Application Note

FESTO

IO-Link parameter description

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

SPAU-.....
pressure sensor

Title ..... IO-Link parameter description
Version 1.10
Document no. 100042
Original ..... en
Author ..... Festo

Last saved 06.02.2025

Copyright Notice

Legal Notice

Table of contents

1 Components/Software used

Type/Name	Version Software/Firmware	Date of manufacture
SPAU-...	general	operative from 2015

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/sp

2 IO-Link operating mode

In the IO-Link operating mode, programmed switching signals and the continuously measured pressure 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:
  Device variants with LCD display: “OutA” Segment switches off every 2 seconds for the period of 0,1 seconds
  Device variants without LCD display: LED (green or red) switches off every 1 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 every pressure range and for every physical pressure unit.

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 will be 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
100	00 00 64	SPAU-P025
101	00 00 65	SPAU-V025
102	00 00 66	SPAU-P05
103	00 00 67	SPAU-V05
104	00 00 68	SPAU-P1
105	00 00 69	SPAU-V1
106	00 00 6A	SPAU-B2
107	00 00 6B	SPAU-P2
108	00 00 6C	SPAU-P6
109	00 00 6D	SPAU-P10
110	00 00 6E	SPAU-B11
111	00 00 6F	SPAU-P12
112	00 00 70	SPAU-P16
113	00 00 71	SPAU-P025-L
114	00 00 72	SPAU-V025-L
115	00 00 73	SPAU-P05-L
116	00 00 74	SPAU-V05-L
117	00 00 75	SPAU-P1-L
118	00 00 76	SPAU-V1-L
119	00 00 77	SPAU-B2-L
120	00 00 78	SPAU-P2-L
121	00 00 79	SPAU-P6-L
122	00 00 7A	SPAU-P10-L
123	00 00 7B	SPAU-B11-L
124	00 00 7C	SPAU-P12-L
125	00 00 7D	SPAU-P16-L

Table 3.2: Device IDs

Index	Subin-dex	Name	Value (example)	Access[1]			Length	Format
				U	M	S		
0x0010	0	Vendor Name	Festo AG & Co. KG	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. SPAU-P10R-H-Q4D-L-PNLK-PNVBA-M12D	R	R	R	64 bytes	
0x0013	0	Product ID	SPAU-P10-L	R	R	R	11 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	REV02	R	R	R	5 bytes	
0x0017	0	Firmware Revision	V00.42.02.37	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 und commands

Index	SubIn-dex	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:* [3]	R	R	R	27 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; Bit3: lock local user interface (EDIT- and TEACH-Mode)
3) maximal 7 different Device status are available

Table 3.4: Standard IO-Link parameters

Value dec	Value hex	Access[1]			Command	Note	Format
		U	M	S			
128	0x80	–	W	W	Device reset	Device warm start	UInteger8
130	0x82	–	W	W	Restore factory settings	Sets the factory settings operative again	
160	0xA0	W	W	W	Reset InA1 min	Reset the minimal measurement value storage	
161	0xA1	W	W	W	Reset InA1 max	Reset the maximal measurement value storage	
168	0xA8	W	W	W	Adjust zero point	User defined zero point adjustment	
65	0x41	–	W	W	SP1 Single Value Teach	Determines Teachpoint for Setpoint SP1	
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	

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	Subin-dex	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)	1 ... 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)	0 ... 16382, default 9830	R	R/W	R/W	2	UInteger16
	2	Setpoint SP2 (SP.Hi)	0 ... 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 / IOLNK “ 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 not available” 0x8035.

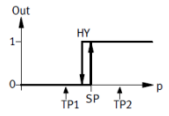
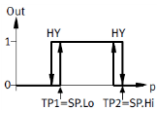
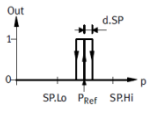
If the first teach command comes once more before the second one, then the currently measured process value will be used again for the first teach point. After sending of second teach command all successfully calculated switching points will be immediately taken over and the remote Teach-In procedure 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 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.
- 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.

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		0x0002	0x4F	always possible during active teach-in process		

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/W	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 (with display) allways green (without display) 1, red if Out = 0 2, red if Out = 1 default 0	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/W	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, allways blue (with display) allways green (without display) 1, red if Out = 0 2, red if Out = 1 default 0	R	R/W	R/W		
0x016A	0	OutD, pressure range (In.Lo) Scaling of analog output to input range start value (in percent of full scale)	0 ... 90, default 0	R	R/W	R/W		
0x016B	0	OutD, pressure range (In.Hi) Scaling of analog output to input range end value (in percent of full scale)	10 ... 100, default 100	R	R/W	R/W		

