**Electropneumatic Positioner
SIPART PS2 PA**

6DR55xx

sipart

SIEMENS

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SIPART PS2 PA

6DR55xx

Edition 03/2006

Manual

Electropneumatic Positioner for
Linear and Part–Turn Actuators

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Contents

Information for the operator

<div style="text-align: right; font-size: large;">**0**</div>

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 n in a metal or plastic housing

- SIPART PS2 EEx d in flameproof enclosure (EEx d)

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

Scope of delivery, see chapter 8, page 167.

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 imminently 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 safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in property damage.

NOTICE

used without the safety alert symbol indicates a potential situation which, if not avoided, may result in an undesireable result or state.

☞

NOTE

highlights important information on the product, using the product, or part of the documentation that is of particular importance and that will be of benefit to the user.

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

The instrument is designed for connection to operate voltage or 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 EC type examination certificate valid in your country.

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

WARNING

The device may not be operated as long as the quick start guides are inside the housing.

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 page 45 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 instructions are a constituent part of the enclosed CD "sipartp ps2 POSITIONERS" (order number A5E00214567). The manual and further documentations are 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.

If you need more information or have particular problems which are not covered sufficiently by the operating instructions, contact your local Siemens office. You will find your local Siemens office on the Internet under:

www.siemens.com/processinstrumentation

Click on "Contact" and select your closest town.

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 8, page 167.

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 Chapter 7 page 161 "Technical Data").

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.

Introduction

<div style="text-align: right; font-size: 3em;">**1**</div>

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.

The positioner together with the PROFIBUS PA communications interface are components in a digital process automation system. It communicates with the master as a slave via the PROFIBUS PS field bus. The field bus is used not only for communication but also to supply the positioner with electrical power.

Purpose

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

- with linear actuator (figure 1, page 15) or
- with part–turn actuator VDI/VDE 3845 (figure 2, page 15)

Different mounting types are available for linear actuators:

- NAMUR or IEC534
- 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

Degree of protection

The device is designed with IP66/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.
Explosion proof type "n" versions can be used in explosion hazard zone 2 areas.

SIL applications

The positioners (version 6DR551* for single acting actuators) 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 part 1–7 and IEC 61511 part 1–3. For this the SIL safety instructions in the "SIL Safety Manual (PA/FF)" order number A5E00489773 must be followed.

Options

The positioner can be expanded with various options modules (chapter 2.6, page 31). The following modules are available in all:

- I_y module: Two–wire current output 4 to 20 mA for position feedback

- Alarm module: three digital outputs and 1 binary input

- SIA module: one binary output for fault messages, two binary outputs for limit value alarms

- Mechnical limit switch module: one binary output for the output of a group error message, two switches for signalling two limit values that can be set mechanically.

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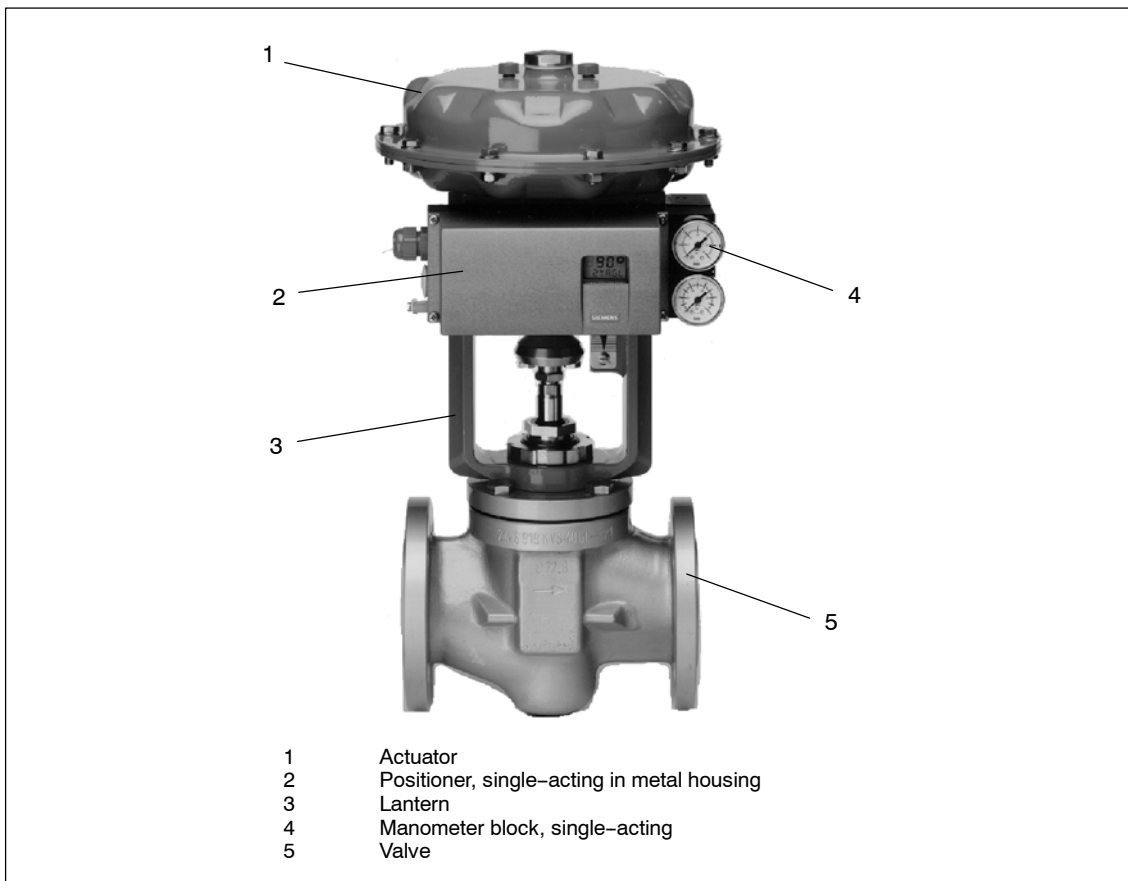
Figure 1   Positioner mounted on **linear actuator** (single–acting)

1	Positioner in plastic housing
2	Part–turn actuator
3	Manometer block, double–acting
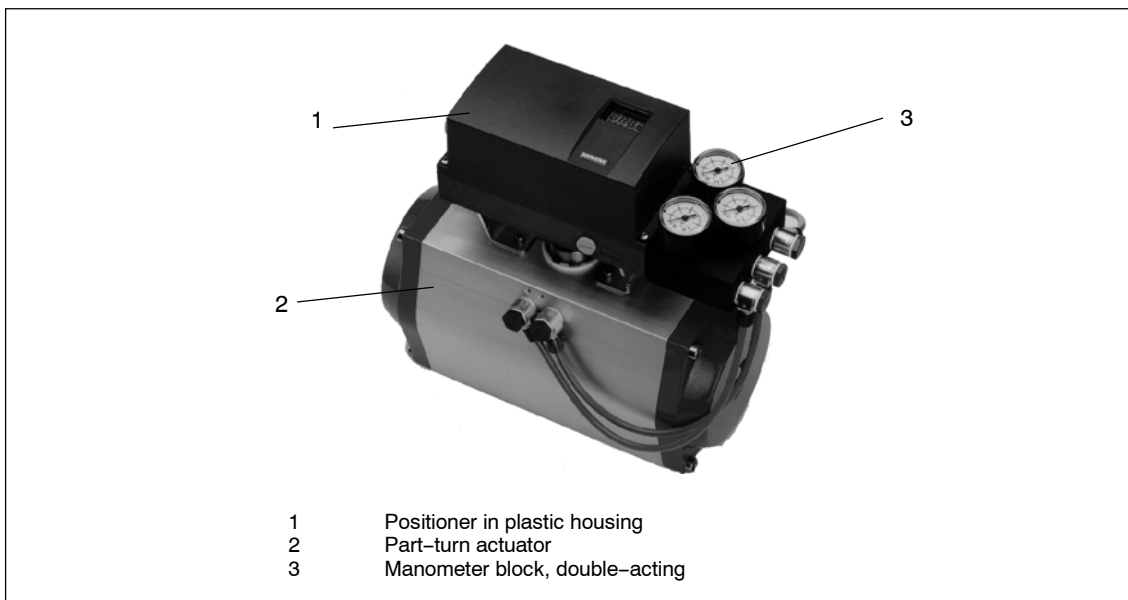
Figure 2   Positioner mounted on **part–turn actuator** (double–acting)

1	Actuator
2	Positioner, single–acting in explosion proof housing
3	Lantern
4	Manometer block, single–acting
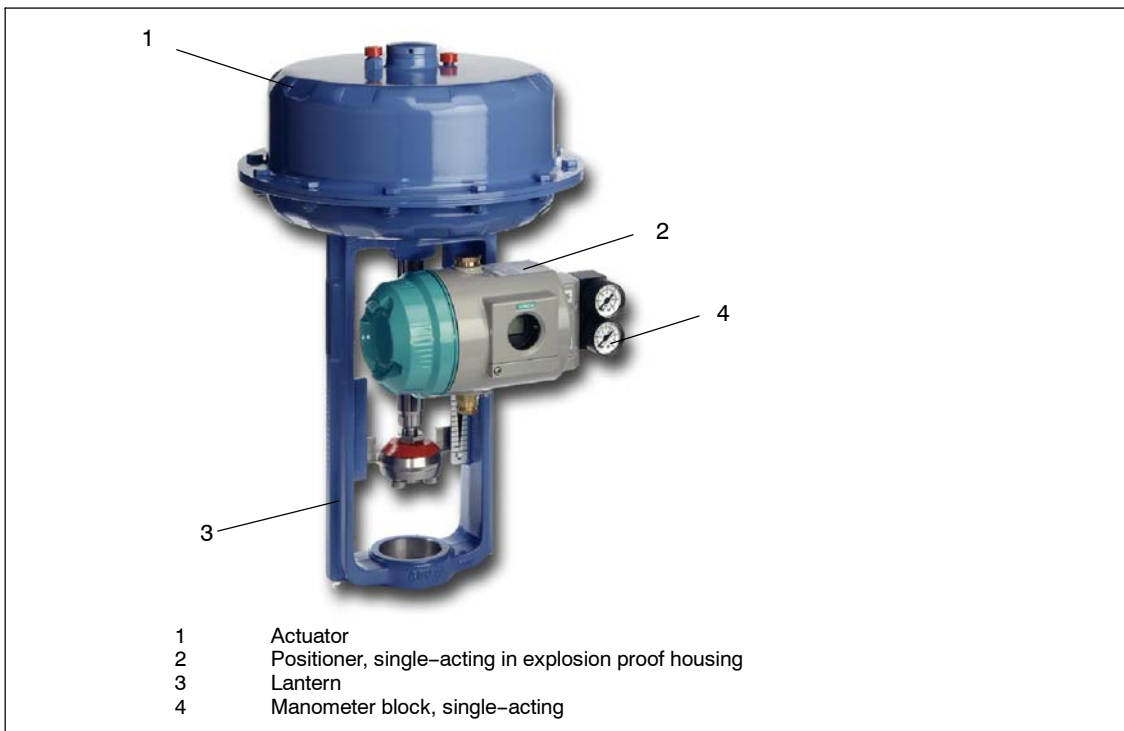
Figure 3   **Explosion proof** positioner mounted on **linear actuator** (single–acting)

1	Positioner double–acting in explosion proof housing
2	Part–turn actuator
3	Manometer block, double–acting
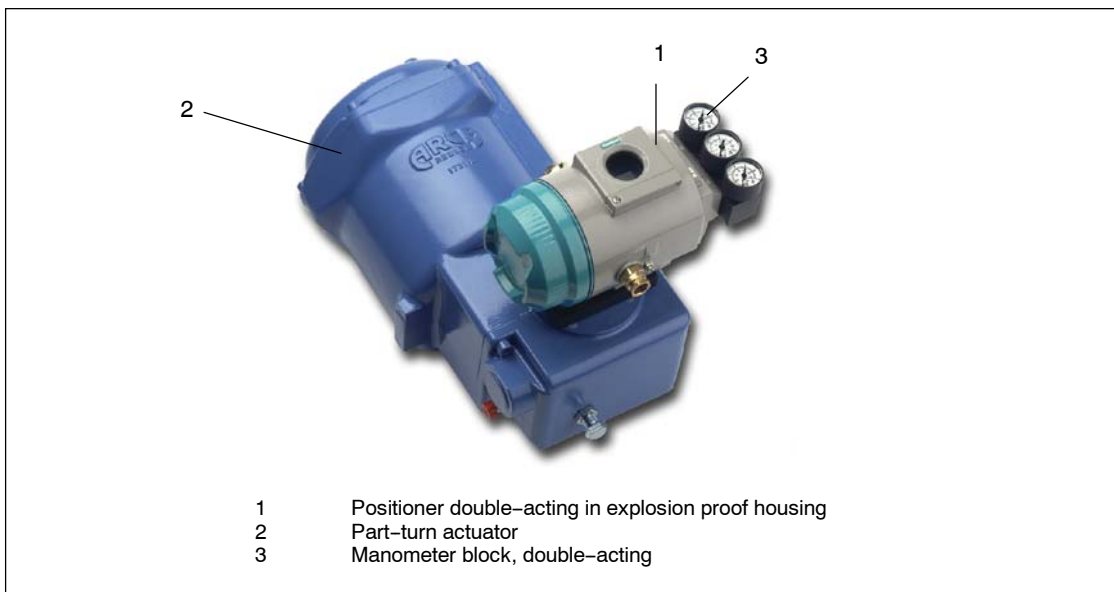
Figure 4   **Explosion proof** positioner mounted on **part–turn actuator** (double–acting)

1.2   General information regarding PROFIBUS

The PROFIBUS PA (PA = **P**rocess **A**utomation) is a variant of the PROFIBUS–DP (DP = Decentral Peripheral) which is widely used in manufacturing engineering.

The PROFIBUS (**Pro**cess **Fi**eld **Bus**) is an open communication system for automation engineering and thousands are used all over the world. It is specified in the European standard EN 50170.

1.2.1 Transmission method

The PROFIBUS PA has a special transmission method and therefore satisfies the requirements of process automation and manufacturing engineering. This transmission method is defined in the international standard IEC61158–2. The low transmission speed reduces the power loss compared to the PROFIBUS–DP and therefore enables an intrinsically safe technique for use in hazardous areas.

1.2.2 Topology

The bus topology can, to a large extent, be freely selected so that line, star and tree structures are possible, as well as mixtures of these. All kinds of field devices such as transformers, actuators, analyzers, etc. can be connected to the PROFIBUS PA

The main advantage is in:

- the saving of installation costs

- the possibility of more extensive diagnostics with an increase in the availability of system parts

- the possibility of automatic tracing of system documentation

- the possibility of system optimization in operation

In an automation system, several PROFIBUS PA channels are usually connected to the fast PROFIBUS–DP with coupling units. The process control system is also linked to this.

Both bus systems use a uniform protocol layer. This makes the PROFIBUS PA a communication–compatible extension of the PROFIBUS–DP into the field.
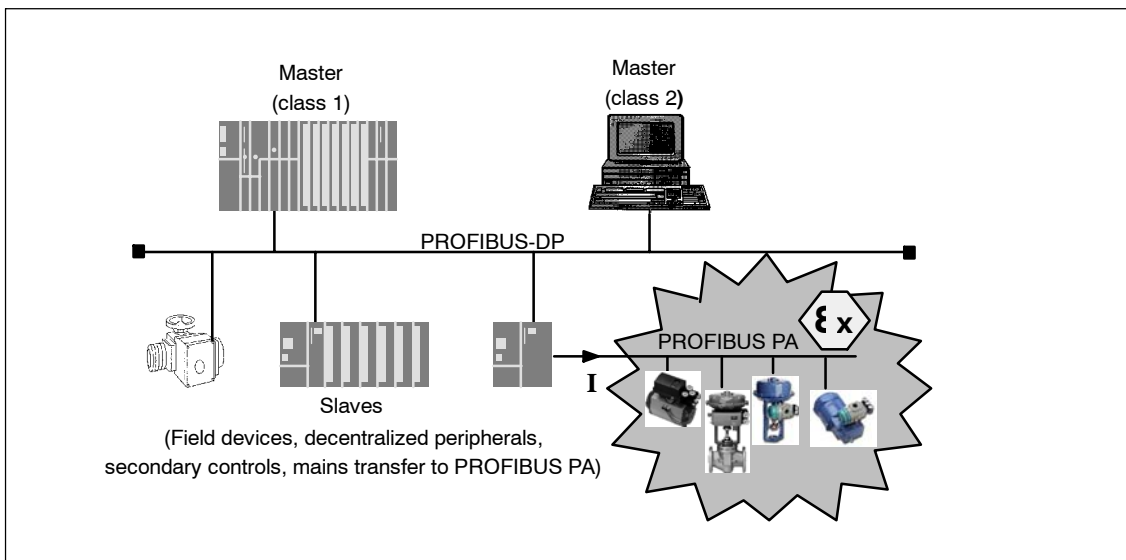
Figure 5   Typical PROFIBUS automation system

Figure 5 shows the section of a typical PROFIBUS automation system. The control system consists of two masters with distributed tasks.

The class 1 master looks after the control and regulation functions, while the class 2 master enables operating and monitoring functions. A cyclic exchange of measuring and setting data takes place between master 1 and the field devices. Parallel to this data, the status data of the field devices is transmitted to and evaluated in the class 1master. No field device parameters are set or other device information read during cyclic operation.

The information necessary for establishing communication is available to the control system from the stored, device–specific device master data (GS*) files. The files are available on the Internet at:

www.siemens.com/sipartps2

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

One or more class 2 masters can access the field devices acyclically in addition to the cyclic mode. With this communication type further information can be fetched from the devices or settings made in the devices.

1.2.3 Properties of the PROFIBUS PA

The PROFIBUS PA enables bi–directional communication between a bus master and the field devices via a shielded two–wire line. At the same time the power is supplied to the two–wire field devices on the same lines.

1.2.4 Profile

Supplementary to the EN standard 50170, the PNO (PROFIBUS Userorganisation) has defined the functionality of the individual field device types in a so–called profile description. This profile defines minimum functional requirements and optional extensions. The device–internal Device Management supplies all the basic information necessary for finding the profile parameters to the control system configuration tool. With this, a parametering tool can operate all profile–conforming devices regardless of type and manufacturer.

Depending on the size of the system and thus the number of field devices and the required timing, the system must be implemented with one or more PROFIBUS PA channels. A PROFIBUS PA channel consists of the components shown in Figure 6.
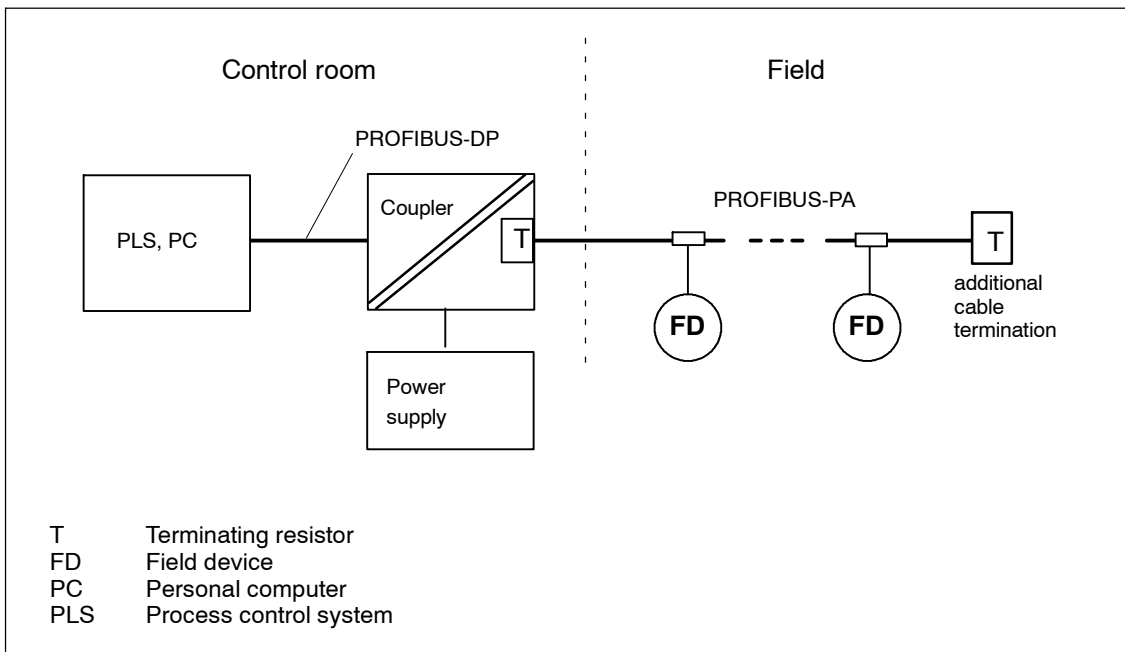
Figure 6   PROFIBUS PA architecture

1.2.5 Interfacing

The central process control system PLS or, in the case of low requirements, a PC, is responsible for the control.

As a rule the signal conversion DP/PA, bus feeding and bus termination functions are combined in a coupling module. Depending on the number of PROFIBUS PA field devices to be operated in the automation system and the required timing, a DP/PA coupler or, in the case of higher requirements, a more powerful DP/PA link is used.

An additional terminating resistor T must be fitted at the far end of the bus for transmission–technical reasons. When using the recommended bus cable, the theoretically possible line length (sum of all line sections) is a maximum of 1900 mm. In addition, the voltage drop over the lines supplying the field devices must be taken into account in the planning.

