Application Note

FESTO

IO-Link parameter description of SPAN pressure sensor.

A brief explanation of the contents:
- identification
- parameter and commands
- block parameterization
- teach-In
- process data
- using different pressure units
- diagnosis

SPAN

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1 Components/Software used

Type/Name	Version Software/Firmware	Date of manufacture
SPAN-...	general	operative from 2016

Table 1.1: Components/Software used

Note

You can find detailed specifications on the product, the instruction manual and the declaration of conformity at:

➔ www.festo.com

Detailed information on the IO-Link specification V1.1 und the Smart Sensor Profile at:

➔ www.io-link.com

The device description file IODD at:

➔ www.festo.com

2 IO-Link operating mode

In the IO-Link operating mode, programmed switching signals and the continuously measured process values (digitally coded analogue values) are transferred.

- Data transmission is serially and digitally coded in the IO-Link protocol
- Usage of unshielded standard cables up to 20 m length is possible
- Process data: 14 bit for the pressure measurement value and 2 bit for the binary channels
- Parameters and functions in accordance with Smart Sensor Profile
- There are two binary channels available, which can be individually programmed as threshold value comparator, window comparator or Auto difference monitoring
- Each binary channel is adjustable as normally closed (NC) or normally open (NO)
- The continuously measured pressure values are always transferred parallel and independent of the binary channels
- Support of optional functions Block Parameterisation and Data Storage
- Display IO-Link operation: “OutA” segment switches off every 2 seconds for the period of 0.1 seconds
- The keys are locked during a parameter access, afterwards the device returns automatically into the RUN mode
- Device description file IODD for all variants

3 Technical data

3.1 General specification

IO-Link	
Protocol	IO-Link
Protocol version	Device V1.1
Profile	Smart Sensor Profile
Function classes	BinaryDataChannel ProcessDataVariable Identification Diagnosis Teach channel
Communication mode	COM2 (38.4 kBaud)
SIO-Mode support	Yes
Port class	A
Process data length OUT	0 byte
Process data length IN	2 bytes
Process data content IN	Pressure monitoring BDC1 (Binary Data Channel 1) Pressure monitoring BDC2 (Binary Data Channel 2) Pressure measured value PDV 14 bit (Process Data Variable)
Min. cycle time	3 ms
Data storage required	0.5 kByte
Device ID	see chapter *3.3.1 Identification parameters*

Table 3.1: General IO-Link specification

3.2 Communication features

- Preoperate: Frame type 1_V, OD-capability 8 bytes
- Operate: Frame type 2_V, OD-capability 2 bytes
- SIO-Mode: supported
- ISDU: supported
- Data storage: supported
- Block parameterization: supported

3.3 On demand data

The detailed description of these parameters can be found in the IO-Link Interface and System specification, in the IODD and in the IO-Link Smart Sensor Profile. The default values and the respective valid ranges of these parameters are listed in the IODD xml file.

3.3.1 Identification parameters

Vendor ID 333 d / 01 4D h
Device ID see the following table

Device ID [dec]	Device ID [hex]	Order Code
137	00 00 89	SPAN-P025-PNLK-PNVBA
138	00 00 8A	SPAN-V025-PNLK-PNVBA
139	00 00 8B	SPAN-P05-PNLK-PNVBA
140	00 00 8C	SPAN-V05-PNLK-PNVBA
141	00 00 8D	SPAN-P1-PNLK-PNVBA
142	00 00 8E	SPAN-V1-PNLK-PNVBA
143	00 00 8F	SPAN-B2-PNLK-PNVBA
144	00 00 90	SPAN-P2-PNLK-PNVBA
145	00 00 91	SPAN-P6-PNLK-PNVBA
146	00 00 92	SPAN-P10-PNLK-PNVBA
147	00 00 93	SPAN-B11-PNLK-PNVBA
148	00 00 94	SPAN-P12-PNLK-PNVBA
149	00 00 95	SPAN-P16-PNLK-PNVBA

