Translation of the original instructions

1 About this document
The operating instructions describe the entire function range. The function range is limited, depending on the product variant. You can find detailed specifications for the product, the device description file (IODD) with a description of the IO-Link®, parameters and the declaration of conformity ➔ www.festo.com.

1.1 Applicable documents
All available documents for the product ➔ www.festo.com/pk.

2 Safety
2.1 General safety instructions
- The product may only be used in its original status without unauthorised modifications.
- Only use the product if it is in perfect technical condition.
- Take into consideration the ambient conditions at the location of use.
- Operate the product only with compressed air of the specified air quality class
  ➔ 13 Technical data
- Observe the specifications on the product labelling.
- Work on the product should only be conducted by qualified personnel.

2.2 Intended use
The pressure sensor SPAU is intended for monitoring pressure of compressed air and inert gases in the piping.

2.3 Area of application and approval
In combination with the UL inspection mark on the product, the information in this section must also be observed in order to comply with the certification conditions of Underwriters Laboratories Inc. (UL) for USA and Canada.

UL approval information

<table>
<thead>
<tr>
<th>Product category code</th>
<th>QUY, QUY7</th>
</tr>
</thead>
<tbody>
<tr>
<td>File number</td>
<td>E322346</td>
</tr>
<tr>
<td>Considered standards</td>
<td>UL 61010-1 CAN/CSA C22.2 No. 61010-1</td>
</tr>
</tbody>
</table>

UL mark

US LISTED

WARNING!
The unit shall be supplied by a power source which fulfills the requirements on a limited-energy circuit in accordance to IEC/EN/UL/CSA 61010-1 or on a Limited Power Source (LPS) in accordance to IEC/EN/UL/CSA 60950-1 or IEC/EN/UL/CSA 62368-1 or a Class 2 circuit in accordance to NEC or CEC.

3 Service
- Contact the regional Festo contact if you have technical problems ➔ www.festo.com.

4 Accessories

6 Function
The sensor converts pneumatic pressure values (relative pressure) into electrical signals, which can be used for control or regulating functions. Measurements are carried out using a piezoresistive sensor element with a following electronic evaluation unit. Connection to the higher-level system is provided by 1 or 2 switching outputs, an analogue output and/or an IO-Link interface. The switching outputs can be configured for monitoring of a threshold value, a pressure range or a differential pressure. For each output, PNP or NPN and normally open (NO) or normally closed (NC) can optionally be set. Through the IO-Link® interface, process values can be read out and parameters changed and transmitted to additional devices.

6.1 Operating statuses

<table>
<thead>
<tr>
<th>Operating status</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>RUN mode</td>
<td>➔ Basic status after the operating voltage is switched on</td>
</tr>
<tr>
<td>SHOW mode</td>
<td>➔ Display of the current measured value</td>
</tr>
<tr>
<td>EDIT mode</td>
<td>➔ Display of the current settings</td>
</tr>
<tr>
<td>TEACH mode</td>
<td>➔ Display and resetting of the minimum and maximum values</td>
</tr>
<tr>
<td></td>
<td>➔ Setting or modification of parameters</td>
</tr>
<tr>
<td></td>
<td>➔ Acceptance of the current measured value to determine switching points</td>
</tr>
</tbody>
</table>

6.2 Switching functions

6.2.1 Threshold value comparator for monitoring of a pressure threshold

<table>
<thead>
<tr>
<th>Function</th>
<th>NO (normandy open)</th>
<th>NC (normally closed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switching function:</td>
<td>Bidirectional</td>
<td></td>
</tr>
<tr>
<td>➔ 1 switching point (SP)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>➔ 2 teach points (TP1, TP2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>➔ SP = ½ (TP1+TP2)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Tab. 3

6.2.2 Window comparator for monitoring of a pressure range

<table>
<thead>
<tr>
<th>Function</th>
<th>NO (normandy open)</th>
<th>NC (normally closed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switching function:</td>
<td>Bidirectional</td>
<td></td>
</tr>
<tr>
<td>➔ 2 switching points (SP.Lo, SP.Hi)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>➔ 2 teach points (TP1, TP2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>➔ TP1 = SP.Lo, TP2 = SP.Hi</td>
<td></td>
<td></td>
</tr>
<tr>
<td>➔ SP = ½ (TP1+TP2)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Tab. 4

6.2.3 Auto difference monitoring
This function permits monitoring of a pressure value for constancy. The applied pressure is constant in the range between [SP.Lo] and [SP.Hi], so the reference

Fig. 1 Display variant without front panel mounting. Representation of other variants can deviate from this.
pressure $P_{ref}$ is automatically determined. The result is a switching operation at the output. The signal change signals the start of pressure monitoring. If the pressure remains in the monitoring range ($d.SP$) around $P_{ref}$, the pressure is stable. When the monitoring range is left (e.g. caused by a leakage in the system), the output switches back.