However, the current requirements of the individual users and voltage drop on the cable must also be taken into account in the planning. The individual field devices FD can be connected almost anywhere in the bus system. Further information can be found in the "PROFIBUS PPNO Guide A".

DP/PA–coupler or DP/PA–link are supplied by a power supply unit with SELV (**S**afety **E**xtra **L**ow **V**oltage). This power supply must have adequate reserves for bridging brief power failures.

The maximum number of devices that can be connected to a bus channel depends on their current consumption and the respective conditions of use. When operating in a safe area, the couplers/links can feed up to 400 mA into the bus.

In zones subject to explosion hazard, intrinsic safety is only ensured if the maximum power fed into the bus does not exceed certain voltage and current values. See chapter 7 "Technical Data" (page 161) device in intrinsically safe version.

WARNING

To power the intrinsically safe PROFIBUS only certified power supply units (DP/PA couplers or links) must be used. See the EC–Type Examination Certificate "for use in Potentially Explosive Atmospheres".

When explosion proof versions of positioners are used in areas where the atmosphere is potentially explosive, they may be supplied with auxiliary electrical power only within the enclosed housing.

The openings for the electronic connections must be executed with EEx–d–certified cable glands or sealed with EEx–d–certified plugs, or the "Conduit Tube System" must be used to provide an explosion barrier at a maximum distance of 46 cm (18 inches) from the housing.

The number of devices which can be connected to a bus channel can be determined from the maximum current consumption of the devices connected (according to standards $\geq$ 10 mA per device) and the available current. A current reserve should be planned for safety reasons, otherwise there is a risk that a defective device could overload the bus with its increased current consumption and the power supply and communication with all unaffected users could collapse. The power reserve quantity depends on the current increase in the event of an error specified by the manufacturer.

Every device has its own address to distinguish between the connected process devices.

Before operation make sure that the positioner addresses of two or more field devices are set on the bus. So that the addresses are unique, each address must only be assigned once. In principle, an address range from 1 to 125 is possible. In its as–supplied state, address 126 is set. The lower addresses are usually assigned to the masters in PROFIBUS systems. We therefore recommend starting address assignment for the positioners with 30.

The address setting is made either on the positioner using operating keys or via the bus with the SIMATIC PDM software. In the latter case, a new positioner is always connected to the bus and the new address set via software. After that, the next positioner is connected to the bus and the same procedure followed.

We recommend that you write the set address on the positioner with a permanent felt–tip pen.

For more detailed information about the components, assembly guidelines and configuration, see the technical description of the field technology package /2/.

Design and method of operation

<div style="text-align: right; font-size: 3em; font-weight: bold;">2</div>

The following chapter describes the mechanical and electrical design, the instrument components and method of operation of the positioner.

2.1   Overview

Introduction

The electropneumatic positioner forms a control system in connection with an actuator. The current position of the positioner is detected by a servo potentiometer and fed back as actual value x. In addition a separate sensor can be fitted to the positioner for purposes of position detection. The setpoint and actual value are output simultaneously on the display.

The setpoint is set by the control system and passed to the positioner by the PROFIBUS PA digitally.

The PROFIBUS PA variant of the positioner differs from previous versions in the bus interface. The basic functions of the positioner including operation and display are virtually unchanged.

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 binary input (BI1). This can be configured individually and can be used for blocking the operating modes for example. A further input (Shut down) has the function of moving the actuator to a pre–set safety position (end stop).

With the I_y-option module, the current actuator position can be output as a two wire signal $I_y = 4$ 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 binary outputs are implemented as semiconductor outputs and are error self–reporting, i.e. the outputs respond even when the power supply fails or the electronics are defective.

The actuator can also be blocked or driven to its final positions depending on the configuration for example by an external event via a binary input (BI2) 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.

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 (9, Fig. 8, page 25) between 33° (as delivered) and 90°.

The friction clutch (8, Fig. 8, page 25) allows you to set the working range, particularly 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. 9, page 26).

NOTICE

for the explosion proof version:

Only adjust the outer friction clutch (8, Fig. 9, page 26). The internal friction clutch (9, Fig. 8 page 25) is fixed and, for the explosion proof version, must **not** be adjusted.

2.2 Design Rating Plate
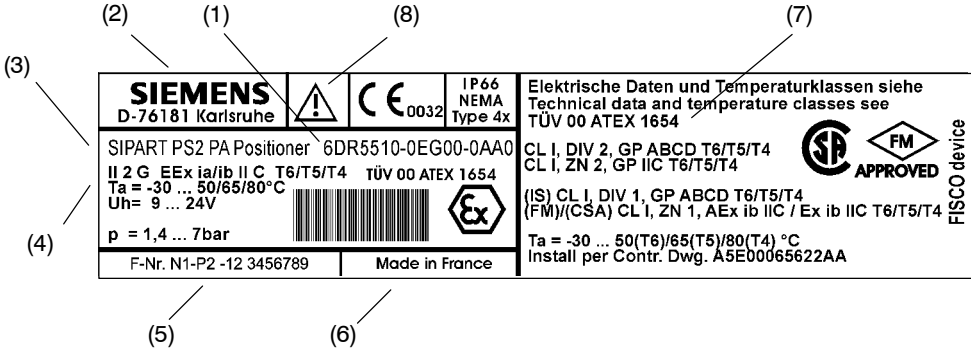
(1) Order number
(2) Manufacturer
(3) Product name
(4) Technical data
(5) Serial number
(6) Place of manufacture
(7) Protection class
(8) Observe manual

Figure 7   Design rating plate, example with protection class EEx ia/ib

2.3 Instrument components
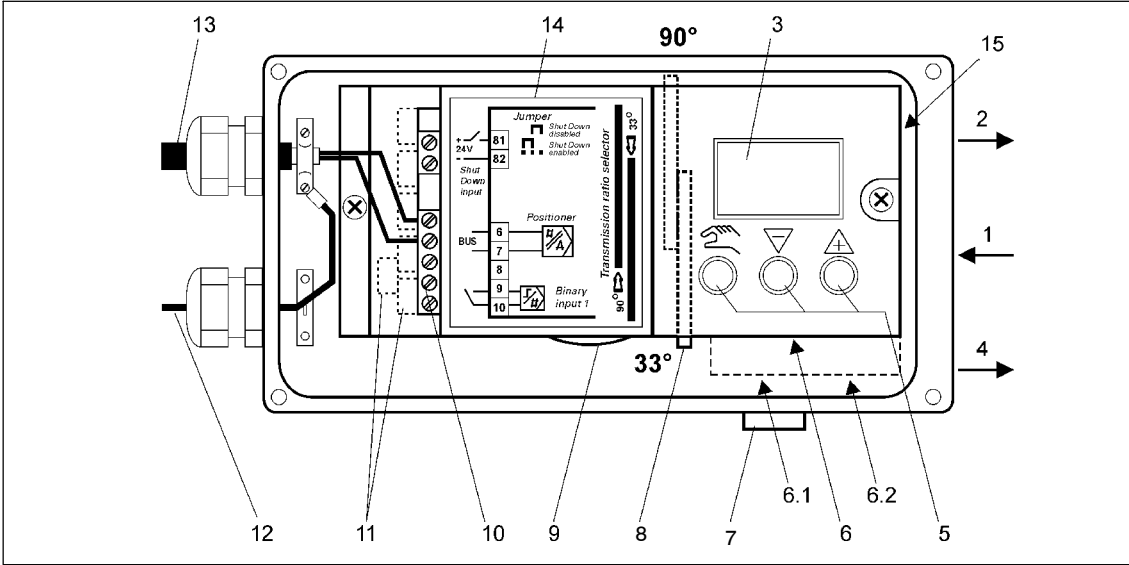
1	Input: Supply air	8	Transmission ratio selector
2	Output: Actuating pressure Y1	9	Adjustment wheel for friction clutch
3	Display	10	Motherboard
4	Output: Actuating pressure Y2 *)	11	Terminals option modules
5	Operating keys	12	Ground cable (only for plastic housing)
6	Restrictor	13	Bus cable
6.1	Restrictor Y1	14	Terminal plate on cover
6.2	Restrictor Y2 *)	15	Purging air switch
7	Silencer		

*)   in double–acting actuators

Figure 8   View of the positioner (cover open); plastic housing
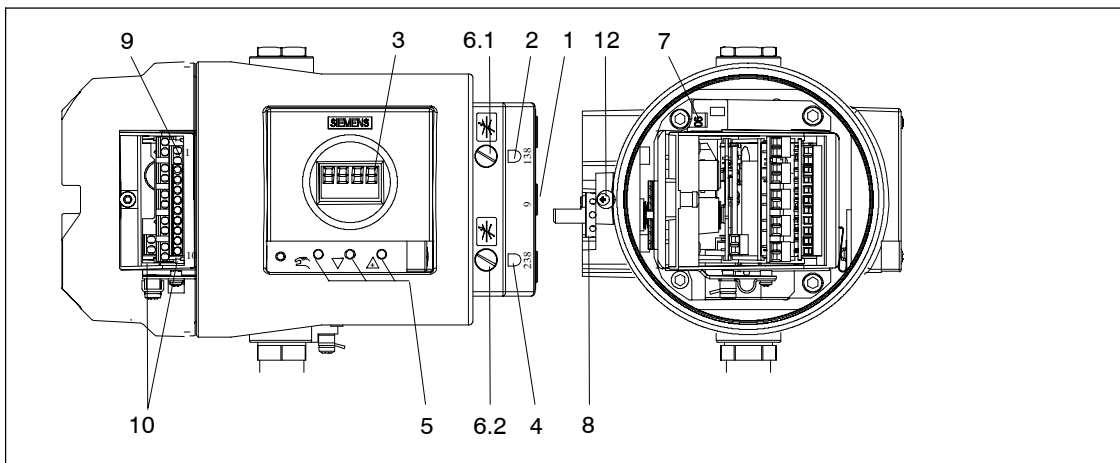
1	Input: Supply air	7	Transmission ratio selector
2	Output: Actuating pressure Y1		(only possible with positioner open)
3	Display	8	Adjustment wheel for friction clutch
4	Output: Actuating pressure Y2 *)	9	Terminals standard controller
5	Operating keys	10	Terminals option modules
6.1	Restrictor Y1	12	Safety catch
6.2	Restrictor Y2 *)		

*) in double–acting actuators

Figure 9   View of the explosion proof version of the positioner

2.3.1 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 option modules are also on the motherboard.

2.3.2 Electrical connections

The terminals of the standard controller, the I_y–, SIA– 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.

2.3.3 Pneumatic connections

The pneumatic connections are on the right hand side of the positioner (figure 10 and figure 11).

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

Figure 10   Pneumatic connection in normal version
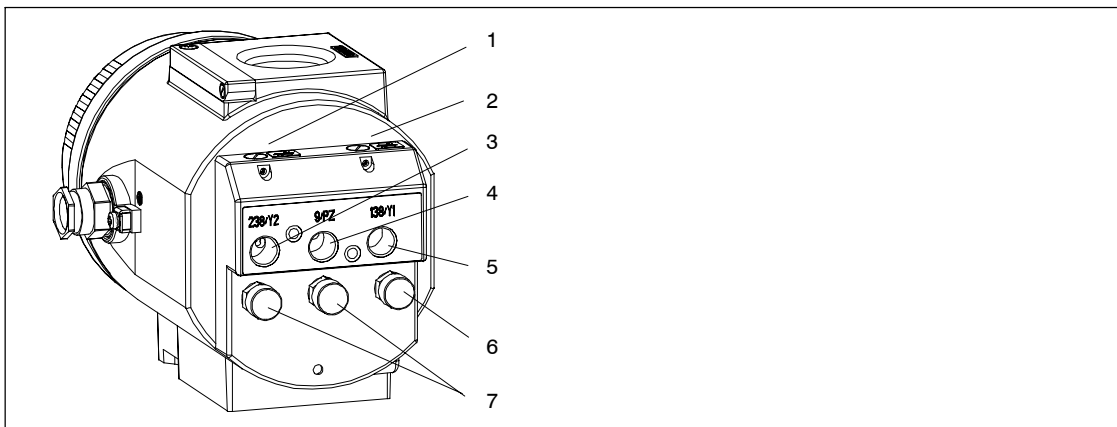
1	Restrictor Y2 *)	5	Actuating pressure Y1
2	Restrictor Y1	6	Exhaust air output E
3	Actuating pressure Y2 *)	7	Housing ventilation (2x)
4	Supply air PZ		

*)   in double–acting actuators

Figure 11   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 20, page 45, figure 22, page 46 and figure 23, page 47).

The exhaust air output E can be provided for supplying dry instrument air to the tapping chamber and spring chamber to prevent corrosion.

Figure 12, page 28 shows the pneumatic connection variants for the different actuator types, the positioning acting and the safety position after power failure.
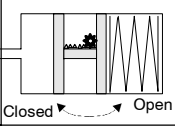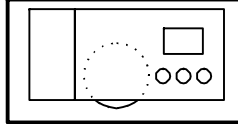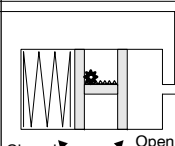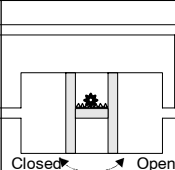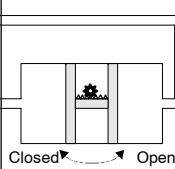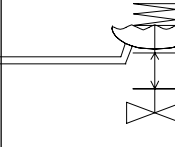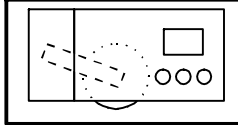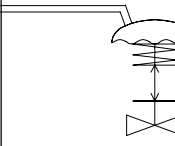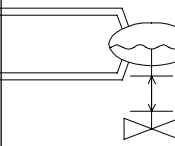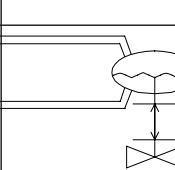
Positioning pressure Connection	Actuator type	Safety position after power failure" electrical	pneumatic	
Y1	Closed ··· Open	Closed	Closed	In part–turn actuators the direction of rotation counterclockwise looking onto the actuating shaft of the valve is usually defined as "Open".
Y1	Closed ··· Open	Open	Open	
Y2 / Y1	Closed ··· Open	Open	Last position (before power failure)	Closed Open
Y1 / Y2	Closed ··· Open	Closed		
Y1	up / down	Down	Down	
Y1	up / down	Up	Up	
Y2 / Y1	up / down	Up	Last position (before power failure)	up down
Y1 / Y2	up / down	Down		

Figure 12   Pneumatic connection positioning

2.3.4 Mounting kit

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

2.3.5 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 13). 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 (for more information: see Chapter 3.3, page 47).
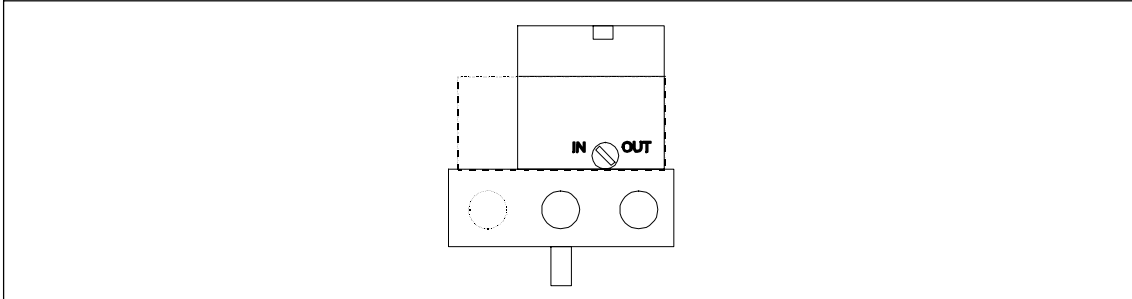
Figure 13   Purge air switch on the valve block, view of the positioner onto pneumatic connection side with cover open

2.3.6 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 14, in explosion proof version, see figure 11, page 27). 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.
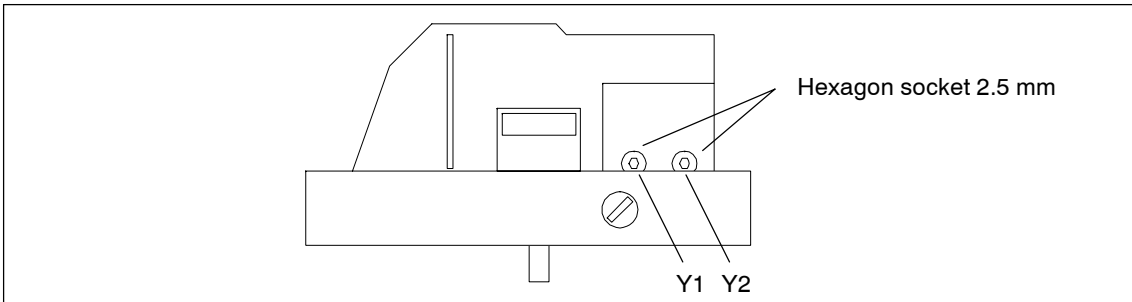
Figure 14   Restrictors

2.4   **Method of operation**

The electropneumatic positioner 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 supplied digitally via the PROFIBUS.

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. The current position of the positioner can also be set using an external sensor. Determining the stroke distance or the angle of rotation is done by an external position detection system (e.g. non–contacting position sensor or a potentiometer) directly on the actuator.

The positioner may correct the angle error of the stroke tap, compares the actual value x with the setpoint w 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.

The control algorithm is an adaptive predictive five–point switch (see figure 15, page 31). 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 actuating path 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 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.

👉 **NOTE**

The exhaust air valve is always open when there is no current.

range of negative control difference   duty cycle (0 to 1)   range of positive control difference

fast step zone (continuous contact)

fast step zone (continuous contact)

-xd (%) valve opens

dead zone

+xd (%) valve closes

slow step zone (variable duty cycle)

slow step zone (variable duty cycle)
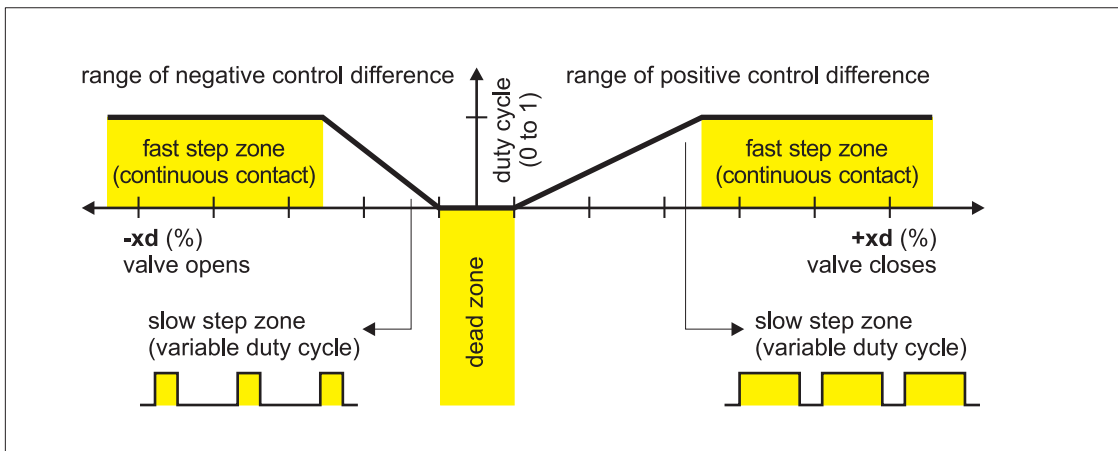
Figure 15   Method of operation five–point switch

2.5   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.

The input for the safety shut down is not activated.

2.6   Option modules

2.6.1 Installation of options modules in normal and intrinsically safe versions

The following option modules are available for the positioner in the standard and the intrinsically safe version:

– I_y module

– Alarm module

– SIA module

– Mechanical limit switch module

– EMC filter module

Installation

The option modules are secured by a assembly covering ((1), see figure 16, page 33) and mechanically fixed.

