SIEMENS

SIPART PS2

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6DR53xx

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Manual

Electropneumatic Positioner for Linear and Part-Turn Actuators
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Siemens AG
Bereich Automatisierungs- und Antriebstechnik
Geschäftsbereich Prozessinstrumentierung- und Analytik
D–76181 Karlsruhe

Disclaimer of Liability

We have checked the contents of this manual for agreement with the hardware and software described. Since deviations cannot be precluded entirely, we cannot guarantee full agreement. However, the data in this manual are reviewed regularly and any necessary corrections included in subsequent editions. Suggestions for improvement are welcomed.

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Dear customer,

Please read this manual before starting work!

It contains important information and data which, when observed, ensure full availability of the equipment and save service costs. This simplifies handling of this control instrument considerably and provides accurate measuring results.

You have purchased an instrument which can be installed in various configurations:

- **SIPART PS2** without Ex-protection in a metal- or plastic housing.
- **SIPART PS2** with EEx ia/ib-protection in a metal- or plastic housing.
- **SIPART PS2 EEx d** in a pressurized explosion proof housing

This manual takes each of these possibilities into consideration. Any differences between the devices are indicated specially.

Scope of delivery, see chapter 7, page 127.

### 0.1 General information

The product described in this manual left the factory in a perfectly safe and tested condition. To maintain this condition and to achieve perfect and reliable operation of this product, it must only be used in the way described by the manufacturer. Successful and safe operation of this equipment is dependent on proper handling, installation, operation and maintenance.

This manual contains the information required for use as intended of the product it describes. It is addressed to technically qualified personnel specially trained or having relevant knowledge of instrumentation and control technology, hereafter called automation technology.

Familiarity with and proper technical observance of the safety notes and warnings contained in this manual are essential for safe installation and commissioning and for safety in operation and maintenance of the product described. Only qualified personnel as defined in Chapter 0.3 has the necessary specialist knowledge to interpret the general safety notes and warnings given in this document in specific cases and to take the necessary action.

The documentation supplied with the instrument is listed in Chapter 0.5.
This manual is not a permanent part of the scope of supply. For reasons of clarity, it does not contain every detail about every version of the product described and cannot take every eventuality in installation, operation, maintenance and use in systems into account. If you require further information or if problems occur that have not been dealt with in sufficient detail in this document, please request the required information from your local Siemens office or the office responsible for you.

Functionality, commissioning and operation are described in this manual.

Please pay special attention to the **Warning and Note** texts. These are separated from the remaining text by horizontal lines and specially marked with symbols (see Chapter 0.2).

### 0.2 Classification of Safety Related Notices

This manual contains notices which you should observe to ensure your own personal safety, as well as to protect the product and connected equipment. These notices are highlighted in the manual by a warning triangle and are marked as follows according to the level of danger:

- **DANGER** indicates an immenently hazardous situation which, if not avoided, **will** result in death or serious injury.

- **WARNING** indicates a potentially hazardous situation which, if not avoided, **could** result in death or serious injury.

- **CAUTION** used with the safety alert symbol indicates a potentially hazardous situation which, if not avoided, **may** result in minor or moderate injury.

- **CAUTION** used without the safety alert symbol indicates a potentially hazardous situation which, if not avoided, **may** result in property damage.
0.3 Qualified Personnel

The result of unqualified intervention in the instrument or nonobservance of the warnings given in this manual or on product labels can be severe personal injury and/or serious material damage. Therefore only properly qualified personnel must make changes and settings in the instrument.

For the purpose of the safety information in this manual and on the product labels, qualified personnel are those who

- in the case of ex-proof equipment, are trained, instructed or authorized to perform work on electrical circuits of equipment subject to explosion hazard.
- if they are configuration personnel, are familiar with the safety concepts of automation technology
- if they are operating personnel, have been instructed in the handling of automation equipment and know the content of this manual relating to operation
- if they are commissioning and/or service personnel, are trained to repair such automation equipment and authorized to energize, de-energize, clear ground and tag circuits and equipment according to safety engineering standards.
- and instructed additionally in first aid
**WARNING**

The instrument must only be installed and commissioned by qualified personnel.

The device may be used solely for the purposes described in this manual.

The instrument is designed for connection to functional and safety extra low voltage.

Electrical safety depends only on the power supply equipment.

Pneumatic actuators exert considerable positioning forces. The safety precautions of the actuator used must therefore be scrupulously observed during installation and commissioning in order to prevent injuries.

We explicitly draw your attention to the necessity of observing safety regulations regarding operation in zones subject to explosion hazard, if applicable.

The specifications of the examination certificate valid in your country must be observed. Laws and regulations valid in your country must be observed for the electrical installation in explosions hazardous areas. In Germany these are for example:

- Working reliability regulations
- Regulations for installing electrical equipment in hazardous areas, DIN EN 60079–14 (in the past VDE 0165, T1).

It should be checked whether the available power supply, insofar as this is required, is compliant with the power supply specified on the rating plate and specified in the examination certificate valid in your country.

Take care to avoid electrostatic discharges within the hazardous area, such as can arise if a dry cloth is used to clean the positioner in the plastic housing.

Devices with the protection type “flameproof enclosure” may only be opened when the power is off.

---

**WARNING**

Devices with the protection type “intrinsically safe” lose their certification as soon as they are operated with circuits that do not conform to the specifications laid down in the examination certificate valid in your country.

The successful and safe operation of this equipment is dependent upon its proper handling, installation, operation and maintenance.
0.4 Use as intended

Use as intended for the purpose of this manual means that this product must only be used for the applications described in the technical description (see also Chapter 3 of this manual).

The product described in this manual has been developed, manufactured, tested and documented observing the relevant safety standards. If the handling rules and safety information for configuration, installation, use as intended and maintenance are observed, there is normally no danger with regard to material damage or for the health of personnel. Extra low voltages that are connected must be fed in by safe isolation.

0.5 Technical Documentation

The operating instructions are a constituent part of the enclosed CD "sipart ps2 POSITIONERS" (order number A5E00214567) and is available on the Internet at:

www.siemens.com/sipartps2

Click on "More Info" and "--> Instructions and Manuals".

On the enclosed CD, you will find an extract of the catalog FI 01 "Field devices for process automation" with the current order data. The entire FI 01 catalog is also available at the above Web address.

0.6 Warranty Information

We should like to point out that the content of this manual is not part of and does not modify a previous or current agreement, undertaking or legal relationship. Siemens is bound solely by the contract of sale, which also contains the complete and exclusive warranty. The contractual warranty conditions are neither extended nor restricted by this document.
0.7 Delivery Notes

The scope of delivery is listed on the dispatch papers accompanying the delivery in accordance with the valid contract of sale.

When you open the packaging please observe the information on the packaging. Check that the delivery is complete and undamaged. If possible, compare the order number on the rating plates with the ordering data.

For the scope of delivery please see Chapter 7, page 127.

0.8 Standards and Regulations

As far as possible, the harmonized European standards were used to specify and manufacture this equipment. If harmonized European standards have not been applied, the standards and regulations of the Federal Republic of Germany apply (see also the Technical Data in Chapter 6, page 121).

If this product is used outside the area of applicability of these standards and regulations, please observe the standards and regulations in force in the country where the product is operated.
1.1 General information about the positioner

The positioner is used to adjust and control pneumatic actuators. The controller operates electropneumatically with compressed air as an energy supply.

**Purpose**

For example, the positioner can be used to control valves as follows:

- with linear actuator (figure 1-1, page 13) or
- with part-turn actuator VDI/VDE 3845 (figure 1-2, page 13)

Different mounting types are available for linear actuators:

- NAMUR or IEC 534
- integrated mounting to ARCA
- integrated mounting to SAMSON (non-explosion-proof version)

This means the positioner can be installed and operated on all common actuator systems.

**Versions**

The positioner is available for the following actuators:

- double-acting and
- single-acting

For following applications:

- potentially explosive or
- not potentially explosive applications.

**Housing**

The electronics with display, position feedback and valve block are integrated in the housing.

The housing is available in three versions:

- Plastic housing for single and double-acting actuators
- Metal housing for single-acting actuators
- Explosion proof housing for single and double-acting actuators
Introduction

Degree of protection

The device is designed with IP65/NEMA4x degree of protection.

Explosion Protection

The intrinsically safe version can be used in hazardous areas in zone 1 or zone 2. The explosion proof version can be used in hazardous areas in zone 1 or zone 2.

SIL applications

The SIPART PS2 positioners in the variations 6DR501*, 6DR511*, 6DR521* and 6DR531* (i.e. with 0/4 up to 20 mA control signal in the single-acting design) are also suitable for positioning on fittings with pneumatic actuators, which satisfy the special requirements for safety devices up to SIL 2 to IEC 61508/ IEC 61511–1. For this, the SIL safety instructions (see "SIPART PS2 SIL safety manual" A5E00442120) must be followed.

Options

The positioner can be expanded with various options modules (chapter 2.5, page 26). The following modules are available in all:

- \(J_y\)-module: Two–wire current output 4 to 20 mA for position feedback
- Alarm module: 3 digital outputs and 1 digital input
- SIA module: one digital output for fault messages, two digital outputs for limit value alarms

Accessories

- Manometer block: 2 or 3 manometers for single and double-acting positioners
- Connection block (NAMUR) for safety valve block
- Mounting kits for linear and part-turn actuator

For decentralized installation of the positioner and position sensor:

- External position detection system
- Non-Contacting Position Sensor (NCS)

Environmental Protection

Only environmentally friendly materials have been used in the construction of the positioner.

The technical manual is printed on chlorine-free bleached paper.
1 Actuator
2 Positioner, single-acting in metal housing
3 Lantern
4 Manometer block, single-acting
5 Valve

Figure 1-1  Positioner mounted on **linear actuator** (single-acting)

1 Positioner double-acting in plastic housing
2 Part-turn actuator
3 Manometer block, double-acting

Figure 1-2  Positioner mounted on **part-turn actuator** (double-acting)
Introduction

Figure 1-3  **Explosion proof version** of the positioner mounted on **linear actuator** (single-acting)

Figure 1-4  **Explosion proof version** of the positioner mounted on **part-turn actuator** (double-acting)
The following chapter describes the mechanical and electrical design, the instrument components and method of operation of the positioner.

2.1 Overview

The electropneumatic positioner forms a control system in connection with an actuator. The current position of the actuator is detected by a servo potentiometer and fed back as actual value \( x \). The setpoint and actual value are output simultaneously on the display.

The setpoint \( w \) is formed by a current fed to the positioner which at the same time serves to supply the positioner in two-wire operation. In 3 / 4-wire operation the supply comes from a 24 V voltage input.

The positioner operates as a predictive five-point switch by the output variable \( \pm \Delta y \) of which the integrated actuating valves are controlled with pulse length modulation.

These actuating signals cause fluctuations in pressure in the actuator chamber(s) and thus adjustment of the actuator until the control error is zero.

Operation (manual) and configuration (structuring, initialization and parameterization) is effected by three keys and a display with the housing cover removed.

The standard controller has one digital input (DI1). This can be configured individually and can be used for blocking the operating modes for example.

With the \( J_y \)-option module, the current actuator position can be output as a two wire signal \( J_y = 4 \) to 20 mA.

In addition the actuator can be monitored for two programmable limit values which respond on exceeding or dropping below the stroke or angle of rotation.

The limit value alarms are output by the alarm option module which can monitor and report the function of the positioner and the actuator additionally through a fault message output. The value of the control difference dependent on the travel time is monitored in automatic mode. The fault signal is always set when the control error cannot be leveled after a certain time because for example the valve is blocked or the mains pressure is insufficient. The three digital outputs are implemented as semiconductor outputs and are error self-reporting, i.e. the out-
puts respond even when the power supply fails or the electronics are
defective.

The actuator can also be blocked or driven to its final positions depend-
ing on the configuration for example by an external event via a digital
input (DI2) on the alarm module.

If you require electrically independent limit value messages from the
standard controller, you will have to use the SIA module with the slot
initiators instead of the alarm module.

Communication with the controller is possible via the optional HART
interface.

To be able to use the positioner with a variety of different part-turn and
linear actuators, it has a friction clutch and switchable gearing.

The switchable gearing allows you to adjust the positioner for small and
large lifts. You can switch using the yellow switch (8, Fig. 2-1) between
33° (as delivered) and 90°.

The friction clutch (9, Fig. 2-1) allows you to set the working range, par-
ticularly for linear actuators, after installation. You thus do not have to
ensure symmetrical mounting during the installation.

As it is not allowed to open the housing of an explosion-proof version
in a potentially explosive atmosphere, the shaft has an externally fitted,
additional friction clutch (8, Fig. 2-2, page 18).

---

**NOTICE**

**for the explosion-proof version:**

Only adjust the outer friction clutch (8, Fig. 2-2, page 18). The internal
friction clutch (9, Fig. 2-1 page 17) is fixed and, for the explosion-proof
version, must **not** be adjusted.
## 2.2 Instrument Components

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Input: Supply air</td>
</tr>
<tr>
<td>2</td>
<td>Output: Actuating pressure Y1</td>
</tr>
<tr>
<td>3</td>
<td>Display</td>
</tr>
<tr>
<td>4</td>
<td>Output: Actuating pressure Y2 *)</td>
</tr>
<tr>
<td>5</td>
<td>Operating keys</td>
</tr>
<tr>
<td>6</td>
<td>Restrictor</td>
</tr>
<tr>
<td>6.1</td>
<td>Restrictor Y1</td>
</tr>
<tr>
<td>6.2</td>
<td>Restrictor Y2 *)</td>
</tr>
<tr>
<td>7</td>
<td>Silencer</td>
</tr>
<tr>
<td>8</td>
<td>Transmission ratio selector</td>
</tr>
<tr>
<td>9</td>
<td>Adjusting wheel for friction clutch</td>
</tr>
<tr>
<td>10</td>
<td>Terminals options modules</td>
</tr>
<tr>
<td>12</td>
<td>Dummy plug</td>
</tr>
<tr>
<td>13</td>
<td>Screw–type cable gland</td>
</tr>
<tr>
<td>14</td>
<td>Terminal plate on cover</td>
</tr>
</tbody>
</table>

*) in double–acting actuators

Figure 2-1 View of the positioner in normal version (cover open)
6.2 Restrictor Y2 *)

*) in double-acting actuators

Figure 2-2 View of the explosion proof version of the positioner

2.2.1 Motherboard

The motherboard contains all the electronic elements such as the CPU, memory, A/D converter. It also contains the display and the operating keys.

In addition, the terminal strips for connecting the options modules are also on the motherboard.

2.2.2 Electrical Connections

The terminals of the standard controller, the \( J \)- and alarm-option module are arranged at the left-hand front edges and offset against each other in staircase form.

A module cover protects the modules from being pulled out and prevents incorrect installation.
2.2.3 Pneumatic Connections

The pneumatic connections are on the right hand side of the positioner (figure 2-3 and figure 2-4).

![Diagram of pneumatic connections in normal version](image)

1. Actuating pressure Y1 in single- and double-acting actuators
2. Feedback shaft
3. Supply air Pz
4. Actuating pressure Y2 in double-acting actuators
5. Exhaust air output E with silencer on the bottom of the instrument

Figure 2-3 Pneumatic connection in normal version

![Diagram of pneumatic connections in explosion proof version](image)

1. Restrictor Y2 *)
2. Restrictor Y1
3. Actuating pressure Y2 *)
4. Supply air Pz
5. Actuating pressure Y1
6. Exhaust air output E
7. Housing ventilation (2x)

*) in double-acting actuators

Figure 2-4 Pneumatic connection in explosion proof version

In addition, there are pneumatic connections on the back of the positioner for integrated installation in single-acting linear actuators.

- Actuating pressure Y1
- Exhaust air output E (not in explosion proof version)

In the ex-factory state, these connections are sealed by screws (see figure 3-1, page 35, figure 3-3, page 36 and figure 3-4, page 37).
The exhaust air output E can be provided for supplying dry instrument air to the tapping chamber and spring chamber to prevent corrosion.

Figure 2-5, page 21 shows the pneumatic connection variants for the different actuator types, the positioning action and the safety position after power failure.
<table>
<thead>
<tr>
<th>Positioning pressure connection</th>
<th>Actuator type</th>
<th>Safety position after power failure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>electrical</td>
</tr>
<tr>
<td>Y1</td>
<td>Y1</td>
<td>Closed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Open</td>
</tr>
<tr>
<td>Y2</td>
<td>Y1</td>
<td>Open</td>
</tr>
<tr>
<td></td>
<td>Y2</td>
<td>Closed</td>
</tr>
</tbody>
</table>

In part-turn actuators the direction of rotation counterclockwise looking onto the actuating shaft of the valve is usually defined as “Open”.

Figure 2-5  Pneumatic connection positioning
2.2.4 Mounting Kit

The positioner can be mounted on almost all actuators with the appropriate mounting kit.

2.2.5 Purge air switching (not in the explosion proof version)

The purge air switch is accessible above the pneumatic terminal strip with the housing open (figure 2-6). In the IN position the inside of the housing is purged with very small amounts of clean, dry instrument air. In the OUT position the purge air is fed directly to the outside air.

2.2.6 Restrictors

In order to achieve travel times of > 1.5 s in small actuators, the air rate can be reduced with the restrictors Y1 and Y2 (figure 2-7, in explosion proof version, see figure 2-4, page 19). By turning to the right the air rate is reduced up to shutting off. To set the restrictors it is advisable to close them and then open them slowly (see initialization RUN3).

In the case of double-acting valves make sure that both chokes are set approximately equal.
2.3 Method of Operation

The electropneumatic positioner SIPART PS2 forms a control circuit with the pneumatic actuator in which the actual value x is the position of the actuator bar in linear actuators or the position of the actuator shaft in part-turn actuators and the command variable w is the actuating current of a controller or a manual control station of 4 to 20 mA.

The stroke or part-turn movement of the actuator is transferred by the appropriate mounting accessories, the feedback shaft and a play–free switchable gearwheel to a high quality conductive plastic potentiometer and to the analog input of the microcontroller.

This may correct the angle error of the stroke tap, compares the potentiometer voltage as actual value x with the setpoint w fed in at the terminals 3 and 7 and calculates the manipulated variable increments \( \pm \Delta y \). Depending on the size and direction of the control error \((x-w)\) the piezo–controlled supply air or exhaust air valve is opened. The volume of the actuator integrates the positioning increments to actuating pressure \( y \) open which moves the actuator bar or actuator shaft approximately proportionally. These positioning increments change the actuating pressure until the control error becomes zero.

The pneumatic actuators are available in single and double-acting versions. Only one pressure chamber is aerated or deaerated in the single-acting version. The resulting pressure operates against a spring. In the double-acting version, two pressure chambers are counteractive. In this case the one volume is deaerated when the other volume is aerated. See the block diagram figure 2-9, page 25.

The control algorithm is an adaptive predictive five–point switch (see figure 2-8, page 24).

The valves are controlled with continuous contact at large control errors (fast step zone). At medium control errors the valve is controlled by pulse length modulated pulses (short step zone).

No actuating pulses are output in the small control error zone (adaptive dead zone). The dead zone adaptation and the continuous adaptation of the minimum pulse lengths in automatic operation cause the best possible control accuracy to be achieved at the lowest switching frequency. The start parameters are determined during the initialization phase and stored in a non–volatile memory. These are basically the real travel with the mechanical limit stops, the travel times, the size of the dead zone etc.

In addition the number of fault messages, changes in direction and the number of strokes are determined and stored every 15 minutes during operation. These parameters can be read out and documented by the communication programs such as PDM and AMS. Conclusions as to the wear on the fitting can be drawn (diagnostic function) especially by comparing the old value with the currently determined values.

Figure 2-9, page 25 shows the block diagrams for single– and double–acting actuators with the linear actuator as an example.
NOTE
The exhaust air valve is always open when there is no current.

Figure 2-8 Method of operation five-point switch
Design and Functional Principle

Figure 2-9  Block diagram of the electro-pneumatic positioner, functional diagram

1  Motherboard with microcontroller and input circuit
2  Control panel with LC-display and momentary action switch
3  Piezo-valve unit, always built-in
4  Valve unit with double-acting positioner always built-in
5  Iy-module for positioner SIPART PS2
6  Alarm module for three alarm outputs and one digital input
7  SIA-module (Slot Initiator-Alarm-module)
8  Spring-loaded pneumatic actuator (single-acting)
9  Spring-loaded pneumatic actuator (double-acting)

NOTE
Alarm module (6) and SIA module (7) can only be used alternatively.