![Diagram](attachment:image.png)

Reference value is determined
1. Measured value deviates by ($d.SP$) from the reference value
2. Monitoring range
3. Tab. 1

The parameters [SP.Lo], [SP.Hi], $t.obS$ and $d.SP$ can be configured by the user. The greater $t.obS$ is set, the more constant the pressure signal must be to establish the reference value $P_{ref}$.

### Function

<table>
<thead>
<tr>
<th>NO (normally open)</th>
<th>NC (normally closed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switching function:</td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td></td>
</tr>
<tr>
<td>2 switching points (SP,Lo, SP,Hi) for setting the valid work range</td>
<td></td>
</tr>
<tr>
<td>1 switching point (d.SP) for determination of the monitoring area</td>
<td></td>
</tr>
<tr>
<td>2 teach points (TP1, TP2)</td>
<td></td>
</tr>
<tr>
<td>TP1 = SP,Lo, TP2 = SP,Hi</td>
<td></td>
</tr>
<tr>
<td>1) SP.Lo = smaller pressure value, SP.Hi = larger pressure value, independent of the Teach sequence</td>
<td></td>
</tr>
</tbody>
</table>

### Installation

#### 7.1 Mechanical and pneumatic

**NOTICE!**
An unfavourable mounting position can impair the function of the product.
- Mount the sensor so that no condensation from the compressed air lines can gather in the device.
- Install the sensor so that it cannot be heated above the maximum permissible operating temperature (plan for convection possibilities).

### Installation

**NOTICE!**

### Hole patterns

#### 7.1.1 Hole patterns

**Fig. 3 Left wall mounting, right mounting bracket**

#### Electric

**WARNING!**

**Risk of injury due to electric shock.**
- For the electric power supply, use only PELV circuits that ensure a reliable electric disconnection from the mains network.
- Observe IEC 60204-1/EN 60204-1.
Long signal lines reduce the immunity to interference.
- Adhere to the maximum permissible cable length of 30 m (20 m for IO-Link).

**Maximum tightening torque of plug connector:** M8 = 0.3 Nm, M12 = 0.5 Nm

### 8.1 LCD display

#### Example for LCD display

<table>
<thead>
<tr>
<th>Output display</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>[OutA]</td>
<td>Switching output OutA selected</td>
</tr>
<tr>
<td>[OutA]</td>
<td>Switching output OutA set</td>
</tr>
<tr>
<td>[OutB]</td>
<td>Switching output OutB selected</td>
</tr>
<tr>
<td>[OutB]</td>
<td>Switching output OutB set</td>
</tr>
<tr>
<td>[OutD]</td>
<td>Analogue output OutD selected</td>
</tr>
</tbody>
</table>

**Information / input display**

- Input signal InA: graphic display of the current measured value related to the maximum measured value of the measuring range
- Analogue output OutD with activated scaling

#### Example for LCD display

<table>
<thead>
<tr>
<th>Main display</th>
<th>Lower display</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>[OutA]</td>
<td>[Lock]</td>
<td>Security code activated</td>
</tr>
<tr>
<td>[Spec]</td>
<td>[Spec]</td>
<td>Special menu activated</td>
</tr>
</tbody>
</table>

### Tab. 9

**Example for LCD display**

<table>
<thead>
<tr>
<th>Main display</th>
<th>Lower display</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>[OutA]</td>
<td>[Lock]</td>
<td>Security code activated</td>
</tr>
<tr>
<td>[Spec]</td>
<td>[Spec]</td>
<td>Special menu activated</td>
</tr>
</tbody>
</table>

**Menu for the switching outputs (OutA and OutB)**

- [Edit] [bin]: Edit menu for the switching outputs (binary)
- [Colr] [Fcm]: Colour menu
- [Out] [bin]: Output menu
- [Out]: Output menu
- [Spec]: Special menu activated

**Tab. 10**

### 8.2 Switch on sensor (RUN mode)

- **Switch on the operating voltage.**
- **Current measured value is displayed.** The sensor is in the basic status (RUN mode).