☞ **NOTE**

The housing must be opened to install the options modules. The degree of protection IP66 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
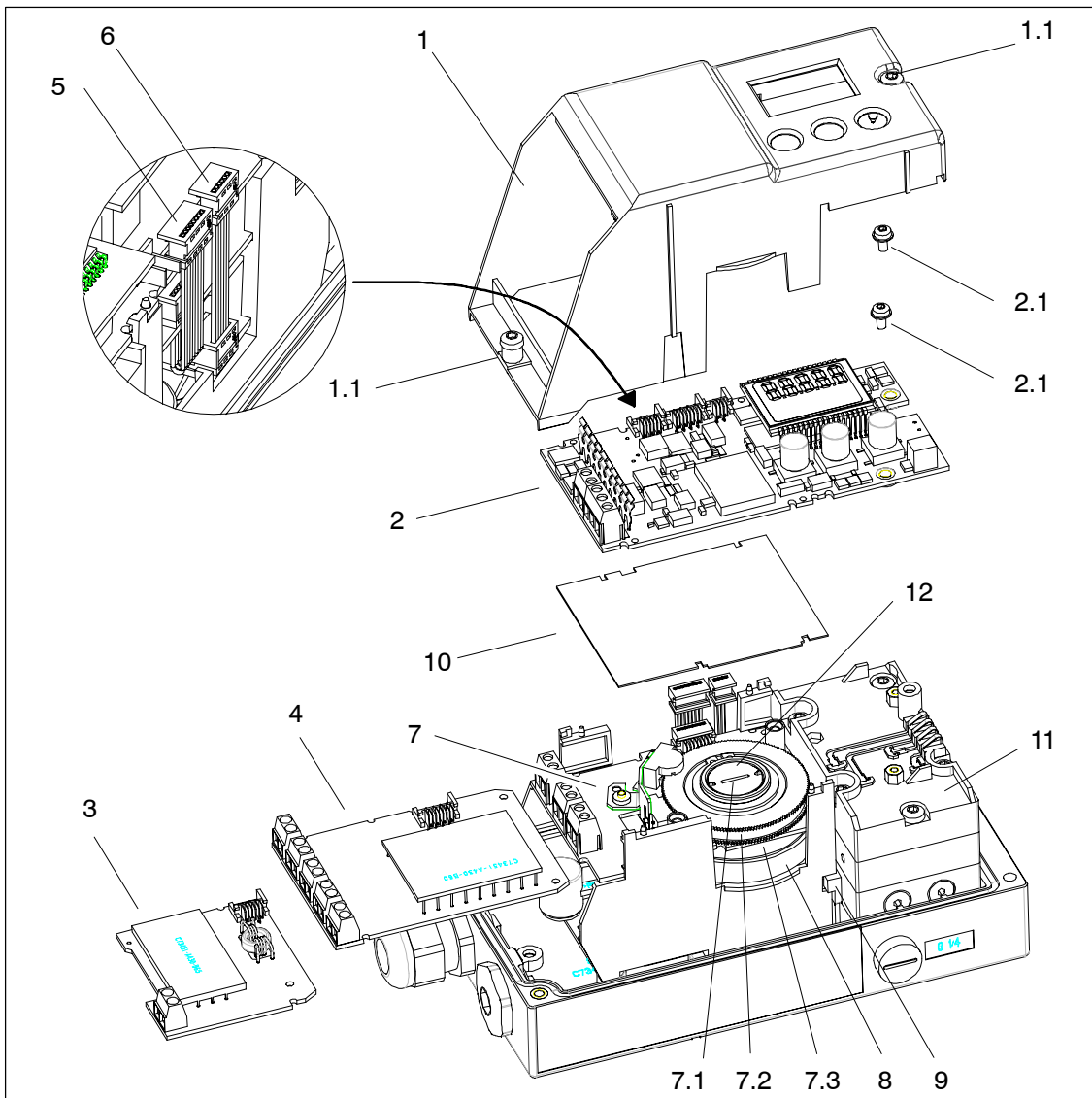
1	Module cover	7	SIA-module and mechanical limit switch module
1.1	Fixing screws	7.1	Special screw
2	Motherboard	7.2	Actuating disc for A1 (terminals 41 and 42)
2.1	Fixing screws	7.3	Actuating disc for A2 (terminals 51 and 52)
3	I$_y$-module with ribbon cable (6)	8	Adjusting wheel for friction clutch
4	Alarm module with ribbon cable (5)	9	Transmission ratio selector
5	Ribbon cable for alarm module	10	Insulating cover
6	Ribbon cable for ly-module	11	Pneumatic block
		12	Actuating disc bearings

Figure 16   Installation of options modules in normal and intrinsically safe version

2.6.2 Installation of options modules in explosion proof version

The following option modules are available for the positioner in the explosion proof version:

- I_y module

- Alarm module

Installation

The options modules are protected and mechanically fixed by a module cover ((1), see figure 17, page 36).

☞ **NOTE**

The housing must be opened to install the options modules. The degree of protection IP66/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–though 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 positio-
ner**

See figure 17, page 36. 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.
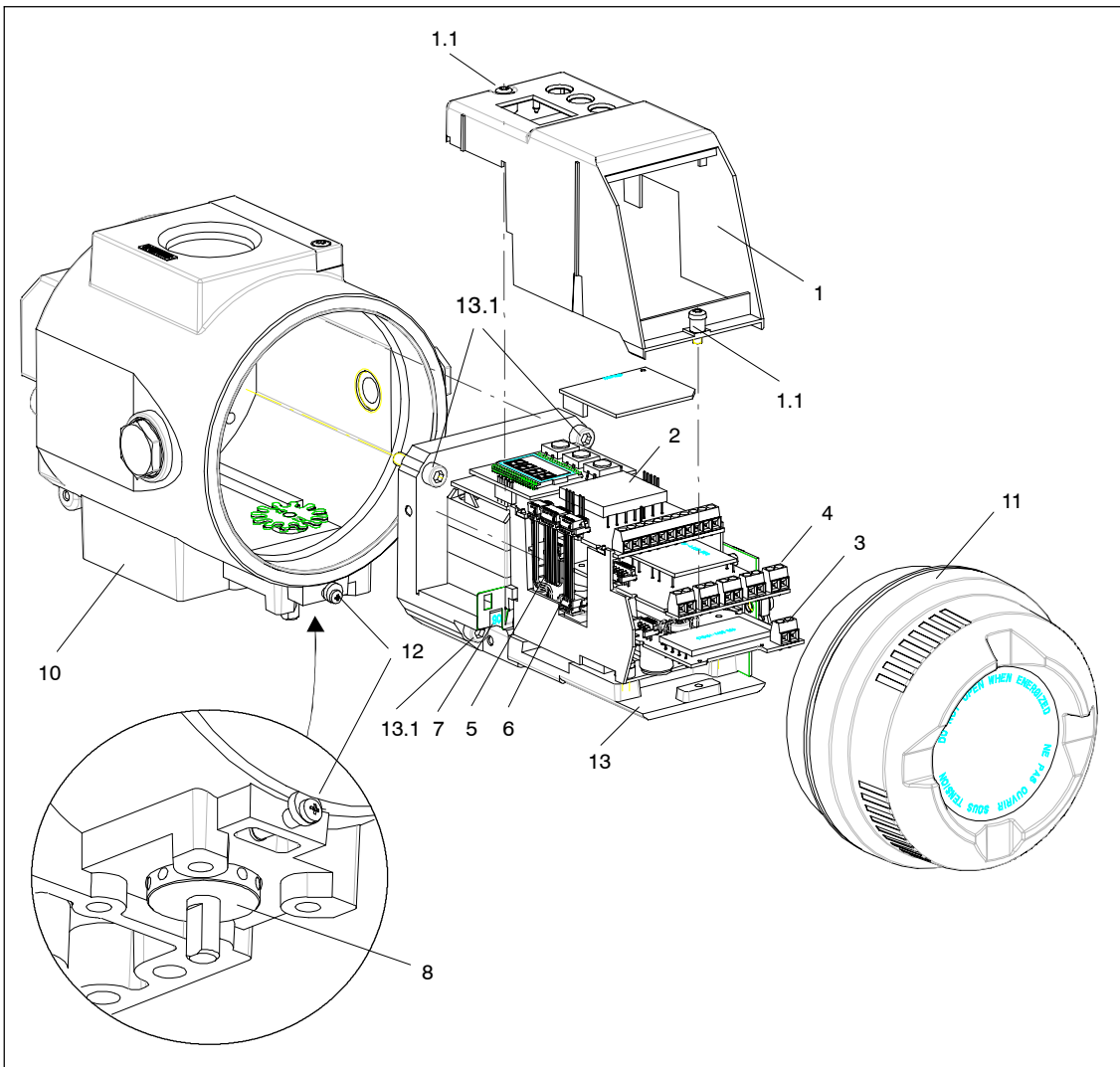
1	Module cover	7	Transmission ratio selector
1.1	Fixing screws	8	Adjusting wheel for friction clutch
2	PA module	10	Housing
3	I_y module with ribbon cable	11	Screw–on cover
4	Alarm module with ribbon cable	12	Safety catch
5	Ribbon cable for alarm module	13	Rack
6	Ribbon cable for I_y module	13.1	Fixing screws

Figure 17   Installation of the options modules in the proof version

2.6.3 Iy module

Function

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

Installation   The I$_y$ module (3) 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 16, page 33).

2.6.4 Alarm module

The alarm module contains

- 3 digital outputs and
- 1 digital input

Function   The digital outputs serve to output fault messages and alarms. The configuration is described in chapter 4.4, page 98, 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 98, with the parameters 43.

The alarm module is available in two versions:

- explosion protected for connecting to switching amplifier EN 60947–5–6
- 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 (4) 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 16, page 33).

2.6.5 SIA module

The SIA module contains three digital outputs.

Function

A collected fault message (see alarme module) is output via a digital-output. The floating digital output is implemented as a self error reporting semiconductor output.

The other two digital outputs are used for reporting two mechanically adjustable limit values (L1, L2) by slot initiators. The two binary outputs are electrically independent of the rest of the electronics.

Installation

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

1. Remove all the electrical connections from the motherboard (2).

2. Loosen the two fixing screws (2.1) of the motherboard.

3. Snap out the motherboard 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 (12) 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 motherboard 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 motherboard 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 (1.1).

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. In the case of the version which doesn't feature explosion protection, stick the warning sign (figure 2) onto the side of the ground plate opposite the typeplate.

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.

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

2. Adjust the top actuating disc (7.2) by hand until the output signal on terminals 41 and 42 changes.

3. Drive the actuator to the second desired mechanical position.

4. 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.

2.6.6 Mechanical limit switch module

The mechanical limit switch module contains the following:

- A binary output for the output of a group error message)

- Two switches for signaling two limit values that can be set mechanically. These two switches are electrically independent from the rest of the electronic system

Installation

CAUTION

The following maximal values only refer to the clamps 41 and 42 as well as the clamps 51 and 52.

Maximal voltage (not Ex)	AC 250 V or DC 24 V
Maximal current (not Ex)	AC/DC 4 A
Maximal voltage (Ex)	DC 30 V
Maximal current (Ex)	DC 100 mA

When you supply one circuit breaker with extra–low voltage (AC < 16 V or DC < 35 V) and the other with low voltage, you ensure that the cable insulation is doubled.

When operating the switch with low voltage, you must position the low voltage circuits so that they are separated from the extra–low voltage circuits.

Follow the instructions below for installation:

1. Remove all electrical connections on the motherboard (2).

2. Loosen carefully both fixing screws (2.1) for the motherboard.

3. Insert the limit switch module (7) from above until it reaches the upper printed circuit board rail of the container.

4. Snap put the motherboard (2) by carefully bending the four holders.

5. Push the mechanical limit switch module (7) in the printed circuit board rail of the container ca. 3 mm towards the right

6. Screw the special screw (7.1) through the mechanical limit switch module into the axle of the positioner **(torque: 2 Nm)**.

CAUTION

The pin pressed into the actuating disc bearing (12) must be adjusted just before it touches the special screw (7.1) In order that the pin slot into the special screw, you must then turn the actuating disc bearing and the special screw simultaneously

---

7. Place the insulating cover (10) over the mechanical limit switch module underneath the surface of the motherboard onto the container on the wall. The recesses in the insulating cover must slot into the corresponding lugs on the container wall. Place the insulating cover on the mechanical limit switch module by carefully bending the container walls.

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

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

10. Fix the enclosed module cover (1) instead of the standard version using the two screws (1.1).

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:

- Turn the screws counterclockwise until you feel them snap into the thread.
- Tighten both screws carefully in a clockwise direction

NOTE

Before connecting up the limit contact module, ensure that:

- only qualified personnel connect and set the limit contact module.
- all cables are de–energized.
- the cables are stripped so that the insulation is flush with the terminal when plugging in the wires.
- the ends of stranded wires have sleeves
- the connection cables are insulated according to the permitted current load.
- the permissible working temperature of the cables exceeds the maximal ambient temperature by minimum 25 °C.
- the Ex–version is only allowed to be operated in intrinsically safe circuits with approved switching amplifiers.

Connection

1. Loosen the screw (1) on the cover (2).

2. Push the cover (2) till it reaches the front stop.

3. Screw each cable tight in the appropriate terminal.

4. Push the cover (2) till it stops at the motherboard.

5. Tighten the screw (1) of the cover (2).

6. Fix the cables of each switch in pairs on the mounting eye using the cable binders provided (3).
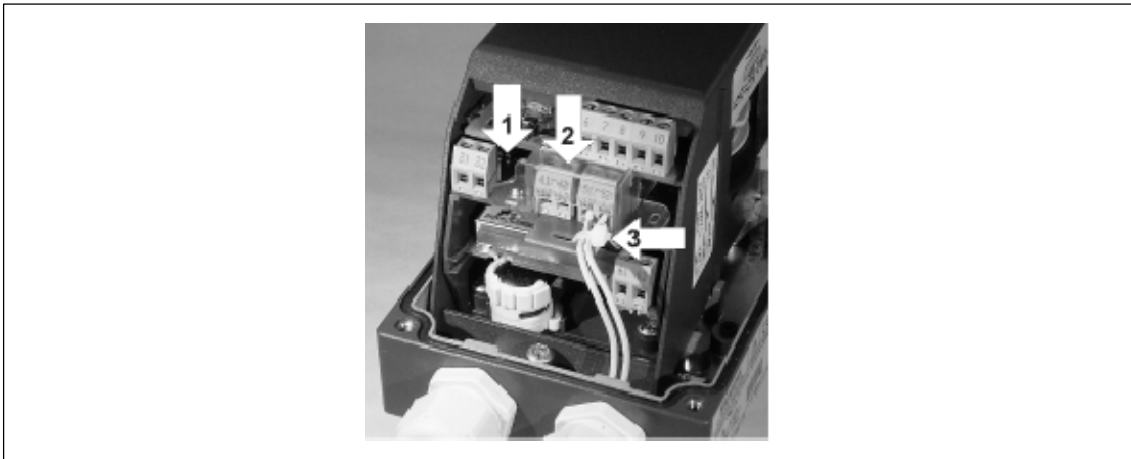
Figure 18   Cable connection

Setting the two limit values:

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

2. Adjust the top actuating disc (7.2) by hand until the output signal on terminals 41 and 42 changes.

3. Drive the actuator to the second desired mechanical position.

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

NOTE

To avoid the actuating discs (7.2/7.3) being accidentally adjusted during operation, 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.

2.6.7 EMC filter module

The positioner can also be driven by an external position sensor (potentiometer or NCS) (see page 50 "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.

2.6.8 Accessories
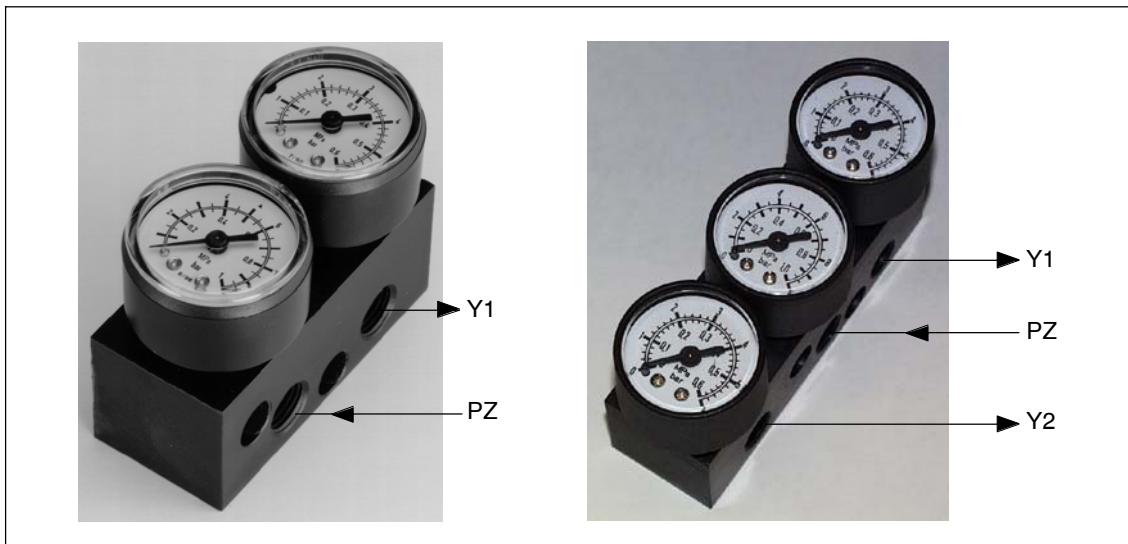
Figure 19   Manometer block (left for single-acting, right for double-acting actuators)

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

3

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 8.1, page 168

Installation of any modules required is described in chapter 2.6, page 31 of this technical manual.