Table 3.2: Device IDs

Index	Sub-index	Name	Value (example)	Access[1]			Length	Format
				U	M	S		
0x0010	0	Vendor Name	Festo	R	R	R	17 bytes	String
0x0011	0	Vendor Text	http://www.festo.com	R	R	R	20 bytes	
0x0012	0	Product Name	Order code, e.g. SPAN-P10R-G18M-PNLK-PNVBA-L1	R	R	R	max 64 bytes	
0x0013	0	Product ID	SPAN-P10R-PNLK-PNVBA	R	R	R	max 64 bytes	
0x0014	0	Product Text	Pressure sensor	R	R	R	15 bytes	
0x0015	0	Serial Number	Product Key, e.g. 3S7PL9V6HHM	R	R	R	11 bytes	
0x0016	0	Hardware Revision	REV01	R	R	R	5 bytes	
0x0017	0	Firmware Revision	V00.43.02.17	R	R	R	12 bytes	
0x0018	0	Application Specific Tag[2]	***	R	R/W	R/W	32 bytes	

1) Authorisation group: U = user, M = maintenance, S = specialist; access: R = read, R/W = read and write, – = no access

2) Value defined by user

Table 3.3: Identification parameters

3.3.2 Standard IO-Link parameters and commands

Index	Sub-Index	Name	Value	Access[1]			Length	Format
				U	M	S		
0x0002	0	SystemCommand	➔ *Table 3.5*				1 byte	UInteger8
0x000C	0	Device Access Locks[2]	bitwise: 0 = unlocked 1 = locked	R	R/W	R/W	2 bytes	Record
0x0020	0	Error Count	0	R	R	R	2 bytes	UInteger16
0x0024	0	Device Status	0	R	R	R	1 byte	UInteger8
0x0025	0	Detailed Device Status	➔ *Table 3.15*	R	R	R	24 bytes	Array of 3 byte records
0x0028	0	ProcessDataInput	➔ *Table 3.12*	R	R	R	2 bytes	Record

1) Authorisation group: U = user, M = maintenance, S = specialist; access: R = read, R/W = read and write, – = no access

2) Bit 0: lock Parameter Write Access; Bit1: lock data storage (no impact); Bit2: lock local parameterization (EDIT- and TEACH-Mode); Bit3: lock local user interface (not used)

Table 3.4: Standard IO-Link parameters

Value dec	Value hex	Access[1]			Command	Note	Format
		U	M	S			
65	0x41	–	W	W	SP1 Single Value Teach	Determines Teachpoint for Setpoint SP1	UInteger8
66	0x42	–	W	W	SP2 Single Value Teach	Determines Teachpoint for Setpoint SP2	
67	0x43	–	W	W	SP1 Two Value Teach TP1	Determines Teachpoint 1 for Setpoint SP1	
68	0x44	–	W	W	SP1 Two Value Teach TP2	Determines Teachpoint 2 for Setpoint SP1	
75	0x4B	–	W	W	One Action Teach	Device specific Teach-In	
79	0x4F	–	W	W	Teach Cancel	Cancels the Teach-In sequence	
128	0x80	–	W	W	Device reset	Device warm start	
130	0x82	–	W	W	Restore factory settings	Sets the factory settings operative again	
160	0xA0	W	W	W	Reset Min PDV (InA)	Minimal measurement value reset	
161	0xA1	W	W	W	Reset Max PDV (InA)	Maximal measurement value reset	
168	0xA8	–	W	W	Adjust zero point	User defined zero point adjustment	

1) Authorisation group: U = user, M = maintenance, S = specialist; access: R = read, R/W = read and write, – = no access