2.4 State as supplied

There are no mechanical mounting accessories on the controller in the state as supplied. These must be ordered and installed according to the "operating instructions" depending on the application.

The respective connections for single or double-acting versions are prepared at the factory as ordered.

The pneumatic connections on the rear are sealed.
2.5 Options modules

2.5.1 Options modules in normal and intrinsically safe versions

The options modules are protected and mechanically fixed by a module cover ((1), see figure 2-10, page 29 and figure 2-11, page 31).

NOTE

The housing must be opened to install the options modules. The degree of protection IP65 is not guaranteed as long as the positioner is open.

Opening the instrument

To open the positioner, the four screws of the housing cover must be loosened with a Phillips screwdriver.

Disconnect or isolate the power supply cables.

Remove the module cover (1). To do this, the two screws (1.1) must be removed with a screwdriver.

NOTE

To prevent premature wearing of the fixture by the self-tapping screws (1.1), the following method of mounting the module cover (1) has proven effective.

1. Turn the screws counterclockwise until you feel them snap into the thread

2. Tighten both screws carefully in clockwise direction

Jy-module

Insert the Jy-module (3) in bottom pcb rails of the container, establish the electrical connection with the enclosed ribbon cable (6).

Alarm module

Insert the alarm module (4) in the top pcb rails of the container, establish the electrical connection with the enclosed ribbon cable (5).

SIA-module

(Slot Initiator Alarm module) Proceed as follows for installation:

1. Remove all the electrical connections from the basic electronics (2).

2. Loosen the two fixing screws (2.1) of the basic electronics.

3. Snap out the basic electronic board by carefully bending the four holders.

4. Insert the SIA-module (7) from above up to the top pcb rail of the container.
5. Push the SIA module in the pcb rail of the container about 3 mm to the right.

6. Screw the special screw (7.1) through the SIA module into the axle of the positioner (Torque: 2 Nm):

---

**CAUTION**

The pin pressed into the actuating disc bearing (11) must be adjusted to just before touching with the special screw. The actuating disc bearing and the special screw must then be turned simultaneously so that the pins slot into the special screw.

---

7. Place the insulating cover (10) over the SIA module underneath the surface of the basic electronics board at the container wall on one side. The recesses in the insulating cover must slot into the corresponding lugs on the container wall. Place the insulating cover on the SIA module by carefully bending the container walls.

8. Snap the basic electronics board into the four holders and screw it tight again with the two fixing screws (2.1).

9. Make all the electrical connections between the motherboard and the options with the ribbon cables provided and between the motherboard and potentiometers with the potentiometer cable.

10. Fix the enclosed module cover instead of the standard version with the two screws.

11. Select the plates which already exist on the standard version of the module cover from the set of plates enclosed. Stick the selected plates according to the standard version to the mounted module cover.

12. Make the electrical connections.

---

**Setting the two limit values:**

---

**NOTE**

Connect a suitable display instrument such as the Initiator-Tester type 2/Ex made by Peperl+Fuchs to the terminals 41 and 42 or terminals 51 and 52 of the SIA module to be able to see the switching state of the slot initiators.

---

13. Drive the actuator to the first desired mechanical position.

14. Adjust the top actuating disc (7.2) by hand until the output signal on terminals 41 and 42 changes.
15. Drive the actuator to the second desired mechanical position.

16. Adjust the bottom actuating disc (7.3) by hand until the output signal on terminals 51 and 52 changes.

---

**NOTE**

If you turn the actuating disc beyond the switching point up to the next switching point, you can set a high-low or a low-high change.

To avoid the actuating discs being accidentally adjusted during operating, they are relatively sluggish. The following remedy might be of help if you are having trouble with the adjustment: open and close the actuator several times while holding the actuating discs. This temporarily reduces the friction. This allows an easier and finer adjustment.

---

**EMC filter module**

The positioner can also be driven by an external position sensor (potentiometer or NCS) (see page 40 "3.3.2 Instructions for using positioners which are exposed to strong accelerations or vibrations"). An EMC filter module, order number C73451–A430–D23, is required for this.
1 Module cover 7 SIA-module
1.1 Fixing screws 7.1 Special screw
2 Motherboard 7.2 Actuating disc for A1 (terminals 41 and 42)
2.1 Fixing screws 7.3 Actuating disc for A2 (terminals 51 and 52)
3 Jy-module with ribbon cable (6) 8 Adjusting wheel for friction clutch
4 Alarm module with ribbon cable (5) 9 Transmission ratio selector
5 Ribbon cable for alarm module 10 Insulating cover
6 Ribbon cable for Jy-module 11 Actuating disc bearings

Figure 2-10 Installation of Options Modules
2.5.2 Options modules in explosion proof version

The options modules are protected and mechanically fixed by a module cover ((1), see figure 2-11, page 31).

**NOTE**

The housing must be opened to install the options modules. The degree of protection IP65/NEMA4x is not guaranteed as long as the positioner is open.

**WARNING**

In areas in which the atmosphere may be potentially explosive, the explosion-proof positioner may only be supplied with electrical auxiliary power when the housing is closed and when built-in, approved electronics are used.

The feed-through openings for the electronic connections must be sealed with EEX-d certified cable glands or EEx-d certified plugs or an ignition lock must be mounted at a maximum distance of 46 cm (18 inches) when using the “conduit”-system.

**Open the positioner**

Disconnect or isolate the power supply cables first.

To open the positioner, the safety catch (12) must be opened and the screw-on cover unscrewed.

After loosening the four fixing screws (13.1) the complete rack (13) can be removed. The actuator may have to be turned so that the clutch can be easily disengaged.

Remove the module cover (1). To do this, the two screws (1.1) must be removed with a screwdriver.

**NOTE**

To prevent premature wearing of the fixture by the self-tapping screw (1.1) next to the display, the following method of mounting the module cover (1) has proven effective.

1. Turn the screws counterclockwise until you feel them snap into the thread.
2. Tighten both screws carefully in clockwise direction.
1. Module cover
1.1 Fixing screws
2 PA module
3 Jy module with ribbon cable
4 Alarm module with ribbon cable
5 Ribbon cable for Jy module
6 Ribbon cable for alarm module
7 Transmission ratio selector
8 Adjusting wheel for friction clutch
9 Housing
10 Screw-on cover
11 Safety catch
12 Rack
13 Rack
13.1 Fixing screws

Figure 2-11 Installation of the options modules in the explosion proof version
2.5.3 HART-function

Function

The positioner is also available with built-in HART-functions. The HART protocol allows you to communicate with your instrument with a handheld communicator®, PC or programming unit. This enables you to configure your instrument comfortably, save configurations, call diagnostic data, display online measured values and much more. Communication takes place as frequency modulation over the existing signal lines for the command variable from 4 to 20 mA.

The SPART PS2 is integrated in the following parameterization tools:

- Handheld communicator®
- PDM (Process Device Manager)
- AMS (Asset Management System; without diagnostic values/functions)
- Cornerstone

NOTE

Operation on the positioner has priority over the settings via the HART interface.

Communication is aborted by a power failure at the positioner.

2.5.4 Alarm module

Function

The alarm module contains

- 3 digital outputs and
- 1 digital input

The digital outputs serve to output fault messages and alarms. The configuration is described in chapter 4.4, page 88, with the parameters 44 to 54.

By an external signal applied at digital input (DI2) the actuator can be blocked or driven to its limit positions for example depending on the configuration. The configuration is described in chapter 4.4, page 88, with the parameters 43.

The alarm module is available in two versions:

- explosion protected for connecting to switching amplifier DIN 19234
- non-explosion protected for connection to voltage sources with a maximum 35 V

The semiconductor outputs of the alarm module report an alarm (signal state Low) by switching off with high resistance. They are conductive in the High state (without alarm). The dynamic control makes them error self-reporting.
The outputs are potentially isolated from the basic circuit and each other.

The digital input is double.

- one potential isolated for voltage level
- one not potential isolated for floating contacts

These two inputs are designed as logic OR links.

**Installation**
The alarm module is pushed in underneath the motherboard into the module rack up to the stop and connected by the enclosed 8-wire ribbon cable (5) to the motherboard (see figure 2-10, page 29).

### 2.5.5 Jy-module

**Function**
With the Jy-option module, the current actuator position can be output as a two wire signal Jy = 4 to 20 mA – potentially isolated from the standard controller. The dynamic control of the Jy-module makes it also error self-reporting.

**Installation**
The Jy-module is pushed in to the bottom compartment of the module rack up to the stop and connected by the enclosed 6-wire ribbon cable (6) to the motherboard (see figure 2-10, page 29).

### 2.5.6 SIA module

The SIA module contains:

- a digital output for outputting a group fault message (see alarm module)
  
  The floating digital output is implemented as a self error reporting semiconductor output.

- two digital outputs for reporting two mechanically adjustable limit values (L1, L2) by slot initiators.
  
  These two outputs are electrically independent of the rest of the electronics.
2.5.7 Accessories

Manometer block

The manometer block for single-acting actuator contains two manometers which are screwed to the lateral pneumatic connection of the positioner with O-rings. The values for the input pressure (supply air PZ) and output pressure (actuating pressure Y1) are displayed.

The manometer block for double-acting actuators contains three manometers which are screwed to the lateral pneumatic connection of the positioner with O-rings. The values for the input pressure (supply air PZ) and output pressure (actuating pressure Y1 and Y2) are displayed.
Preparing for Operation

This chapter describes all the preparations necessary for operating the positioner.

3.1 Instrument identification (type key)

The order number of the positioner is printed on the rating plate and on the packaging. Compare this with the order number in chapter 7.2, page 129.

Installation of any modules required is described in chapter 2.5, page 26 of this technical manual.

3.2 Dimensional drawings

![Dimensional drawing version plastic housing 6DR5xx0](image)

Figure 3-1  Dimensional drawing version plastic housing 6DR5xx0
Preparing for Operation

Figure 3-2  Dimensional drawing terminal strip for plastic housing

Figure 3-3  Dimensional drawing version metal housing 6DR5xx1
3.3 Assembly

General

**WARNING**

To avoid injury or mechanical damage to the positioner/mounting kit, the following order must be observed for assembly:

1. Mechanical fitting of positioner  
   this chapter
2. Connection of electric power supply  
   see chapter 3.4, p. 51
3. Connection of pneumatic power supply  
   see chapter 3.5, p. 63
4. Put into operation  
   see chapter 3.6, p. 64

Please also observe the warning on page 52!
NOTE

The positioner will be equipped at the factory and delivered complete with the necessary options at the customer’s request. Options modules may only be retrofitted by our service technicians.

The positioner must be assembled – especially in a moist environment – in such a way as to rule out freezing of the positioner axle at low ambient temperature.

The operating keys must be covered to prevent liquid getting in.

WARNING

In the combination of components it must be ensured that only positioners and options modules are combined which are approved for the respective area of application. This applies especially for safe operation of the positioner in areas in which the atmosphere is potentially explosive (zone 1 and 2). The instrument categories (2 and 3) of the instrument itself and those of its options must be observed.

In addition, you must always make sure that no water gets into an open housing or screw-type gland. This may be the case for example when the positioner cannot be finally assembled and connected immediately.

It generally applies that the positioner may only be operated with dry compressed air. Therefore use the normal water traps. An additional drying unit may even be necessary in extreme cases. This is particularly important when operating the positioner at low ambient temperatures. Please set the purge air switch (on the valve block above the pneumatic terminals) additionally to the “OUT” position.

Use a sufficiently rugged console (e.g. plate thickness > 4 mm with reinforcements) for part-turn actuators and the mounting kit “linear actuator” or integrated connection for linear actuators.

3.3.1 Instructions for using positioners in a wet environment

This information gives you important instructions for the assembly and operation of the positioner in a wet environment (frequent, heavy rain and/or prolonged tropical condensation) in which the IP65 degree of protection is no longer sufficient and especially when there is a danger that water may freeze.

To prevent water getting into the instrument in normal operation (e.g. through the exhaust air openings) or the display being poorly legible, please avoid the unfavorable installation positions illustrated in figure 3-5.
If conditions oblige you to operate the positioner in a unfavorable installation position, you can take additional precautionary measures to prevent penetration by water.

**NOTE**

Never clean the positioner with a high pressure water jet because the IP65 degree of protection is inadequate protection for this.

The necessary additional measures to prevent penetration by water depend on the installation position chosen and you may additionally require:

- screw–type gland with sealing ring (e.g. FESTO: CK –1 / 4–PK–6)
- plastic hose approx. 20 to 30 cm (e.g. FESTO PUN– 8X1,25 SW)
- cable straps (number and length depends on local conditions)

**Procedure**

- Connect the pipes in such a way that rain water which runs along the pipes can drip off before it reaches the terminal strip of the positioner.
- Check the electrical connections for perfect firm contact.
- Check the seal in the housing cover for damage and contamination. Clean and replace if necessary.
- Mount the positioner if possible so that the sinter bronze silencer faces downwards on the underside of the housing (vertical installation position). If this is not possible, the silencer should be replaced by a suitable screw–type gland with a plastic hose.
Assembly of the screw-type gland with plastic hose

- Unscrew the sinter bronze silencer from the exhaust air opening on the underside of the housing.
- Screw the screw-type gland mentioned above into the exhaust air opening.
- Mount the above mentioned plastic hose on the screw-type gland and check the good fit.
- Fix the plastic hose with a cable strap to the fitting so that the opening faces downwards.
- Make sure that the hose has no kinks and the exhaust air can flow out unhindered.

3.3.2 Instructions for using positioners which are exposed to strong accelerations or vibrations

**NOTICE**

for explosion-proof versions:

Only adjust the outer friction clutch (8, Fig.2-11, page 31). The internal friction clutch (8, Fig.2-10 page 29) is fixed and, for the explosion-proof version, must not be adjusted.

The electro-pneumatic positioner SIPART PS2 has a friction clutch and switchable gearing and can thus be used universally for part-turn and linear actuators. This means that, for part-turn actuators you don't have to worry about the zero point and for linear actuators, you don't have to worry about symmetrical mounting, as you can adjust the working range after installation, with the help of the friction clutch. The switchable gearing allows you to also adjust the positioner for small or large lifts.

Occasionally it can happen, that in the rough environment of process systems (e.g. due to incorrectly fitted valves or if “steam pulses” occur) that the shaft to monitor the position of the SIPART PS2 positioner is exposed to extreme acceleration, which far exceeds its specified load limits, and which could result in an unwanted shift in the friction clutch or in the gears in the position monitoring jumping briefly out.

For cases like this, as standard, the SIPART PS2 positioner is fitted with a locking device for the friction clutch and you can also lock the setting of the transmission ratio selector. This means that an unwanted change to the position monitoring due to the above mentioned effects can be reliably prevented.

Both of these locking options are labeled via additional tags inside the device (see Figure 3-6, page 41). Note that these locks are only required if extreme acceleration or strong vibration might be present within your process.
Procedure

After you have installed the positioner and put it fully into operation, you can set the torque for the friction clutch as follows:

- On the module cover, insert an ordinary 4 mm wide screwdriver into a slot on the yellow wheel.
- Now use the screwdriver to move the yellow wheel to the left, until you can feel that it clicks in. This increases the torque of the friction clutch.
- You can recognize a locked friction clutch by an approx. 1 mm wide gap between the yellow and black wheels.
- If you have to set the zero pint e.g. after exchanging the actuator, first reduce the torque by turning the yellow wheel to the right until you hit the stop. After setting the zero point, you can refix the friction clutch as described above.

Starting from the neutral setting (as delivered), you can lock the transmission ratio selector as follows:

- Adjust the yellow wheel underneath the terminals with an ordinary 4 mm wide screwdriver to correspond to the setting that you would like (33° or 90°), turning to the left or right, until you can feel that it clicks in.
- Please note that you can only adjust the transmission ratio selector after releasing the fixing.

For this reason you first have to put the yellow ring into the neutral position, if you have to adjust the transmission ratio selector e.g. after exchanging the actuator).

![Diagram](image)

(1) Transmission ratio selector interlock
(2) Open
(3) Friction clutch
(4) Close

Figure 3-6 Locking and fixing mechanisms
Applications in which the measures described above are inadequate are also conceivable. This applies for instance with continuous and heavy vibration, increased or too low ambient temperatures and in the case of nuclear radiation.

The separate attachment of position displacement sensor and controller unit can help here. A universal component is available which is suitable both for linear and part-turn actuators.

You require the following:

- The external position detection system (order no. C73451-A430-D78). This consists of a SIPART-PS2-housing with integrated friction clutch, built-in potentiometer and various dummy plugs and seals.
- or a Non-Contacting Position Sensor (e.g. 6DR4004–6N)
- The controller unit, any positioner version.
- The EMC filter module, this is is a set together with cable clips and M-20 screw–type cable gland and has the order number C73451-A430-D23. The EMC filter module must be installed in the positioner. The installation instructions enclosed with the EMC filter module explain how to assemble the components.
- A 3-wire cable for connecting the components.

This EMC filter module should always be used for the controller unit when any actuator-mounted potentiometer (resistance 10 kΩ) is to be used instead of the position detection system C73451–A430–D78.
3.3.3 Mounting kit "linear actuator" 6DR4004-8V and 6DR4004-8L

The scope of delivery of the mounting kit linear actuator IEC 534 (3 mm to 35 mm) are contained (ser. no. see figure 3-7, page 45):

<table>
<thead>
<tr>
<th>Ser. no.</th>
<th>pieces</th>
<th>Designation</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>NAMUR mounting kit bracket IEC 534</td>
<td>Standardized connection for mounting console with ledge, column or plane surface</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>Pick-up bracket</td>
<td>Guides the roller with carrier pin and turns lever arm</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>Clamping assembly</td>
<td>Mounting of pick-up bracket on actuator spindle</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>Carrier pin</td>
<td>Assembly with roll (5) on lever (6)</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>Lever NAMUR</td>
<td>For stroke range 3 mm to 35 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>For stroke ranges&gt; 35 mm to 130 mm (special delivery), lever 6DR4004-8L is required additionally</td>
</tr>
<tr>
<td>6</td>
<td>2</td>
<td>U bolt</td>
<td>Only for actuators with columns</td>
</tr>
<tr>
<td>7</td>
<td>4</td>
<td>Hexagon head screw</td>
<td>M8 x 20 DIN 933-A2</td>
</tr>
<tr>
<td>8</td>
<td>2</td>
<td>Hexagon head screw</td>
<td>M8 x 16 DIN 933-A2</td>
</tr>
<tr>
<td>9</td>
<td>6</td>
<td>Lock washer</td>
<td>A8 – DIN 127-A2</td>
</tr>
<tr>
<td>10</td>
<td>6</td>
<td>Flat washer</td>
<td>B 8,4 – DIN 125-A2</td>
</tr>
<tr>
<td>11</td>
<td>2</td>
<td>Flat washer</td>
<td>B 6,4 – DIN 125-A2</td>
</tr>
<tr>
<td>12</td>
<td>1</td>
<td>Spring washer</td>
<td>A6 – DIN 137A-A2</td>
</tr>
<tr>
<td>13</td>
<td>1</td>
<td>Lock washer</td>
<td>3.2 – DIN 6799-A2</td>
</tr>
<tr>
<td>14</td>
<td>3</td>
<td>Spring washer</td>
<td>A6 – DIN 127-A2</td>
</tr>
<tr>
<td>15</td>
<td>3</td>
<td>Socket cap screw</td>
<td>M6 x 25 DIN 7984-A2</td>
</tr>
<tr>
<td>16</td>
<td>1</td>
<td>Hexagon nut</td>
<td>M6 – DIN 934-A4</td>
</tr>
<tr>
<td>17</td>
<td>1</td>
<td>Square nut</td>
<td>M6 – DIN 557-A4</td>
</tr>
<tr>
<td>18</td>
<td>4</td>
<td>Hexagon nut</td>
<td>M8 – DIN 934-A4</td>
</tr>
</tbody>
</table>

Table 3-1 Scope of delivery of the mounting kit "linear actuator"
3.3.4 Assembly procedure (see figure 3-7, page 45)

1. Mount clamping assembly (3) with hexagon socket cap screws (17) and lock washer (16) on the actuator spindle.

2. Insert the pick-up bracket (2) into the recesses of the clamping assembly. Set the necessary length and tighten the screws so that the pick-up bracket can still be shifted.