3.2 Dimensional drawings
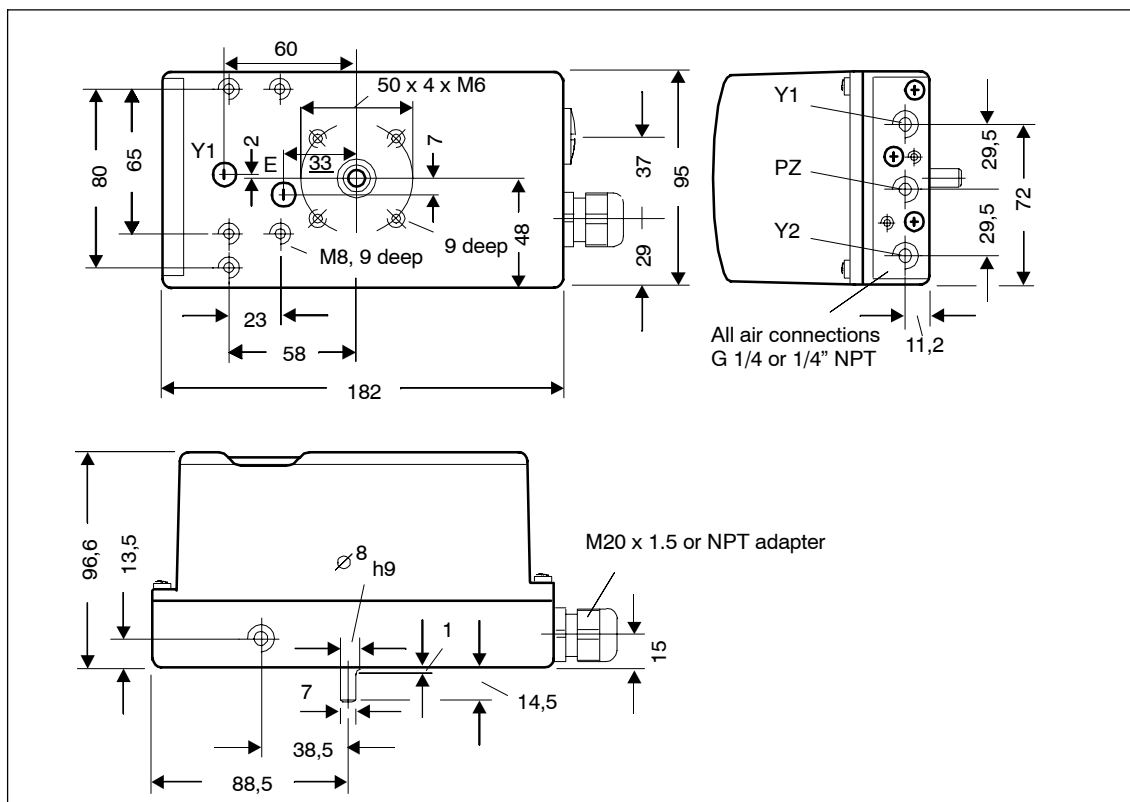
Figure 20   Dimensional drawing version plastic housing 6DR5xx0
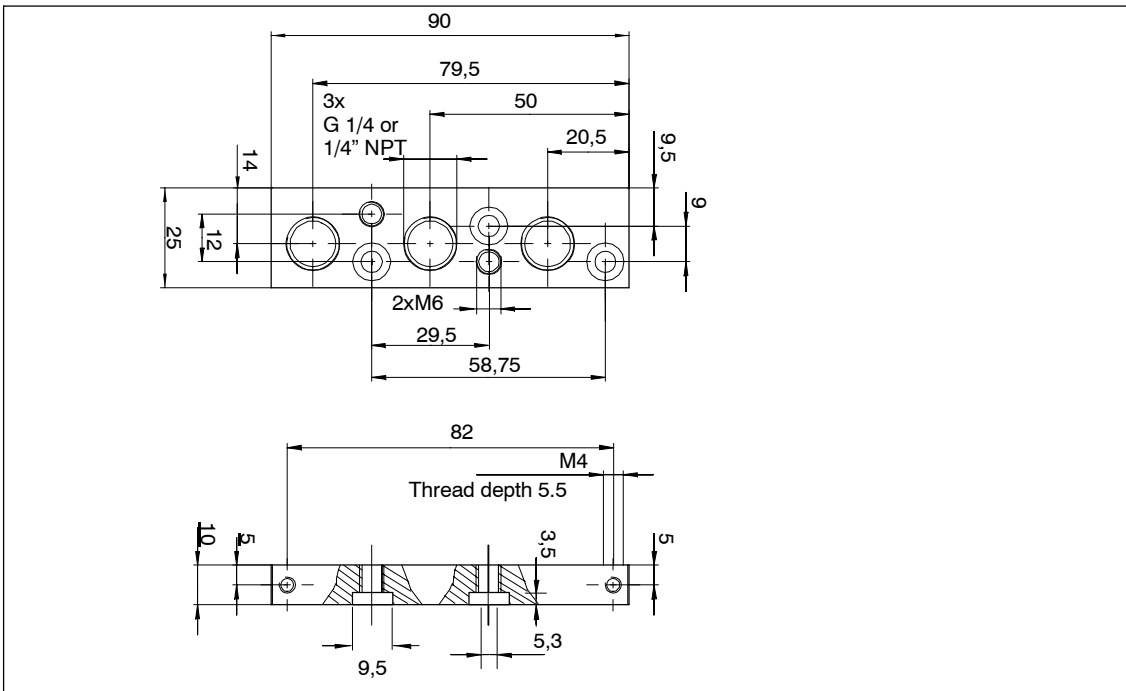
Figure 21   Dimensional drawing terminal strip for plastic housing
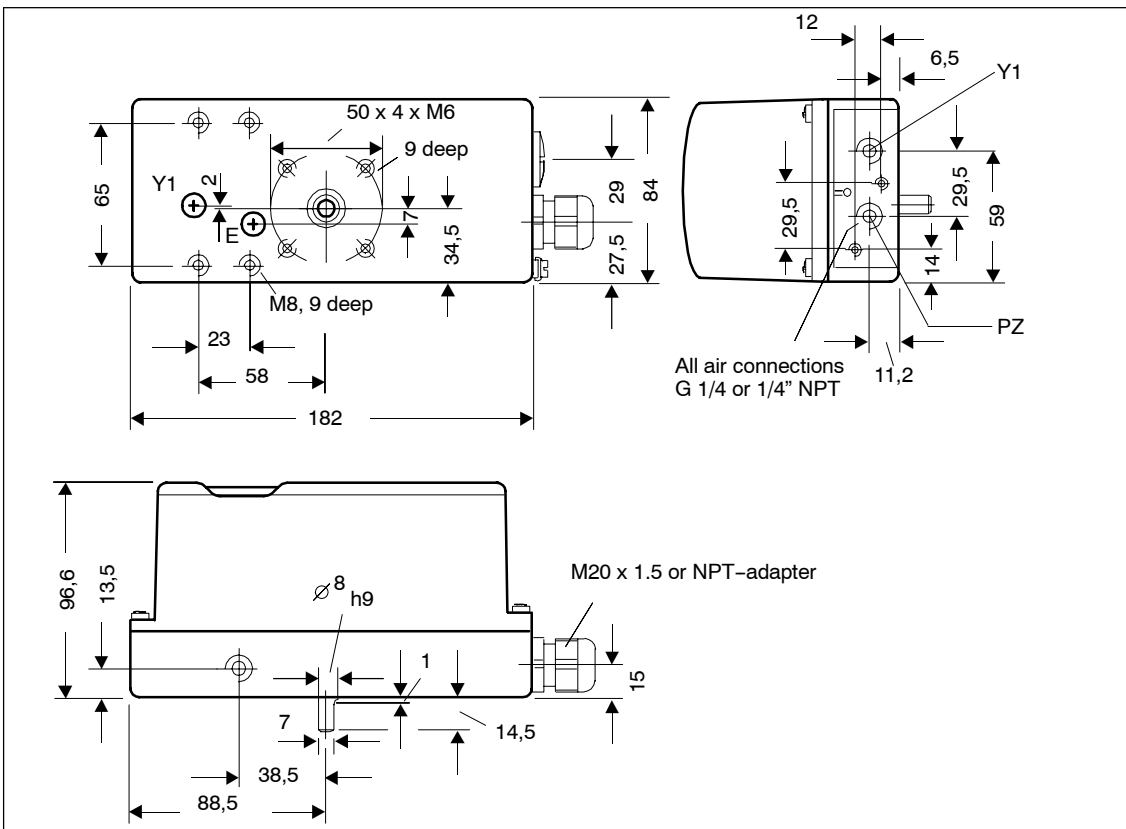
Figure 22   Dimensional drawing version metal housing 6DR5xx1
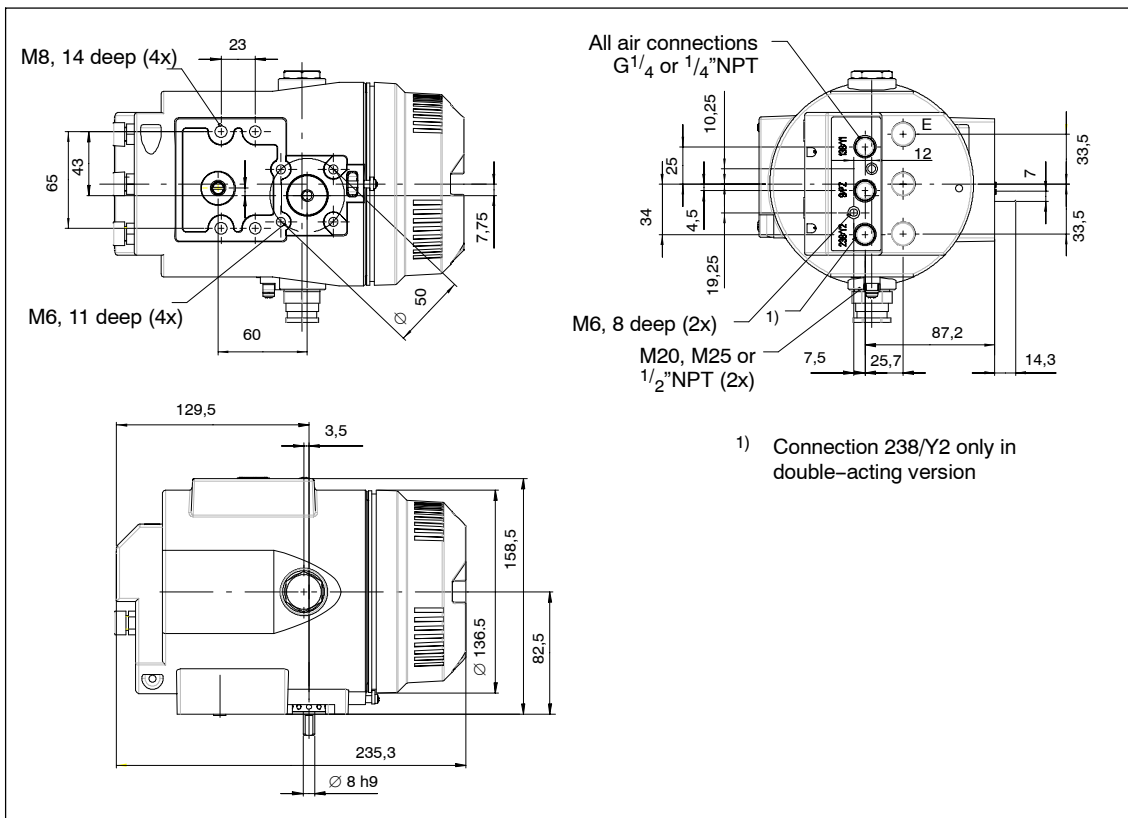
Figure 23   Dimensional drawing for positioner with metal housing in explosion proof version 6DR5xx5

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. 62
>
> 3. Connection of pneumatic power supply   see chapter 3.5, p. 73
>
> 4. Put into operation   see chapter 3.6, p. 74
>
> Please also observe the warning on page 10 and 62!

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 IP66 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 24.
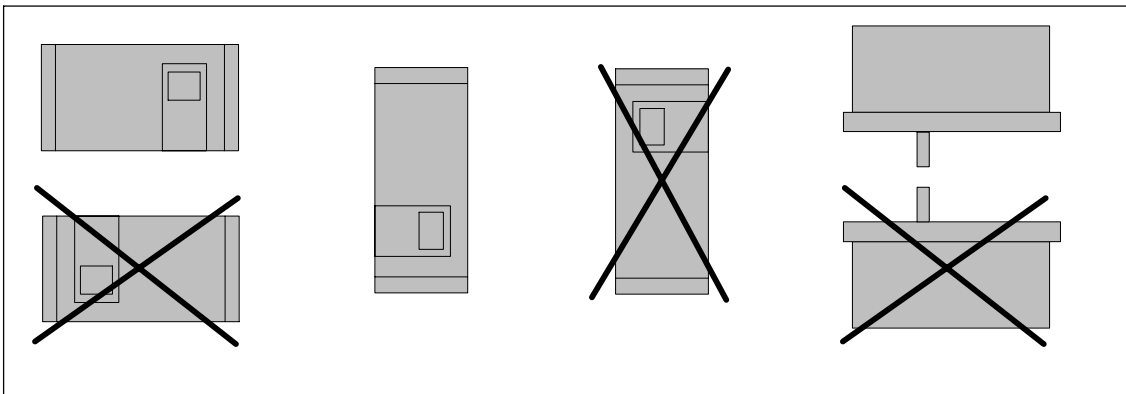
Figure 24 Favorable and unfavorable installation positions

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 IP66 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 great accelerations or vibrations

NOTICE

for explosion proof versions:

Only adjust the outer friction clutch (8, Fig.17, page 36). The internal friction clutch (8, Fig.16 page 33) is fixed and, for the explosion proof version, must **not** be adjusted.

The electro–pneumatic positioner features a friction clutch and a switchable drive and is, therefore, universally applicable for part–turn and linear actuators. That's why it is not necessary to take a zero–point into consideration when implementing part–turn actuators. Similarly, there is no need to ensure that the extension is symmetrically attached when implementing linear actuators. In both cases, the work space can be adjusted afterwards via the friction clutch.

The switchable drive can be used to adjust the positioner for short or long strokes.

Large accelerating forces can occur on fittings subject to heavy mechanical wear and tear, such as openings which could break off, valves subject to heavy vibrations as well as beating blast pipes. In some cases, these forces can far exceed the specifications. In extreme cases, these forces could even cause the friction clutch to shift.

For these cases, the positioner is equipped with a position–securing device for holding the friction clutch in place. Furthermore, it is also possible to lock the transmission ratio selector into position, thus preventing it from shifting due to the influences stated above.

Both setting options are designated accordingly by icons on additional signs (see Fig. 25 page 51).

Procedure

After you have mounted the positioner and commissioned it completely, you can set the friction clutch torque as follows:

- Plug a conventional 4 mm wide screwdriver into a slot in the yellow wheel.

- Then turn the yellow wheel to the left with the screwdriver until it snaps in audibly. This increases the torque of the friction clutch.

- A fixed friction clutch is recognizable from an approx. 1 mm wide gap between the yellow and black wheel.

- If you have to make a zero point setting, e.g. after changing the drive, please reduce the torque first by turning the yellow wheel to the right stop. After the zero point setting, you can fix the friction clutch as described above.

To lock the transmission ratio selector, takt the unit as factory set and do as follows:

- Using a conventional flat headed screwdriver (approx. 4 mm wide) turn the yellow wheel underneath the clamps to the left or right according to your chosen setting (either 33° or 90°) until it snaps in audibly.

- In order to set the transmission ratio selector any locks in place must first be released. Hence the yellow wheel must first be put into the original factory set position in order to reset the transmission ratio selector if necessary, e.g. after replacing the actuator.
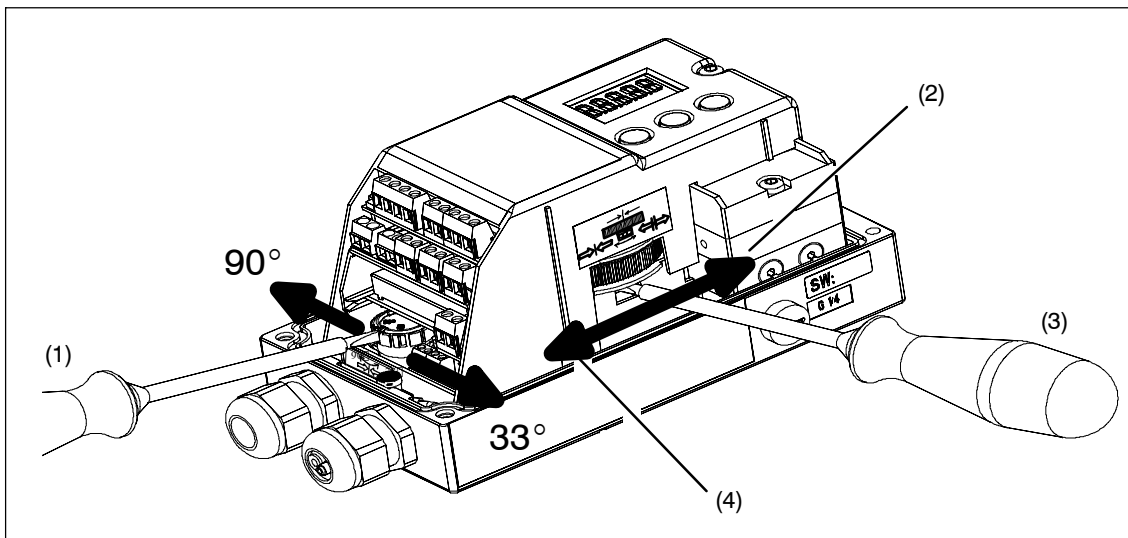
(1) Transmission ratio switch interlock
(2) Open
(3) Friction clutch
(4) Close

Figure 25 Adjustable retaining device for the friction clutch

External position detection

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 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 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 always has to be used for the controller unit whenever the external position detection unit C73451-A430-D78 is to be replaced by a random drive–mounted potentiometer (resistance va- lue 10 kOhm) or if a NCS sensor is to be installed.

⚠ **WARNING**

The explosion proof version may not be run together with the external position detection system.

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 26, page 55):

Ser. no.	pieces	Designation	Note
1	1	NAMUR mounting kit bracket IEC534	Standardized connection for mounting console with ledge, column or plane surface
2	1	Pick–up bracket	Guides the roller with carrier pin and turns lever arm
3	2	Clamping assembly	Mounting of pick–up bracket on actuator spindle
4	1	Carrier pin	Assembly with roll (5) on lever (6)
6	1	Lever NAMUR	For stroke range 3 mm to 35 mm
			For stroke ranges> 35 mm to 130 mm (special delivery), lever 6DR4004–8L is required additionally
7	2	U bolt	Only for actuators with columns
8	4	Hexagon head screw	M8 x 20 DIN 933–A2
9	2	Hexagon head screw	M8 x 16 DIN 933–A2
10	6	Lock washer	A8 – DIN 127–A2
11	6	Flat washer	B 8,4 – DIN 125–A2
12	2	Flat washer	B 6,4 – DIN 125–A2
14	1	Spring washer	A6 – DIN 137A–A2
15	1	Lock washer	3.2 – DIN 6799–A2
16	3	Spring washer	A6 – DIN 127–A2
17	3	Socket cap screw	M6 x 25 DIN 7984–A2
18	1	Hexagon nut	M6 – DIN 934–A4
19	1	Square nut	M6 – DIN 557–A4
21	4	Hexagon nut	M8 – DIN 934–A4

3.3.4 Assembly procedure (see figure 26, page 55)

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 premounted 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 axle 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. If no symmetrical mounting is possible it must be guaranteed that the horizontal lever position is passed through within the stroke range.
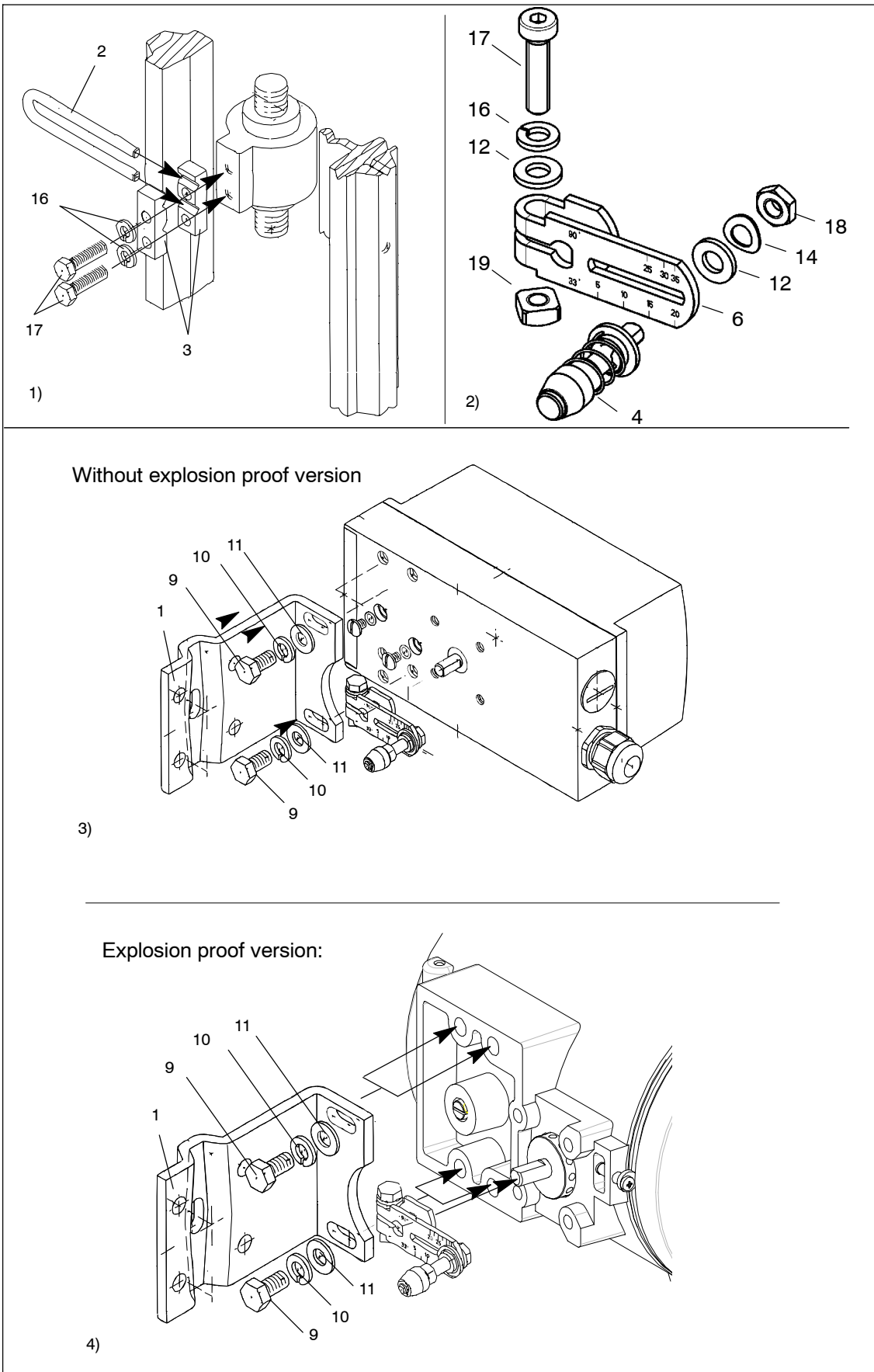
Figure 26   Assembly procedure (linear actuator)
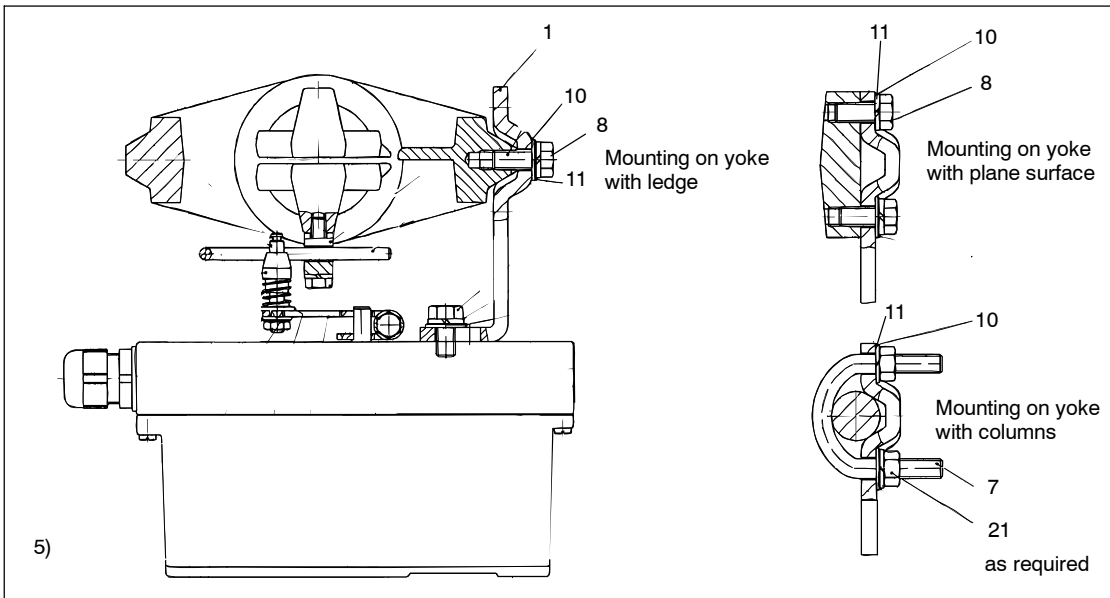
Figure 26   Assembly procedure (linear actuator) *continued*

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 27 and 28):

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

3.3.6 **Assembly procedure** (see figure 27 and figure 28)

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 axle, 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 driver.

