Positioners
SIPART PS2

Technical description

**Explosion-proof versions**
- Device with protection type "intrinsic safety" for use in Zone 1, 2, 21 or Class I, Division 1, Groups A B C D.
- Device with protection type "dust protection with enclosure" for use in Zone 22.
- Device with protection type "non-sparking" for use in Zone 2 or Class I, Division 2, Groups A B C D.
- Device with protection type "flameproof enclosure" for use in Zone 1 or Class I, Division 1, Groups A B C D.

**Stainless steel enclosure for extreme ambient conditions**

The SIPART PS2 is available in a stainless steel enclosure (with no window in the cover) for use in particularly aggressive environments (e.g., offshore operation, chlorine plants etc.). The device functions are the same as for the basic version.

**Design**

The SIPART PS2 positioner is a digital field device with a highly-integrated microcontroller.

The positioner consists of the following components:
- Enclosure and cover
- PCB with corresponding electronics with or without communication through HART
  - or with electronics for communication in accordance with
    - PROFIBUS PA specification, IEC 61158-2; bus-supplied device, or
    - FOUNDATION Fieldbus (FF) specification, IEC 61158-2; bus-supplied device
- Position detection system
- Terminal housing with screw terminals
- Pneumatic valve manifold with piezoelectric valve precontrol.

The valve manifold is located in the housing, the pneumatic connections for the inlet air and the positioning pressure on the right-hand side. A pressure gauge block and/or a safety solenoid valve can be connected there as options. The SIPART PS2 positioner is fitted to the linear or part-turn actuator using an appropriate mounting kit. The circuit board container in the casing provides slots for separately ordered boards with the following functions:

**I_f module**
- Position feedback as a two-wire signal 4 to 20 mA

**Alarm unit (3 outputs, 1 input)**
- Signaling of two limits of the travel or angle by binary signals. The two limits can be set independently as maximum or minimum values.
- Output of an alarm if the setpoint position of the final control element is not reached in automatic mode or if a device fault occurs.
- Second binary input for alarm signals for triggering safety reactions, e.g., blocking function or safety position.

**Limit signaling through slot-type initiators (SIA module)**

Two limits can be signaled redundantly as NAMUR signals (EN 60947-5-6) by slot-type initiators. An alarm output is also integrated in the module (see “Alarm Module”).

**Mechanical limit switch module (limit value contact module)**

Two limits can be signaled redundantly by switching contacts. An alarm output is also integrated in the module (see “Alarm Module”).

**Separate mounting of position detection system and controller unit**

The position detection system and controller unit can be connected separately for all casing versions of the SIPART PS2 (except flameproof design). Measurement of the travel or angle is carried out directly on the actuator. The controller unit can then be fitted a certain distance away, e.g., on a mounting pipe or similar, and is connected to the position detection system by an electric cable and to the actuator by one or two pneumatic lines. Such a split design is frequently advantageous if the ambient conditions at the fitting exceed the specified values for the positioner (e.g., strong vibrations).

The following can be used for measuring the travel or angle:
- NCS sensor
- External position detection system C73451-A430-D78
- A commercially available potentiometer (10 kΩ resistance), e.g., for higher application temperatures or customer-specific applications

The use of potentiometers is recommended for very small linear actuators with a short valve travel since, on the one hand, the space required by the potentiometer is very small and, on the other, the transmission characteristic is optimum for a small travel.

**Separate mounting of position detection system and controller unit**

**Non contacting sensor (NCS)**

NCS for part-turn actuator (6DR4004-NN110) mounted with mounting console (left) and NCS for linear actuator ≤ 14 mm (0.55 inch) (6DR4004-NN20) mounted with actuator-specific mounting solution (right)
The positioner outputs a continuous signal in the area where there is a large system deviation (high-speed zone); in areas of moderate system deviation (slow-speed zone) it outputs a sequence of pulses. No positioning signals are output in the case of a small system deviation (adaptive or variable deadband).