3. Insert the pin in the lever (6) and assemble with nut (18), spring washer (14) and washer (12).

4. The value of the stroke range specified on the actuator or if this does not exist as a scaling value, the next greatest scaling value is set. The center of the pin must be in line with the scaling value. The same value can be set later under parameter 3.YWAY in commissioning to display the way in mm after initialization.

5. Assemble the hexagon socket cap screw (17), spring washer (16), washer (12) and square nut (19) on the lever.

6. Push the premounted lever onto the positioner axis up to the stop and fix with the hexagon socket cap screw (17).

7. Fit the mounting bracket (1) with two hexagon head screws (9), lock washer (10) and flat washer (11) on the rear of the positioner.

8. Selection of the row of holes depends on the width of the actuator yoke. The roll (5) should engage in the pick-up bracket (2) as close as possible to the spindle but may not touch the clamping assembly.

9. Hold the positioner with the mounting bracket on the actuator so that the pin (4) is guided within the pick-up bracket (2).

10. Tighten the pick-up bracket.

11. Position the mounting parts according to the type of actuator.

   - Actuator with ledge: Hexagon head screw (8), flat washer (11) and lock washer (10).

   - Actuator with plane surface: Four hexagon head screws (8), flat washer (11) and lock washer (10).

   - Actuator with columns: Two U bolts (7), four hexagon nuts (21) with flat washer (11) and lock washer (10).

12. Secure positioner onto the yoke using the previously positioned mounting parts.

NOTE

Set the height of the positioner so that the horizontal lever position is reached as close to the stroke center as possible. You can use the lever scale as orientation. It must be guaranteed that the horizontal lever position is passed through within the stroke range.
Figure 3-7 Assembly procedure (linear actuator)
3.3.5 Mounting kit "part-turn actuator" 6DR4004-8D

The scope of delivery of the mounting kit "part-turn actuator" contains (ser. no. see figures 3-8 and 3-9):

<table>
<thead>
<tr>
<th>Ser. no.</th>
<th>Pieces</th>
<th>Designation</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>1</td>
<td>Coupling wheel</td>
<td>Mounting on position feedback shaft of the SIPART PS2</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>Carrier</td>
<td>Mounting on end of actuator shaft</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>Multiple plate</td>
<td>Indication of actuator position, comprising 4.1 and 4.2</td>
</tr>
<tr>
<td>4.1</td>
<td>8</td>
<td>Scales</td>
<td>Different divisions</td>
</tr>
<tr>
<td>4.2</td>
<td>1</td>
<td>Pointer mark</td>
<td>Reference point for scale</td>
</tr>
<tr>
<td>14</td>
<td>4</td>
<td>Hexagon head screw</td>
<td>DIN 933 – M6 x 12</td>
</tr>
<tr>
<td>15</td>
<td>4</td>
<td>Lock washer</td>
<td>S6</td>
</tr>
<tr>
<td>16</td>
<td>1</td>
<td>Fillister head screw</td>
<td>DIN 84 – M6 x 12</td>
</tr>
<tr>
<td>17</td>
<td>1</td>
<td>Washer</td>
<td>DIN 125 – 6.4</td>
</tr>
<tr>
<td>18</td>
<td>1</td>
<td>Hexagon socket head screw</td>
<td>Premounted with coupling wheel</td>
</tr>
<tr>
<td>19</td>
<td>1</td>
<td>Allen key</td>
<td>For item 18</td>
</tr>
</tbody>
</table>

Table 3-2 Scope of delivery of the mounting kit "part-turn actuator"
3.3.6 Assembly procedure (see figure 3-8 and figure 3-9)

1. Attach VDI/VDE 3845 mounting console ((9), actuator-specific, scope of delivery actuator manufacturer) onto rear of positioner and secure using hexagon head screws (14) and lock washers (15).

2. Adhere pointer (4.2) onto mounting console in the center of the centering hole.

3. Push the coupling wheel (2) onto positioner axis, pull back by about 1 mm and tighten the hexagon socket head screw (18) with the Allen key provided.

4. Place the carrier (3) onto the end of the actuator and secure using Fillister head screw (16) and washer (17).

5. Carefully place positioner with mounting console onto the actuator such that the pin of the coupling wheel engages in the actuator.

6. Align the positioner/mounting console assembly in the center of the actuator and screw tight. (Screws not included in delivery; they are part of the actuator mounting console!)

7. Following startup as described in Chapter 3.6, page 64: Drive the actuator to the end position and adhere scale (4.1) on the coupling wheel (2) according to direction of rotation and part-turn actuator. The scale is self-adhesive!
Figure 3-8  Assembly procedure (part-turn actuator)
Figure 3-9  Assembly procedure for explosion proof version (part-turn actuator)
Figure 3-10  Mounted positioner for part-turn actuator
3.4 Electrical Connection

NOTE
Any necessary options modules must be installed before electrical connection (see chapter 2.5, page 26).

N.B.: The transmission ratio selector can only be set when the positioner is open. Therefore check this setting before closing the controller.

WARNING
The specifications of the examination certificate valid in your country must be observed.

Electrical connection in hazardous areas
The national directives and laws which apply in your country for hazardous areas, must be followed for electrical installations. In Germany these are, for example:
- Working reliability regulations
- Regulations for installing electrical equipment in hazardous areas, DIN EN 60079–14 (in the past VDE 0165, T1).
- The EC type examination certificates
WARNING

If the intrinsically safe version is operated with a higher operating voltage by mistake, the positioner must no longer be used for intrinsically safe application.

The explosion-proof positioner may only be supplied with electrical power in areas in which the atmosphere may be potentially explosive when the housing is closed.

The feed-through openings in the explosion-proof version for the electronic connections must be sealed with EEx-d certified cable glands or EEx-d certified plugs or an ignition lock must be mounted at a maximum distance of 46 cm (18 inches) when using the "conduit"-system.

The plastic housing is metal lined to increase the electromagnetic compatibility (EMC) against high frequency radiation. This screen is connected electrically to the threaded bushes shown in figure 3-12, page 52.

Please bear in mind that this protection can only be effective if you connect at least one of these bushes with grounded fittings by electrically conductive (blank) mounting parts.

Figure 3-12  Base plate

Shield
NOTE

Use standard M20 x 1.5 cable gland nuts to ensure leakage (IP-protection of the housing) and for the necessary tensile strength use only cables with a cable diameter ≥ 8 mm, or for smaller diameters use a suitable sealing insert.

For the NPT version, the positioner will be delivered with an adapter. Make sure that when fitting a part into the adapter, that the maximum permissible torque of 10 Nm is not exceeded.

NOTE for use in zone 2:

Non-sparking equipment for Zone 2 may not be connected or disconnected under power in normal operation.

However, during installation or repair work the positioner may be connected or disconnected even under power (see also certificate for zone 2).

NOTE for use in two-wire systems:

Never connect the current input (terminal 6 and 7) to a voltage source as this could destroy the positioner.

Always use a current source with a maximum output current of 20 mA. To maintain the power supply, the input current must be ≥ 3.6 mA.

3.4.1 Connection in non-intrinsically safe and explosion proof version

![Diagram](image.png)

Figure 3-13 Two-wire connection
Figure 3-14 Two-wire connection

Figure 3-15 Three-/four-wire connection
Current output

\[ U_H \leq 35 \text{ V} \]

Figure 3-16  \( J_y \) module 6DR4004-8J

Digital inputs and outputs

Figure 3-17  Alarm module 6DR4004–8A
3.4.2 Connection in intrinsically safe version

**NOTE**
Only certified intrinsically safe circuits may be connected as power supply, control and signal circuits.

---

**Standard controller**

---

Figure 3-19 Two-wire connection, EEx i
Figure 3-20 Two-wire connection, EEx i

Figure 3-21 Three-/four--wire connection, EEx i
Split-range

Figure 3-22  Series circuit of two positioners, e.g. split range (separate power supply), EEx i
Current output

Non-hazardous area

Hazardous area zone 1 or zone 2

U_{H} \leq 30 \text{ V}

J_y module 6DR4004-6J

Intrinsically safe power source

Figure 3-23  J_y-module 6DR4004-6J, EEx i

Digital inputs and outputs

Non-hazardous area

Hazardous area zone 1 or zone 2

\begin{align*}
&\text{Alarm module} \\
&6DR4004-6A \\
&\text{Digital input 2} \\
&\leq 25.2 \text{ V} \\
&3 \text{ V} \\
&8.2 \text{ V} \\
&10K \\
&\text{Limit value A1} \\
&\text{Fault message} \\
&\text{Limit value A2}
\end{align*}

Intrinsically safe switching amplifier to DIN EN 60947--5--6

Figure 3-24  Alarm module 6DR4004-6A, EEx i
SIA module

3.4.3 Connection in type of protection “n” version

Standard controller
Figure 3-27  Two-wire connection, EEx n

Figure 3-28  Three-/Four-wire connection, EEx n

*) Only for three-wire connection
Current output

![Diagram of current output](image)

Figure 3-29  J_y-module 6DR4004-6J, EEx n

Digital inputs and outputs

![Diagram of digital inputs and outputs](image)

Figure 3-30  Alarm module 6DR4004-6A, EEx n
3.5 Pneumatic Connection

**WARNING**
For reasons of safety, the pneumatic power may only be supplied after assembly when the positioner is switched to operating level P manual operation with electrical signal applied (as-delivered state, see figure 4-4, page 84).

**NOTE**
Note the air quality! Oil-free industrial air, solid content < 30 μm, pressure dew point 20 K below the lowest ambient temperature (chapter 7 “Technical Data”, page 127).

- Connect a manometer block for supply air and actuating pressure if necessary.
- Connection by female thread G 1/4 DIN 45141 or 1/4” NPT:

  \[
  P_2 \quad \text{Supply air 1.4 to 7 bar} \\
  Y_1 \quad \text{Actuating pressure 1 for single- and double-acting actuators} \\
  Y_2 \quad \text{Actuating pressure 2 for double-acting actuators} \\
  E \quad \text{Exhaust air outlet (remove silencer if necessary)}
  \]

  see figure 2-3 and 2-4, page 19.
- Safety position when the electric power supply fails:
  - single-acting: Y1 deaerated
  - double-acting: Y1 Max. Actuating pressure
    (supply air pressure)
    Y2 deaerated

- Connect actuating pressure Y1 or Y2 (only in double-acting actuators) according to the desired safety position.

- Connect supply air to PZ.

**NOTE**

In order for spring-loaded pneumatic actuators to be able to reliably exploit the maximum possible travel, the supply pressure must be sufficiently greater than the maximum required final pressure of the actuator.

After installing the device, check the pneumatic connections of the entire assembly for leakage. Any leakage would cause not only continuous consumption of compressed air but also would cause the positioner to continually endeavor to compensate for the variance in position, leading in time to premature wear of the whole control mechanism.

### 3.6 Commissioning

Once the positioner has been fitted to a pneumatic actuator, it must be provided with electrical and pneumatic auxiliary power.

Then you can then adapt the position controller to the respective actuator by parameterizing and initializing it.

- **Mode** operating mode (which can also if necessary be attained by "PRST") – "NOINI" will flash.

- If the positioner has not been initialized it will be in the "P Manual Mode" operating mode (which can also if necessary be attained by "PRST") – "NOINI" will flash.

This initialization can be effected in three different ways:

- **Automatic initialization**
  Initialization takes place automatically. Hereby the positioner determines the direction of action, the stem travel and the angle of rotation, the travel times of the actuator one after the other and adapts the control parameters to the dynamic behavior of the actuator.

- **Manual initialization**
  The stem travel or angle of rotation of the actuator can be set manually, the other parameters are determined as in automatic initialization. This function is useful in actuators with soft limit stops.

- **Copying initialization data (positioner exchange)**
  In the devices with HART function the initialization data of a positioner can be read out and copied to another positioner. This enables a defective device to be changed without having to interrupt an ongoing process by initialization.
Only a few parameters need to be set in the positioner prior to initialization. The others are defaulted so that they do not normally need to be adjusted. You will have no problems with commissioning if you observe the following points.

The possible operating modes and parameters, together with the adjustment capabilities and their effects are described in chapter 4 page 81 "Operation".

NOTE
N.B.: The operating pressure should be at least one bar greater than is necessary for closing/opening the valve during initialization.

N.B.: The transmission ratio selector can only be set when the positioner is open. Therefore check this setting before closing the housing.

3.6.1 Preparations for linear actuators

1. Assemble the positioner with the appropriate mounting kit (see chapter 3.3.3, page 39).

NOTE
Particularly important is the position of the transmission ratio selector (8, figure 2-1, page 17) in the positioner:

<table>
<thead>
<tr>
<th>Stroke</th>
<th>Lever</th>
<th>Position of the transmission ratio selector</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 to 20 mm</td>
<td>short</td>
<td>33° (i.e. down)</td>
</tr>
<tr>
<td>25 to 35 mm</td>
<td>short</td>
<td>90° (i.e. up)</td>
</tr>
<tr>
<td>40 to 130 mm</td>
<td>long</td>
<td>90° (i.e. up)</td>
</tr>
</tbody>
</table>

2. Push the carrier pin (4, figure 3-7 (page 45) 2) onto the lever (6, figure 3-7, 2) to the scale position corresponding to the rated stroke or next highest position and screw the carrier pin tight with the nut (18, figure 3-7, 2).

3. Connect the actuator and the positioner with the pneumatic lines and supply pneumatic power to the positioner (figure 2-3 and 2-4, page 19).

4. Connect a suitable current or voltage source (see figure 3-13, page 53 and figure 3-19, page 56).

5. The positioner is now in the operating mode "P-manual operation". The current potentiometer voltage (P) is displayed in percent in the top line of the display, e.g.: "P12.3", and "NOINI" flashes in the bottom line:
6. Check the free running of the mechanics in the whole actuating range by moving the actuator with the keys ▲ and ▼ and driving to the respective end position.

NOTE
You can move the actuator quickly by pressing the other direction key additionally whilst keeping the direction key selected first pressed.

7. Now move the actuator to the horizontal position of the lever. A value between P48.0 and P52.0 should be visible in the display. If this is not the case, adjust the friction clutch (8, figure 2-10, page 29 or in frameproof enclosure 8, figure 2-11, page 31) until "P50.0" is displayed with a horizontal lever. The more accurately you hit this value, the more exactly the positioner can determine the path.

NOTICE
for the explosion-proof version:
Only adjust the outer friction clutch (8, Fig. 2-2, page 18). The internal friction clutch (9, Fig. 2-1 page 17) is fixed and, for the explosion-proof version, must not be adjusted.

3.6.2 Automatic initialization of linear actuator

If you can move the actuator correctly, leave it standing in a central position and start automatic initialization:

1. Press the operation mode key ▼ for longer than 5 s. This brings you to the Configuration mode.
   Display:
   ![Configuration Mode Display]

2. Switch to the second parameter by pressing the operation mode key ▼ briefly.
   Display:
   ![Parameter Selection Display]
NOTE

It is vital that this value corresponds to the setting of the transmission ratio selector (8, figure 2-1, page 17) (33° or 90°).

3. Switch on to the following display with the operation mode key \[ \text{OFF} \]:

![Display: OFF]

You only need to set this parameter if you want to have the total stroke in mm displayed at the end of the initialization phase. To do this, select the same value in the display to which you have set the carrier pin to the scale on the lever.

4. Switch on to the following display with the operation mode key \[ \text{NO} \]:

![Display: NO]

5. Start initialization by pressing the key \[ \text{△} \] for longer than 5 s.
   Display:

![Display: START]

During the initialization phase "RUN1" to "RUN5" appear one after another in the bottom display (see also structograms figure 3-33, page 75 to figure 3-36, page 78).

NOTE

The initialization process may last up to 15 minutes depending on the actuator.

The initialization is complete when the following display appears:

![Display: FINISH]
The following display appears after pressing the operation mode key briefly:

![Display]

To exit the Configuration mode, press the operation mode key for longer than 5 s. The software version is displayed after about 5 s. The instrument is in manual operation after releasing the operation mode key.

**NOTE**

You can abort an ongoing initialization at any time by pressing the operation mode key. Your previous settings are retained. All the parameters are reset to the factory setting only after performing a "Preset".

### 3.6.3 Manual initialization of linear actuator

The positioner can be initialized with this function without the actuator being driven hard against the limit stop. The start and end positions of the travel are set manually. The other initialization steps (optimization of the control parameters) run automatically as in automatic initialization.

**Manual initialization procedure in linear actuator**

1. Make preparations as described in chapter 3.6.1, page 65 for linear actuator. In particular, make sure by manually driving the whole travel that the displayed potentiometer setting moves in the permissible range between P5.0 and P95.0.

   Press the operation mode key for longer than 5 s. This brings you to the Configuration mode.

   Display:

   ![Display]

2. Switch to the second parameter by pressing the operation key briefly. One of the following displays appears:

   ![Display] or ![Display]

**NOTE**

It is vital that this value corresponds to the setting of the transmission ratio selector (33° or 90°).
4. Switch on to the following display with the operation mode key:

![Display Image]

You only need to set this parameter if you want to have the total stroke in mm displayed at the end of the initialization phase. To do this, select the same value in the display to which you have set the carrier pin to the scale on the lever or the next highest position in intermediate positions.

5. Switch on to the following display by pressing the operation mode key twice:

![Display Image]

6. Start initialization by pressing the increment key for longer than 5 s.

Display:

![Display Image]

7. After 5 s the display changes to:

![Display Image]

(The display of the potentiometer setting is shown here and below as an example only).

Now move the actuator to the position which you want to define as the first of the two end positions with the increment and decrement key. Then press the operation mode key. This accepts the current position as end position 1 and switches on to the next position.
NOTE
If the message “RANGE” appears in the bottom line, the selected end position is outside the permissible measuring range. There are several ways to correct the error:

- Adjust the friction clutch until “OK” appears and press the operation mode key again or
- move to another end position with the increment and decrement key or
- abort initialization by pressing the operation mode key. You then have to change to P manual operation and correct the travel and the position detection according to step 1.

8. If step 7 was successful, the following display appears:

Now move the actuator to the position which you want to define as the second end position with the increment and decrement key. Then press the operation mode key. This enters the current position as end position 2.

NOTE
If the message “RANGE” appears in the bottom line, the selected end position is outside the permissible measuring range. There are several ways to correct the error:

- move to another end position with the increment and decrement key or
- abort initialization by pressing the operation mode key. You then have to change to P manual operation and correct the travel and the position detection according to step 1.

If the message “Set Middl” appears, the lever arm must be driven to horizontal position using the increment and decrement key and then the operation mode key pressed. This sets the reference point of the sine correction in linear actuators.

9. The rest of the initialization now runs automatically. “RUN1” to “RUN5” appear one after another in the bottom line of the display. The following display appears on successful completion of initialization:
Preparing for Operation

The first line additionally contains the determined stroke in millimeters if the set lever length was specified with parameter 3 YWAY.

5 INITM appears in the bottom line again after pressing the operation mode key briefly. This brings you back to the Configuration operating mode.

To exit the Configuration mode, press the operation mode key for longer than 5 seconds. The software version is displayed after about 5 seconds. The instrument is in manual operation after releasing the operation mode key.

3.6.4 Preparations for part-turn actuator

NOTE

Very important: Switch the transmission ratio selector in the positioner (8, figure 2-1, page 17) to position 90° (normal angle for part-turn actuator).

1. Mount the positioner with the appropriate mounting kit (see chapter 3.3.5, page 46).
2. Connect the actuator and the positioner with the pneumatic lines and supply pneumatic power to the positioner (figure 2-3 and 2-4, page 19).
3. Connect a suitable current or voltage source (see figure 3-13, page 53 and figure 3-19, page 56).
4. The positioner is now in the operating mode "P-manual operation". The current potentiometer voltage (P) is displayed in % in the top line of the display, e.g.: "P12.3", and "NOINI" flashes in the bottom line:

5. Check the free running of the mechanics in the whole actuating range by moving the actuator with the keys and driving to the respective end position.