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 74: 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!
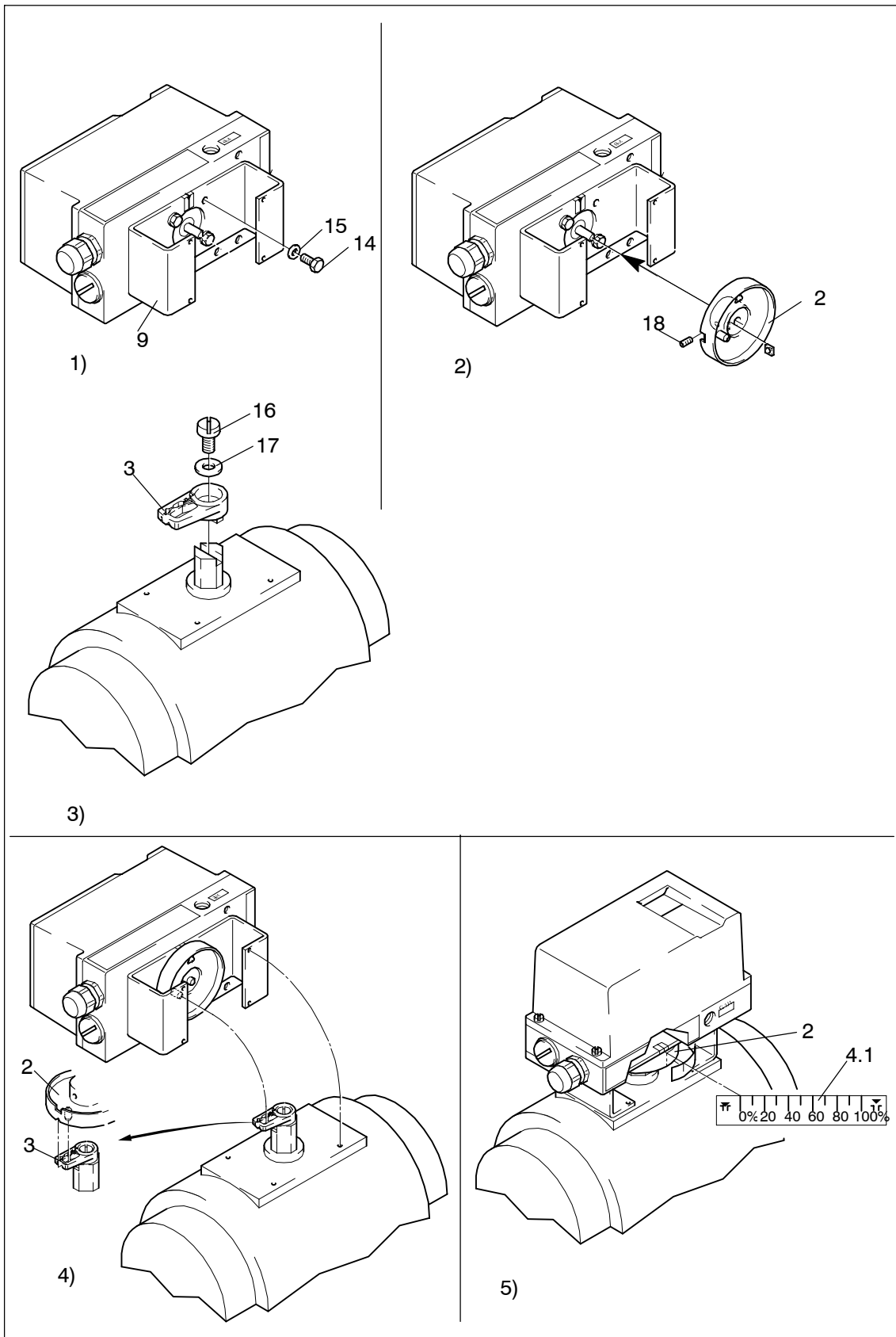
Figure 27   Assembly procedure (part–turn actuator)
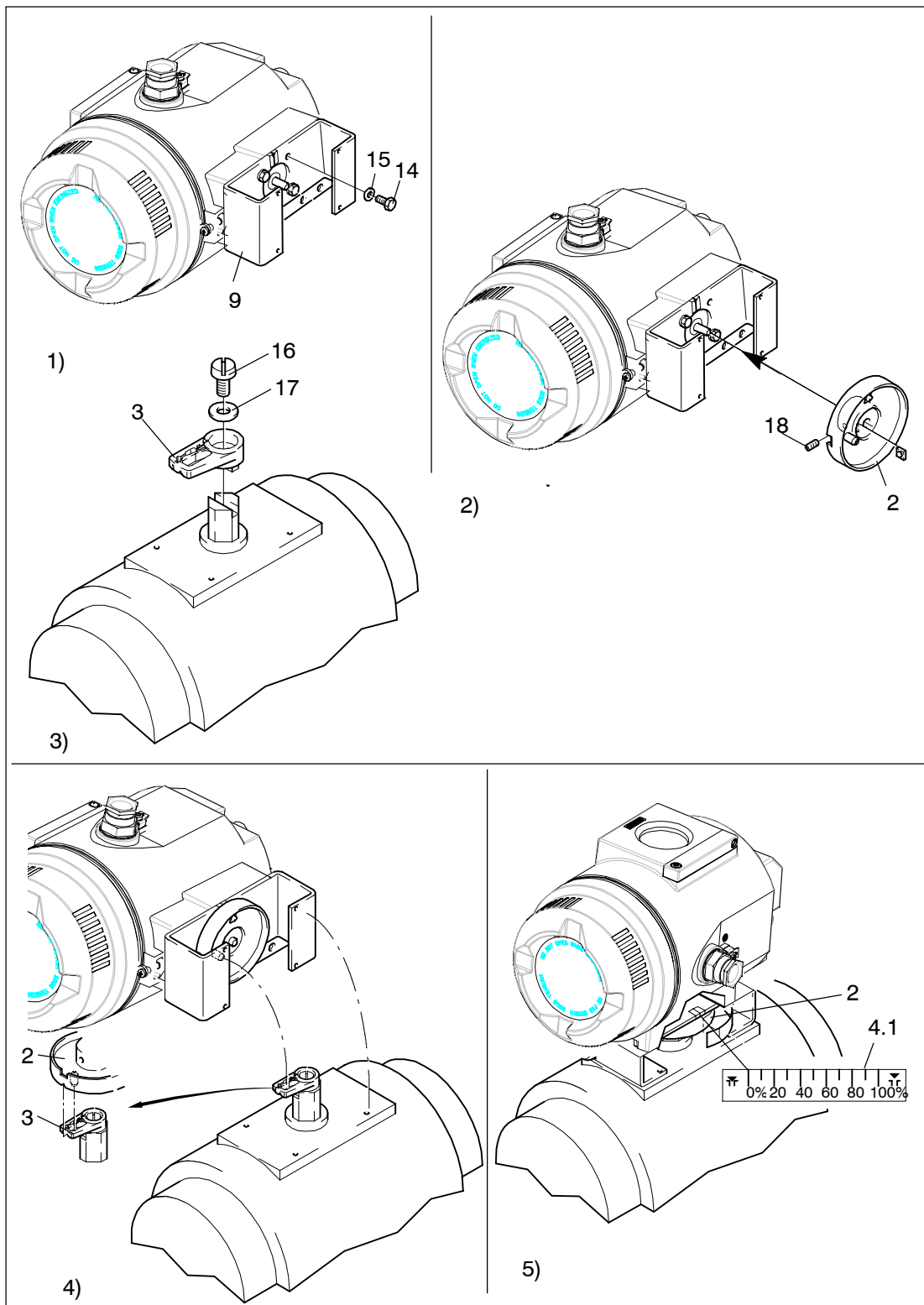
Figure 28   Assembly procedure for **explosion proof version** (part–turn actuator)
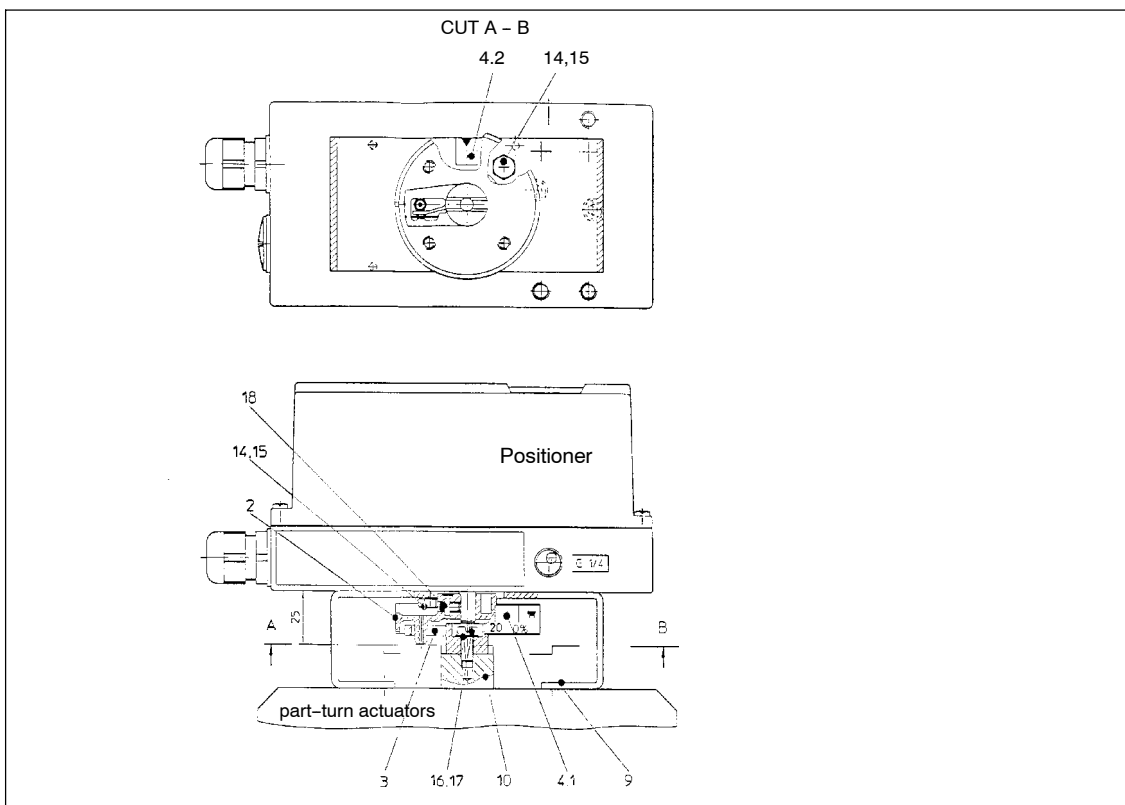
2	Clutch wheel	10	Feedback shaft
3	Driver	14	Hexagon–head screw M6 × 12
4	Multiple–purpose plate	15	Retaining washer S6
4.1	Scale	16	Round–head screw M6 × 12
4.2	Pointer mark	17	Washer
9	VDI/VDE 3845 mounting bracket	18	Socket–head cap screw

Figure 29   Mounted positioner for part–turn actuators
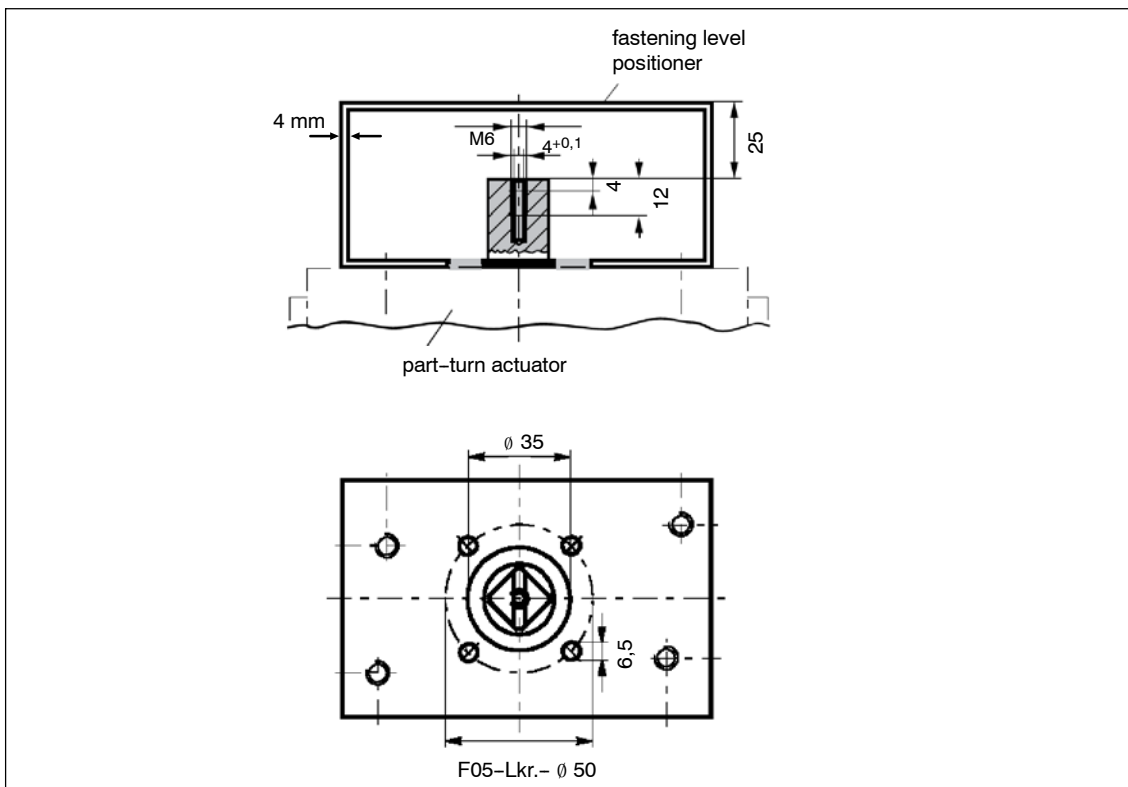
Figure 30   Attachment of part–turn actuator, mounting console (scope of delivery actuator manufacturer), dimensions

3.4 Electrical connection

NOTE

Any necessary options modules must be installed before electrical connection (see chapter 2.6, page 31).

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

WARNING

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

Electrical connection in hazardous areas

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).
– The certificate of conformity

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–though 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 31, page 63.

The specified noise immunity and noise emission are only ensured if the bus shield is fully effective.

This includes connecting the shields with the metallic connections of the positioner with PROFIBUS PA, but also routing the shield to the terminal boxes, distributors, DP/PA coupler or DP/PA link.

⚠ **CAUTION**

To discharge impulses under fault conditions, the positioner must be connected via a low resistance to an equipotential bonding (ground potential). For this the positioner in plastic housing is provided with an additional cable. Connect this cable using the cable clip to the PROFIBUS cable shield and to the equipotential bonding.

Devices in metal housings have a corresponding terminal on the outside of the housing, which also must be connected to equipotential bonding.

Provide for suitable potential equibonding between the hazardous and non–hazardous areas for applications in areas where there is a risk of explosions.
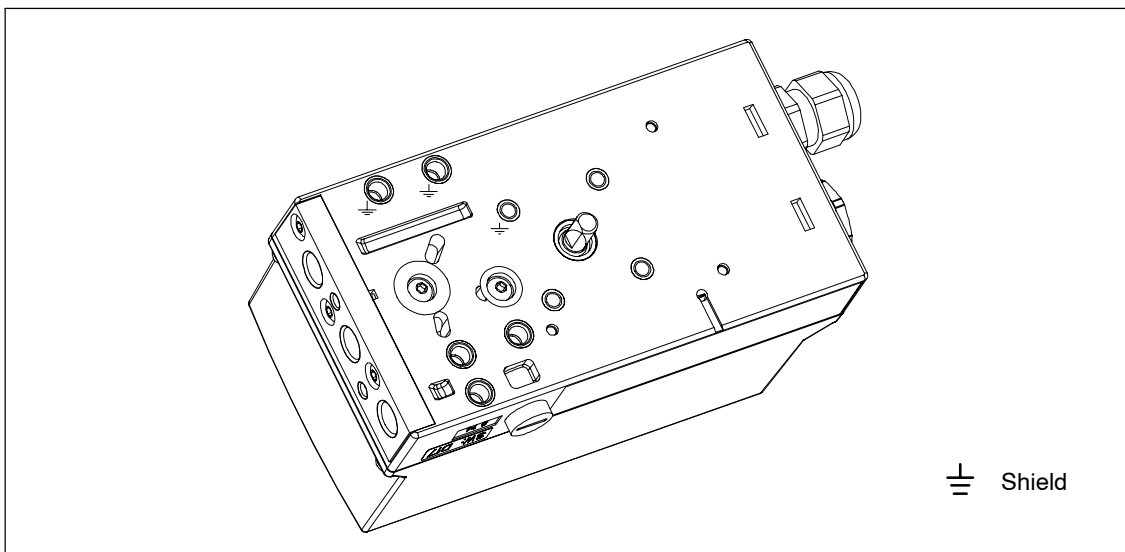
Figure 31   Base plate

Fitting the bus cable

Normal, intrinsically safe and zone 2 versions.	Explosion proof version
1. Isolate the bus cable as shown in figure 32, page 64.	1. Isolate the bus cable as shown in figure 32, page 64.
2. Open the positioner housing by undoing the four cover screws.	2. To open the positioner, the cover catch (12) must be undone and the screw cover unscrewed.
3. Insert the prepared bus cable through the cable gland.	3. Insert the prepared bus cable through the Ex–d–certified cable gland *)
4. Secure the shield with the cable clip and the two screws to the housing.	4. Secure the shield with the cable clip and the two screws to the housing.

5. Tighten the cable gland.	5. Tighten the Ex–d–certified cable gland. *)
6. Connect the red and green wires as shown in figure 33, page 65 to terminals 3 and 7 of the motherboard (the polarity is immaterial).	6. Connect the red and green wires as shown in figure 35, page 66 to terminals 6 and 7 of the motherboard (the polarity is immaterial).
	*) if the Conduit Tube System is being used, refer to the relevant instructions.

for positioner in normal version **and** in explosion proof version

Buscable 6XV1 830–5AH10 or 6XV1 830–5BH10

Cable shield

a =   80   in normal version (without Ex and without Ex i)
a = 120   in explosion proof version (Ex d)
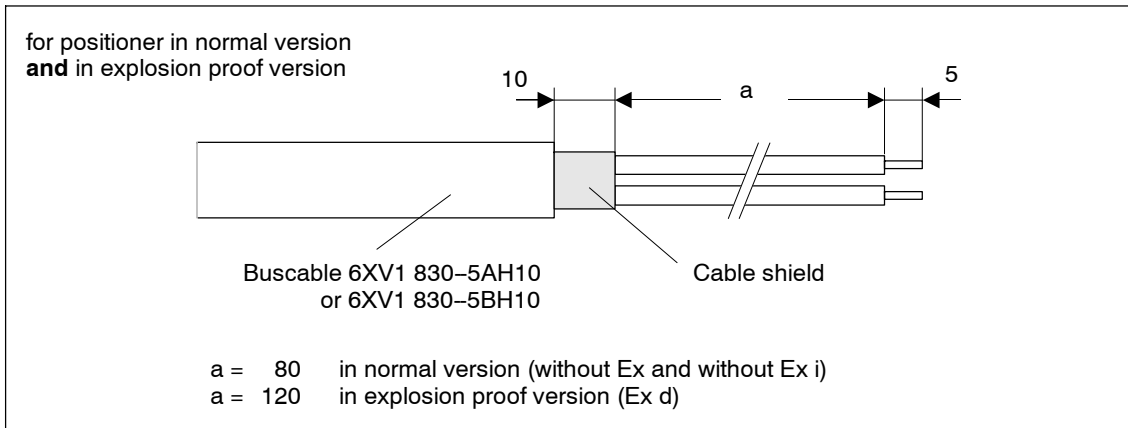
Figure 32   Preparation of bus cable

For error–free communication the bus must be terminated at both ends with a bus terminator. At the end nearest the control system, this is already assured by the terminator contained within the coupling or link. At the far end of the bus this must be achieved by fitting an additional terminator.

So as to avoid potential differences between individual equipment parts and thus the risk of functional impairment, a suitable potential bonding is to be provided. Information regarding dimensions and types can be found in DIN VDE 0100 parts 410 and 540.