0x016C	0	OutD, analog out type	0 = 0..10V voltage output 1 = 1..5V voltage output 2 = 4..20mA current output default 0[2] for variants with LCD display variants without LCD display: default value is selected by order code	R	R/W	R/W		
0x017F	0	InA, unit [2]	1137 = bar (default), 1133-kPa, 1132-Mpa, 1141-psi, 1157-mmHG, 1155-inHG, 1146-inH2O, 1626-kgf/cm²	R	R/W	R/W		
0x0182	0	Filter response time InA (Filt) (τ=2,5ms x 2^n)	0 = Filter Off 1 = 5 ms, default value 2 = 10 ms 3 = 20 ms 4 = 40 ms 5 = 80 ms 6 = 160 ms 7 = 320 ms 8 = 640 ms 9 = 1280 ms	-	-	R/W		
0x0184	0	User zero adjustment on/off [2] [3] (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 [2] (Eco)	0 – always on / 1 … 3600 sec. Default value: 0	R	R/W	R/W		
0x01E9	0	Sub-display mode [2] (Sub.d)	0 = units, (default) 1 = SP1, 2 = SP2, 3= d.SP	R	R/W	R/W		
0x01EA	0	Lock code [2] 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		
0x2010	0	Supply voltage	0 … 2^{14} – 1, (scaled to 0 .. 50V)	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 variants with LCD

3) only for variants with LCD and unipolar pressure ranges (for other 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 SPAU there are three blocks of parameters:

Block parameterization for **BDC1** (OutA)

Index	Sub-Index	Name
0x003C	1	Setpoint SP1 (SP, SP.Lo)
	2	Setpoint SP2 (SP.Hi)
0x003D	2	Switchpoint mode (Fctn)
	3	Hysteresis (HY)
0x01E9	0	Sub display (Sub.d)

Table 3.9: Block of OutA coherent parameters

Block parameterization for **BDC2** (OutB)

Index	Sub-Index	Name
0x003E	1	Setpoint SP1 (SP, SP.Lo)
	2	Setpoint SP2 SP.Hi)
0x003F	2	Switchpoint mode (Fctn)
	3	Hysteresis (HY)

Table 3.10: Block of OutB coherent parameters

Block parameterization for **analog OutD**

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

Table 3.11: Block of OutD coherent parameters

Note

- The following table show the Bits and Bytes based on the IO-Link Standard, with Motorola Byte order! Big-Endian
- If you use PLC controller with other Byte order, the program have to convert the Bytes into the correct order of the particular controller. Respect the MSB and LSB indicator in the table.

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

Note

- The table in chapter 3.5 show the conversion factors, for the calculation of the desired measuring value.

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	O	0,610388817677	0,000610388818	0,061038881768	0,000061038882	0,008852957334	0,457829457364	0,018024781786	0,245052798633	0,000622413477
	G	0	0	0	0	0	0	0	0	0
0 ... 12 P12	O	0,732466581212	0,000732466581	0,073246658121	0,000073246658	0,010623548801	0,549395348837	0,021629738143	0,294063358359	0,000746896173
0 ... 162 P16	O	0,976622108283	0,000976622108	0,097662210828	0,000097662211	0,014164731734	0,732527131783	0,028839650858	0,392084477812	0,000995861564
	G	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	inch$H_2$0	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	O	0,610388817677	0,000610388818	0,061038881768	0,000061038882	0,008852957334	0,457829457364	0,018024781786	0,245052798633	0,000622413477
	G	0	0	0	0	0	0	0	0	0
0 ... 12 P10	O	0,732466581212	0,000732466581	0,073246658121	0,000073246658	0,010623548801	0,549395348837	0,021629738143	0,294063358359	0,000746896173
	G	0	0	0	0	0	0	0	0	0
0 ... 16 P10	O	0,976622108283	0,000976622108	0,097662210828	0,000097662211	0,014164731734	0,732527131783	0,028839650858	0,392084477812	0,000995861564
	G	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 Hysteresis, d.SP and Max Signal-Delta (s.obS)

3.7 Diagnosis

Event Codes	Event Type	Mode	Device Status	Local Indication	Possible cause	Remedy
0x5000	Error	(Dis)appear	Failure	Display [Er 01] Subdisplay [dev]	Device defective	• Replace device
0x1802	Error	(Dis)appear	Failure	Display regular Subdisplay [Er 02] / [ASIC]	Device defective	• Replace device
0x8C10	Warning	(Dis)appear	Out-of-Specification	Display regular Subdisplay [Er10] / [OVER]	Measuring range exceeded	• Stay within measuring range
0x5111	Error	(Dis)appear	Out-of-Specification	Display regular Subdisplay [Er17] / [SUPL]	Undervoltage	• Apply permissible operatingvoltage
0x4210	Error	(Dis)appear	Out-of-Specification	Display regular Subdisplay [Er20] / [tEMP]	Temperature error	• Check operating conditions • Replace device
0x1815	Error	(Dis)appear	Failure	Display regular Subdisplay [Er21] / [SHRt]	Short circuit of OutA	• Eliminate short circuit
0x1816	Error	(Dis)appear	Failure	Display regular Subdisplay [Er22] / [SHRt]	Short circuit of OutB	• Eliminate short circuit

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	➔ *Table 3.6:*							

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