NOTE

You can move the actuator quickly by pressing the other direction key additionally whilst keeping the direction key selected first pressed.
3.6.5 Automatic initialization of part-turn actuator

If you can move the actuator correctly through the actuating range, leave it standing in a central position and start automatic initialization:

1. Press the operation mode key for longer than 5 s. This brings you to the configuration operating mode.

   Display

   ![Display](image)

2. Set the parameter with the key to “turn”

   Display

   ![Display](image)

3. Switch to the second parameter by pressing the operation mode key briefly. This has set automatically to 90°.

   Display

   ![Display](image)

4. Switch on to the following display with the operation mode key:

   ![Display](image)

5. Start initialization by pressing the key for longer than 5 s.

   Display

   ![Display](image)

During the initialization phase “RUN1” to “RUN5” appear one after another in the bottom display (see also structograms in figure 3-33, page 75 to figure 3-36, page 78).

---

**NOTE**

The initialization process may last up to 15 minutes depending on the actuator.
The initialization is complete when the following display appears:

![Display: 93.5° FINISH]

The top value indicates the total angle of rotation of the actuator (example 93.5°).

The following display appears after pressing the operation mode key briefly:

![Display: 93.5° INIT]

To exit the Configuration mode, press the operation mode key for longer than 5 s. The software version is displayed after about 5 s. The instrument is in manual operation after releasing the operation mode key.

---

**NOTE**

You can abort an ongoing initialization at any time by pressing the operation mode key. Your previous settings are retained. All the parameters are set to the factory setting only after performing a “Preset”.

---

### 3.6.6 Manual initialization of part-turn actuators

The positioner can be initialized with this function without the actuator being driven hard against the limit stop. The start and end positions of the travel are set manually. The other initialization steps (optimization of the control parameters) run automatically as in automatic initialization.

**Manual initialization procedure in part-turn actuators**

1. Make preparations as described in chapter 3.6.4, page 71 for part-turn actuators. In particular, make sure by manually driving the whole travel that the displayed potentiometer setting moves in the permissible range between P5.0 and P95.0.

2. Press the operation mode key for longer than 5 s. This brings you to the Configuration mode. Display:
3. Set the parameter YFCT to “turn” with the decrement ▼ key. Display:

4. Switch to the second parameter by pressing the operation mode key [ ] briefly. Display:

   ![Display](image)

**NOTE**

Make sure that the transmission ratio selector is in position 90 °!

5. Switch on to the following display by pressing the operation mode key [ ] twice:

   ![Display](image)

   The following steps are identical with the steps 6) to 9) for initialization of linear actuators.

   After successful initialization the determined part-turn range appears in the top display.

   “5.INITM” appears in the bottom line again after pressing the operation mode key [ ] briefly. This brings you back to the Configuration mode.

   To exit the Configuration mode, press the operation mode key [ ] for longer than 5 seconds. The software version is displayed after about 5 seconds. The instrument is in manual operation after releasing the operation mode key.
3.6.7 Automatic initialization (structograms)

The initialization procedure should be taken from the following structogram (figure 3-33 to figure 3-36). The terms Open/Closed and up/down in the structogram refer to the direction of action of the actuators as illustrated in figure 3-32.

Figure 3-33 Automatic initialization, part 1
Figure 3-34  Automatic initialization part 2 (in part-turn actuators)
Figure 3-35  Automatic initialization part 2 (in linear actuators)
Figure 3-36  Automatic initialization, part 3
3.7 Copying initialization data (positioner exchange)

With this function you have the possibility of starting up a positioner without running the initialization routine. This allows for example a positioner to be changed on a running system in which automatic or manual initialization cannot be performed without disturbing the process.

**NOTICE**

Initialization (automatic or manual) should be performed as soon as possible afterwards because only then can the positioner be optimally adapted to the mechanical and dynamic properties of the actuator.

Data are transmitted from the positioner to be replaced to the replacement instrument via the HART®- communication interface.

The following steps must be performed to exchange a positioner:

1. Read in and save instrument parameters and initialization data (determined in initialization) of the instrument to be replaced with PDM (Process Device Manager). This step is unnecessary if the instrument has been parameterized with PDM and the data have already been stored.

2. Fix the actuator in its momentary position (mechanical or pneumatic).

3. Read and note the current position actual value of the positioner to be changed. If the electronics are defective, determine the current position by measuring on the actuator or valve.

4. Disassemble the positioner. Mount the lever arm of the positioner on the replacement instrument. Mount the replacement instrument on the fitting. Move the transmission ratio selector to the same position as the defective instrument. Copy the instrument data and initialization data from the PDM or handheld.

5. If the displayed actual value does not match the noted value of the defective positioner, set the correct value with the friction clutch.

6. The positioner is now ready to operate.

The accuracy and dynamic behavior may be restricted in relation to correct initialization. The position of the hard stops and the related maintenance data may show deviations in particular. Therefore initialization must be performed at the earliest opportunity.
The following chapter describes the operation of the positioner.

4.1 Display

The LC display has two lines whereby the lines have different segmentation. The elements of the top line consist of 7, those of the bottom line of 14 segments. The contents of the display depend on the selected operating mode (see chapter 4.3, page 84).

NOTE

If the positioner is operated in ranges with temperatures below −10 °C the liquid crystal display becomes sluggish and the display refresh rate is reduced considerably.

Figure 4-1 shows you the various display options. The meaning of further display capabilities is detailed in chapter 4.6 page 113.

4.2 Input keys

The positioner is operated by three keys (figure 4-2) the function of which depends on the selected operating mode. In the explosion proof version of the positioner the input keys are underneath a key cover which can be lifted up after loosening the cover screw.

NOTE

The input keys of the explosion proof version must be covered to prevent liquid getting in. The IP65/NEMA4x degree of protection is not guaranteed when the housing is open or the key cover is open.

The housing cover must be removed to operate the keys in the normal and intrinsically safe versions of the positioners.
NOTE

The degree of protection IP 65/NEMA4x is not guaranteed as long as the positioner is open.
Explanations of the input keys

- The operation mode key (manual key) serves to switch over the operating mode and pass on parameters.

NOTE

By pressing and holding the operation mode key and additionally pressing the decrement key, you can select the parameters in reverse order.

- The decrement key \( \downarrow \) serves to select parameter values in configuration and to move the actuator in manual operation.
- The increment key \( \uparrow \) serves to select parameter values in configuration and to move the actuator in manual operation.

Firmware version

The current firmware state is displayed when you exit the configuration menu.
4.3 Operating modes

The positioner can be operated in five operating modes.

1. P-manual mode (ex-factory state)
2. Configuration and initialization
3. Manual mode (MAN)
4. Automatic (AUT)
5. Diagnostic display

Figure 4-4 gives you an overview of the possible operating modes and the change between them.

<table>
<thead>
<tr>
<th>Operating mode</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>P-manual operation</td>
<td>![Display Image]</td>
</tr>
<tr>
<td>change position</td>
<td>![Display Image]</td>
</tr>
<tr>
<td>with ( \downarrow \uparrow )</td>
<td>![Display Image]</td>
</tr>
<tr>
<td>Configure</td>
<td>![Display Image]</td>
</tr>
<tr>
<td>select parameter</td>
<td>![Display Image]</td>
</tr>
<tr>
<td>with ( \uparrow ) or ( \downarrow \uparrow )</td>
<td>![Display Image]</td>
</tr>
<tr>
<td>change value</td>
<td>![Display Image]</td>
</tr>
<tr>
<td>with ( \downarrow \uparrow )</td>
<td>![Display Image]</td>
</tr>
<tr>
<td>Manual operation</td>
<td>![Display Image]</td>
</tr>
<tr>
<td>change position</td>
<td>![Display Image]</td>
</tr>
<tr>
<td>with ( \downarrow \uparrow )</td>
<td>![Display Image]</td>
</tr>
<tr>
<td>Automatic</td>
<td>![Display Image]</td>
</tr>
<tr>
<td>Diagnosis</td>
<td>![Display Image]</td>
</tr>
</tbody>
</table>

Figure 4-4  Change between the operating modes
**P-manual mode (ex–factory state)**

The display of the positioner shows you the current potentiometer setting in the top line and “NOINIT” flashes in the second line. You can move the actuator with the decrement and increment key. In order to adapt the positioner to your actuator, you have to change to the Configuration menu. See also chapter 3.6, page 64 “Commissioning”.

Output of alarms and position feedback is possible after successful initialization.

**Configuration and initialization**

To go to the Configuration menu, press the operation mode key for at least 5 seconds. In the Configuration menu you can adapt the positioner individually to your actuator and start initialization. Only a few parameters need to be set in the positioner prior to initialization. The others are defaulted so that they do not normally need to be adjusted. You can block the Configuration menu against manipulation by an appropriately parameterized and activated digital input. Which parameters you need to set and all other parameters are explained in chapter 4.4, page 87 Parameters.

The configuration mode can be reported by outputting a parameterizable fault message, a position feedback or output of limit values A1 and A2 is not possible.

---

**NOTE**

If the electric power supply fails during configuration, the positioner switches back to the first parameter after recovering the power supply, values which have already been parameterized are retained. When doing this, please note that the new value will only be saved when leaving the configuration menu or when another parameter is selected. Without a power failure you re-enter the configuration menu at the point you exited it when you call the Configuration menu again.
**Manual mode (MAN)**

In this operating mode you can move the actuator with the decrement (\(\downarrow\)) and increment keys (\(\uparrow\)) and the current position is held regardless of the setpoint current and any leakages.

**NOTE**

You can move the actuator quickly by pressing the other direction key additionally whilst keeping the direction key selected first pressed.

The manual mode can be reported by outputting a parameterizable fault message, a position feedback or output of limit values A1 and A2 is only possible in automatic mode.

**NOTE**

The positioner switches over to automatic mode automatically after an electrical power failure.

**Automatic (AUT)**

The automatic mode is the normal mode. In this mode the positioner compares the setpoint current with the current position and moves the actuator until the control deviation reaches the parameterizable dead zone. Error messages are output if this is not possible for various reasons.

**Diagnostic display**

In this operating mode you can have the current operating data (such as number of strokes, number of changes in direction, number of faults messages, etc.) displayed (see table 4-1, page 103).

From the automatic or manual mode you go to the diagnostic display by simultaneously pressing all three keys for at least two seconds.

See chapter 4.5, page 102 for further information.
**NOTE**

The respective operating mode (MAN or AUT) of the positioner is retained when you switch to the diagnostic display, i.e. in automatic operation the specified setpoint is still used for controlling and in manual operation the position last reached is retained.

---

### 4.4 Parameters

All the parameters of the positioner are listed in this chapter. Figure 4-6 shows an overview of the parameters.

The parameter name is shown once in plain text and once as it appears in the display. The function of the parameter is described briefly in the "Function" column. In addition, the possible parameter values, the physical unit and the factory setting of the parameters are shown.
<table>
<thead>
<tr>
<th>Parameter name</th>
<th>Display</th>
<th>Function</th>
<th>Parameter values</th>
<th>Unit</th>
<th>Factory setting</th>
<th>Customer setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>YPCT</td>
<td>YPCT</td>
<td>Type of actuator</td>
<td>1m (piston actuator)</td>
<td>WAY (Linear actuator)</td>
<td>WAY (Linear actuator without rear connector)</td>
</tr>
<tr>
<td>2.</td>
<td>YMAL</td>
<td>YMAL</td>
<td>Stated angle of rotation of feedback</td>
<td>90°</td>
<td>Deg</td>
<td>90°</td>
</tr>
<tr>
<td>3.</td>
<td>YWAY</td>
<td>YWAY</td>
<td>Stroke range (optional setting)</td>
<td>0 to 20 mA</td>
<td>mm</td>
<td>OFF</td>
</tr>
<tr>
<td>4.</td>
<td>ENTA</td>
<td>ENTA</td>
<td>Initialization (automatic)</td>
<td>no</td>
<td>mm</td>
<td>/</td>
</tr>
<tr>
<td>5.</td>
<td>EMT</td>
<td>EMT</td>
<td>Initialization (manual)</td>
<td>no</td>
<td>mm</td>
<td>/</td>
</tr>
<tr>
<td>6.</td>
<td>ECUH</td>
<td>ECUH</td>
<td>Current range of setpoint</td>
<td>0 to 20 mA</td>
<td>0 MA</td>
<td>0 MA</td>
</tr>
<tr>
<td>7.</td>
<td>ETAPR</td>
<td>ETAPR</td>
<td>Setpoint direction</td>
<td>FALL</td>
<td>FALL</td>
<td>&amp;SE</td>
</tr>
<tr>
<td>8.</td>
<td>SPRI</td>
<td>SPRI</td>
<td>Setpoint for start of split range</td>
<td>0.0 to 100.0</td>
<td>0.0 %</td>
<td>100</td>
</tr>
<tr>
<td>9.</td>
<td>SPFRE</td>
<td>SPFRE</td>
<td>Setpoint for end of split range</td>
<td>0.0 to 100.0</td>
<td>0.0 %</td>
<td>100</td>
</tr>
<tr>
<td>10.</td>
<td>TPIUP</td>
<td>TPIUP</td>
<td>Setpoint ramp up</td>
<td>0.0 to 400</td>
<td>0 s</td>
<td>0</td>
</tr>
<tr>
<td>11.</td>
<td>TPIDD</td>
<td>TPIDD</td>
<td>Setpoint ramp down</td>
<td>0.0 to 400</td>
<td>0 s</td>
<td>0</td>
</tr>
<tr>
<td>12.</td>
<td>SFCST</td>
<td>SFCST</td>
<td>Setpoint function Linear</td>
<td>Equations (example) 1.25, 1.3, 1.50</td>
<td>1.25, 1.3, 1.50</td>
<td>1.25, 1.3, 1.50</td>
</tr>
<tr>
<td>13.</td>
<td>SL1</td>
<td>SL1</td>
<td>Setpoint turning point of %</td>
<td>0% to 100%</td>
<td>0% to 100%</td>
<td>0% to 100%</td>
</tr>
<tr>
<td>14.</td>
<td>SL2</td>
<td>SL2</td>
<td>Setpoint turning point of %</td>
<td>0% to 100%</td>
<td>0% to 100%</td>
<td>0% to 100%</td>
</tr>
<tr>
<td>15.</td>
<td>EDBZ</td>
<td>EDBZ</td>
<td>Dead zone of controller</td>
<td>Auto</td>
<td>%</td>
<td>Auto</td>
</tr>
<tr>
<td>16.</td>
<td>EVA</td>
<td>EVA</td>
<td>Start of manipulator variable limiting</td>
<td>0.0 to 100.0</td>
<td>0.0 %</td>
<td>100</td>
</tr>
<tr>
<td>17.</td>
<td>EVA</td>
<td>EVA</td>
<td>End of manipulator variable limiting</td>
<td>0.0 to 100.0</td>
<td>0.0 %</td>
<td>100</td>
</tr>
<tr>
<td>18.</td>
<td>WRM</td>
<td>WRM</td>
<td>Standardization of manipulator variable</td>
<td>% to %</td>
<td>% to %</td>
<td>% to %</td>
</tr>
<tr>
<td>19.</td>
<td>VDR</td>
<td>VDR</td>
<td>Orientation of manipulator variable</td>
<td>FALL</td>
<td>FALL</td>
<td>&amp;SE</td>
</tr>
<tr>
<td>20.</td>
<td>VOL</td>
<td>VOL</td>
<td>Light signal with manipulator variable</td>
<td>No top only</td>
<td>No top only</td>
<td>No top only</td>
</tr>
<tr>
<td>21.</td>
<td>VDOD</td>
<td>VDOD</td>
<td>Value for light display, bottom</td>
<td>0.0 to 100.0</td>
<td>0.0 %</td>
<td>0.5</td>
</tr>
<tr>
<td>22.</td>
<td>VDOP</td>
<td>VDOP</td>
<td>Value for light display, top</td>
<td>0.0 to 100.0</td>
<td>0.0 %</td>
<td>95.0</td>
</tr>
<tr>
<td>23.</td>
<td>B1N6</td>
<td>B1N6</td>
<td>Function of Bit 1</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>24.</td>
<td>B1N8</td>
<td>B1N8</td>
<td>Function of Bit 2</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>25.</td>
<td>AFCT</td>
<td>AFCT</td>
<td>Alarm function</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>26.</td>
<td>A1</td>
<td>A1</td>
<td>Response threshold of alarm 1</td>
<td>0.0 to 100.0</td>
<td>0.0 %</td>
<td>100</td>
</tr>
<tr>
<td>27.</td>
<td>A2</td>
<td>A2</td>
<td>Response threshold of alarm 2</td>
<td>0.0 to 100.0</td>
<td>0.0 %</td>
<td>95.0</td>
</tr>
<tr>
<td>28.</td>
<td>AFCT</td>
<td>AFCT</td>
<td>Function of alarm output on front panel</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30.</td>
<td>A2RM</td>
<td>A2RM</td>
<td>Response threshold for fault message</td>
<td>0.0 to 100.0</td>
<td>0.0 %</td>
<td>100</td>
</tr>
<tr>
<td>31.</td>
<td>A3E</td>
<td>A3E</td>
<td>Limit for stroke integrated</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>32.</td>
<td>ASOHD</td>
<td>ASOHD</td>
<td>Limit for direction change</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>33.</td>
<td>A2E</td>
<td>A2E</td>
<td>Limit for end stop monitoring, bottom</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>34.</td>
<td>A2E</td>
<td>A2E</td>
<td>Limit for end stop monitoring, top</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>35.</td>
<td>A3E</td>
<td>A3E</td>
<td>Limit for dead zone monitoring</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>36.</td>
<td>A1E</td>
<td>A1E</td>
<td>Press button setting</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) If "turn" is selected, you cannot set "33".
2) Parameter does not appear if "Y-YPCT"-yam has been selected.
3) Turning points only appear with selection 12.5FCST = "FREE".
4) NC context means: action with opened switch or Low level
   Normal means: action with closed switch or High level
5) NO context means: action with opened switch or Low level
The following configuration block diagram shows the effects of the parameters.

Figure 4-7 Configuration block diagram
Normally adjustment of the first three following parameters is completely sufficient to enable a positioner to be operated by an actuator. If you wish to become familiar with all details of the positioner, try out incrementally the effects of the remaining parameters by selective trials.

NOTE

In particular if the positioner has previously been operated using a different actuator, it must always be reinitialized in order to restore the factory settings. Only in this way can the positioner matching process start from known conditions. The parameter "51 PRST" is provided for this purpose.

This is also recommended if multiple parameters have been changed in a single session, the effects cannot be assessed and unintended consequences may result.

1. YFCT

Positioning actuator type

This is to match the positioner with the respective actuator and where necessary to the position sensor being used. The following adjustment capabilities are provided:

- **YFCT = turn**
  
  This adjustment is necessary for the part-turn actuator.
  
  If "turn" is selected, the following parameter "2. YAGL" is automatically set to 90° and cannot be changed.

- **YFCT = WAY (Factory setting)**
  
  This is necessary for a linear actuator. This allows the positioner to compensate for the non-linearity that arises due to the conversion of the linear movement of the linear actuator into the part-turn movement of the feedback shaft. For this the positioner is factory set so that it shows between "P 49.0 and P 51.0" when the arm on the feedback shaft is vertical to the linear actuator spindle.

- **YFCT = LWAY**
  
  This must be adjusted, if an external linear potentiometer is to be connected to a linear actuator.

  **TIP**: use this adjustment also for part-turn actuators with reverse direction of control action.

- **YFCT = ncSt**
  
  Use this when an NCS is fitted to a part-turn actuator.

- **YFCT = ncSt**
  
  This must be set when an NCS is used with a part-turn actuator with reverse direction of control action.

- **YFCT = ncSL**
  
  This must be set when an NCS is used with a linear actuator.
NOTE

After "LWAY, ncSt, -ncSt or ncSL" have been adjusted, both the following parameters "2. YAGL" and "3. YWAY" will not be displayed.

2.YAGL

Rated angle of rotation of the feedback shaft

In part-turn actuators, an angle of 90° is preset automatically by 1.YFCT = turn (see above). In linear actuators (1.YFCT = WAY) a value of 33° or 90° can be selected depending on the stroke range:

- 33° for strokes ≤ 20 mm
- 90° for strokes > 20 mm

When using the lever up to 35 mm, both angles of rotation (33° and 90°) are possible.