☞   **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 $\geq$ 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).

for positioner in normal version:
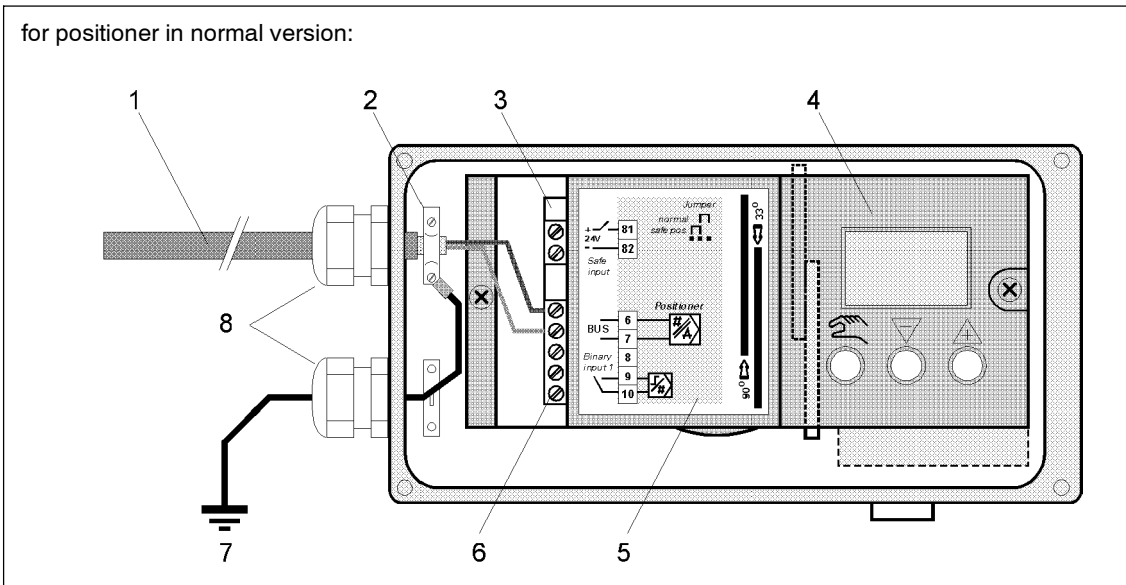
1 Bus cable
2 Cable clip
3 Basic PCB
4 Module cover
5 Plate
6 Terminal block
7 Ground potential
8 Cable glands

Figure 33   Bus cable connection

for positioner in explosion proof version
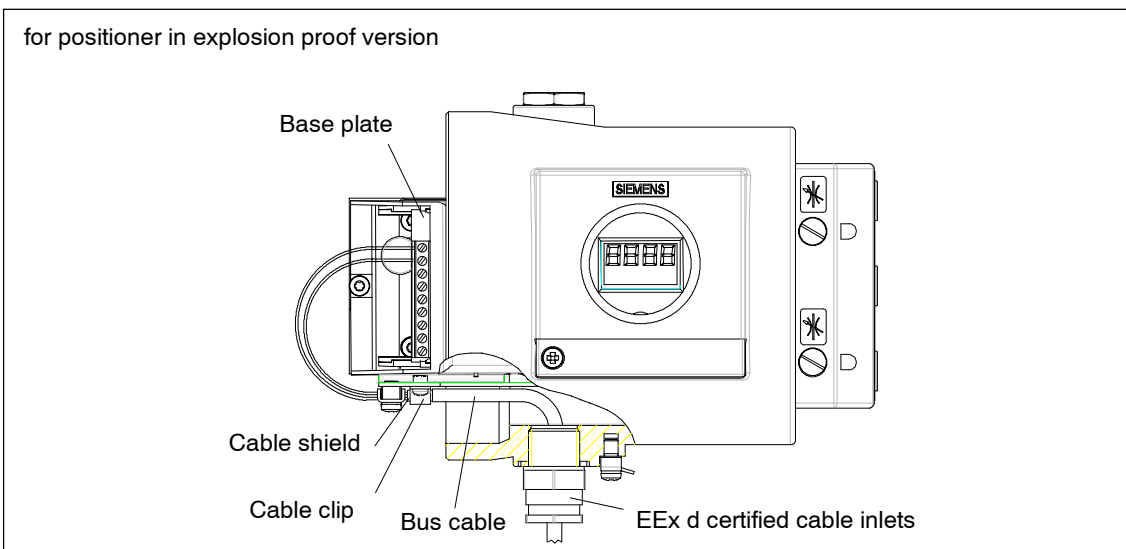
Figure 34   Bus cable connection for positioner in explosion proof version
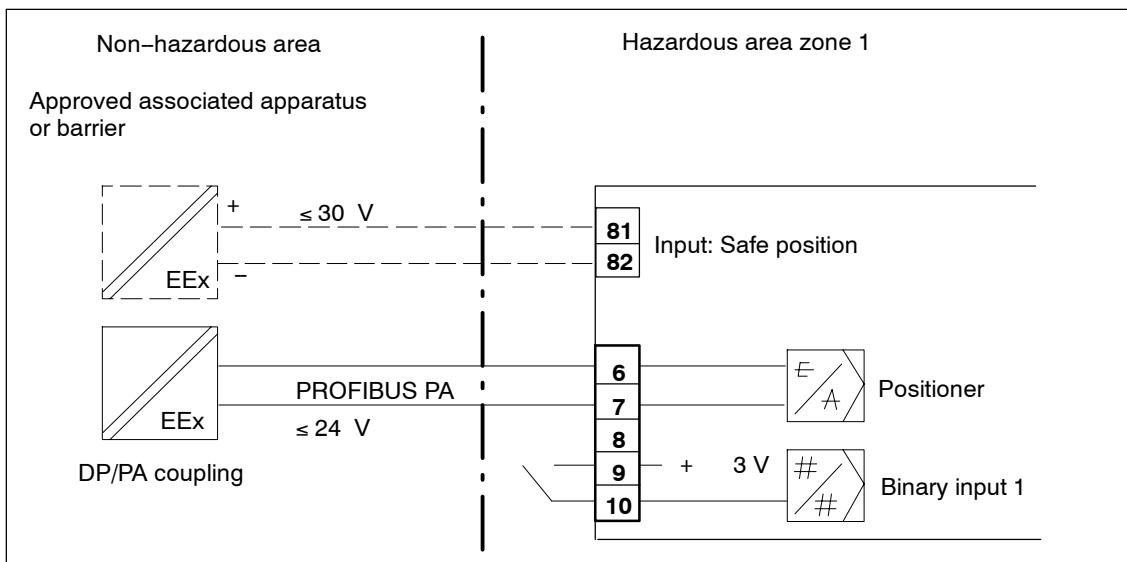
Figure 35   Electric connection of basic device with in intrinsically safe version
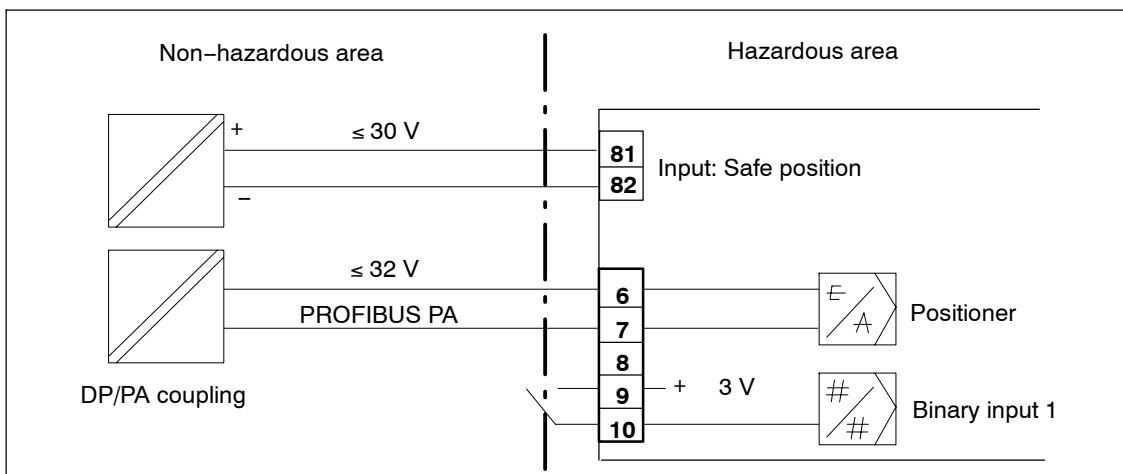
Figure 36   Electric connection for positioner in explosion proof version or in type of explosion protection "n" version

Safety position   The positioner is equipped with an additional input (terminal 81 [+] and terminal 82 [–]) for driving to the safety position. After activating this function this input must be supplied with uninterrupt +24 V, to allow normal positioning operation.

If this power supply is switched off or drops out, the air exhaust valve is automatically opened and the drive will move to the pre–arranged safety position, so that the drive cannot be activated using the keys on the control unit or by means of the master switch. The communication with the Master is still possible.

This function is activated by the coding bridge on the motherboard. This is accessible after removing the module cover and must be moved from the right position (as delivered) to the left position.

3.4.1 Connection variant: options in positioner in non–intrinsically safe and explosion proof version

Current output
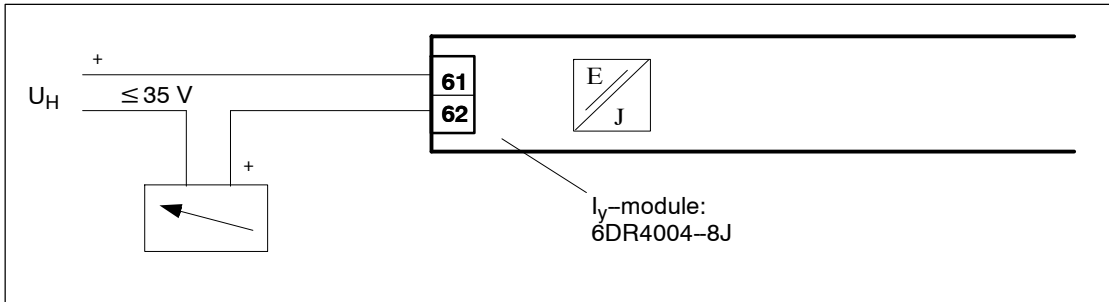
Figure 37 I_y–module 6DR4004–8J, **non** Ex

Binary inputs and outputs
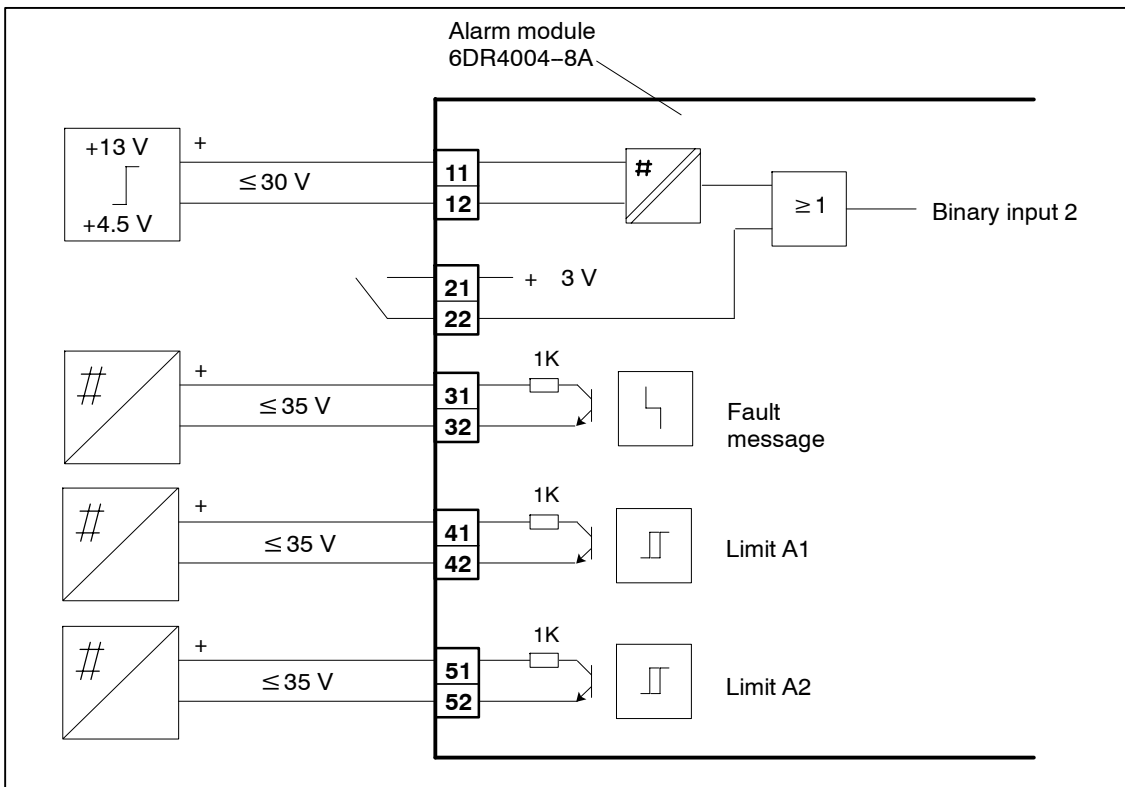
Figure 38 Alarm module 6DR4004–8A, **non** Ex

SIA module
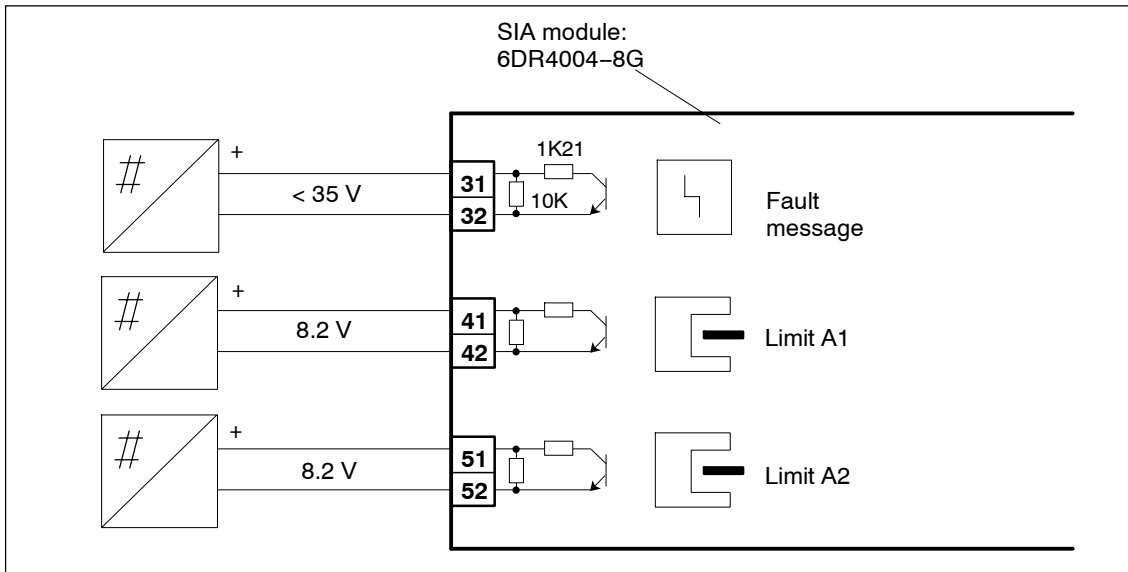
Figure 39   SIA module 6DR4004–8G, **non** Ex

Mechnical limit switch module
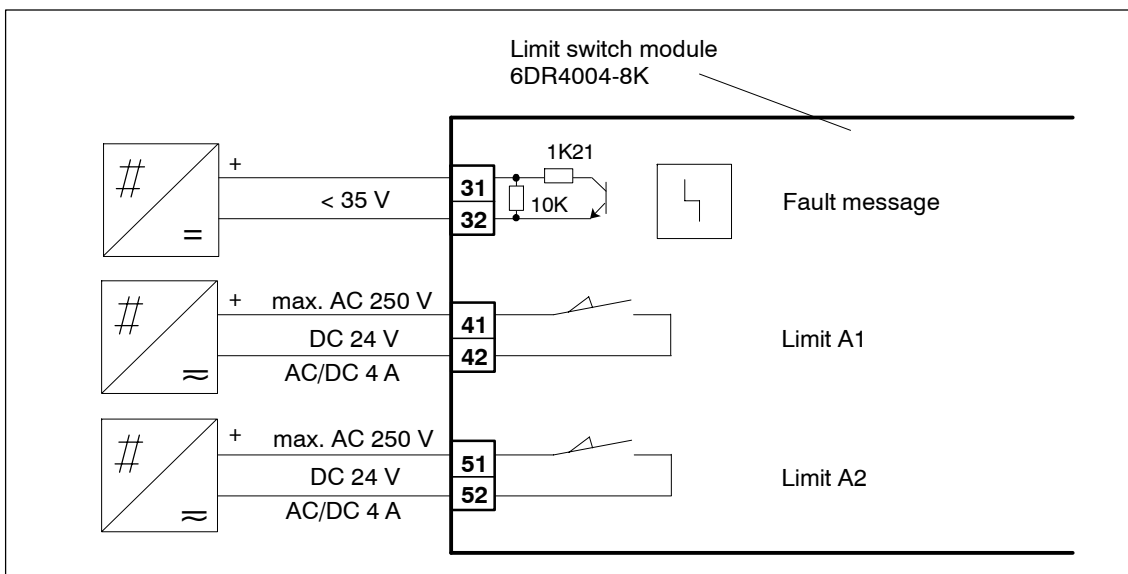
Figure 40   Mechanical limit switch module 6DR4004–8K, **non** Ex

3.4.2 Connection variant: options in the positioner in intrinsically safe version

Current output
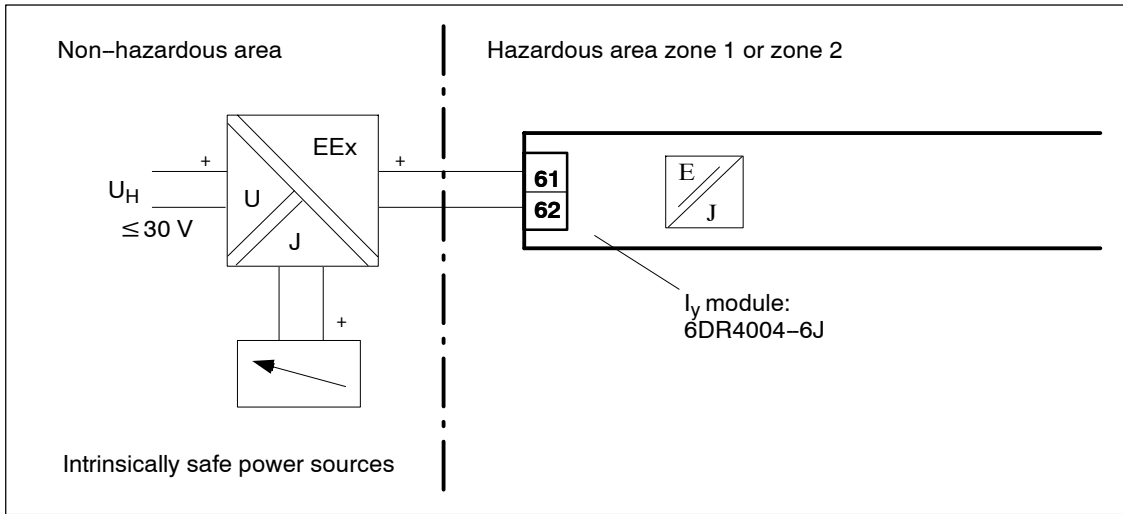
Figure 41 I_y module 6DR4004–6J, EEx i

Binary inputs and outputs
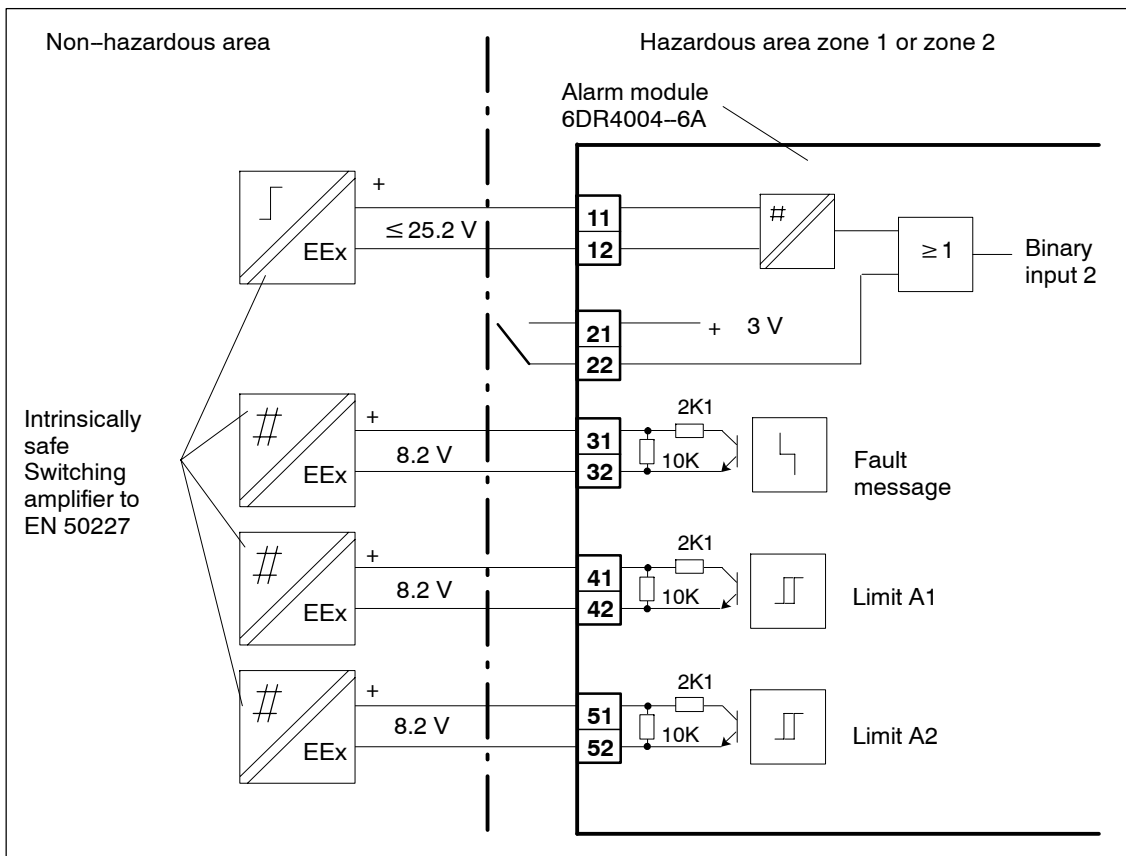
Figure 42   Alarm module 6DR4004–6A, EEx i