The basic status can be reached from other modes by:
- Pressing Edit button for 3 seconds
- Expiration of a monitoring time (timeout)

### 8.3 Displaying parameters (SHOW mode)

**Requirement:** The sensor is ready for operation (RUN mode).
8.3.1 Switching output OutA
- Press the A pushbutton.
  - The first parameter set is displayed. [Fctn] flashes.
  - The following parameters can be displayed by repeatedly pressing the A pushbutton ➔ Fig. 5. At the end, the min. and max. values are displayed. This can be reset with the Edit pushbutton.

8.3.2 Switching output OutB or analogue output OutD
- Press B pushbutton.
  - The first parameter set is displayed. [Fctn] with OutB or [Out] with OutD flashes.

The following parameters are displayed by repeatedly pressing the B pushbutton ➔ Fig. 5.

<table>
<thead>
<tr>
<th>Measured value (RUN mode)</th>
<th>OutA / OutB (Switching output)</th>
<th>OutD (Analogue output)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fctn</td>
<td>Fctn</td>
</tr>
<tr>
<td></td>
<td>SP</td>
<td>SP,Lo</td>
</tr>
<tr>
<td></td>
<td>SP,Hi</td>
<td>SP,Hi</td>
</tr>
<tr>
<td></td>
<td>HY</td>
<td>HY</td>
</tr>
<tr>
<td></td>
<td>logic</td>
<td>logic</td>
</tr>
<tr>
<td></td>
<td>COLR</td>
<td>COLR</td>
</tr>
<tr>
<td></td>
<td>MIN</td>
<td>MIN</td>
</tr>
<tr>
<td></td>
<td>MAX</td>
<td>MAX</td>
</tr>
</tbody>
</table>

Fig. 5

Legend for ➔ Fig. 5

| MIN, MAX Parameter is displayed only for switching output OutA, without Timeout | Edit button | A or B pushbutton |

Tab. 11

8.4 Entering the security code
The security code must be entered when "Lock" is active.
Requirement: The sensor is ready for operation (RUN mode).
1. Press the Edit button.
   - The EDIT mode is active. If the security code is activated, the parameter entry option is blocked: [Lock] flashes.
2. Enter security code set with A or B pushbutton.
3. Press the Edit button briefly.
   - [OutA] flashes. The parameter entry option is unblocked.

8.5 Configuring switching output (EDIT mode)

The process is the same for configuring the switching outputs for OutA and OutB. In the following, the process is described using the switching output OutA. Menu structure ➔ Fig. 7.

Changing the switching behaviour of the switching outputs in the EDIT mode is effective immediately.

Requirement: The sensor is ready for operation (RUN mode).

Switching functions ➔ 6 Function
1. Press the Edit button briefly.
2. Press the Edit button briefly.
   - [Fctn] flashes.
3. With A or B pushbutton, select _I_ or _I_/Lo or d_1_/Lo.
4. Press the Edit button briefly.
   - The set value is saved.
   - The next adjustable parameter is shown.

5. Set the parameter with A or B pushbutton.
6. Repeat points 4 and 5 until all parameters are set ➔ Fig. 5.
7. Press the Edit button.
   - Switch to the RUN mode.

8.6 Set analogue output (EDIT mode)
Requirement: The sensor is ready for operation (RUN mode).
1. Press the Edit button briefly.
2. Select [OutD] with the A pushbutton or B pushbutton.
3. Press the Edit button briefly.
   - [Out] flashes.
4. Set the parameter with A or B pushbutton.
5. Press the Edit button briefly.
   - The set value is saved.
   - The next adjustable parameter is shown.
6. Repeat points 4 and 5 until all parameters are set.
7. Press the Edit button.
   - Switch to the RUN mode.

8.7 Change device settings (EDIT mode)
Requirement: The sensor is ready for operation (RUN mode).
1. Press the Edit button briefly.
2. With A or B pushbutton, select special menu [Spec].
   - [Spec] flashes.
3. Press the Edit button briefly.
   - [Filt] flashes.
4. Set the parameter with A or B pushbutton.
5. Press the Edit button briefly.
   - The set value is saved.
   - The next adjustable parameter is shown.
6. Repeat points 4 and 5 until all parameters are set.

8.8 Replicating parameters (EDIT mode)
Requirements:
- The pre-configured master sensor is ready for operation (RUN mode).
- Master sensor and device sensor have the same design regarding the parameters (same device ID).
- The master sensor is connected with the device sensor ➔ Fig. 6.
- Parameterisation of the device sensor must not be blocked via IO-Link.
- The device sensor is in an unswitched status (switching output PNP, display OutA off).