The long lever (> 35 mm stroke) is only designed for an angle of rotation setting of 90°. It is not part of the mounting kit set 6DR4004-8V but must be ordered separately under order number 6DR4004-8L.

NOTE

The setting of the transmission ratio selector on the positioner (see figure 2-1, page 17 and figure 2-2, page 18) must correspond to the angle value selected under “2.YAGL”.

3.YWAY

Lever arm transmission

NOTE

The use of this parameter is optional. You only need to set this parameter if you want to have the way in mm displayed at the end of the initialization.

Selection of the lever arm range: serves to display the real stroke after initialization.

This parameter is only relevant for linear actuator. If the parameter value “off” is selected here, the real stroke is not displayed after initialization.

NOTE

The specification “YWAY” must match the mechanical lever arm transmission. The carrier must be set to the value of the actuator stroke, if this is not scaled to the next highest scaled value.
4.INITA

Automatic initialization (see chapter 3.6, page 64)

By selecting “Strt” and pressing the increment key ▲ for at least 5 seconds, automatic initialization is started. The initialization process is displayed by “RUN 1” to “RUN 5” (see figure 3-33, page 75 to figure 3-36, page 78).

5.INITM

Manual initialization

By selecting “Strt” and pressing the increment key ▲ for at least 5 seconds, manual initialization is started. The manual initialization process is described in chapter 3.6.3, page 68 and chapter 3.6.6, page 73.

NOTE

If the positioner has already been initialized, for INITA and INITM it is possible to transfer it to its non-initialized state without changing the remaining parameters by pressing the decrement key ▼ for 5 s.

6.SCUR

Current range of the setpoint

The selection of the current range depends on the connection type. "0mA" (0 to 20 mA) is only possible in three-/four-wire connections (see figure 3-22, page 58).

7.SDIR

Setpoint direction (see figure 4-8, page 93)

The setting of the setpoint direction serves to reverse the direction of action of the setpoint. It is used mainly for the split range mode and in single-acting actuators with the safety position "up".

8.SPRA

Split range start (see figure 4-8)

and

9.SPRE

Split range end (see figure 4-8)

The parameters “8.SPRA” and “9.SPRE” in connection with the parameter “7.SDIR” serve to restrict the active setpoint range. In this way split range tasks can be solved with the following characteristics.

• rising / falling
• falling / rising
• falling / falling
• rising / rising
Figure 4-8  Example: Split range-operation with two positioners

10.TSUP  Setpoint ramp UP
and
11.TSDO  Setpoint ramp DOWN

The setpoint ramp is effective in automatic operation and limits the speed of alteration of the active setpoint. When switching over from manual operation to automatic the active setpoint is adjusted to the setpoint on the positioner with the setpoint ramp.

This bumpless manual/automatic switchover avoids excessive pressure increases on long pipelines.

In the position TSUP = Auto the slower of the two travel times determined during initialization is used for the setpoint ramp. TSDO is then ineffective.

12.SFCT  Setpoint function (see figure 4-9, page 94)

Non-linear valve characteristics can be linearized with this function and any flow characteristics simulated in linear valve characteristics.
Six valve characteristics are stored in the positioner

- linear \(12.\text{SFCT} = \text{Lin}, \text{factory setting}\)
- equal percentage 1 : 25 \(12.\text{SFCT} = 1:25\)
- equal percentage 1 : 33 \(12.\text{SFCT} = 1:33\)
- equal percentage 1 : 50 \(12.\text{SFCT} = 1:50\)
- inverse equal percentage 25 : 1 \(12.\text{SFCT} = n1:25\)
- inverse equal percentage 33 : 1 \(12.\text{SFCT} = n1:33\)
- inverse equal percentage 50 : 1 \(12.\text{SFCT} = n1:50\)
- freely adjustable \(12.\text{SFCT} = \text{FrEE}\)

13.SL0 to 33.SL20 Setpoint turning points

A flow parameter can be assigned to the respective setpoint turning value at an interval of 5 %. These points lead to a polygon chain with 20 straight lines which therefore represents a projection of the valve characteristic.

The setpoint vertex values can only be input at 12.SFCT=FrEE. You may only enter a strictly monotonous characteristic, and two consecutive vertex values must differ by at least 0.2 %.
34.DEBA Dead zone of the controller
At \( \text{dEbA} = \text{AUto} \) the dead zone in automatic operation is adapted continuously to the requirements of the control circuit. The dead zone is gradually increased on detecting a control oscillation. The reverse adaptation takes place by a time criterion.

In the other discrete settings the fixed value is used for the dead zone.

35.YA Manipulated variable limiting start (see figure 4-9 and 4-10)
36.YE Manipulated variable limiting end (see figure 4-9 and 4-10)
With the parameters “YA” and “YE” the mechanical actuating distance (from stop to stop) is limited to the set values. In this way the mechanical setting range of the actuator can be limited to the active flow and the integral saturation of the commanding controller avoided.

**NOTE**
YE must always be set to greater than YA.

37.YNRM Manipulated variable standardization (see figure 4-9 and 4-10)
With limiting of the manipulated variable (by “35.YA” and “36.YE”) two different scalings are produced for the display and the position feedback via the current output (MPOS or FLOW).

The MPOS scaling shows the mechanical position (0 to 100%) between the hard stops of the initialization. This is not affected by the parameters “35.YA” and “36.YE”. The parameters “35.YA” and “36.YE” are displayed in the MPOS-scale.

The FLOW-scale is the standardization (0 to 100%) to the range between “35.YA” and “36.YE”. The setpoint \( w \) (0 to 100%) is always referred to this range. This gives (also by using valve characteristics) a quasi-flow-proportional display and position feedback.

To calculate the control difference, the setpoint is also shown in the appropriate scale on the display.
YNRM = MPOS or YNRM = FLOW  
Presetting: YA = 0% and YE = 100%

Example:
YNRM = MPOS with YA = 10 % and YE = 80 %

Example:
YNRM = FLOW with YA = 10 % and YE = 80%

38. YDIR  
Manipulated variable direction of action

The direction of action (rising or falling) of the display and the position feedback (Iy) can be set with this.

39. YCLS  
Tight closing with manipulated variable (see figure 4-9, page 94)

With this function the valve can be driven to the seat with the maximum actuating force of the actuator (continuous contact of the piezo-valves). The tight closing function can be activated on one side or for both limit positions. YCLS becomes active when the setpoint is below the value set with parameter “YCDO” or above that set with parameter “YCUP”.

---

Figure 4-10  Dependence on the stroke of standardization and on YA and YE in the example of an 80 mm linear actuator
NOTE
If the control function to close tightly is activated, for parameter "49. LIM" the monitoring of the control deviation in each overrun direction (YCDO: < 0 %, YCUP: > 100 %) is disabled. This function is particularly useful for valves with a soft seating. For long term monitoring of the end-stop positions, we recommend activating the parameters "52. \text{\textasciitilde}ZER\text{\textasciitilde}" and "53. \text{\textasciitilde}O\text{\textasciitilde}P\text{\textasciitilde}".

40.\text{\textasciitilde}YCOD\text{\textasciitilde}
Value for tight closing, bottom
and
41.\text{\textasciitilde}YCUP\text{\textasciitilde}
Value for tight closing, top

NOTE
"40.\text{\textasciitilde}YCOD\text{\textasciitilde}" must always be set to less than "41.\text{\textasciitilde}YCUP\text{\textasciitilde}". The tight closing function has a fixed hysteresis of 1 %. "40.\text{\textasciitilde}YCOD\text{\textasciitilde}" and "41.\text{\textasciitilde}YCUP\text{\textasciitilde}" relate to mechanical stops and are independent of the settings of "7.\text{\textasciitilde}SDIR\text{\textasciitilde}" and "38.\text{\textasciitilde}YDIR\text{\textasciitilde}".

42.\text{\textasciitilde}BIN\text{\textasciitilde}1
Function digital input 1 (see figure 4-6, page 88)
and
43.\text{\textasciitilde}BIN\text{\textasciitilde}2
Function digital input 2 (see figure 4-6)
The parameters "BIN1" and "BIN2" can be set individually depending on the purpose. The direction of action can be adapted to an NCC or an NOC.

- BIN1 or BIN2 = on or \text{\textasciitilde}on
  Digital messages of the periphery (e.g. pressure or temperature switches) can be read out via the HART interface or lead to responding of the fault message output by OR linking with other messages.

- BIN1 = bLoc1
  The Configuration operating mode is locked to prevent it being adjusted (e.g. by a wire jumper between terminals 9 and 10).

- BIN1 = bLoc2
  If digital input 1 has been activated, manual operation is also locked in addition to the Configuration operating mode.

- BIN1 or BIN2 = uP or doWn (contact closes) or \text{\textasciitilde}uP or \text{\textasciitilde}doWn (contact opens).
  The actuator drives the linear actuator to the upper or lower stop when the digital input is activated with continuous contact.

- BIN1 or BIN2 (contact closes) = StoP or \text{\textasciitilde}StoP (contact opens).
  With activated digital input the piezo-valves are blocked and the actuator remains in the last position. Leakage messages can then be executed without initialization function.
• BIN1 or BIN2 = off (factory setting)
  no function

special function of DI1: If the digital input 1 is activated in P manual operation by a jumper between terminals 9 and 10, when the operating mode key is pressed the firmware version will be displayed line of the display.

If one of the above named functions is selected with the parameters “BIN1” and “BIN2” simultaneously, then “Blocking” has priority over “Up” and “Up” priority over “Down”.

44.AFCT

Alarm function

The actuator can report the exceeding (max.) or dropping below (min) of a specified stroke or angle of rotation. The response of the alarms (limit contacts) is related to the MPOS-scaling (see figure 4-10, page 96). The alarms are reported by the alarm module (order no. 6DR4004-6A or -8A). In addition the alarms can be read out through the HART interface (optional).

The direction of action of the digital outputs can be adapted from high active to low active sequence systems.

45.A1 Response threshold alarm 1

46.A2 Response threshold alarm 2

The alarm thresholds are related to the mechanical path (MPOS-scale).
Function of the fault message output

The fault message output serves as a group message for following faults:

- Control error (e.g. by actuator fault, valve fault, compressed air failure) with the parameters "48.TIM" and "49.LIM"
- Positioner not in automatic mode
- Digital input activated (see parameter "42.BIN1" and "43.BIN2")
- Exceeding of a limit value (e.g. way integral or valve seat, see parameter 50 to 54)

It also responds at:

- Power failure
- Processor fault

The direction of action of the digital outputs can be adapted from high active to low active sequence systems.

For more information on error messages, see chapter 4.5.3 Online-Diagnosis, page 107.

Monitoring time for setting the fault messages

The set value (s) serves as a specification for the time within which the positioner must have reached the controlled state. The corresponding response threshold is specified with "49.LIM".

The fault message output is set on exceeding the set time.

NOTE

If the control function to close tightly is activated, for parameter "49.LIM" the monitoring of the control deviation in each overrun direction (YCDO: < 0 %, YCUP: > 100 %) is disabled. This function is particularly useful for valves with a soft seating. For long term monitoring of the end-stop positions, we recommend activating the parameters "52.ZERO" and "53.OPEN".

For more information on error messages, see chapter 4.5.3 Online-Diagnosis, page 107.

Response threshold of the fault message

Here a value (%) can be set for the permissible variable of control error for releasing the fault message.

If the parameters 48 and 49 are both set to "Auto" (factory setting), the fault message is set if the short step zone is not reached within a certain time. This time is 5 times the initialization travel time within 5 to 95% of the travel and 10 times this time outside 10 to 90% of the travel.
Limit value for monitoring the way integral
A limit value for the way integral can be set here. If the way integral exceeds the limit value, the fault message output (optional) is activated.
This function enables a preventive maintenance of the fitting, see also chapter 4.5 “Diagnostics”, page 102.
This monitoring function can be deactivated with the OFF setting (factory setting).

Limit value for monitoring the changes of direction
A limit value for the direction change counter can be set here. If this counter exceeds the limit value, the fault message output is activated.
This function enables a preventive maintenance of the fitting, see also chapter 4.5 “Diagnostics”, page 102.
This monitoring function can be deactivated with the OFF setting (factory setting).

Tolerance value for monitoring the bottom hard stop
With this value a limit value (in percent related to the total mechanical distance) can be preset for the monitoring of the bottom hard stop. If this tolerance value is exceeded or dropped below of, the fault message output (optional) is activated.
This function detects when the bottom stop has changed by more then the specified tolerance related to its initialization value. Monitoring takes place when the valve is in tight closing bottom. Activation of the tight closing bottom function (parameter “39.YCLS”) is therefore a prerequisite.
The fault message remains activated until either a subsequent monitoring remains within the tolerance or a new initialization is performed.
This monitoring function can be deactivated with the OFF setting (factory setting). See also chapter 4.5 “Diagnostics”, page 102.

Tolerance value for monitoring the top hard stop
With this value a limit value (in percent related to the total mechanical distance) can be preset for the monitoring of the top hard stop. If this tolerance value is exceeded or dropped below of, the fault message output (optional) is activated.
This function detects when the top stop has changed by more than the specified tolerance related to its initialization value. Monitoring takes place when the valve is in tight closing top. Activation of the tight closing top function (parameter “39.YCLS”) is therefore a prerequisite.
The fault message remains activated until either a subsequent monitoring remains within the tolerance or a new initialization is performed.
This monitoring function can be deactivated with the OFF setting (factory setting).
NOTE
But the monitors of the bottom and top hard stop do not only react to valve errors. Adjustment of the position feedback is also detected as an error if the tolerance values are exceeded as a result.

54. DEBA
Limit value for monitoring the dead zone adaptation
The automatic adaptation of the dead zone can be monitored with this value (%). If the dead zone exceeds the set value, the fault message output (optional) is activated.
Prerequisite for this function is the setting of the parameter “34.DEBA” = Auto. This monitoring function can be deactivated with the OFF setting (factory setting).

55. PRST
Preset
Establishing the factory setting and resetting the initialization.

NOTE
The positioner must be re-initialized after "Preset". All previously determined maintenance parameters are cleared.
4.5 Diagnosis

4.5.1 Diagnostic display

You go to the diagnostic display from automatic or manual operation by simultaneously pressing all three keys for at least two seconds.

The following table shows an overview of the displayable values.

The diagnostic display has a similar structure to in the "Configuration" operating mode. the top line shows the value of the diagnostic variable, the bottom line the number and abbreviation of the displayed variable.

The respective next diagnostic value can be selected with the operation mode key \( \uparrow \). By pressing and holding the operation mode key and additionally pressing the decrement key \( \downarrow \) you can select the diagnostic values in reverse order.

Certain values can be set to zero by pressing the increment key \( \Delta \) for at least 5 seconds. This is noted in the last column in the table.

Some diagnostic values may be greater than 99999. In this case the display switches to exponential display. Example: the value 1234567 is displayed as 1.23E6.

<table>
<thead>
<tr>
<th>No.</th>
<th>Abbreviation</th>
<th>Meaning</th>
<th>Displayable values</th>
<th>Unit</th>
<th>Rest poss.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>STRKS</td>
<td>Number of strokes</td>
<td>0 to 4.29E9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>CHDIR</td>
<td>Changes of direction</td>
<td>0 to 4.29E9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>FNT</td>
<td>Fault counter</td>
<td>0 to 4.29E9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>A1CNT</td>
<td>Alarm counter 1</td>
<td>0 to 4.29E9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>A2CNT</td>
<td>Alarm counter 2</td>
<td>0 to 4.29E9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>HOURS</td>
<td>Operating hours</td>
<td>0 to 4.29E9 Hours</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>WAY</td>
<td>Determined travel</td>
<td>0 to 130 mm or *</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>TUP</td>
<td>Travel time up</td>
<td>0 to 1000 s</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>TDOWN</td>
<td>Travel time down</td>
<td>0 to 1000 s</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>LEAK</td>
<td>Leakage</td>
<td>0.0 to 100.0 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>P0</td>
<td>Potentiometer value lower stop (0 %)</td>
<td>0.0 to 100.0 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>P100</td>
<td>Potentiometer value upper stop (100 %)</td>
<td>0.0 to 100.0 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>IMPUP</td>
<td>Impulse length up</td>
<td>2 to 100 ms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>IMPDN</td>
<td>Impulse length down</td>
<td>2 to 100 ms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>DBUP</td>
<td>Dead Band Up</td>
<td>0.1 to 100.0  %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>DBDN</td>
<td>Dead Band Down</td>
<td>0.1 to 100.0 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>SSUP</td>
<td>Short step zone up</td>
<td>0.1 to 100.0 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>SSDN</td>
<td>Short step zone down</td>
<td>0.1 to 100.0 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>TEMP</td>
<td>Current temperature</td>
<td>-40 to 85 °C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>TMIN</td>
<td>Minimum temperature (&quot;drag pointer&quot;)</td>
<td>-40 to 85 °C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>TMAX</td>
<td>Maximum temperature (&quot;drag pointer&quot;)</td>
<td>-40 to 85 °C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>T1</td>
<td>Number of operating hours in temperature range 1</td>
<td>0 to 4.29E9 Hours</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>T2</td>
<td>Number of operating hours in temperature range 2</td>
<td>0 to 4.29E9 Hours</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>T3</td>
<td>Number of operating hours in temperature range 3</td>
<td>0 to 4.29E9 Hours</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>T4</td>
<td>Number of operating hours in temperature range 4</td>
<td>0 to 4.29E9 Hours</td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>T5</td>
<td>Number of operating hours in temperature range 5</td>
<td>0 to 4.29E9 Hours</td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>T6</td>
<td>Number of operating hours in temperature range 6</td>
<td>0 to 4.29E9 Hours</td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>T7</td>
<td>Number of operating hours in temperature range 7</td>
<td>0 to 4.29E9 Hours</td>
<td></td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>T8</td>
<td>Number of operating hours in temperature range 8</td>
<td>0 to 4.29E9 Hours</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>T9</td>
<td>Number of operating hours in temperature range 9</td>
<td>0 to 4.29E9 Hours</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### 4.5.2 Meaning of the diagnostic values

1 **STRKS**  
Number of strokes  
The actuator movements during operation are totaled and can be read here as number of strokes. Unit: 100% strokes The value is written every 15 minutes in a non-volatile memory. It can be reset to zero with the increment key ▲.

2 **CHDIR**  
Number of direction changes  
Every change in direction leaving the dead zone is noted in the controller and added to the number of changes of direction.  
The value is written every 15 minutes in a non-volatile memory. It can be reset to zero with the increment key ▲.

3 **CNT**  
Fault counter  
Every fault is noted in the controller and added to the number of fault messages. The counter can be reset to zero with the increment key ▲.
Alarm counter 1 and alarm counter 2

Responses of alarm 1 and alarm 2 are counted with these two counters. The prerequisite is the activation of the alarms with the parameter "44.AFCT". The counters can be reset to zero with the increment key △.

Operating hours

The operating hours counter is updated every hour as soon as the positioner has been supplied with electrical power.

Determined actuating way

This value indicates the actuating way determined during initialization according to the display at the end of an initialization. Prerequisite in linear actuator: Specification of the lever arm with the parameter "3.YWAY".

Travel time up and travel time down

These values show the travel times which have been determined during initialization. The unit is seconds.

Leakage

If a leakage message has been output during initialization, the value of the leakage can be read here in %/min.

Potentiometer value bottom stop and potentiometer value top stop

These two values indicate the measured values of displacement measurement (potentiometer) at the bottom and top hard stops as determined in automatic initialization. In manual initialization the values of the manually reached limit positions are indicated here.

Impulse length up and impulse length down

During initialization the smallest impulse lengths are determined with which a movement of the actuator can be achieved. They are determined and displayed here for the "Up"-direction and the "Down"-direction.

These two parameter can be used for special applications (see chapter 4.7 page 117).
15 DBUP  Dead zone up and
16 DBDN  Dead zone down

Here the dead zone of the controller is displayed in "Up"-direction or in "Down"-direction. The values correspond either to the manually set value of the parameter "DEBA" or the value adapted automatically by the instrument when "DEBA" has been set to "Auto".