SIA module
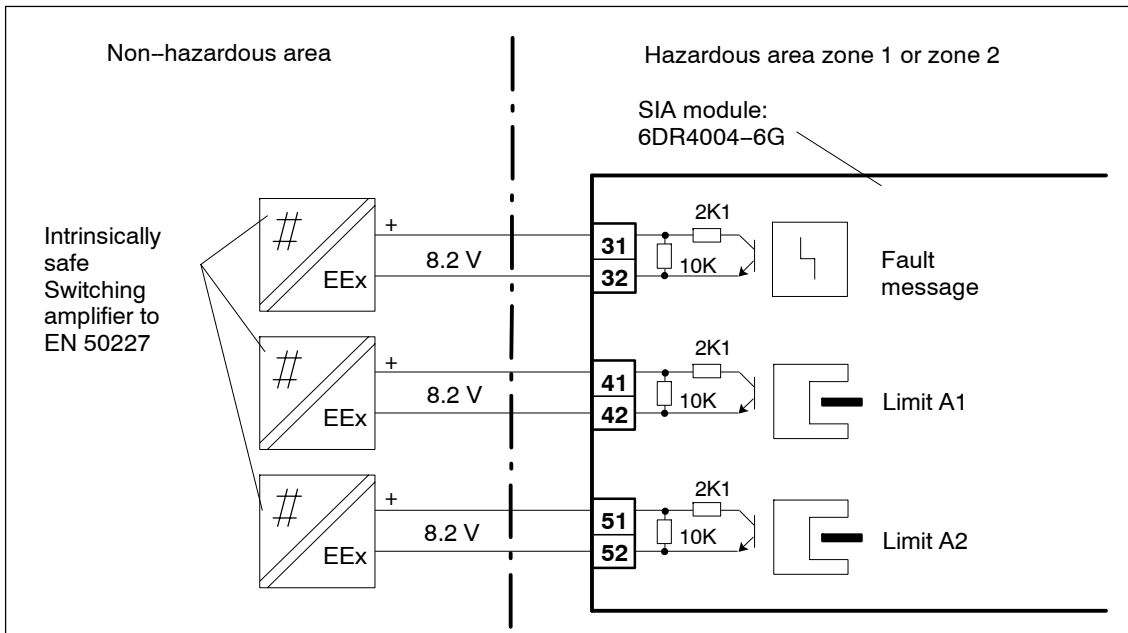
Figure 43   SIA module 6DR4004–8G, EEx i

Mechnical limit switch module
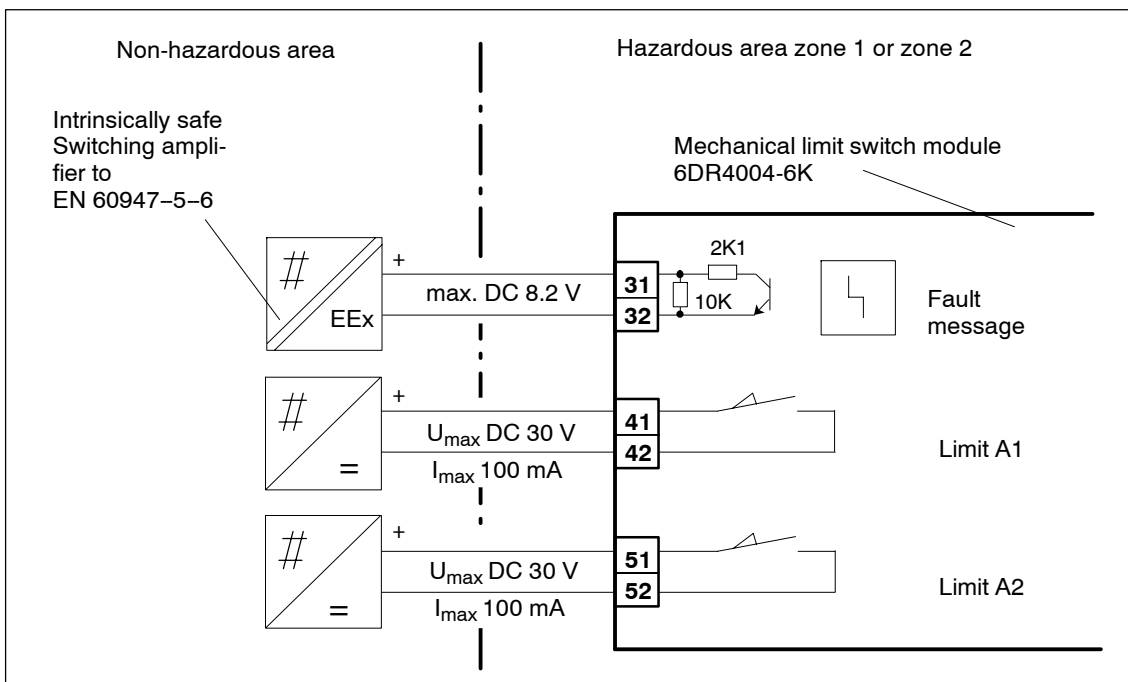
Figure 44   Mechanical limit switch module 6DR4004–6K, EEx i

3.4.3 Connection variant: options in the positioner in type of protection "n" version

Current output
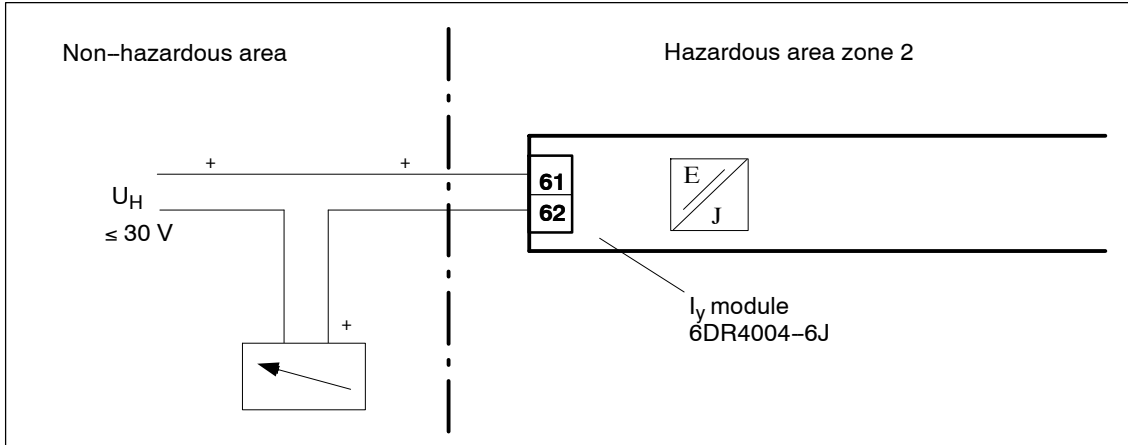
Figure 45   I$_y$ module 6DR4004–6J, EEx n

Binary inputs and outputs
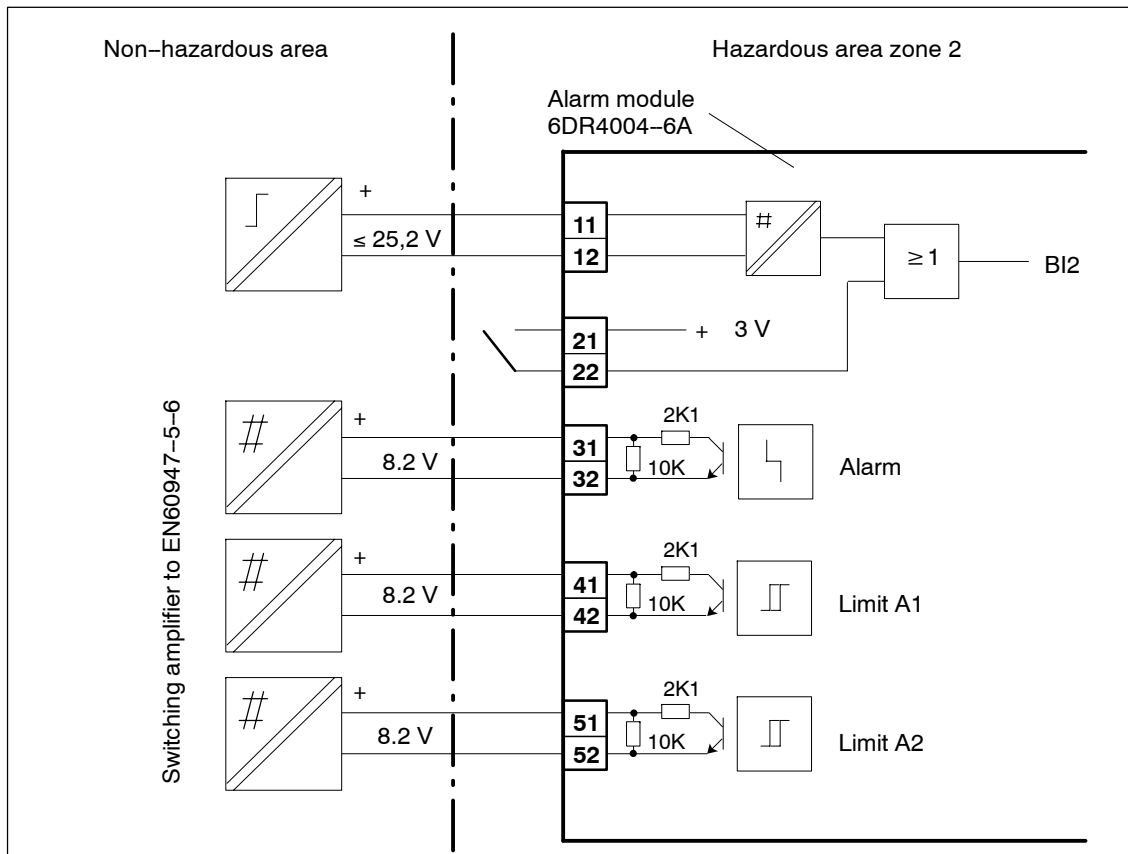
Figure 46   Alarm module 6DR4004–6A, EEx n

SIA module
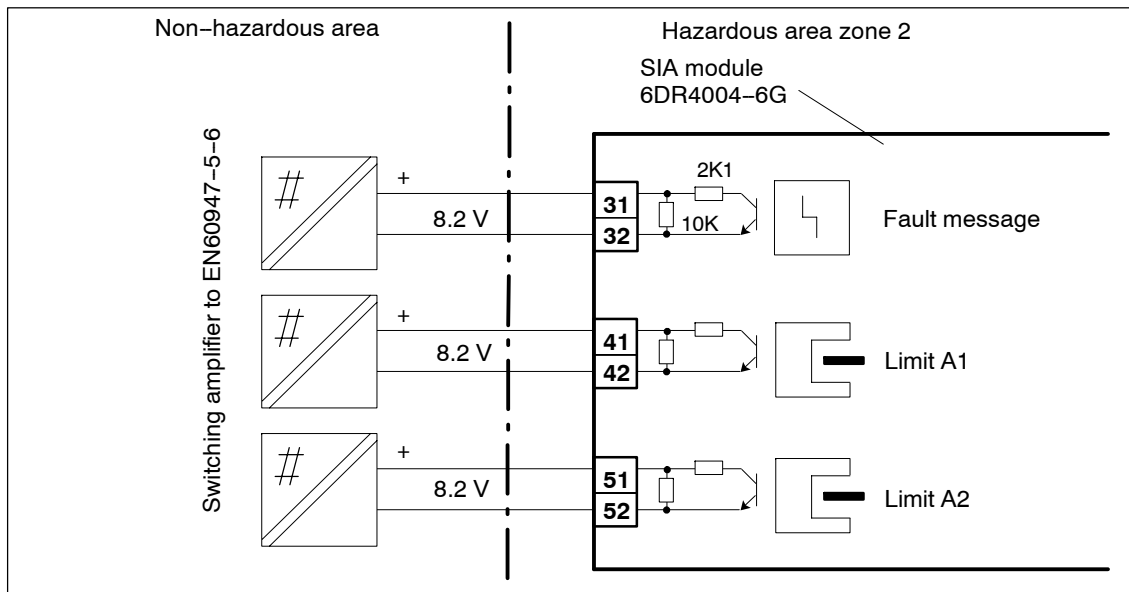
Figure 47   SIA module 6DR4004–6G, EEx n

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 mode P manual operation with electrical signal applied (as–delivered state, see figure 57, page 94).

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 161).

- 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_Z Supply air 1.4 to 7 bar
  Y1   actuating pressure 1 for single– and double–acting actuators
  Y2   actuating pressure 2 for double–acting actuators
  E   exhaust air outlet (remove silencer if necessary)
  see figure 10 and 11, page 27.

- 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 P_Z.

NOTE

In order for spring-loaded pneumatic actuators to be able to reliably exploit the maximum possible actuating path, 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.

The electrical auxiliary power can be provided via a bus interface or separate power source with 15 to 30 V DC. Then you can then adapt the positioner to the respective actuator by parameterizing and initializing it and setting the bus address. Communication with a master is not necessary for this.

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 path and the angle of rotation, the adjusting 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)**
  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 91 "Operation".

NOTE

N.B.: The operating pressure should be at least one bar greater than is necessary for closing/opening the valve during initialization. Jedoch darf der Betriebsdruck nicht größer sein als der maximal zulässige Betriebsdruck des Antriebs.

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 (7, figure 8, page 25) in the positioner:

Stroke	Lever	Position of the transmission ratio selector
5 to 20 mm	short	33° (i.e. down)
25 to 35 mm	short	90° (i.e. up)
40 to 130 mm	long	90° (i.e. up)

2. Push the carrier pin (4, figure 26 (page 55) 2) onto the lever (6, figure 26, 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 26, 2).

3. Connect the actuator and the positioner with the pneumatic lines and supply pneumatic power to the positioner (figure 10 and 11, page 27).

4. Connect the positioner to the PROFIBUS line (figure 35, page 66 and figure 36, page 66).

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 16, page 33) 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. 9, page 26). The internal friction clutch (9, Fig. 8 page 25) 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 [key] for longer than 5 s. This brings you to the Configuration operating mode.
   Display:

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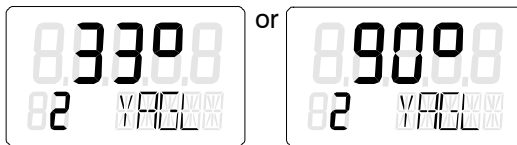
    or

NOTE

It is vital that this value corresponds to the setting of the transmission ratio selector (8, figure 8, page 25) (33° or 90°).

3. Switch on to the following display with the operation mode key [key]:

   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 ⬚:

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

During the initialization phase "**RUN1**" to "**RUN5**" appear one after another in the bottom display (see also structograms figures 49, page 85 to figure 52, page 88).

NOTE

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

The initialization is complete when the following display appears:

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

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 stem path are set manually. The other initialization steps (optimization of the control parameters) run automatically as in automatic initialization.

**Manual initializ–
tion procedure in
linear actuator**

1. Make preparations as described in chapter 3.6.1, page 75 for linear actuator. In particular, make sure by manuallydriving the whole stem path 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:

3. Switch to the second parameter by pressing the operation mode key 🖐 briefly. One of the following displays appears:
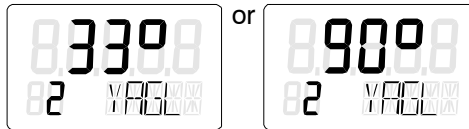
     or

👉 **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:

    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:

```
  no
S  INITM
```
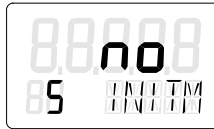
6. Start initialization by pressing the increment key △ for longer than 5 s.
Display:

```
 Strt
S  INITM
```

7. After 5 s the display changes to:

```
 P32.9
   YENDA
```

(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 stem path and the displacement detection according to step 1.

---

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

```
 P22.4
    YEND2
```

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 displacement path and the displacement 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:

```
 8.8.8.8.8
    FINSH
```

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 8, page 25) to position 90° (normal angle for part–turn actuator).

1. Mount the positioner with the appropriate mounting kit (see chapter 3.3.5, page 56).

2. Connect the actuator and the positioner with the pneumatic lines and supply pneumatic power to the positioner (figure 10 and 11, page 27).

3. Connect the positioner to the PROFIBUS line (Figure 35, page 66 and Figure 36, page 66).

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 ▽ 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 seconds. This brings you to the Configuration mode.
Display

2. Set the parameter with the ▽ key to "turn"
    Display:

    ```
     turn
    1  YFCT
    ```

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

    ```
     90º
    2  YAGL
    ```

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

    ```
       no
    4  INITA
    ```

5. Start initialization by pressing the key △ for longer than
    5 seconds.
    Display:

    ```
    Strt
    4  INITA
    ```

During the initialization phase "**RUN1**" to "**RUN5**" appear one after
another in the bottom display (see also structograms in figure 49,
page 85 to figure 52, page 88).

☞   **NOTE**

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

The initialization is complete when the following display
appears:

```
 93.5º
   FINSH
```

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:
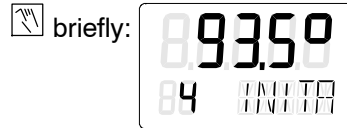
```
  93.5°
4    INITA
```

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.

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 displacement path are set manually. The other initialization steps (optimization of the control parameters) run automatically as in automatic initialization.

Manual initializa-tion procedure in part–turn actuators

1. Make preparations as described in chapter 3.6.4, page 81 for part–turn actuators. In particular, make sure by manually driving the whole displacement path 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 seconds. This brings you to the Configuration mode.
   Display:

   ```
     WAY
   1    YFCT
   ```

3. Set the parameter YFCT to "turn" with the decrement ▽ key.
   Display:

   ```
    turn
   1    YFCT
   ```

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

```
 90°
2   YAGL
```

☞ **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:

```
   no
5   INITM
```

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 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.

3.6.7 Automatic initialization (structograms)
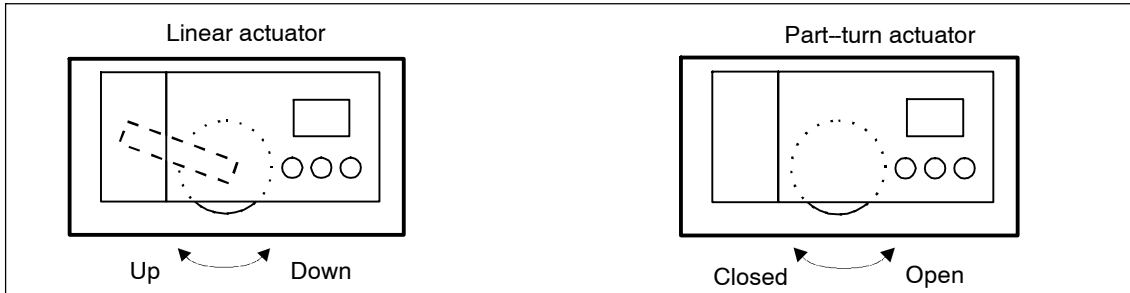
Figure 48   Direction of action of the actuators

