </ul> </li> </ul>
CALIB. OFFSET (847)	<ul> <li>For displaying and querying the value entered or calculated for the CALIB. OFFSET parameter (POSITION ADJUSTMENT group).</li> <li>Options: <ul> <li>Valid</li> <li>Select this option if the selected and desired value is displayed</li> </ul> </li> <li>Not valid</li> <li>Select this option if an incorrect value or a value that was not selected is displayed. In this case, operation in the safe measuring mode is not possible.</li> <li>You can also perform position adjustment by means of the POS. ZERO ADJUST or POS. INPUT VALUE parameters. The CALIB. OFFSET parameter then displays the calculated value.</li> </ul>
MEASURING MODE (845)	<ul> <li>For displaying and querying the set measuring mode.</li> <li>Possibilities: <ul> <li>Pressure</li> <li>Level</li> </ul> </li> <li>Options: <ul> <li>Valid (for "Pressure" measuring mode)</li> <li>Select this option if the selected and desired value is displayed</li> <li>Not valid (for "Level" measuring mode)</li> <li>Select this option if an incorrect value or a value that was not selected is displayed. In this case, operation in the safe measuring mode is not possible.</li> </ul> </li> </ul>
SET LRV (852)	<ul> <li>For displaying and querying the value entered or calculated for the SET LRV parameter (BASIC SETUP or QUICK SETUP group).</li> <li>Options: <ul> <li>Valid</li> <li>Select this option if the selected and desired value is displayed</li> </ul> </li> <li>Not valid</li> <li>Select this option if an incorrect value or a value that was not selected is displayed. In this case, operation in the safe measuring mode is not possible.</li> <li>You can also configure the lower-range value via the GET LRV parameter and a pressure present at the device. The SET LRV parameter displays the pressure value that has been assigned to the lower-range value.</li> </ul>

Parameter name	Description
SET URV (853)	For displaying and querying the value entered or calculated for the SET URV parameter (BASIC SETUP or QUICK SETUP group).
	<ul> <li>Options:</li> <li>Valid Select this option if the selected and desired value is displayed</li> <li>Not valid Select this option if an incorrect value or a value that was not selected is displayed. In this case, operation in the safe measuring mode is not possible.</li> </ul>
	You can also configure the upper-range value via the GET URV parameter and a pressure present at the device. The SET URV parameter displays the pressure value that has been assigned to the upper-range value.
DAMPING VALUE (855)	For displaying and querying the value entered for the DAMPING VALUE parameter (BASIC SETUP or QUICK SETUP group).
	<ul> <li>Options:</li> <li>Valid Select this option if the selected and desired value is displayed</li> <li>Not valid Select this option if an incorrect value or a value that was not selected is displayed. In this case, operation in the safe measuring mode is not possible.</li> </ul>
	Changing the "Damping" DIP switch on the electronic insert does not have any effect on the damping time when operation for the safe measuring mode is locked via SAFETY LOCK (836), SAFETY PASSWORD (838) and CONF. PASSWORD (856). A change only takes effect once operation has been unlocked.
CONF. PASSWORD (856)	Once the safety-related parameters have been successfully interrogated, the password "7452" must be entered again via the CONF. PASSWORD parameter. Afterwards, the device is locked for the safe measuring mode. The SAFETY LOCKSTATE parameter displays the status "Locked".

### 8.4 Version history

### FY01047P

- Firmware version: from 02.00.zz (zz: any double number)
- Hardware version: from 02.00.ww (ww: any double number)
- Changes:
  - Certificate renewed
- Predecessor: SD00190P Cerabar S PMC71, PMP71, PMP75



www.addresses.endress.com