17 SSUP  Short step zone up and
18 SSDN  Short step zone down

The short step zone is the range of the controller in which pulse-shaped control signals are output. The impulse length here is proportional to the control error. If the control error is outside the short step zone, the valves are controlled in continuous contact.

These two parameter can be tuned for special applications (see chapter 4.7 page 117).

19 TEMP  Current temperature

Current temperature in the positioner housing. The sensor is on the electronics board.

The temperature display can be switched between °C and °F by pressing the decrement key.

20 TMIN  Minimum temperature (drag pointer) and
21 TMAX  Maximum temperature (drag pointer)

The minimum and maximum temperature inside the housing is determined and stored continuously in a kind of drag pointer and can only be reset in the factory.

22 T1 to 30 T9  Number of operating hours in temperature range T1 to T9

Statistics how long operation takes place in which temperature ranges is kept in the instrument. To do this, the measured temperature over one hour respectively is averaged and incremented in the counter which is assigned to the corresponding temperature range every hour. This enables you to draw conclusions about the past operating conditions and thus the whole fitting.

The temperature ranges are divided up as follows:

<table>
<thead>
<tr>
<th></th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
<th>T5</th>
<th>T6</th>
<th>T7</th>
<th>T8</th>
<th>T9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range °C</td>
<td>≥ -30</td>
<td>≤ -15</td>
<td>&gt; 0</td>
<td>≥ 15</td>
<td>&lt; 30</td>
<td>≥ 30</td>
<td>&lt; 45</td>
<td>≤ 60</td>
<td>≤ 75</td>
</tr>
<tr>
<td>°F</td>
<td>≤ -22</td>
<td>&lt; 5</td>
<td>≤ 5</td>
<td>≥ 32</td>
<td>&lt; 59</td>
<td>≥ 86</td>
<td>&lt; 113</td>
<td>≤ 140</td>
<td>≤ 167</td>
</tr>
</tbody>
</table>
31 VENT1  Number of cycles pre-control valve 1 and
32 VENT2  Number of cycles pre-control valve 2
These two counters add up the control processes of the pre-control valves.

33 STORE  Store maintenance data
A store function is triggered by pressing the increment key for at least 5 seconds. Here the diagnostic data 7 to 17 are stored in a non-volatile memory as “Data of the last maintenance”. These diagnostic data are selected values, the changes of which can provide information on the mechanical wear of the valve.

Normally this function is operated via PDF, menu item Instrument → Store maintenance info. It is possible to compare the data of the last maintenance with the current data via PDM.

34 PRUP  Prediction up
35 PRDN  Prediction down
see chapter 4.7 page 117).

36 WT00 to  Number of operating hours in distance class WT00 to WT95
43 WT95

If the positioner is in automatic mode, statistics are constantly kept for how long a valve or a flap has been operated in which section of the setting range. To do this, the total setting range (0 to 100%) is divided into 8 sections (distance classes). The positioner continuously registers the current position and increments the operating hours meter assigned to the corresponding section (distance class) every hour. This allows returns to previous operating conditions and is particularly used to evaluate the control properties of the control circuit or the entire fitting.

The setting range is divided as follows:

<table>
<thead>
<tr>
<th>Setting range section</th>
<th>WT00</th>
<th>WT05</th>
<th>WT10</th>
<th>WT30</th>
<th>WT50</th>
<th>WT70</th>
<th>WT90</th>
<th>WT95</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 5 %</td>
<td>≥ 5 %</td>
<td>≥ 10 %</td>
<td>≥ 30 %</td>
<td>≥ 50 %</td>
<td>≥ 50 %</td>
<td>≥ 90 %</td>
<td>≥ 95%</td>
<td></td>
</tr>
<tr>
<td>≥ 5 %</td>
<td>&lt; 10%</td>
<td>&lt; 30%</td>
<td>&lt; 50%</td>
<td>&lt; 70%</td>
<td>&lt; 90%</td>
<td>&lt; 95%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

You can collectively set the 8 operating hours meters to zero by pressing the increment key (for at least 5 seconds).

TIP: As the distance classes at the end of the diagnostic menu have the numbers 36 to 43, in addition to the operating mode key press the decrement key repeatedly. This takes you quickly to the diagnostic numbers 36 to 43.
44 MA

Setpoint

You can display the current setpoint in mA here.

NOTE

All diagnostic values are updated every 15 minutes to a non-volatile memory, so that in the event of a loss of electrical power only the events of at most the last 15 minutes will be lost.

4.5.3 Online-Diagnosis

Some important variables and parameters are monitored continuously during operation. In the “Configuration” operating mode you can configure this monitoring so that the fault message output is activated when a certain event such as exceeding a limit value occurs.

Table 4-2, page 108 shows which events can activate the fault message output, how the parameters must be set for this event to be monitored, when the fault message disappears again and where the possible causes of the fault lie.

In automatic and manual operation response of the fault message output on the display shows which is the fault message trigger. The two digits at the bottom left indicate the corresponding error code. If several triggers occur at the same time, these are displayed cyclically. The instrument status which also contains all fault messages can be called via HART with the command #48.
Table 4-2 Events which can activate the fault message output

<table>
<thead>
<tr>
<th>Error code</th>
<th>Event</th>
<th>Parameter setting</th>
<th>Fault message disappears when ...</th>
<th>Possible causes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Remaining control error</td>
<td>always active</td>
<td>... the control error has disappeared again</td>
<td>Compressed air missing, actuator fault, valve fault (e.g. blockade).</td>
</tr>
<tr>
<td>2</td>
<td>Instrument not in automatic mode</td>
<td>47.(\text{FCT}) = (\text{nA}) or (\text{nAB})</td>
<td>... the instrument is brought into automatic mode</td>
<td>The instrument is configured or in manual operation.</td>
</tr>
<tr>
<td>3</td>
<td>Digital input DI1 or DI2 active</td>
<td>47.(\text{FCT}) = (\text{nAB}) and digital function BIN1 or BIN2 to &quot;on&quot;</td>
<td>... the digital input is no longer activated</td>
<td>The contact connected to the binary input has become active (e.g. stuff box monitoring, excess pressure, temperature switch).</td>
</tr>
<tr>
<td>4</td>
<td>Limit value Number of strokes exceeded</td>
<td>50.(\text{STRK}) (\neq) OFF</td>
<td>... the stroke counter is reset or the limit value increased</td>
<td>The total distance traveled by the actuator exceeded the set limit value.</td>
</tr>
<tr>
<td>5</td>
<td>Limit value change of direction exceeded</td>
<td>51.(\text{DCHG}) (\neq) OFF</td>
<td>... the change of direction counter is reset or the limit value increased</td>
<td>The number of changes of direction exceeded the set limit value.</td>
</tr>
<tr>
<td>6</td>
<td>Limit value bottom hard stop exceeded</td>
<td>52.(\text{ZERO}) (\neq) OFF 39.(\text{YCLS = do or up do})</td>
<td>... the deviation of the stop disappears or the instrument is re-initialized</td>
<td>Wear of the valve seat, deposits or foreign bodies in the valve seat, mechanical maladjustment, friction clutch maladjusted.</td>
</tr>
<tr>
<td>7</td>
<td>Limit value top hard stop exceeded</td>
<td>53.(\text{OPEN}) (\neq) OFF 39.(\text{YCLS = up or do})</td>
<td>... the deviation of the stop disappears or the instrument is re-initialized</td>
<td>Wear of the valve seat, deposits or foreign bodies in the valve seat, mechanical maladjustment, friction clutch maladjusted.</td>
</tr>
<tr>
<td>8</td>
<td>Limit value dead zone adaptation exceeded</td>
<td>54.(\text{DEBA}) (\neq) OFF 34.(\text{DEBA = Auto})</td>
<td>... the limit value is dropped below again</td>
<td>Increased stuffing box friction, mechanical lots of the position feedback</td>
</tr>
</tbody>
</table>

Explanations of column “Error codes”:

1. **Monitoring of control error**
   In automatic operation the error between setpoint and actual value is monitored continuously. The fault message is activated with unchanged control error according to the setting of the parameters 48.\(\text{TIM}\), monitoring time for setting the fault messages and 49.\(\text{LIM}\), response threshold of the fault message. As soon as the control error drops back below the response threshold, the fault message is reset.

2. **Monitoring automatic operation**
   A fault message is generated when the instrument is not in the automatic mode at the appropriate parameter setting "47.\(\text{FCT}\)". In this way the control system can be warned for example when the instrument has been switched to manual operation or Configuration on site.
3 Digital input DI1 or DI2 active
A fault message is generated when the digital input is activated at the the corresponding setting of the parameter "47. FCT", function of the fault message output and the parameter "42. BIN1", function digital input 1. This may be a switch for stuffing box monitoring, a temperature switch or a limit value switch for example.

Digital input 2 (on the alarm module option) can be configured in the same way.

4 Monitoring of number of strokes
5 Monitoring of number of changes of direction
The two values number of strokes and number of changes of direction are compared continuously with the limit values which are specified with the parameters "50. STRK" and "51. DCHG". The fault message output responds when exceeded. Both functions can be deactivated with the parameter setting "OFF".

6 Monitoring of the bottom hard stop (valve seat)
7 Monitoring of the top hard stop
Monitoring of the bottom hard stop is activated when the parameter "52. ZERO" has a value ≠ OFF. Errors of the valve seat can be detected with this function for example. Exceeding of the limit value may hint at deposits or foreign bodies in the valve seat. Exceeding the limit value may be caused by wear of the valve seat. Mechanical maladjustment of the position feedback may also trigger this error message.

Monitoring takes place every time the valve is in tight closing position. The current position is compared with the one determined during initialization as a bottom end stop. Activation of the tight closing bottom function (parameter "39. YCLS") is therefore a prerequisite.

Example: 3% is set as a value. Normally the setting 0% is adopted when closed. If a value >3% or <-3% is determined instead, a fault is reported.

The fault message remains activated until either a subsequent monitoring remains within the tolerance or a new initialization is performed. The deactivation of the monitoring ("52. ZERO"=OFF) also clears any existing fault message.

This monitoring function supplies no useful results when the stops have not been determined automatically in initialization but the limits set manually (manual initialization "5. INITM").

An appropriate diagnosis is made for the top hard stop. The limit value for this is set with the parameter 4. Activation of the tight closing top function (parameter "39. YCLS") is therefore a prerequisite.
8 Monitoring of the dead zone adaptation

If the dead zone increases unproportionally in operation in automatic adaptation of the dead zone (parameter DEBA = Auto) this points to an error in the system (e.g. a marked increase in stuffing box friction, play in the displacement detection, leakage). Therefore a limit value can be specified for this value (“54.\(^\text{DEBA}\)”, limit value for dead zone monitoring) which activates the fault message output when it is exceeded.

4.5.4 Fault correction

Diagnostics indicator

<table>
<thead>
<tr>
<th>In which operating mode did the fault occur?</th>
<th>see Table</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Initialization</td>
<td>1</td>
</tr>
<tr>
<td>• Manual mode and automatic mode</td>
<td>2 3 4 5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Under which circumstances and conditions did the fault occur?</th>
<th>see Table</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Wet environment (e.g. heavy rain or constant condensation)</td>
<td>2</td>
</tr>
<tr>
<td>• Vibrating fittings</td>
<td>2 5</td>
</tr>
<tr>
<td>• Under impact or shock (e.g. steam jets or breakaway flaps)</td>
<td>1</td>
</tr>
<tr>
<td>• Damp (wet) compressed air</td>
<td>2</td>
</tr>
<tr>
<td>• Dirty (contaminated with solid particles) compressed air</td>
<td>2 3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>When does the fault occur?</th>
<th>see Table</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Constantly (reproducibly)</td>
<td>1 2 3 4</td>
</tr>
<tr>
<td>• Sporadically (not reproducible)</td>
<td>5</td>
</tr>
<tr>
<td>• Usually after a certain operating period</td>
<td>2 3 5</td>
</tr>
</tbody>
</table>
### Fault description

#### (symptoms)

<table>
<thead>
<tr>
<th>Fault description</th>
<th>Possible cause(s)</th>
<th>Corrective actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIPART PS2 comes to a halt in RUN 1</td>
<td>• Initialization started from the final stop and • Reaction time of max. 1 min. not waited • Network pressure not connected or too low</td>
<td>• Up to 1 min. waiting time required • Do not start initialization from an end stop • Confirm network pressure</td>
</tr>
<tr>
<td>SIPART PS2 comes to a halt in RUN 2</td>
<td>• Transmission ratio selector and parameter 2 (YAGL) and true stroke did not correlate • Stroke on the lever incorrectly set • Piezo valve(s) do not switch (see Table 2)</td>
<td>• Check settings: • See leaflet: Figure Device view (7) and parameters 2 and 3 • Check stroke setting on the lever • see Table 2</td>
</tr>
<tr>
<td>SIPART PS2 comes to a halt in RUN 3</td>
<td>• Actuator positioning time too long</td>
<td>• Open restrictor fully and/or set pressure PZ(1) to the highest permissible value • Use booster if necessary</td>
</tr>
<tr>
<td>SIPART PS2 comes to a halt in RUN 5, does not reach FINISH (waiting time &gt; 5 min)</td>
<td>• Play in the positioner, actuator, fittings system</td>
<td>• Linear actuator: Check seating of the stud screw of the coupling wheel • Part-turn actuator: Check seating of the lever on the positioner shaft • Correct any other play between the actuator and the fittings</td>
</tr>
</tbody>
</table>

### Corrective actions

<table>
<thead>
<tr>
<th>Fault description</th>
<th>Possible cause(s)</th>
<th>Corrective actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPU test blinks in the display of the SIPART PS2 (ca. every 2 secs)</td>
<td>• Water in the valve manifold (from wet compressed air)</td>
<td>• At the early stages the fault can be corrected by subsequent operation with dry air (when necessary, in a temperature cupboard at 50 to 70 °C) • Otherwise: Repair (see Chapter 5, page 119)</td>
</tr>
<tr>
<td>Actuator cannot be moved in manual or automatic mode, or only in one direction</td>
<td>• Dampness in the valve manifold</td>
<td></td>
</tr>
<tr>
<td>Piezo valve(s) do not switch (no soft clicking can be heard when the + or – keys are pressed in manual mode)</td>
<td>• Screw between cover hood and the valve manifold is not tight or the hood is jammed</td>
<td>• Tighten screw, or release cause of jamming when necessary</td>
</tr>
<tr>
<td>Piezo valve(s) do not switch</td>
<td>• Dirt (swarf, particles) in the valve manifold</td>
<td>• Repair (see Chapter 5, page 119) or new device with integrated fine filter which can be replaced and cleaned</td>
</tr>
<tr>
<td></td>
<td>• Deposits on the contact(s) between the electronics board and the valve manifold can occur from abrasion through continuous stresses from strong vibrations</td>
<td>• Clean all contact surfaces with alcohol: when necessary bend the valve manifold contact springs back into place</td>
</tr>
</tbody>
</table>

---

Table 1

Table 2
### Operation

<table>
<thead>
<tr>
<th>Fault description (symptoms)</th>
<th>Possible cause(s)</th>
<th>Corrective actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actuator does not move</td>
<td>Compressed air &lt; 1.4 bar</td>
<td>Set inlet air pressure to &gt; 1.4 bar</td>
</tr>
<tr>
<td>Piezo valve(s) do not switch (although a soft clicking can be heard when the + or – keys are pressed in manual mode)</td>
<td>Restrictor(s) closed down (screw(s) at the right end stop)</td>
<td>Open restrictor screw(s) (see leaflet, Figure &quot;View of device (6)&quot;) by turning to the left</td>
</tr>
<tr>
<td>Dirt in the valve manifold</td>
<td></td>
<td></td>
</tr>
<tr>
<td>One piezo valve constantly switches in stationary automatic mode (constant setpoint) and in manual mode</td>
<td>Pneumatic leak in the positioner, actuator system, start leak test in RUN 3 (Initialization) !!!</td>
<td>Fix leak in the actuator and/or supply line</td>
</tr>
<tr>
<td>Dirt in the valve manifold (see above)</td>
<td></td>
<td>See above</td>
</tr>
</tbody>
</table>

Table 3

<table>
<thead>
<tr>
<th>Fault description (symptoms)</th>
<th>Possible cause(s)</th>
<th>Corrective actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>The two piezo valve constantly switch alternately in stationary automatic mode (constant setpoint), actuator oscillates around a middle point</td>
<td>Static friction on the packing glands of the fittings or actuator too high</td>
<td>Reduce static friction or increase dead zone of SIPART PS2 (parameter dEbA) until the oscillating movements stop.</td>
</tr>
<tr>
<td>Play in the positioner, actuator, fittings system</td>
<td>Linear actuator: Check seating of the stub screw of the coupling wheel</td>
<td></td>
</tr>
<tr>
<td>Actuator too fast</td>
<td>Increase positioning times by means of restrictor screws</td>
<td></td>
</tr>
<tr>
<td>SiPART PS2 does not drive the valve up to the end stop (at 20 mA)</td>
<td>Supply pressure too low</td>
<td>Increase supply pressure</td>
</tr>
<tr>
<td>Supply pressure too low</td>
<td>Load of the supply controller or system output too low; required load potential.</td>
<td>Intermediate burden converter</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Select 3/4 wire operation</td>
</tr>
</tbody>
</table>

Table 4
### Operation

<table>
<thead>
<tr>
<th>Fault description (symptoms)</th>
<th>Possible cause(s)</th>
<th>Corrective actions</th>
</tr>
</thead>
</table>
| • Zero point shifts sporadically (> 3 %) | • Such high accelerations have occurred through impact or shock that the friction clutch has shifted (e.g. through steam jets in the steam pipelines) | • Shut off the cause of the shocks  
• Reinitialize the positioner |
| • Device function breaks down totally: no display | • Insufficient electrical supply | • Check electrical supply |
|                         | With very high continuous stresses by vibrations, the following can occur:  
• Screws of the electrical terminals can loosen  
• The electrical terminals and/or electronic modules can be shaken loose | • Tighten screws and secure with sealing varnish  
• Repair at (see Chapter 5, page 119)  
• Prevention: Mount the SIPART PS2 on rubber metal |

Table 5

### 4.6 Meanings of other display texts

#### Notes on the tables:

- nn stands for variable numerical values
- € Fault symbol
- / (slash): the texts to the left and right of the slash flash alternately

#### Reports before initializing (first commissioning):

<table>
<thead>
<tr>
<th>Upper line</th>
<th>Lower line</th>
<th>Meaning/Cause</th>
<th>Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPU START</td>
<td>x</td>
<td>Report after connecting the electrical auxiliary power</td>
<td>• Wait</td>
</tr>
</tbody>
</table>
| P nn.n    | x         | Potentiometer voltage for non-initialized positioner (P manual mode) (Setting actual value in % of measurement range) | • Check using the "+" and "-" keys whether the overall travel can be traversed without ever "P----" being displayed  
• Perform initialization |
| P----     | x         | Measurement range exceeded, potentiometer is in the inactive zone, transmission ratio selector or effective lever arm are not matched to the travel | • Set transmission ratio selector to 90 degrees, in particular for part-turn actuators  
• Match effective arm length for linear actuators to measurement range |
| NOINI     | x         | Positioner not initialized | • Start initialization |

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## Messages during initialization:

<table>
<thead>
<tr>
<th>Upper line</th>
<th>Lower line</th>
<th>Meaning/Cause</th>
<th>Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>P----x</td>
<td></td>
<td>See above</td>
<td>See above</td>
</tr>
<tr>
<td>RUN 1</td>
<td>x</td>
<td>Initialization started, part 1 active (direction of control action being determined)</td>
<td>• Wait</td>
</tr>
<tr>
<td>RUN 2</td>
<td>x</td>
<td>Initialization part 2 active (travel check and determination of the end stops)</td>
<td>• Wait</td>
</tr>
<tr>
<td>RUN 3</td>
<td>x</td>
<td>Initialization part 3 active (determination and display of positioning times)</td>
<td>• Wait</td>
</tr>
<tr>
<td>RUN 4</td>
<td>x</td>
<td>Initialization part 4 active (determination the minimum positioning increment length)</td>
<td>• Wait</td>
</tr>
</tbody>
</table>
| RUN 5      | x          | Initialization part 5 active (optimization of the behavior on transients) | • Wait until "FINISH" is displayed (initialization completed successfully)  
• Press "operating mode" key briefly to acknowledge or longer to quit configuration mode |
| YEND1      | x          | only during manual initialization  
first end position can be moved to | • Move to first end position using the "+" or "−" key  
• Press "operating mode" key to acknowledge |
| YEND2      | only during manual initialization  
second end position can be moved to | • Move to second end position using the "+" or "−" key  
• Press "operating mode" key to acknowledge |
| RANGE      | x          | only during manual initialization  
End position or measurement span are outwith the permitted measurement range | • Using "+" and "−" keys move to the other end position and press "operating mode" key to acknowledge, or  
• Adjust friction clutch until "ok" is displayed and press "operating mode" key to acknowledge or  
• Interrupt initialization by pressing the "operating mode" key, switch to P manual mode and correct the travel and position sensing |
| ok         |            | permitted measurement range for end positions reached | • Press "operating mode" key to acknowledge, the remaining steps ("RUN1" to "FINISH") will run through automatically |
| RUN 1/ERROR| x          | Fault in RUN 1  
no movement e.g. no compressed air | • Ensure compressed air is sufficient  
• Open any choke(s)  
• Re-start initialization |
| ½ d___U    | x          | Bar display of the zero point  
Zero point is outwith the tolerance range | • With friction clutch set to "P 4.0" to "P 9.9" ( >0<)  
• Continue using the "+" or "−" key |
| SET MIDD    | x          | Friction clutch misaligned; "P 50.0" no displayed when arm horizontal | • For linear actuators, use the "+" and "−" keys to bring the arm to the correct angle on the spindle  
• Press "operating mode" key briefly to acknowledge (initialization will resume) |
<table>
<thead>
<tr>
<th>Upper line</th>
<th>Lower line</th>
<th>Meaning/Cause</th>
<th>Actions</th>
</tr>
</thead>
</table>
| 4 UP >     | x          | "UP" – tolerance range exceeded or inactive zone of potentiometer entered     | • Match effective arm length for linear actuators to measurement range, or set transmission ratio selector to 90 degrees  
|            |            |                                                                               | • Press "operating mode" key briefly to acknowledge  
|            |            |                                                                               | • Re-start initialization                                                              |
| 4 90_95    | x          | Only applies to part-turn actuators: travel is not within range 90 to 95%    | • Use the "+" and "-" keys to move into the range of 90 to 95%  
|            |            |                                                                               | • Press "operating mode" key briefly to acknowledge                                      |
| 4 U-d>     | x          | Measurement span "Up–Down" is insufficient                                   | • Reduce effective arm length for linear actuators or set transmission ratio selector to 33 degrees  
|            |            |                                                                               | • Press "operating mode" key briefly to acknowledge  
|            |            |                                                                               | • Re-start initialization                                                              |
| U nn.n     | x          | Display the positioning time "Up"                                             | • Wait, or  
| D->U       | x          |                                                                               | • To change the travel time interrupt initialization with the "-" key, or  
|            |            |                                                                               | • Activate the leakage test with the "+" key                                            |
| d nn.n     | x          | Display the positioning time "Down"                                          | • Wait, or  
| U->d       | x          |                                                                               | • To change the travel time interrupt initialization with the "-" key, or  
|            |            |                                                                               | • Activate the leakage test with the "+" key                                            |
| NOZZL      | x          | Actuator stationary (initialization interrupted with the "-" key during actuation speed display) | • Travel time can be adjusted by varying the choke(s)  
|            |            |                                                                               | • Use the "-" key to repeat the determination of the positioning speed  
|            |            |                                                                               | • Continue using the "+" key                                                           |
| TEst       | x          | Leakage test active initialization interrupted with the "+" key during travel-speed display | • Wait 1 minute  
| LEAKG      | x          |                                                                               | • Continue with the "+" key                                                            |
| nn.n       | x          | Value and units of results of the leakage test                              | • Remove leakage if value is too high.  
| oMIN       | x          |                                                                               | • Continue with the "+" key                                                            |
| nn.n       | x          | Initialization completed successfully, with display of the travel or positioning angle as appropriate | • Press "operating mode" key briefly to acknowledge or longer to quit configuration mode |
Reports on leaving "configuration" operating mode:

<table>
<thead>
<tr>
<th>Upper line</th>
<th>Lower line</th>
<th>Automatic</th>
<th>Manual mode</th>
<th>P manual mode</th>
<th>Meaning/Cause</th>
<th>Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cn VER</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td>Software version</td>
<td>Wait</td>
</tr>
<tr>
<td>Error</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td>Monotonicity transgression of the free characteristic line at support point &quot;n&quot;</td>
<td>Correct value</td>
</tr>
</tbody>
</table>

Reports on leaving "configuration" operating mode:

<table>
<thead>
<tr>
<th>Upper line</th>
<th>Lower line</th>
<th>Automatic</th>
<th>Manual mode</th>
<th>P manual mode</th>
<th>Meaning/Cause</th>
<th>Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPU START</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td>Message after applying auxiliary electrical power</td>
<td>Wait</td>
</tr>
<tr>
<td>HW / ERROR</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td>Fault in the hardware</td>
<td>Exchange electronics</td>
</tr>
<tr>
<td>NOINI</td>
<td>x</td>
<td></td>
<td>x</td>
<td></td>
<td>Positioner not initialized</td>
<td>Start initialization</td>
</tr>
<tr>
<td>nnn.n</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td>Setting actual value [in %] for initialized positioners. Flashing decimal point indicates communication with a class 2 master</td>
<td></td>
</tr>
<tr>
<td>AUTnn</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td>Automatic mode (nn = setpoint)</td>
<td></td>
</tr>
<tr>
<td>MANnn</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td>Manual mode (nn = setpoint)</td>
<td></td>
</tr>
<tr>
<td>oFL/127.9</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td>Display range exceeded. Possible causes:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td>• Friction clutch or</td>
<td>Adjust friction clutch so that when moving the actuator the actual value display remains within 0.0 to 100.0 or</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Transmission ratio selector changed or</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Positioner installed without reinitialization, having previously been fitted to another actuator</td>
<td></td>
</tr>
<tr>
<td>EXSTP</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td>Actuator stopped by binary input</td>
<td></td>
</tr>
<tr>
<td>EX UP</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td>Actuator moved by binary input to upper stop</td>
<td></td>
</tr>
<tr>
<td>EXDWN</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td>Actuator moved by binary input to lower stop</td>
<td></td>
</tr>
<tr>
<td>HTCNF</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>HART configuration is running</td>
<td></td>
</tr>
</tbody>
</table>
4.7 Optimization of the control data

The data automatically determined during initialization for control quality are optimized for short duration commands with small overshoots. In special cases (e.g. extremely small and specially quick actuators or when operating with boosters) it can however occur that these data need to be revised to achieve quick responses or heavy damping. The following six parameters are available for this purpose:

13 Pulse length up
14 Pulse length down

This determines for any sense of actuation the smallest drive movement pulse length. The optimum value depends heavy on the volume of the actuator. Small values will lead to small actuation increments and frequent actuator movements. Note that if the value is too small no movement will result. If actuator volumes are large, then it is better to use larger actuation increments. Note also that large actuation increments will still lead to large movements for small actuators.

17 Short step zone up
18 Short step zone down

The short step zone is the range in which the deviation from setpoint varies between the fast step zone and the dead band. In this zone the actuator is activated in pulses.

If the value is small, even small changes of setpoint will evoke relatively large positioning speeds and can thus lead to overshoots. If the value is large, the overshoots will be reduced, particularly on large changes of setpoint but will lead to slow positioning speeds, particularly as the target setpoint is approached.

34 Prediction up
35 Prediction down

These parameters modify the damping factor, changing the control dynamics.

If the value is small, responses will be quick but with overshoots. If the value is large, response will be slow but without overshoots.

During setup it is recommended that an automatic initialization is performed first, later changing positioner parameters to match any special requirements.

TIP: So as to have a fixed reference value, it is advantageous for special control optimization to set a fixed value for the dead zone (parameter DEBA) instead of "Auto".

The above parameters are usually selected from the diagnostics menu and activated for general adjustment by pressing the increment or decrement key. Any adjustment to a parameter will be immediately effective. This means the effect of the new values on the control results can be immediately tested.

On leaving the diagnostic menu the activation of the parameter for adjustment will be deactivated again.
The positioner is largely maintenance–free. The positioners are fitted with filters in the pneumatic connections as protection against coarse particles of dirt. If the pneumatic energy supply contains particles of dirt, the filters may clog and impair the function of the positioner. In this case the filters can be cleaned as follows.

**Positioner in metal housing and explosion proof version**

1. Switch off the pneumatic power supply and remove the pipes.
2. Remove the metal filters carefully from the holes and clean (e.g. with compressed air).
3. Insert the filters.
4. Re-connect the pipes and supply pneumatic energy.

**Positioner in plastic housing**

*Removal*

1. Switch off the pneumatic power supply and remove the pipes.
2. Unscrew the cover
3. Remove the three screws from the pneumatic connector strip.
4. Remove the filters and O-rings behind the connector strip.
5. Clean the filters (e.g. with compressed air).

*Installation*

6. First insert the filters in the recesses in the plastic housing and then place the O-rings on the filters.
7. Align the pneumatic connector strip on the two lugs and screw tight with the three self–tapping screws.

**Important:**

Make sure that the same thread is used. To do this turn the screws counterclockwise until they snap into the thread audibly. Only then should you tighten the screws.
8. Replace the cover and screw it tight.

9. Re-connect the pipes and supply pneumatic energy.

---

**DANGER**

Electrostatic charging must be prevented in hazardous areas. These could be caused by example when cleaning the positioner in plastic housing with a dry cloth.

---

**Repair/Upgrade**

Faulty equipment should be sent to the repair department with details of the fault and its origin. When ordering replacement equipment, please specify the serial number of the original equipment. You will find the serial number on the type plate.

Address of the responsible repair location, your contact, lists of spare parts etc. can all be found on the Internet, under:

www.siemens.com/automation/services&support or
www.automation.siemens.com/partner
Technical Data

General data for basic device 6DR50xx
   6DR51xx
   6DR52xx
   6DR53xx

(see following pages)
Technical Data

SIPART PS2 (all versions)

### General data
- **Travel range (linear actuators)**: 3...130 mm (0.12...5.12 inch) (angle of feedback shaft 16...90°)
- **Angle of rotation (part-turn actuators)**: 30...100°

#### Installation
- **On linear actuators**: Using attachment set 6DR4004-8V and where necessary with an additional lever arm 6DR4004-8L on actuators according to IEC 534-6 (NAMUR) with ribs, bars or flat face.
- **On part-turn actuators**: Using attachment set 6DR4004-8D on actuators with mounting plane according to VDI/VDE 3845 and DIN 3337: The required mounting console has to be provided on the actuator side; shaft with groove and female thread M6.

### Controller
- **Five-point switch**: Self-adjusting
- **Dead zone**
  - **dEbA = Auto**: Self-adjusting or can be set as fixed value
  - **dEbA = 0.1...10%**: Self-adjusting or can be set as fixed value
- **A/D converter**
  - **Scan time**: 10 ms
  - **Resolution**: ≤ 0.05%
  - **Transmission error**: ≤ 0.2%
  - **Temperature effect**: ≤ 0.1%/10 K (≤ 0.1%/18 °F)
- **Cycle time**
  - **20 mA/HART device**: 20 ms
  - **PA device**: 60 ms
  - **FF device**: 60 ms (min. loop time)
- **Binary input BE1** (terminals 9/10; electrically connected to the basic device)
- **Degree of protection**: IP65 to EN 60 529/NEMA 4x
- **Mounting position**: Any; pneumatic connections and exhaust opening not facing up in wet environment
- **CE marking**: Conformity as regards EMC Directive 89/336 EC in accordance with the following standards
- **EMC requirements**: EN 61326/A1 Appendix A.1 and NAMUR NE21 August 98

### Certificate and approvals
- **Classification according to pressure equipment directive (DRGL 97/23/EC)** For gases of fluid group 1, complies with requirements of article 3, paragraph 3 (sound engineering practice SEP)

### Pneumatic data
- **Power supply (inlet air)**
  - **Pressure**
    - 1.4 ... 7 bar (20.3 ... 101.5 psi): Sufficiently greater than max. drive pressure (actuating pressure)
  - **Air quality to ISO 8573-1**
    - **Solid particle size and density**: Class 2
    - **Pressure dew point**: Class 2 (min. 20 K (36 °F) below ambient temperature)
  - **Oil content**: Class 2
- **Unthrottled flow**
  - **Inlet air valve**
    - 2 bar (29 psi): 8.2 Nm³/h (36.1 USgpm)
    - 4 bar (58 psi): 13.7 Nm³/h (60.3 USgpm)
    - 6 bar (87 psi): 19.2 Nm³/h (84.5 USgpm)
  - **Outlet air valve**
    - 2 bar (29 psi): 8.2 Nm³/h (36.1 USgpm)
    - 4 bar (58 psi): 13.7 Nm³/h (60.3 USgpm)
    - 6 bar (87 psi): 19.2 Nm³/h (84.5 USgpm)
- **Valve leakage**
  - < 6⋅10⁻⁴ Nm³/h (0.0026 USgpm)
- **Throttle ratio**
  - Adjustable up to ∞ : 1
- **Power consumption in the controlled state**
  - < 3.6⋅10⁻² Nm³/h (0.158 USgpm)

### Types of actuators
- **In plastic casing**: Single-action and double-action
- **In aluminium casing**: Single-action
- **In flameproof casing**: Single-action and double-action
- **In stainless steel casing**: Single-action and double-action

#### Vibration resistance
- **Harmonic oscillations** (sine-wave) according to DIN EN 60062-2-6/05.96
  - 3.5 mm (0.14 inch), 2 ... 27 Hz
  - 3 cycles/axis
- **Bumping (half-sine)** to DIN EN 60062-2-29/03.95
  - 150 m/s² (492 ft/s²), 6 ms, 1000 shocks/axis
- **Noise (digitally controlled)** to DIN EN 60062-2-64/08.96
  - 10 ... 200 Hz, 1 (m/s²)²/Hz
  - 200 ... 500 Hz, 0.3 (m/s²)²/Hz
  - (0.98 (ft/s²)²/Hz)
  - 4 hours/axis
- **Recommended continuous duty range of the complete fitting**
  - ≤ 30 m/s² (≤ 98.4 ft/s²) without resonance sharpness

#### Weight, basic device
- **Plastic casing**: Approx. 0.9 kg (0.90 kg)
- **Aluminium casing**: Approx. 1.3 kg (1.30 kg)
- **Stainless steel casing**: Approx. 3.9 kg (3.90 kg)
- **EEEx d version**: Approx. 5.2 kg (11.46 lb)

#### Dimensions
- See Dimension drawing

#### Climate class to DIN EN 60721-3-4
- **Storage**
  - 1) 1K5, but -40 ... +80 °C (1K5, but -40 ... +176 °F)
- **Transport**
  - 1) 2K4, but -40 ... +80 °C (2K4, but -40 ... +176 °F)
- **Operation**
  - 2) 4K3, but -30 ... +80 °C (4K3, but -22 ... +176 °F)

#### Certificate and approvals
- **Classification according to pressure equipment directive (DRGL 97/23/EC)** For gases of fluid group 1, complies with requirements of article 3, paragraph 3 (sound engineering practice SEP)

#### Pneumatic data
- **Power supply (inlet air)**
  - **Pressure**
    - 1.4 ... 7 bar (20.3 ... 101.5 psi): Sufficiently greater than max. drive pressure (actuating pressure)
  - **Air quality to ISO 8573-1**
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- **Unthrottled flow**
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- **Valve leakage**
  - < 6⋅10⁻⁴ Nm³/h (0.0026 USgpm)
- **Throttle ratio**
  - Adjustable up to ∞ : 1
- **Power consumption in the controlled state**
  - < 3.6⋅10⁻² Nm³/h (0.158 USgpm)

#### Types of actuators
- **In plastic casing**: Single-action and double-action
- **In aluminium casing**: Single-action
- **In flameproof casing**: Single-action and double-action
- **In stainless steel casing**: Single-action and double-action

1) During commissioning at ≤ 0 °C (≤ 32 °F) make sure that the valves are flushed long enough with the dry medium.

2) At ≤ -10 °C the display refresh rate of the LCD is limited. Only T4 is permissible when using Iy module.

3) With EEx d version (6DR5.5...) the values are reduced by approx. 20%
## Technical Data

### SIPART PS2

<table>
<thead>
<tr>
<th>Protection Type</th>
<th>Basic device without Ex protection</th>
<th>Basic device with EEx-d protection (flameproof casing)</th>
<th>Basic device with EEx ia/ib protection</th>
<th>Basic device with EEx n protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explosion protection</td>
<td>Without</td>
<td>EEx d II 2 G EEx d Il C T6 Zone 1</td>
<td>EEx ia/ib II 2 G EEx ia/ib Il C T6 Zone 1</td>
<td>EEx n Il 3 G EEx n A L [L] II C T6 Zone 2</td>
</tr>
<tr>
<td>Mounting location</td>
<td>-30...+80 °C (-22...+176 °F)</td>
<td>-30...+80 °C (-22...+176 °F)</td>
<td>-30...+80 °C (-22...+176 °F)</td>
<td>-30...+50 °C (-22...+122 °F)</td>
</tr>
</tbody>
</table>

- Permissible ambient temperature for operation
- (for basic devices with EEx ia/ib and EEx n protection the following applies: At ≤ -10 °C (+14 °F) the display refresh rate of the LCD is limited. Only T4 is permissible when using Lx module.)