The linear or rotary motion of the actuator is detected by the mounting kit and transferred to a high-quality potentiometer over a shaft and a non-floating gear transmission.

The angular error of the pick-up in cases where the assembly is mounted on a linear actuator is corrected automatically.

When connected in a 2-wire system, the SIPART PS2 draws its power exclusively from the 4 to 20 mA setpoint signal. The electric power is also connected through the 2-wire bus signal with PROFIBUS operation (SIPART PS2 PA).

The same applies for the FOUNDATION Fieldbus version.

**Pneumatic valve manifold with piezoelectric valve precontrol**

The piezoelectric valve can release very short control pulses. This helps achieve a high positioning accuracy. The pilot element is a piezoelectric bending converter which switches the pneumatic main controller unit. The valve manifold is characterized by an extremely long service life.

**Local operation**

Local operation is performed using the built-in display and the three buttons. Switching between the operating levels Automatic, Manual, Configuring and Diagnosis is possible at the press of a button.

In manual mode the drive can be adjusted over the entire range without interrupting the circuit.

**Operation and monitoring with SIMATIC PDM configuration software**

The configuration software SIMATIC PDM permits simple operation, monitoring, configuration and parameterization of the device. The diagnostic information available can be read via SIMATIC PDM from the device. Communication is carried out via the HART protocol or PROFIBUS PA. For the HART protocol, the device can be accessed both via a HART modem and via a HART-compatible input/output module (remote IO). The corresponding device description files, such as GSD and (Enhanced) EDD are available for both types of communication.

In addition, the SITRANS DTM provides software based on tried and tested EDD technology that can be used to parameterize field devices via a DTM (Device Type Manager) using an FDT frame application (e.g. PACTware). SITRANS DTM and the necessary device-specific enhanced EDD are available for download free of charge. The software provides the relevant communication interfaces for HART and PROFIBUS.

**Automatic commissioning**

With a simple configuration menu the SIPART PS2 can be quickly adapted to the fitting and adjusted by means of an automatic startup function.

During initialization, the microcontroller determines the zero point, full-scale value, the direction of action and the positioning speed of the fitting. From this data it establishes the minimum pulse time and the deadband, thus optimizing the control.

**Low air consumption**

A hallmark of the SIPART PS2 is its own extremely low consumption of air. Normal air losses on conventional positioners are very costly. Thanks to the use of modern piezoelectric technology, the SIPART PS2 consumes air only when it is needed, which means that it pays for itself within a very short time.

---

**Function**

The SIPART PS2 positioner works in a completely different way to normal positioners.

**Mode of operation**

Comparison of the setpoint and the actual value takes place electronically in a microcontroller. If the microcontroller detects a deviation, it uses a 5-way switch procedure to control the piezoelectric valves, which regulates the flow of air into and from the chambers of the pneumatic actuator or blows it in the opposite direction.

The microcontroller then outputs an electric control command to the piezoelectric valve in accordance with the size and direction of the deviation (deviation between setpoint and actual values). The piezoelectric valve converts the command into a pneumatic positional increment.
Positioners

SIPART PS2

Technical description

Comprehensive monitoring functions

The SIPART PS2 has various monitoring functions with which changes on the actuator and valve can be detected and signaled if applicable when a selectable limit has been exceeded. This information may be important for diagnosis of the actuator or valve. The measuring data to be determined and monitored, some of whose limits can be adjusted, include:

- Travel integral
- Number of changes in direction
- Alarm counter
- Self-adjusting deadband
- Valve end limit position (e.g., for detection of valve seat wear or deposits)
- Operating hours (also according to temperature and travel ranges) as well as min./max. temperature
- Operating cycles of piezoelectric valves
- Valve positioning time
- Actuator leakages

Status monitoring with 3-stage alarm concept

The intelligent electropneumatic SIPART PS2 positioner is equipped with additional monitoring functions. The status indications derived from these monitoring functions signal active faults of the unit. The severity of these faults are graded using “traffic light signaling”, symbolized by a wrench in the colors green, yellow and red (in SIMATIC PDM and Maintenance Station):

- Need for maintenance (green wrench)
- Urgent need for maintenance (yellow wrench)
- Imminent danger of unit failure or general failure (red wrench)

This allows users to put early measures into action before a serious valve or actuator fault occurs which could result in a system shutdown. The fact that a fault indication is signaled, such as the onset of a diaphragm break in the actuator or the progressive sluggishness of a unit, enables the user to ensure system reliability at any time by means of suitable maintenance strategies.