Table 3.5: Standard IO-Link commands

3.3.3 Smart Sensor Profile parameters

Index	Sub-index	Name	Value	Access [1]			Length (byte)	Format
				U	M	S		
0x000D	0	Profile Characteristics		R	R	R	12	Array of UInteger16
	1	Device Profile ID	0x0001: Smart Sensor Profile	R	R	R	2	UInteger16
	2	Function Class ID	0x8000: Device Identification	R	R	R	2	
	3	Function Class ID	0x8001: BinaryDataChannel	R	R	R	2	
	4	Function Class ID	0x8002: ProcessDataVariable	R	R	R	2	
	5	Function Class ID	0x8003: Device Diagnosis	R	R	R	2	
	6	Function Class ID	0x8004: Teach Channel	R	R	R	2	
0x000E	0	PDInput Descriptor		R	R	R	6	Array of OctetString3
	1	BDC1, BDC2	0x01, 0x02, 0x00	R	R	R	3	OctetString3
	2	ProcessDataVariable	0x02, 0x0E, 0x02	R	R	R	3	OctetString3
0x003A	0	Teach-In Channel	0 - BDC1 (OutA), default 1 - BDC1 (OutA) 2 - BDC2 (OutB)	-	R/W	R/W	1	UInteger8
0x003B	0	Teach-In Status	0	-	R	R	1	Record
	1	Teach Flag TP2 for SP2	0 - not taught, 1 - taught	-	R	R	1	BooleanT
	2	Teach Flag TP1 for SP2	0 - not taught, 1 - taught	-	R	R	1	
	3	Teach Flag TP2 for SP1	0 - not taught, 1 - taught	-	R	R	1	
	4	Teach Flag TP1 for SP1	0 - not taught, 1 taught	-	R	R	1	
	5	Teach State	0	-	R	R	1	UInteger4
BDC1, Pressure monitoring OutA								
0x003C	1	Setpoint SP1 (SP, SP.Lo)	1 ... 16382, default 9830	R	R/W	R/W	2	UInteger16
	2	Setpoint SP2 (SP.Hi)	83 ... 16382, default 11468				2	
0x003D	1	Switchpoint logic (logic)	0 – normally open, default 1 – normally closed				1	UInteger8
	2	Switchpoint mode (Fctn)	1 – single point mode, default 2 - Window mode 128 – Auto diff. monitoring				1	
	3	Switchpoint hysteresis (HY)	0 ... 14745, default 82				2	UInteger16
BDC2, Pressure monitoring OutB								
0x003E	1	Setpoint SP1 (SP, SP.Lo)	1 ... 16382, default 9830	R	R/W	R/W	2	UInteger16
	2	Setpoint SP2 (SP.Hi)	83 ... 16382, default 11468				2	
0x003F	1	Switchpoint logic (logic)	0 – normally open, default 1 – normally closed				1	UInteger8
	2	Switchpoint mode (Fctn)	1 – single point mode, default 2 - Window mode 128 - Auto diff. monitoring				1	
	3	Switchpoint hysteresis (HY)	0 ... 14746, default 82				2	UInteger16

1) Authorisation group: U = user, M = maintenance, S = specialist; access: R = read, R/W = read and write, – = no access

Table 3.6: Smart Sensor Profile parameters

3.3.4 IO-Link Teach-In

The remote Teach-In procedure via IO-Link is the same as the manual one. Instead of key pressing the teaching points will be taught by the corresponding commands from IO-Link Smart Sensor Profile. The chronological order of determining teaching points does not matter too.

All switching functions require two applied Teach-In pressure values.

In case of an over-pressure event every teach command causes ISDU error “function temporarily unavailable” 0x8036 and the Teach-In procedure is cancelled. If the Teach-In mode was not yet started, then the device will remain in the run mode.

A survey on the Teach-In commands ➔ *Table 3.5*

The sensor starts the Teach-In procedure as soon as a successful Teach-In command is sent. It sets the corresponding teach point, the teach state, the status “ successfully taught “ and waits for the second command. The keys A, B and EDIT are locked and the display flashes alternately “ t-IN / IOL “ until either the Teach-In procedure is successfully completed or aborted. The display shows the currently measured process value.

In contrast to the manual Teach-In procedure a teach point can be repeatedly set with the commands 0x41, 0x42, 0x43 and 0x44. This procedure is regardless of the chronological order of applying the teach pressure TP1 or TP2.

In case an invalid command, respective to the current switching / Teach-In mode, is sent, the device will signal the ISDU error “function temporarily unavailable” 0x8036.

If the first teach command comes once more before the second one, then the currently measured process value will be used again for the first teach point. After sending of second teach command all successfully calculated switching points will be immediately taken over and the remote Teach-In procedure will end. The Teach Apply command 0x40 is not used during Teach-In process.

All Teach-In commands are in format UInterger8. They should be sent with the index 0x0002 (system command) sub index 0.

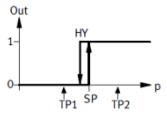
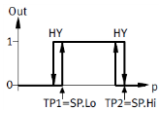
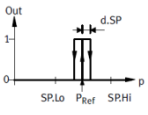
➔ **Note**

There is also a specific Teach-In command 0x4B, which is used in IODD to simulate key pressing in IODD device tool. This command reflects the logic of the manual Teach-In and operates analogous to the local Teach-In via display and keys. Additionally this command can ease the use of the Teach-In functions provided by IO-Link for customer applications.