### Electrical data

#### Input

<table>
<thead>
<tr>
<th>Rated signal range</th>
<th>Current to maintain the power supply</th>
<th>Required load voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>4...20 mA</td>
<td>≥ 3.6 mA</td>
<td>U_b (corresponds to Ω at 20 mA)</td>
</tr>
</tbody>
</table>

- **Without HART (6DR50..)**
  - Typical: ≤ 6.36 V (corresponds to 318 Ω)
  - Max.: ≤ 6.48 V (corresponds to 324 Ω)
- **Without HART (6DR53..)**
  - Typical: ≤ 7.9 V (corresponds to 395 Ω)
  - Max.: ≤ 8.4 V (corresponds to 420 Ω)
- **With HART (6DR51..)**
  - Typical: ≤ 6.6 V (corresponds to 330 Ω)
  - Max.: ≤ 6.72 V (corresponds to 336 Ω)
- **With HART (6DR52..)**
  - Typical: ≤ 8.4 V (corresponds to 420 Ω)
  - Max.: ≤ 8.8 V (corresponds to 440 Ω)

#### Static destruction limit

<table>
<thead>
<tr>
<th>± 40 mA</th>
</tr>
</thead>
</table>

#### Internal capacitance C_i

- Without HART: ≤ 22 nF
- With HART: ≤ 7 nF

#### Internal inductance L_i

- Without HART: ≤ 0.12 mH
- With HART: ≤ 0.24 mH

#### For connection to power circuits with intrinsically safe

<table>
<thead>
<tr>
<th>U_o ≤ 30 V DC</th>
<th>I_k ≤ 100 mA</th>
<th>P ≤ 1 W</th>
</tr>
</thead>
<tbody>
<tr>
<td>U_i ≤ 30 V DC</td>
<td>I ≤ 100 mA</td>
<td></td>
</tr>
</tbody>
</table>
### Technical Data

**SIPART PS2**

<table>
<thead>
<tr>
<th>3-/4-wire device (terminals 2/4 and 6/8) (6DR52.. and 6DR53..)</th>
<th><strong>Basic device without Ex protection</strong></th>
<th><strong>Basic device with EEx-d protection (flameproof casing)</strong></th>
<th><strong>Basic device with EEx ia/ib protection</strong></th>
<th><strong>Basic device with EEx n protection</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>- Power supply $U_H$</td>
<td>$18 \ldots 35 \text{ V DC}$</td>
<td>$18 \ldots 35 \text{ V DC}$</td>
<td>$18 \ldots 30 \text{ V DC}$</td>
<td>$18 \ldots 30 \text{ V DC}$</td>
</tr>
<tr>
<td>- Current consumption $I_H$</td>
<td>$(U_H - 7.5 \text{ V})/2.4 \text{ kW [mA]}$</td>
<td>$(U_H - 7.5 \text{ V})/2.4 \text{ kW [mA]}$</td>
<td>$\leq 22 \text{ nF}$</td>
<td>$(U_H - 7.5 \text{ V})/2.4 \text{ kW [mA]}$</td>
</tr>
<tr>
<td>- Internal capacitance $C_i$</td>
<td>-</td>
<td>-</td>
<td>$\leq 0.12 \text{ mH}$</td>
<td>-</td>
</tr>
<tr>
<td>- Internal inductance $L_i$</td>
<td>-</td>
<td>-</td>
<td>intrinsically safe</td>
<td>-</td>
</tr>
<tr>
<td>- For connection to power circuits with</td>
<td></td>
<td></td>
<td>$U_o \leq 30 \text{ V DC}$</td>
<td>$I_i \leq 30 \text{ V DC}$</td>
</tr>
<tr>
<td>- Current input $I_W$</td>
<td>$4 \ldots 20 \text{ mA}$</td>
<td>$4 \ldots 20 \text{ mA}$</td>
<td>$4 \ldots 20 \text{ mA}$</td>
<td>$4 \ldots 20 \text{ mA}$</td>
</tr>
<tr>
<td>- Rated signal range</td>
<td>≤ 0.2 V (corresponds to 10 Ω)</td>
<td>≤ 0.2 V (corresponds to 10 Ω)</td>
<td>≤ 1 V (corresponds to 50 Ω)</td>
<td>≤ 1 V (corresponds to 50 Ω)</td>
</tr>
<tr>
<td>- Internal capacitance $C_i$</td>
<td>-</td>
<td>-</td>
<td>≤ 22 nF</td>
<td>-</td>
</tr>
<tr>
<td>- Internal inductance $L_i$</td>
<td>-</td>
<td>-</td>
<td>≤ 0.12 mH</td>
<td>-</td>
</tr>
<tr>
<td>- For connection to power circuits with</td>
<td>-</td>
<td>-</td>
<td>intrinsically safe</td>
<td>-</td>
</tr>
<tr>
<td>- Electrical isolation</td>
<td>between $U_H$ and $I_W$</td>
<td>between $U_H$ and $I_W$</td>
<td>between $U_H$ and $I_W$ (2 intrinsically safe circuits)</td>
<td>between $U_H$ and $I_W$</td>
</tr>
<tr>
<td>- Test voltage</td>
<td>840 V DC (1 s)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Connections</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Electric</td>
<td>Screw terminals 2.5 AWG28-12</td>
<td>Screw terminals 2.5 AWG28-12</td>
<td>Screw terminals 2.5 AWG28-12</td>
<td>Screw terminals 2.5 AWG28-12</td>
</tr>
<tr>
<td></td>
<td>Cable gland M20 or ¼&quot; NPT</td>
<td>Cable gland M20 or ¼&quot; NPT</td>
<td>Cable gland M20 or ¼&quot; NPT</td>
<td></td>
</tr>
<tr>
<td>- Pneumatic</td>
<td>Female thread G1/4 DIN 45141 or ¼&quot; 18 NPT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- External position sensor (potentiometer or NCS, as option)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- $U_o$</td>
<td>-</td>
<td>-</td>
<td>≤ 5 V</td>
<td>≤ 5 V</td>
</tr>
<tr>
<td>- $I_o$</td>
<td>-</td>
<td>-</td>
<td>≤ 75 mA</td>
<td>≤ 75 mA</td>
</tr>
<tr>
<td>- $I_s$</td>
<td>-</td>
<td>-</td>
<td>≤ 160 mA</td>
<td>≤ 160 mA</td>
</tr>
<tr>
<td>- $P_o$</td>
<td>-</td>
<td>-</td>
<td>≤ 120 mW</td>
<td>≤ 120 mW</td>
</tr>
<tr>
<td>- Maximum permissible external capacitance $C_o$</td>
<td>-</td>
<td>-</td>
<td>&lt; 1 μF</td>
<td>&lt; 1 μF</td>
</tr>
<tr>
<td>- Maximum permissible external inductance $L_o$</td>
<td>-</td>
<td>-</td>
<td>&lt; 1 mH</td>
<td>&lt; 1 mH</td>
</tr>
</tbody>
</table>
## Technical Data

### Option modules

<table>
<thead>
<tr>
<th>Without Ex protection</th>
<th>With Ex protection</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ex protection to EN 50 014 and EN 50 020</strong></td>
<td><strong>III 2G Ex ia/ib II T4/T5/T6</strong></td>
</tr>
<tr>
<td><strong>Mounting location</strong></td>
<td><strong>Zone 1</strong></td>
</tr>
<tr>
<td><strong>Permissible ambient temperature for operation</strong></td>
<td><strong>Zone 2</strong></td>
</tr>
<tr>
<td>(For devices with Ex protection: Only in conjunction with the basic device 6DR5... -E... Only T4 is permissible when using Iy module)</td>
<td><strong>-30 ... +80 °C (-22 ... +176 °F)</strong></td>
</tr>
<tr>
<td><strong>Ex protection to EN 50 014 and EN 50 020</strong></td>
<td><strong>T4: -30 ... +80 °C (-22 ... +176 °F)</strong></td>
</tr>
<tr>
<td>(For devices with Ex protection: Only in conjunction with the basic device 6DR5... -E... Only T4 is permissible when using Iy module)</td>
<td><strong>T5: -30 ... +65 °C (-22 ... +149 °F)</strong></td>
</tr>
<tr>
<td><strong>Mounting location</strong></td>
<td><strong>T6: -30 ... +50 °C (-22 ... +122 °F)</strong></td>
</tr>
</tbody>
</table>

### Electrical data

#### Alarm module

- Binary alarm outputs A1, A2 and alarm output

#### Signal status

- **High** (not responded)
- **Low** (responded)

- **Internal capacitance** C <i><sub>i</sub></i>
- **Internal inductance** L <i><sub>i</sub></i>

- **Power supply** U <i><sub>i</sub></i>

- **Connection to power circuits**

#### Binary input BE2

- **Electrical isolation**

### SIA module (not for Ex d version)

- **Limit transmitter with slot-type initiators and alarm output**
- **Ex protection**
- **Connection**
- **2 slot-type initiators**
- **Function**
- **Connection to power circuits with nominal voltage 8 V**
- **Current consumption:**
  - limit value not responded
  - limit value responded

- **Internal capacitance**
- **Internal inductance**
- **Electrical isolation**

### Additional Information

- **Alarm output**

---

**Note:** The technical specifications provided are subject to change without notice. Always refer to the latest version of the manual for the most accurate and up-to-date information.
## Technical Data

### Accessory modules

<table>
<thead>
<tr>
<th>Without Ex protection</th>
<th>With Ex protection</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Electrical data</strong></td>
<td></td>
</tr>
<tr>
<td>Explosion protection to EN 50014 and EN 50020</td>
<td>II 2G Ex ia/ib II C T4/T5/T6</td>
</tr>
<tr>
<td>Mounting location</td>
<td>Zone 1</td>
</tr>
<tr>
<td>Permissible ambient temperature for operation</td>
<td>T4: -30 ... +80 °C (-22 ... +176 °F)</td>
</tr>
<tr>
<td>(For devices with Ex protection: Only in conjunction with the basic device 6DR5... - E... Only T4 is permissible when using ( I_y ) module.)</td>
<td>T5: -30 ... +85 °C (-22 ... +185 °F), T6: -30 ... +50 °C (-22 ... +122 °F)</td>
</tr>
<tr>
<td><strong>Electrical isolation</strong></td>
<td>Electrically isolated from the basic device</td>
</tr>
<tr>
<td><strong>Nominal signal range ( i )</strong></td>
<td>4 ... 20 mA, short-circuit-proof</td>
</tr>
<tr>
<td><strong>Power supply ( U_{in} )</strong></td>
<td>+12 ... +30 V</td>
</tr>
<tr>
<td><strong>External load ( R_{ext} ) [kW]</strong></td>
<td>( \leq (U_{in} \text{ [V]} - 12 \text{ V}) / i \text{ [mA]} )</td>
</tr>
<tr>
<td><strong>Temperature effect</strong></td>
<td>( \leq 0.1%/10 \text{ K} ) (( \leq 0.1%/18 \text{ °F} ))</td>
</tr>
<tr>
<td><strong>Resolution</strong></td>
<td>( \leq 0.1% )</td>
</tr>
<tr>
<td><strong>Residual ripple</strong></td>
<td>( \leq 1% )</td>
</tr>
<tr>
<td><strong>For connection to power circuits with Intrinsically safe:</strong></td>
<td>( U_i \leq 30 \text{ V DC} ), ( I_i \leq 100 \text{ mA} ), ( P_i \leq 1 \text{ W} ) (only T4)</td>
</tr>
<tr>
<td><strong>Electrical isolation</strong></td>
<td>Electrically isolated from the basic device</td>
</tr>
<tr>
<td><strong>Test voltage</strong></td>
<td>840 V DC, 1 s</td>
</tr>
<tr>
<td><strong>NCS sensor</strong></td>
<td>(not for Ex d version)</td>
</tr>
<tr>
<td><strong>Position range</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Linear actuator</strong></td>
<td>3 ... 130 mm (0.12 ... 5.12 inch), to 200 mm (7.87 inch) on request</td>
</tr>
<tr>
<td><strong>Part-turn actuator</strong></td>
<td>30° ... 100°</td>
</tr>
<tr>
<td><strong>Linearity (after correction by SIPART PS2)</strong></td>
<td>( \pm 1% )</td>
</tr>
<tr>
<td><strong>Hysteresis</strong></td>
<td>( \pm 0.2% )</td>
</tr>
<tr>
<td><strong>Continuous working temperature</strong></td>
<td>-40 ... +85 °C (-40 ... +185 °F), extended temperature range on request</td>
</tr>
<tr>
<td><strong>Degree of protection of casing</strong></td>
<td>IP68/NEMA 4X</td>
</tr>
</tbody>
</table>
Scope of Delivery

The positioner and its options modules are delivered as separate units and in different versions. Positioners and options modules for operation in hazardous areas and non-hazardous areas are available. These versions are identified respectively by a special rating plate.

WARNING

In the combination of components it must be ensured that only positioners and options modules are combined which are approved for the respective area of application. This applies especially for safe operation of the positioner in areas in which the atmosphere is potentially explosive (zone 1 and 2). The instrument categories (2 and 3) of the instrument itself and those of its options must be observed.
# Scope of delivery

## 7.1 Ordering data

### Selection and Ordering Data

<table>
<thead>
<tr>
<th>Order No.</th>
<th>SIPART PS2, PS2 PA and PS2 FF electropneumatic positioner</th>
</tr>
</thead>
<tbody>
<tr>
<td>6DR5127</td>
<td></td>
</tr>
</tbody>
</table>

### Design

- **without HART (4 to 20 mA)**
  - Two-wire, three-wire, four-wire
  - Two-wire
  - Three-wire
  - Four-wire
- **with HART, without explosion protection** (except EEx d)
  - Two-wire
  - Three-wire
  - Four-wire
- **with HART, with explosion protection**
  - Two-wire
  - Three-wire
  - Four-wire

### Customer-specific design

- Without
- Instruction manual
  - German/English
  - French/Spanish/Italian
- Attached gauge block assembly
  - Without
  - Single G¼
  - Double G¼
  - Single NPT
  - Double NPT
- VDI/VDE 3847

### Housing

- Plastic
- Aluminium: only single-action
- Stainless steel: not for EEx d version: not FM/CSA
- Aluminium: EEx d casing (flame-proof)¹

### Explosion protection

- Without
- With explosion protection EEx ia/ib or EEx d (CENELEC/FM/CSA)¹
- With explosion protection EEx n (CENELEC)

### Connection thread electric/pneumatic

- M20 x 1.5 / G1/4
- 1/2" NPT / 1/4" NPT
- 1/2" NPT / G1/4
- M25 x 1.5 / G1/4" (EEx d version only)¹
- PROFIBUS plug M12 / G1/4
- PROFIBUS plug M12 / N1/4
- VDI/VDE 3847

### Limit monitor

- Built-in, incl. 2nd cable gland
- Without
- Alarm module: electronic (6DR4004-A)
- SI module: slot initiators (6DR4004-G), not with EEx d version

### Option modules

- Built-in, incl. 2nd cable gland
- Without
- Iy module for position feedback (4 ... 20 mA) (6DR4004-J)
- EMC filter module for external position sensor (C73451-A430-D23), not with EEx d version
- Iy module and EMC filter module for external position sensor, not with EEx d version

---

¹ Available ex stock

\[ \]
7.2 Scope of delivery of standard controller

<table>
<thead>
<tr>
<th>Versions</th>
<th>Housing</th>
<th>Valve</th>
<th>Ex-protection</th>
<th>Order numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIPART PS2</td>
<td>Plastic housing</td>
<td>single action</td>
<td>non Ex</td>
<td>6DR5010-xNxxx-0AA0</td>
</tr>
<tr>
<td>2L without</td>
<td>Plastic housing</td>
<td>double action</td>
<td>non Ex</td>
<td>6DR5020-xNxxx-0AA0</td>
</tr>
<tr>
<td>HART</td>
<td>Metal housing</td>
<td>single action</td>
<td>non Ex</td>
<td>6DR5011-xNxxx-0AA0</td>
</tr>
<tr>
<td>SIPART PS2</td>
<td>Plastic housing</td>
<td>single action</td>
<td>CENELEC/FM</td>
<td>6DR5010-xExxx-0AA0</td>
</tr>
<tr>
<td>2L without</td>
<td>Plastic housing</td>
<td>double action</td>
<td>CENELEC/FM</td>
<td>6DR5020-xExxx-0AA0</td>
</tr>
<tr>
<td>HART</td>
<td>Metal housing</td>
<td>single action</td>
<td>CENELEC/FM</td>
<td>6DR5011-xExxx-0AA0</td>
</tr>
<tr>
<td>SIPART PS2</td>
<td>Explosion proof</td>
<td>single action</td>
<td>CENELEC/FM</td>
<td>6DR5015-xExxx-0AA0</td>
</tr>
<tr>
<td>2L with HART</td>
<td>Explosion proof</td>
<td>double action</td>
<td>CENELEC/FM</td>
<td>6DR5025-xExxx-0AA0</td>
</tr>
<tr>
<td>SIPART PS2</td>
<td>Plastic housing</td>
<td>single action</td>
<td>non Ex</td>
<td>6DR5110-xNxxx-0AA0</td>
</tr>
<tr>
<td>4L with HART</td>
<td>Plastic housing</td>
<td>double action</td>
<td>non Ex</td>
<td>6DR5120-xNxxx-0AA0</td>
</tr>
<tr>
<td>SIPART PS2</td>
<td>Metal housing</td>
<td>single action</td>
<td>non Ex</td>
<td>6DR5111-xNxxx-0AA0</td>
</tr>
<tr>
<td>4L without</td>
<td>Plastic housing</td>
<td>single action</td>
<td>CENELEC/FM</td>
<td>6DR5210-xExxx-0AA0</td>
</tr>
<tr>
<td>HART</td>
<td>Plastic housing</td>
<td>double action</td>
<td>CENELEC/FM</td>
<td>6DR5220-xExxx-0AA0</td>
</tr>
<tr>
<td>SIPART PS2</td>
<td>Explosion proof</td>
<td>single action</td>
<td>CENELEC/FM</td>
<td>6DR5215-xExxx-0AA0</td>
</tr>
<tr>
<td>4L without</td>
<td>Explosion proof</td>
<td>double action</td>
<td>CENELEC/FM</td>
<td>6DR5225-xExxx-0AA0</td>
</tr>
<tr>
<td>SIPART PS2</td>
<td>Plastic housing</td>
<td>single action</td>
<td>non Ex</td>
<td>6DR5310-xNxxx-0AA0</td>
</tr>
<tr>
<td>4L without</td>
<td>Plastic housing</td>
<td>double action</td>
<td>non Ex</td>
<td>6DR5320-xNxxx-0AA0</td>
</tr>
<tr>
<td>HART</td>
<td>Metal housing</td>
<td>single action</td>
<td>non Ex</td>
<td>6DR5311-xNxxx-0AA0</td>
</tr>
</tbody>
</table>

2L corresponds to two-wire operation
4L corresponds to four-wire-operation
-x stands for sub-variant

7.3 Scope of delivery of options

<table>
<thead>
<tr>
<th>Option</th>
<th>Order number</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIA module non Ex</td>
<td>6DR4004-8G</td>
</tr>
<tr>
<td>SIA module Ex (CENELEC / FM) ¹²</td>
<td>6DR4004-6G</td>
</tr>
<tr>
<td>Alarm module non Ex</td>
<td>6DR4004-8A</td>
</tr>
<tr>
<td>Alarm module Ex (PTB)¹</td>
<td>6DR4004-6A</td>
</tr>
<tr>
<td>Alarm module Ex (FM)²</td>
<td>6DR4004-7A</td>
</tr>
<tr>
<td>Jy-module non Ex</td>
<td>6DR4004-8J</td>
</tr>
<tr>
<td>Jy-module Ex (PTB)¹</td>
<td>6DR4004-6J</td>
</tr>
<tr>
<td>Jy-module Ex (FM)²</td>
<td>6DR4004-7J</td>
</tr>
</tbody>
</table>

¹ EC-type examination certificates
² Approval Reports of Factory Mutual System
### 7.4 Scope of delivery of accessories

<table>
<thead>
<tr>
<th>Accessories</th>
<th>Order number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting kit set linear actuators IEC 534 – 6 including lever arm for 3 to 35 mm way</td>
<td>6DR4004-8V</td>
</tr>
<tr>
<td>Additional lever for &gt; 35 to 130 mm way</td>
<td>6DR4004-8L</td>
</tr>
<tr>
<td>Mounting kit part-turn actuators VDI/VDE 3845</td>
<td>6DR4004-8D</td>
</tr>
<tr>
<td>Solenoid valve block for SAMSON actuator (integrated mounting)</td>
<td>6DR4004-1C</td>
</tr>
<tr>
<td>Manometer block single acting</td>
<td>6DR4004-1M</td>
</tr>
<tr>
<td>Manometer block double acting</td>
<td>6DR4004-2M</td>
</tr>
<tr>
<td>Solenoid valve block single acting (NAMUR)</td>
<td>6DR4004-1B</td>
</tr>
<tr>
<td>Mounting set for SAMSON actuator (integrated mounting)</td>
<td>6DR4004-8S</td>
</tr>
<tr>
<td>NCS-Sensor</td>
<td>6DR4004- _ N _ _ 0</td>
</tr>
<tr>
<td>not explosion protected</td>
<td>6DR4004-8N</td>
</tr>
<tr>
<td>explosion-protected</td>
<td>6DR4004-6N</td>
</tr>
<tr>
<td>cable length 6 m</td>
<td>6DR4004- _ NN</td>
</tr>
<tr>
<td>for part-turn actuators</td>
<td>6DR4004- _ N _ 10</td>
</tr>
<tr>
<td>for linear actuators up to 14 mm</td>
<td>6DR4004- _ N _ 20</td>
</tr>
<tr>
<td>EMC filter module</td>
<td>C73451-A430-D23</td>
</tr>
<tr>
<td>External position detection system</td>
<td>C73451-A430-D78</td>
</tr>
<tr>
<td>Operating software SIMATIC PDM</td>
<td>on request</td>
</tr>
</tbody>
</table>
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<th>Title</th>
<th>Issue by</th>
<th>Order no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>/1/</td>
<td>Industrial Communication for Automation and Devices</td>
<td>Siemens AG</td>
<td>E86060–K6710–A101–B4–7600</td>
</tr>
<tr>
<td></td>
<td>Catalog IK PI · 2005</td>
<td></td>
<td></td>
</tr>
<tr>
<td>/2/</td>
<td>Field Instruments for Process Automation</td>
<td>Siemens AG</td>
<td>E86060–K6201–A101–A6–7600</td>
</tr>
<tr>
<td></td>
<td>Catalog FI 01 · 2005</td>
<td></td>
<td></td>
</tr>
<tr>
<td>/3/</td>
<td>SIMATIC PCS 7 Process Control System</td>
<td>Siemens AG</td>
<td>E86060–K4678–A111–A9–7600</td>
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<td>Catalog ST PCS 7 · 2005</td>
<td></td>
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