This three-stage alarm hierarchy also allows early detection and signaling of other faults, such as the static friction of a packing box, the wearing of a valve plug/seating, or precipitations or in-crustations on the fittings.

These fault indications can be output either line-conducted over the alarm outputs (see above) of the positioner (max. 3), or via communication over the HART or field bus interfaces. In this case, the HART, PROFIBUS and FF versions of SIPART PS2 permit a differentiation of the various fault indications, as well as a trend representation and histogram function of all key process variables with regard to the fittings.

The device display also displays the graded maintenance requirements, complete with identification of the source of the fault.

Functional safety acc. to SIL2

The positioner is suitable for use on valves that satisfy the special requirements in terms of functional safety up to SIL 2 in accordance with IEC 61508 or IEC 61511. The variants 6DRS.1-0,...,Z C20 are available for this.

These are single-acting positioners for mounting on pneumatic actuators with spring return.

The positioner vents the valve actuator on demand/in the event of a fault and puts the valve in the preset safety position.

This positioner meets the following requirement:

- “Functional safety up to SIL 2 in accordance with IEC 61508 or IEC 61511 for safe venting.

SIPART PS 2 as “intelligent solenoid valve”

Open/Close valves, safety fittings in particular, are generally pneumatically controlled over a solenoid valve. If you use SIPART PS2 instead of this type of solenoid valve, the positioner performs two tasks in a single device (without extra wiring)

- Firstly, it switches the fitting off on demand by venting the actuator (functional safety acc. to SIL 2 (see above)
- Secondly, it can perform a Partial Stroke Test at regular intervals (1 - 365 days), which prevents the blocking of the fitting, e.g., due to corrosion or furring.

As in this case SIPART PS2 is constantly working in normal operation (e.g., 99% position), it also acts as a permanent test function for the pneumatic output circuit, which is not usually possible when using a solenoid valve.

Solenoid valves on control valves can also not normally be tested during operation. They are therefore not necessary when using SIPART PS 2 with a 4-wire connection system as the venting is carried out on demand by SIPART PS2. This means that on control valves, both the control function and the shut-off function can be carried out by a single device.

Configuring

In configuring mode, the SIPART PS2 positioner can be configured to requirements and include the following settings:

- Input current range 0 to 20 mA or 4 to 20 mA
- Rising or falling characteristic curve at the setpoint input
- Positioning speed limit (setpoint ramp)
- Split range operation; adjustable start-of-scale and full-scale values
- Response threshold (deadband); self-adjusting or fixed
- Direction of action; rising or falling output pressure with rising setpoint
- Limits (start-of-scale and full-scale values) of positioning range
- Limits (alarms) of the final control element position; minimum and maximum values
- Automatic “tight closing” (with adjustable response threshold)
- The travel can be corrected in accordance with the valve characteristic curve
- Function of binary inputs
- Function of alarm output etc.

Configuration of the various SIPART PS2 versions is largely identical.
SIPART PS2, electropneumatic positioner, function diagram

1. Motherboard with microcontroller and input circuit
2. Control panel with display and pushbuttons
3. Piezoelectric valve unit, always present
4. Valve unit, present as accessory in double-acting positioner
5. I/O module for SIPART PS2 controller
6. Alarm module for 3 alarm outputs and one binary input
7. SIA module (slot initiator alarm module, fig.) or mechanical limit switch module
8. Spring loaded pneumatic actuator (single-acting)
9. Springless pneumatic actuator (double-acting)

Note: Alarm module (6) and SIA module (7) can only be inserted as alternatives.