- In mode threshold value comparator the first sending of this command equates to the “SP1 two value teach TP1” command 0x43 and the second sending equates to the “SP1 two value teach TP2” command 0x44.
- In mode window comparator and Auto Difference Monitoring the first sending equates to the “SP1 single value teach” command 0x41 and the second equates to the “SP2 single value teach” commands 0x42.

For more information see IO-Link Smart Sensor Profile.

Survey of the Teach-In command sequence

					Mode		
					_I¯	_I¯I_	**d**_I¯I_
					Single Point Mode	Window Mode	Window Mode
							
					Threshold value comparator	Window-comparator	Auto difference monitoring [1]
No.	**Action**	**Out**	**Index**	**Sub-Index**	**Data**		
1	If necessary choose the appropriate switching function[2]	A	0x003D	0x02	0x01	0x02	0x80
		B	0x003F	0x02			
2	Choose BDC	A	0x003A	0x00	0x01		
		B	0x003A	0x00	0x02		
i	Single Value Teach-In					✓	✓
	Two Value Teach-In				✓		
3	Apply the first teach pressure						
4	SP1 Single Value Teach		0x0002	0x00		0x41	0x41
	SP1 Two Value Teach TP1		0x0002	0x00	0x43		
5	Apply the second teach pressure						
6	SP2 Single Value Teach		0x0002	0x00		0x42	0x42
	SP1 Two Value Teach TP2		0x0002	0x00	0x44		
i	Canceling Teach-In (always possible during active teach-in process)		0x0002	0x00	0x4F		

1) for Auto Difference Monitoring: Teach-In is only available for the limits of the work range (SP.Lo and SP.Hi)
2) By changing the switching function an inconsistent set of parameters for switchpoint mode, SP1, SP2, HY could occur which prevents the switching function to be changed. An appropriate error message is shown. In this case it is recommended to restore the factory settings. With the factory settings a free choice of a switching function is always possible.

Table 3.7: Teach-In commands

3.3.5 Device specific parameters

Index	Sub-Index	Name	Value	Access[1)]			Length	Format
				U	M	S		
0x0112	0	OutA, Auto difference monitoring, max. signal delta (s.obS) boundary value for constant signal observation	16 ... 328, default 33	R	R	R/W	2 Bytes	UInteger16
0x0113	0	OutA, Auto difference monitoring, time delta (t.obS) time period for constant signal observation (msec)	5 ... 9999, default 200	R	R/W	R/W		
0x0114	0	OutA , Auto difference monitoring, switchpoint delta (d.SP) threshhold for pressure difference	82 ... 8192, default 328	R	R/W	R/W		
0x0118	0	OutA, backlight color (COLR)	0, allways blue (default) 1, red if Out = 0 2, red if Out = 1	R	R/W	R/W		
0x0130	0	OutB, Auto difference monitoring, max. signal delta (s.obS) boundary value for constant signal observation	16 ... 328, default 33	R	R	R/W		
0x0131	0	OutB, Auto difference monitoring time delta (t.obS) time period for constant signal observation (msec)	5 ... 9999, default 200	R	R/W	R/W		
0x0132	0	OutB, Auto difference monitoring, switchpoint delta (d.SP) threshhold for pressure difference	82 ... 8192, default 328	R	R/W	R/W		
0x0136	0	OutB, backlight color (COLR)	0, always blue (default) 1, red if Out = 0 2, red if Out = 1	R	R/W	R/W		
0x016A	0	Analog output scaling, Input range start value (In.Lo) in percent of full scale	0 ... 90, default 0	R	R/W	R/W		
0x016B	0	Analog output scaling, Input range end value (In.Hi) in percent of full scale	10 ... 100, default 100	R	R/W	R/W		
0x016C	0	Analog out type (Out)	0: 0..10V voltage output (default) 1: 1..5V voltage output 2: 4..20mA current output	R	R/W	R/W		