Fig. 6

1. Select special menu [Spec] at the master sensor via device settings.
2. Press the Edit button briefly until [MASTER] appears.
3. With A or B pushbutton, select [ON].
4. Press the Edit button.
5. Press A or B pushbutton.
   - The parameters are transmitted to the device sensor.
   - If an error occurs, an error message appears ➔ 12 Fault clearance.
6. Repeat point 5 if an additional sensor should be parameterised.
7. Press the Edit button briefly.
   - Switch to the RUN mode.
8.9 Zero point synchronisation (zero adjust)
Requirement:
- The sensor is ready for operation (RUN mode).
- [Z.ADJ] / [ON] is set ➔ 8.7 Change device settings (EDIT mode).
- The measured value lies in the range 0 bar ± 3 % FS.
1. Press the A pushbutton and B pushbutton simultaneously.
2. Press the EDIT pushbutton also.
   - [OK] appears. The zero point synchronisation was successful.
If [FAIL] appears: the zero point synchronisation was not successful. Check requirements.

If [Z.ADJ] / [OFF] is set for a later time, the device takes over the factory setting calibration values.

8.10 Menu structure (EDIT mode)
Some menu options or setting values are not applicable, depending on the selected switching function.
Property damage due to high temperatures.

Extreme pneumatic conditions (high cycle rate with large pressure amplitude) can heat the product above 80°C.

Select the operating conditions (in particular the ambient temperature, pressure amplitude, cycle rate, current consumption) such that the product does not heat up above the maximum permitted operating temperature.

9 Operation and use

NOTICE!

1. Switch off operating voltage.
2. Keep the A and B pushbuttons pressed down simultaneously.
3. Switch on the operating voltage.
4. Additionally, press the Edit button.
   b. [Rsto PARM] appears. All parameters are reset to the factory settings ➔ Fig.7

10 Maintenance and care

1. Switch off the energy sources (operating voltage, compressed air).
2. Clean sensor with non-abrasive cleaning agents.

11 Disassembly

1. Switch off the energy sources (operating voltage, compressed air).
2. Separate connections from the sensor.
3. Loosen the mountings.

12 Fault clearance

12.1 General

<table>
<thead>
<tr>
<th>Fault description</th>
<th>Cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>No display</td>
<td>No operating voltage or impermissible operating voltage</td>
<td>Apply permissible operating voltage.</td>
</tr>
<tr>
<td></td>
<td>Electrical connections swapped</td>
<td>Connect the device in accordance with the circuit diagram.</td>
</tr>
<tr>
<td></td>
<td>Device defective</td>
<td>Replace device.</td>
</tr>
<tr>
<td>Indicator or switching output does not react in accordance with the settings</td>
<td>Short circuit or overload at the output</td>
<td>Eliminate short circuit/overload.</td>
</tr>
<tr>
<td></td>
<td>Incorrect switching point taught (e.g. at 0 bar)</td>
<td>Repeat teaching.</td>
</tr>
<tr>
<td></td>
<td>Device defective</td>
<td>Replace device.</td>
</tr>
<tr>
<td></td>
<td>Parameter incorrect</td>
<td>Reset to factory settings.</td>
</tr>
</tbody>
</table>

Tab. 13

12.2 Device variants with LCD display

<table>
<thead>
<tr>
<th>Fault description</th>
<th>Cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Er01] / [FAIL]</td>
<td>Device error</td>
<td>Replace device.</td>
</tr>
<tr>
<td>[Er02] / [ASIC]</td>
<td>Device error</td>
<td>Replace device.</td>
</tr>
<tr>
<td>[Err] / [BUSY]</td>
<td>OutA is switched active in the device sensor.</td>
<td>Check device settings.</td>
</tr>
<tr>
<td>[Err] / [ID]</td>
<td>Device ID error, devices do not have the same design.</td>
<td>When replicating, use sensors with the same pressure range / type (same device ID).</td>
</tr>
</tbody>
</table>

Tab. 12

8.11 Teach switching points (TEACH mode)

The process for teaching the switching outputs for OutA (A pushbutton) and OutB (B pushbutton) is the same. In the following, the process is described using the switching output OutA.

There is no timeout in the TEACH mode. The sensor changes to the RUN mode only after the entire teach process is ended.

Requirement: The sensor is ready for operation (RUN mode).
Fault description | Cause | Remedy
---|---|---
[Err] / [COMM] | IO-Link® communication error | Check line OutA. Check settings of the device sensor.

1) Display flashes.
2) Display illuminates red.

Tab. 14

12.3 Device variants without LCD display

Fault description | Cause | Remedy
---|---|---
LED flashes red | Device error | Replace device.
LED illuminated red | Temperature error, under-voltage, measuring range exceeded, short circuit | Checking operating conditions.