Index	Sub-Index	Name	Value	Access[1]			Length	Format
				U	M	S		
0x017F	0	InA, unit	0 = bar (default), 1-kPa, 2-Mpa, 3-psi, 4-mmHG, 5-inHG, 6-inH2O, 7-kgf/cm²	R	R/W	R/W	2 Bytes	UInteger16
0x0182	0	Filter response time InA (Filt) (τ=1ms x 2ⁿ)	0 = Filter Off 1 = 2 ms, default value 2 = 4 ms 3 = 8 ms 4 = 16 ms 5 = 32 ms 6 = 64 ms 7 = 128 ms 8 = 256 ms 9 = 512 ms 10 = 1024 ms	R	R/W	R/W		
0x0184	0	User zero adjustment on/off [2] (Z.Adj)	0 = off, 1 = on default 0	R	R/W	R/W		
0x01E2	0	Pin 2 selection	0 = OutB (switch), 1 = OutD (analogue) default 1	R	R/W	R/W		
0x01E8	0	Backlight duration (Eco)	0 – always on (default) 1 … 3600 sec	R	R/W	R/W		
0x01E9	0	Sub-display mode (Sub.d)	0 = units, (default) 1 = SP1, 2 = SP2, 3= d.SP	R	R/W	R/W		
0x01EA	0	Lock code for local parameter access	0 - no lock (default) 1…9999 – code	R	R/W	R/W		
0x2005	0	InA minimal measured pressure value (MIN) - volatile -	0 … 2^{14} - 1	R	R	R		
0x2006	0	InA maximal measured pressure value (MAX) - volatile -	0 … 2^{14} - 1	R	R	R		

1) Authorisation group: U = user, M = maintenance, S = specialist; access: R = read, R/W = read and write, – = no access

2) only for unipolar pressure ranges, for bipolar variants Z.Adj is always on

Table 3.8: Device specific parameters

3.3.6 Block parameterization

With this feature the sending of invalid parameters to a device can be prevented. Individually sent parameter values are possibly not compatible to the parameter values already stored in the device. The parameters transmitted as a block will be simultaneously accepted and activated.

For SPAN there are three blocks of parameters:

Block parameterization for **BDC1** (OutA)

Index	Sub-Index	Name
0x003C	1	Setpoint SP1
	2	Setpoint SP2
0x003D	2	Switchpoint mode (Fctn)
	3	Hysteresis (HY)
0x0112	0	Auto difference monitoring, max. signal delta (s.obS) boundary value for constant signal observation
0x0113	0	Auto difference monitoring, time delta (t.obS) time period for constant signal observation (msec)
0x0114	0	Auto difference monitoring, switchpoint delta (d.SP)

Table 3.9: Block of OutA coherent parameters

Block parameterization for **BDC2** (OutB)

Index	Sub-Index	Name
0x003E	1	Setpoint SP1
	2	Setpoint SP2
0x003F	2	Switchpoint mode (Fctn)
	3	Hysteresis (HY)
0x0130	0	Auto difference monitoring, max. signal delta (s.obS) boundary value for constant signal observation
0x0131	0	Auto difference monitoring, time delta (t.obS) time period for constant signal observation (msec)
0x0132	0	Auto difference monitoring, switchpoint delta (d.SP)

Table 3.10: Block of OutB coherent parameters

Block parameterization for **analog output** (of pressure InA)

Index	Sub-Index	Name
0x016A	0	pressure range start value (In.Lo)
0x016B	0	pressure range end value (In.Hi)

Table 3.11: Block of analog output coherent parameters

3.4 Process Data IN

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Significance	MSB													LSB		
Process data	ProcessDataVariable (PDV)														BDC2	BDC1
Data content	14-bit measured value (pressure measurement value InA)														OutB	OutA
Index	0x0028															
Sub-Index	1														2	3
Data type	UInteger14														BooleanT	

Table 3.12: Process data mapping

3.5 Conversion factors for the parameters ProcessDataVariable, ProcessDataVariable Min, ProcessDataVariable Max, and Setpoints SP1, SP2

The conversion factors, necessary for the correct representation of the measurement values and the switching points in different physical units in the control unit, are:

Range		Units								
[bar]		mbar	bar	kPa	MPa	psi	mmHg	inchHg	inchH_20	kgf/cm²
0 ... 0,25 P025	G[1)]	0,015259720442	0,000015259720	0,001525972044	0,000001525972	0,000221323933	0,011445736434	0,000450619545	0,006126319966	0,000015560337
	O[1)]	0	0	0	0	0	0	0	0	0
0 ... -0,25 V025	G	-0,015259720442	-0,000015259720	-0,001525972044	-0,000001525972	-0,000221323933	-0,011445736434	-0,000450619545	-0,006126319966	-0,000015560337
	O	0	0	0	0	0	0	0	0	0
0 ... 0,5 P05	G	0,030519440884	0,000030519441	0,003051944088	0,000003051944	0,000442647867	0,022891472868	0,000901239089	0,012252639932	0,000031120674
	O	0	0	0	0	0	0	0	0	0
0 ... -0,5 V05	G	-0,030519440884	-0,000030519441	-0,003051944088	-0,000003051944	-0,000442647867	-0,022891472868	-0,000901239089	-0,012252639932	-0,000031120674
	O	0	0	0	0	0	0	0	0	0
0 ... -1 V1	G	-0,061038881768	-0,000061038882	-0,006103888177	-0,000006103888	-0,000885295733	-0,045782945736	-0,001802478179	-0,024505279863	-0,000062241348
	O	0	0	0	0	0	0	0	0	0
0 ... 1 P1	G	0,061038881768	0,000061038882	0,006103888177	0,000006103888	0,000885295733	0,045782945736	0,001802478179	0,024505279863	0,000062241348
	O	0	0	0	0	0	0	0	0	0
0 ... 2 P2	G	0,122077763535	0,000122077764	0,012207776354	0,000012207776	0,001770591467	0,091565891473	0,003604956357	0,049010559727	0,000124482695
	O	0	0	0	0	0	0	0	0	0
0 ... 6 P6	G	0,366233290606	0,000366233291	0,036623329061	0,000036623329	0,005311774400	0,274697674419	0,010814869072	0,147031679180	0,000373448086
	O	0	0	0	0	0	0	0	0	0
0 ... 10 P10	G	0,610388817677	0,000610388818	0,061038881768	0,000061038882	0,008852957334	0,457829457364	0,018024781786	0,245052798633	0,000622413477
	O	0	0	0	0	0	0	0	0	0
0 ... 12 P12	G	0,732466581212	0,000732466581	0,073246658121	0,000073246658	0,010623548801	0,549395348837	0,021629738143	0,294063358359	0,000746896173
	O	0	0	0	0	0	0	0	0	0
0 ... 16 P16	G	0,976622108283	0,000976622108	0,097662210828	0,000097662211	0,014164731734	0,732527131783	0,028839650858	0,392084477812	0,000995861564
	O	0	0	0	0	0	0	0	0	0
-1 ... 1 B2	G	0,122077763535	0,000122077764	0,012207776354	0,000012207776	0,001770591467	0,091565891473	0,003604956357	0,049010559727	0,000124482695
	O	-1000	-1	-100	-0,1	-14,5038	-750,062	-29,53	-401,47	-1,0197
-1 ... 10 B11	G	0,671427699445	0,000671427699	0,067142769944	0,000067142770	0,009738253067	0,503612403101	0,019827259965	0,269558078496	0,000684654825
	O	-1000	-1	-100	-0,1	-14,5038	-750,062	-29,53	-401,47	-1,0197

1) G = Gradient, O = Offset

Table 3.13: Conversion factors for PDV, Min, Max, SP1, SP1

3.6 Conversion factors for the Hysteresis, Switchpoint d.SP and Max Signal-Delta (s.obS)

Range		Units								
[bar]		mbar	bar	kPa	MPa	PSI	mmHg	inchHg	inchH_20	kgf/cm²
0 ... 0,25 P025	G[1)]	0,015259720442	0,000015259720	0,001525972044	0,000001525972	0,000221323933	0,011445736434	0,000450619545	0,006126319966	0,000015560337
	O[1)]	0	0	0	0	0	0	0	0	0
0 ... -0,25 V025	G	0,015259720442	0,000015259720	0,001525972044	0,000001525972	0,000221323933	0,011445736434	0,000450619545	0,006126319966	0,000015560337
	O	0	0	0	0	0	0	0	0	0
0 ... 0,5 P05	G	0,030519440884	0,000030519441	0,003051944088	0,000003051944	0,000442647867	0,022891472868	0,000901239089	0,012252639932	0,000031120674
	O	0	0	0	0	0	0	0	0	0
0 ... -0,5 V05	G	0,030519440884	0,000030519441	0,003051944088	0,000003051944	0,000442647867	0,022891472868	0,000901239089	0,012252639932	0,000031120674
	O	0	0	0	0	0	0	0	0	0
0 ... -1 V1	G	0,061038881768	0,000061038882	0,006103888177	0,000006103888	0,000885295733	0,045782945736	0,001802478179	0,024505279863	0,000062241348
	O	0	0	0	0	0	0	0	0	0
0 ... 1 P1	G	0,061038881768	0,000061038882	0,006103888177	0,000006103888	0,000885295733	0,045782945736	0,001802478179	0,024505279863	0,000062241348
	O	0	0	0	0	0	0	0	0	0
0 ... 2 P2	G	0,122077763535	0,000122077764	0,012207776354	0,000012207776	0,001770591467	0,091565891473	0,003604956357	0,049010559727	0,000124482695
	O	0	0	0	0	0	0	0	0	0
0 ... 6 P6	G	0,366233290606	0,000366233291	0,036623329061	0,000036623329	0,005311774400	0,274697674419	0,010814869072	0,147031679180	0,000373448086
	O	0	0	0	0	0	0	0	0	0
0 ... 10 P10	G	0,610388817677	0,000610388818	0,061038881768	0,000061038882	0,008852957334	0,457829457364	0,018024781786	0,245052798633	0,000622413477
	O	0	0	0	0	0	0	0	0	0
0 ... 12 P10	G	0,732466581212	0,000732466581	0,073246658121	0,000073246658	0,010623548801	0,549395348837	0,021629738143	0,294063358359	0,000746896173
	O	0	0	0	0	0	0	0	0	0
0 ... 16 P10	G	0,976622108283	0,000976622108	0,097662210828	0,000097662211	0,014164731734	0,732527131783	0,028839650858	0,392084477812	0,000995861564
	O	0	0	0	0	0	0	0	0	0
-1 ... 1 B2	G	0,122077763535	0,000122077764	0,012207776354	0,000012207776	0,001770591467	0,091565891473	0,003604956357	0,049010559727	0,000124482695
	O	0	0	0	0	0	0	0	0	0
-1 ... 10 B11	G	0,671427699445	0,000671427699	0,067142769944	0,000067142770	0,009738253067	0,503612403101	0,019827259965	0,269558078496	0,000684654825
	O	0	0	0	0	0	0	0	0	0

1) G = Gradient, O = Offset

Table 3.14: Conversion factors for the Hysteresis, d.SP and Max Signal-Delta (s.obS)

3.7 Diagnosis

Event Codes	Event Type	Mode	Device Status	Local Indication	Possible cause	Remedy
0x1802	Error	(Dis)appear	Failure	Display: Measured Value Subdisplay: [Er 02] / [ASIC]	Sensor defective	Replace sensor
0x1815	Error	(Dis)appear	Out-of-Specification	Display: Measured Value Subdisplay [Er21] / [SHRt]	Pin2 (OutA) overload / short circuit	Eliminate short circuit
0x1816	Error	(Dis)appear	Out-of-Specification	Display: Measured Value Subdisplay [Er22] / [SHRt]	Pin3 (OutB) overload / short circuit	Eliminate short circuit
0x180A	Warning	(Dis)appear	Out-of-Specification	Display: Measured Value Subdisplay [Er10] / [OVER]	Pressure measuring range has been exceed	Comply with the specified measuring range
0x4000	Error	(Dis)appear	Failure	Display: Measured Value Subdisplay [Er20] / [tEMP]	Sensor temperature error	Check operating temperature and ambient temperature Check load conditions Check circuitry Replace sensor
0x5000	Error	(Dis)appear	Failure	Display: [Er 01] Subdisplay: [FAIL]	Sensor defective	Replace sensor

Table 3.15: Supported errors and warnings

3.8 I-Port

I-Port is an internal technology for automatically identification of Festo devices on I-Port compatible masters.

Index	Name	Default Value	Length (byte)
0x40	Device Attributes	0x00	1
0x41	Extended Parameters	0x0000	2
0x42	Diagnosis Parameter	0x0000	2
0x43	Device Specific Parameters	➔ *Table 3.17:*	8
0xFE	I-Port Revision	0x0100	2

Table 3.16: Supported I-Port Indexes

Byteorder	1	2	3	4	5	6	7	8
IO-Link Index	0x003C				0x003D			
Subindex	1		2		1	2	3	
Function	SP1		SP2		logic	mode	HY	
Byte	high	low	high	low	-	-	high	low
Default value	➔ *3.3.3 Smart Sensor Profile parameters*							

Table 3.17: Mapping of Smart Sensor Profile Indexes on I-Port parameter 0x43