Tab. 15

13 Technical data

SPAU-

| General | Certification | RCM Mark c UL us – Listed (OL) |
| CE marking (⇒ declaration of conformity) | according to EU-EMC-RL Directive, according to EU-RoHS-RL Directive |

Input signal/measuring element

Operating medium | Compressed air to ISO 8573-1:2010 [7-4-a] inert gases |

Temperature of medium [°C] | 0 → +50 |

Output, general

Accuracy

P16 | [% FS] | ±2 at room temperature |
B2, B11, V1, P1, P2, P6, P10, P02S, P05, V025, V05, V12 | [% FS] | ±1.5 at room temperature |
B2, B11, V1, P1, P2, P6, P10, P02S, P05, V025, V05, P12 | [% FS] | ±3 in the entire temperature range |

Polarity

Repetition accuracy [% FS] | ±0.3 (short-time), with [Filt] = [OFF] |

Temperature coefficient [% FS/K] | typ. ± 0.05 |

Switching output

Switch-on time [ms] | max. 4.6 with [Filt] = [OFF] |
Switch-off time [ms] | max. 5.3 with [Filt] = [OFF] |

Max. output current [mA] | 100 |

Capacitive load maximum DC [nF] | 100 |

Voltage drop [V] | Max. 1.6 |

Pull-down/pull-up resistor | PNP: integrated; NPN: not integrated |

Inductive protective circuit | Available |

Analogue output

Output characteristic curve start value ... end value

SPAU-...V | [V] | 0 → 10 |

SPAU-...B | [V] | 1 → 5 |

SPAU-...A | [mA] | 4 → 20 |

Rise time [ms] | 1, at [Filt] = [OFF] |

Max. load resistance of current output (SPAU-...A) [Ω] | 500 |

Min. load resistance of output voltage output (SPAU-...V, SPAU-...B) [Ω] | 10 |

Additional output data

Short circuit current rating | Yes |

Overload protection | Available |

Electronic system

Operating voltage range [V] | 20 → 30 |

Idle current [mA] | Typically 35 |

Ready-state delay [ms] | Typically 160 |

Reverse polarity protection | All connections against each other |

Mechanical system

Mounting position | Any, avoid condensation gathering in the sensor |
Housing material | PA reinforced |

Material of keypad | SPL-G |

Material of plug housing | Brass (nickel-plated) |

Display operation

Displayable units | bar, kPa, MPa, psi, mmHg, inchHg, inchH2O, kgf/cm2 |

Threshold value setting range [% FS] | 0 → 100 (recommended range 1 → 99) |

SPAU-

| Threshold value setting range, auto difference monitoring | [% FS] | 0.5 … 100 |

Hysteresis setting range [% FS] | 0 … 90 |

Immissions/ emissions

Storage temperature [°C] | -20 → +80 |

Ambient temperature [°C/°F] | 0 → +50 / 122 |

Degree of protection to EN 60529

SPAU-...T/H/W/A | IP65/IP67 |

SPAU-...F/MS4/MS6 | IP65 |

Protection class in accordance with DIN VDE 0106-1 | III |

Resistance to shocks in accordance with EN 60068-2 | 30 g acceleration with 11 ms duration (half sine) |

Vibration resistance in accordance with EN 60068-2 | 10 → 60 Hz: 0.35 mm / 60 ... 150 Hz: 5g |

Tab. 16

Tab. 17

Tab. 18

IO-Link®

Protocol version | Device V1.1 |
Profile | Smart Sensor profile |

Function classes

Binary data channel (BDC), Process data variable (PDV), Identification, diagnostics, Teach channel |
Communication mode | COM2 (38.4 kBit)aud |
SIO mode support | Yes |
Port class | A |

Process data width OUT | 0 bytes |

Process data width IN | 2 bytes |

Process data content | 2 bit BDC (pressure monitoring), 14 bit PDV (pressure measurement value) |

Minimum cycle time | 1 ms |

Data memory required | 2 KByte |

IDO-D, IO-Link® device description | www.festo.com |

Tab. 19

Electrical data and ambient conditions UL/CSA

Input current | max. 0.24 A |
Power | max. 7.2 W |
Pressure differential | max. 1.6 MPa |
Pollution degree | 3 |

Humidity range | 93 % |

Installation site

for indoor use only |
Max. installation height | 2000 m |

Degree of protection

The degree of protection IP65/IP67 is not UL-tested. |

Tab. 20 Electrical data and ambient conditions UL/CSA