The initialization procedure should be taken from the following structogram (figure 49 to figure 52). The terms Open/Closed and up/down in the structogram refer to the direction of action of the actuators as illustrated in figure 48.
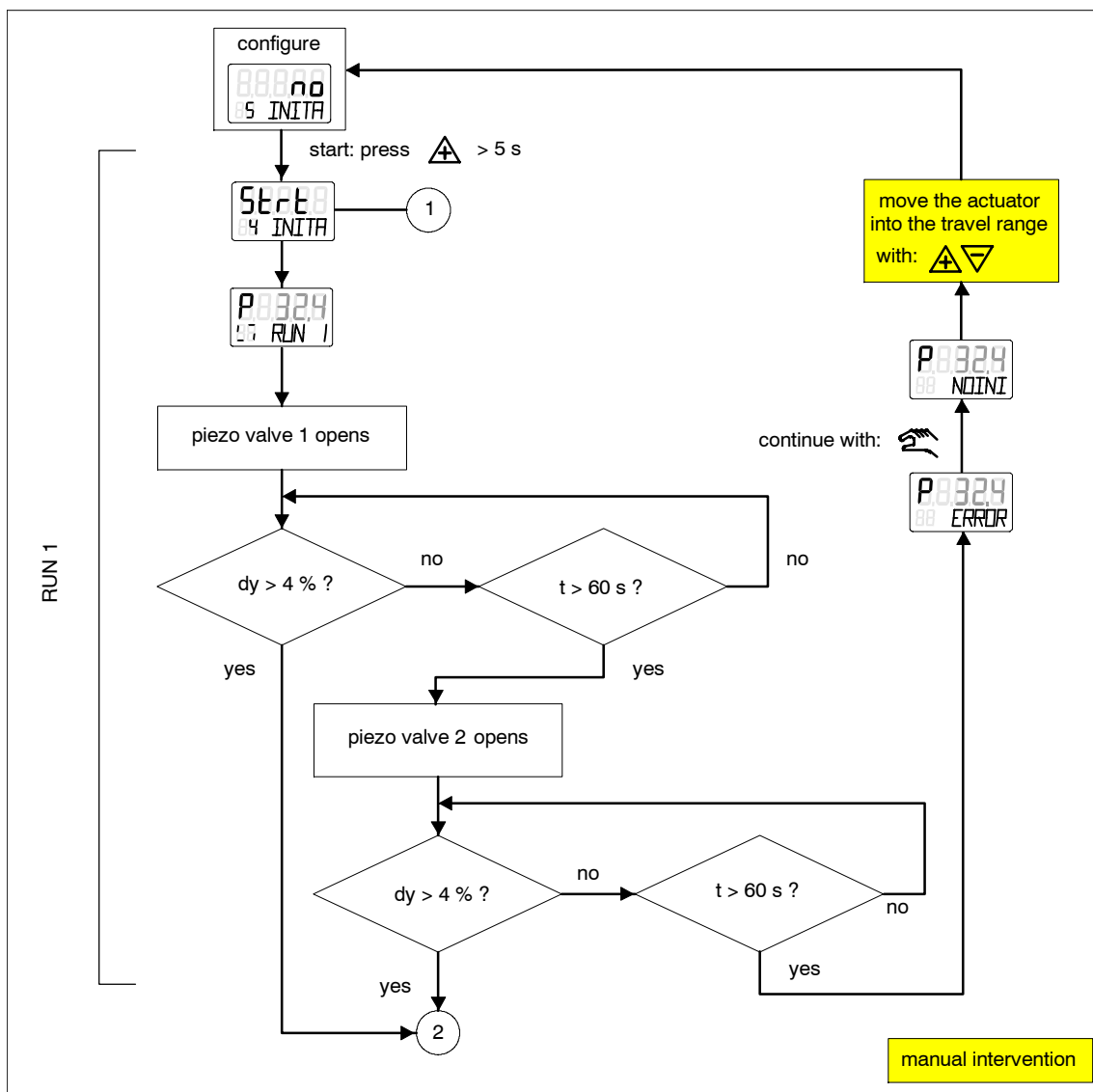
Figure 49   Automatic initialization, part 1
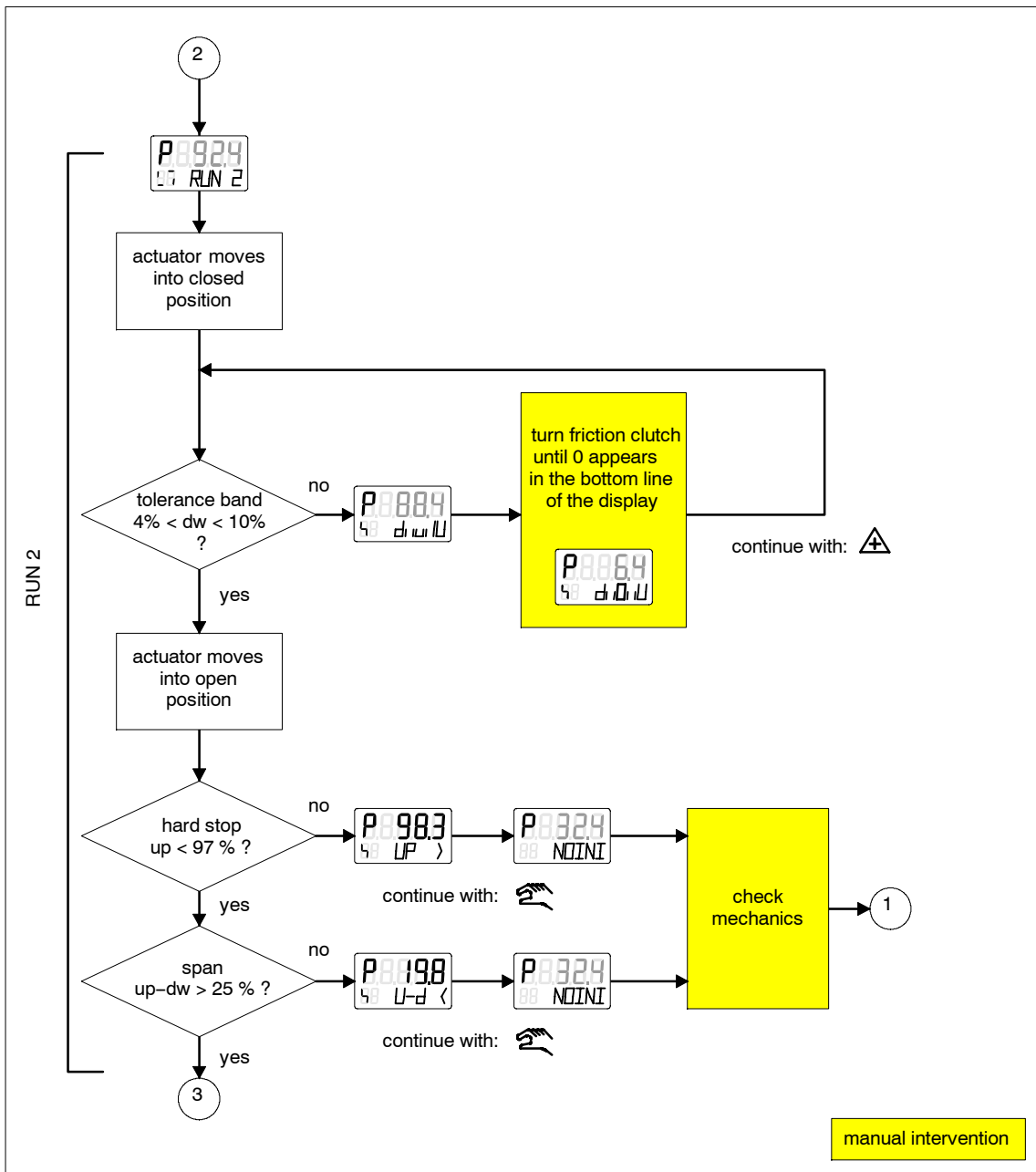
Figure 50   Automatic initialization part 2 (in part–turn actuators)
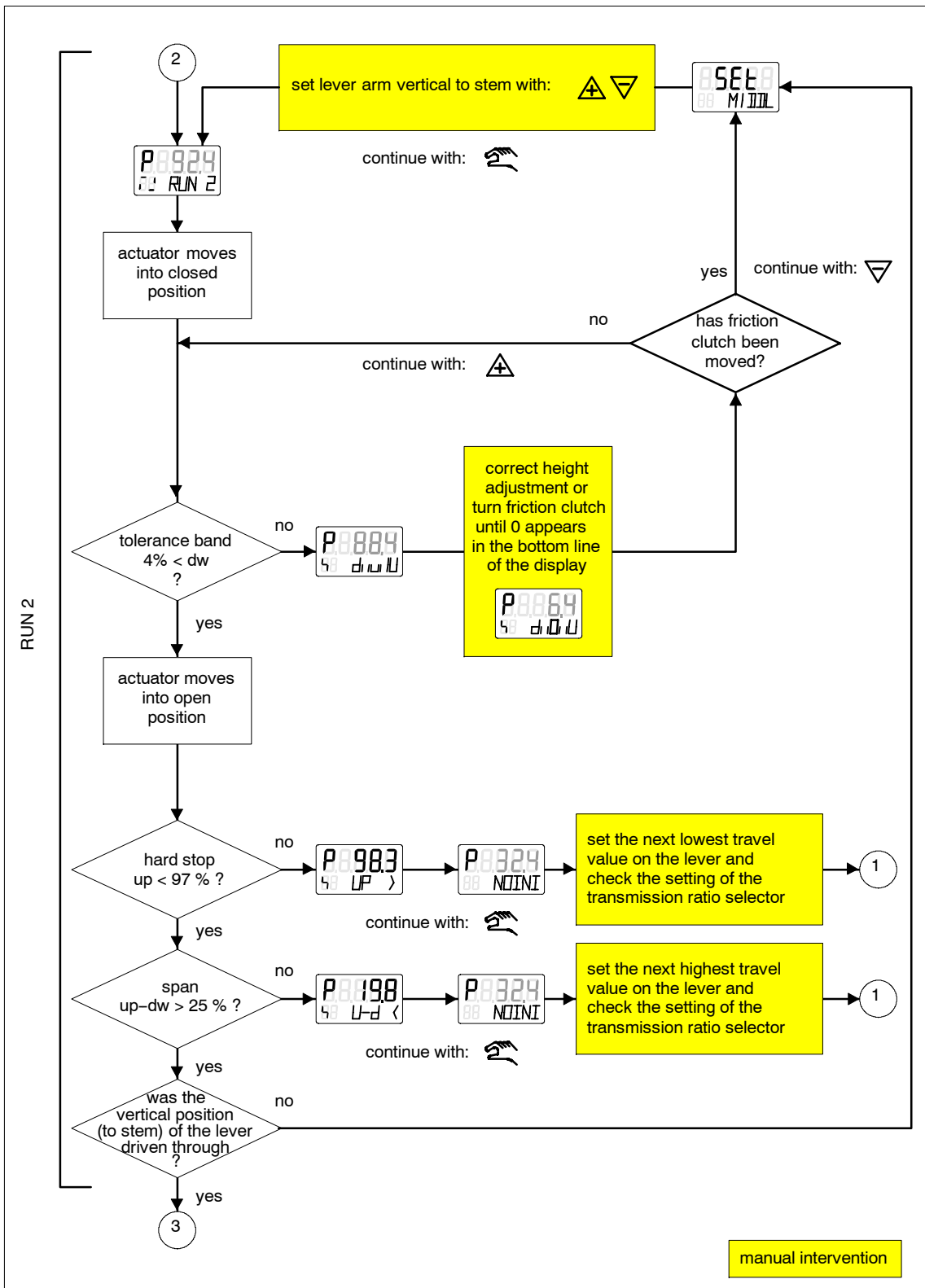
Figure 51   Automatic initialization part 2 (in linear actuators)
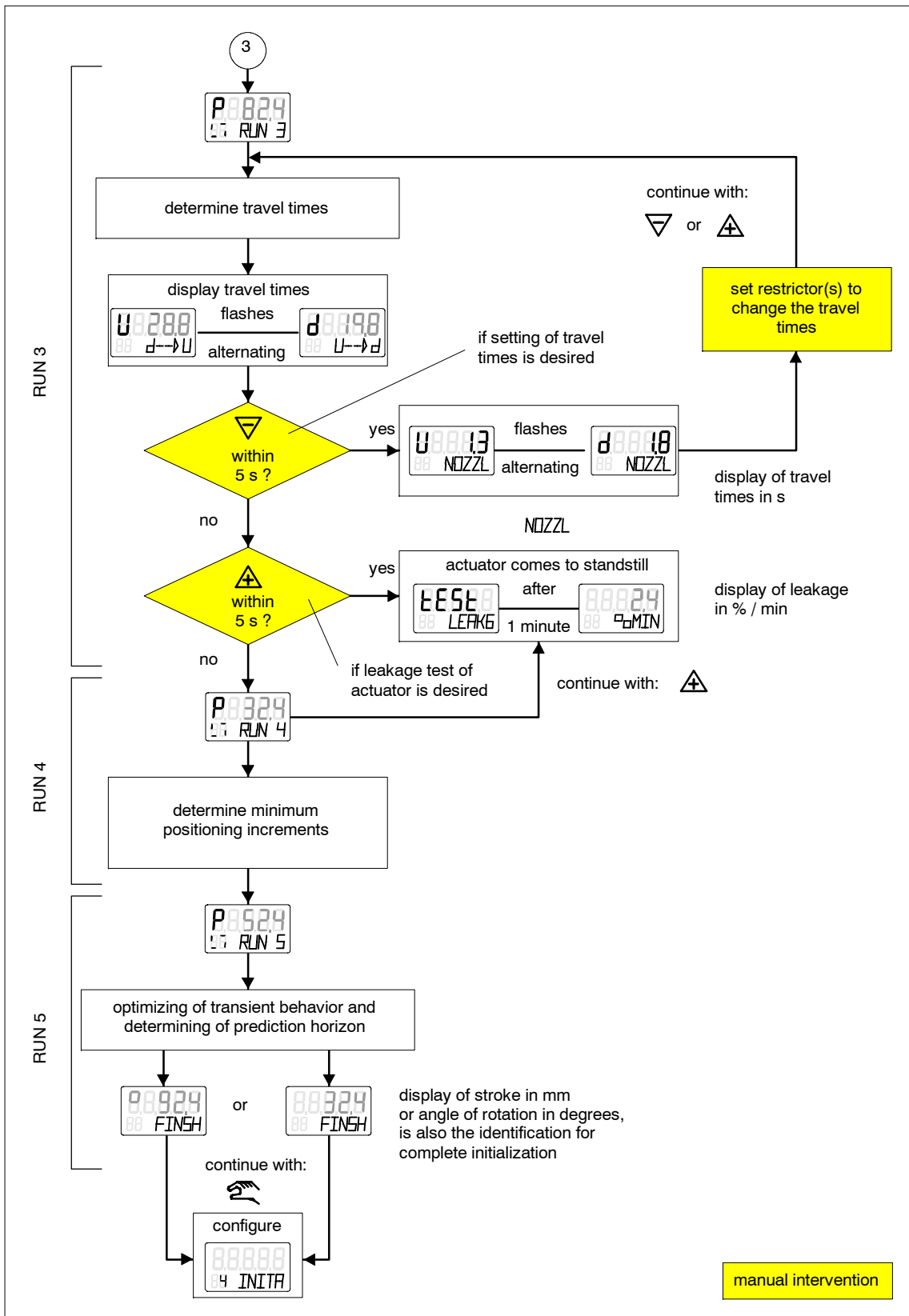
Figure 52   Automatic initialization, part 3

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 (**P**rocess **D**evice **M**anager) or HART®–Communicator. 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.

Operation   4

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 display depends on the selected
operating mode (see chapter 4.3, page 94)

☞	**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 54 shows you the various display options.

The meaning of further display capabilities is detailed in chapter 4.6
page 122.

4.2   Input keys

The positioner is operated by three keys (figure 55, page 93) 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 IP66/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.

P-manual operation	[display: P37.5 / NOINI]	Potentiometer setting [%] Flashing indicator for non-initialized state
Initialization mode	[display: P37.5 / RUN1]	Potentiometer setting [%] Display of current initialization state or poss. error message Indicator for current initialization state or poss. error message
Configuration menu	[display: turn / YFCT]	Parameter value Parameter name Parameter number
Manual mode (MAN)	[display: 96.3 / MAN36]	Position [%] Setpoint [%] Fault message
Automatic (AUT)	[display: 36.1 / AUT36]	Position [%] Setpoint [%] Fault message
Diagnosis menu	[display: 51377 / STRKS]	Diagnosis value Diagnosis name Diagnosis number

Figure 54   Meaning of the various display options
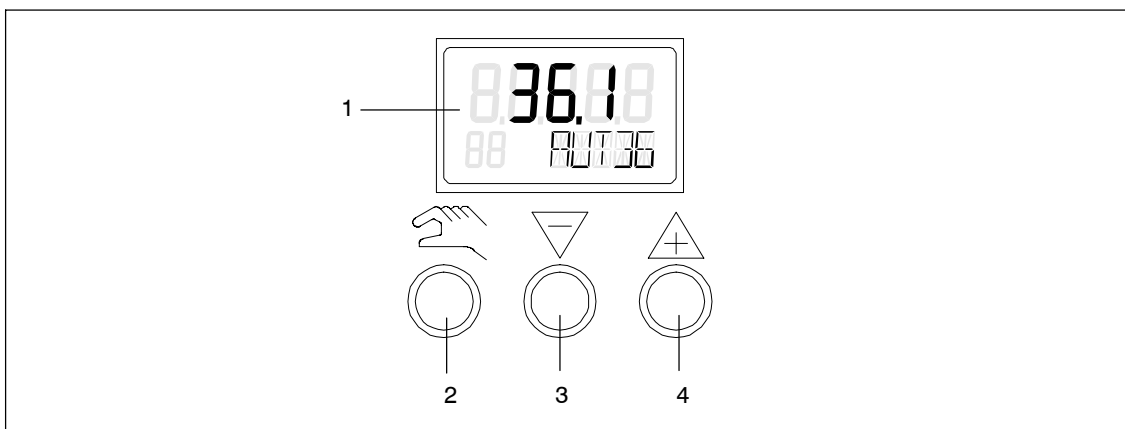
1 Display
2 Operation mode key
3 Decrement key
4 Increment key

Figure 55 Display and input keys of the positioner

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 $\triangledown$ serves to select parameter values in configuration and to move the actuator in manual operation.

- The increment key $\triangle$ 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.

Figure 56 Firmware version

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 57 gives you an overview of the possible operating modes and the change between them.
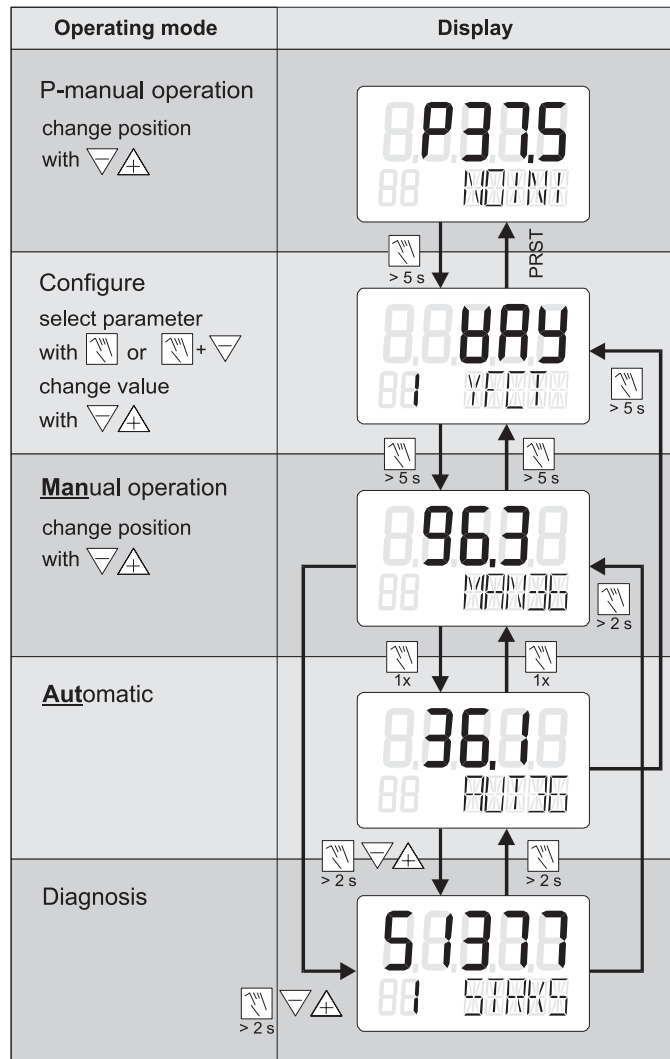
Figure 57   Change between the operating modes

P–manual mode (ex–factory state)

The display of the positioner shows you the current potentiometer setting in the top line and "NOINI" 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 74 "Commissioning".

Manual and automatic mode or output of alarms and position feedback are 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 binary input. Which parameters you need to set and all other parameters are explained in chapter 4.4, page 97 Parameterization.

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 in configuration mode.

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.
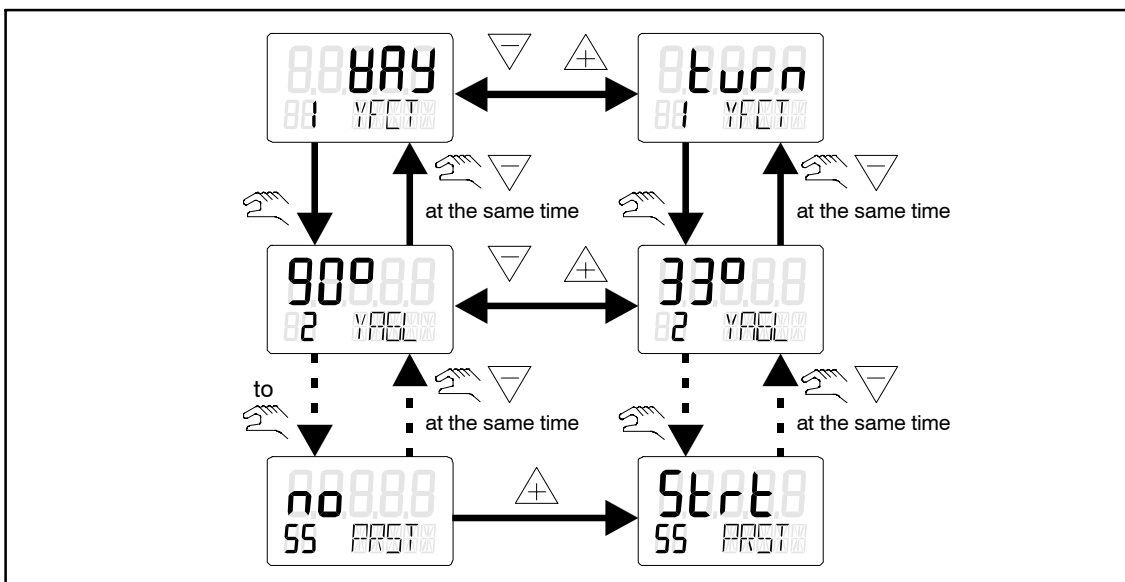
Figure 58   Overview: Configuration

Manual mode (MAN)

In this operating mode you can move the actuator with the decrement ($\bigtriangledown$) and increment keys ($\bigtriangleup$) 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 1, page 114).

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 113 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 59 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.

The configuration block diagram (figures 60 page 99) shows the effects of the parameters.

■ SIPART PS2 PA configurations (PROFIBUS version)

Parameter-name	Function	Parameter values	Dimen-sion
1. YFCT	Type of actuator: part-turn/linear		
	- Part-turn actuator	turn	
	- Linear actuator	WAY	
	- Linear actuator without sine-wave correction	LWAY	
	- Part-turn actuator with NCS	ncST	
	- Part-turn actuator with NCS, reverse direction	-ncST	
	- Linear actuator with NCS	ncSL	
2. YAGL [1]	Rated angle of feedback	90 ° / 33 °	De-grees
3. YWAY [2]	Travel range 5 to 130 mm (0.20 to 5.12 inch)		
	- None	OFF	
	- Short lever 33°	5/10/15/20	mm
	- Short lever 90°	25/30/35	
	- Long lever 90°	40/50/60/70/90/ 110/130	
4. INITA	Initialization (automatic commissioning)	no / ###.# / Strt / FINISH	
5. INITM	Initialization (manual commissioning)	no / ###.# / Strt / FINISH	
6. SDIR	Setpoint direction rising / Setpoint direction falling	riSE / FALL	
7. TSI	Setpoint ramp OPEN	Auto / 0 to 400	s
8. TSD	Setpoint ramp CLOSED	0 to 400	s
9. SFCT	Setpoint function		
	- Linear	Lin	
	- Equal percentage	1-25, 1-33, 1-50	
	- Equal percentage, reversed	n1-25, n1-33, n1-50	
	- Freely adjustable	FrEE	
10. SL0 [3] . . 30. SL20	Setpoint interpolation points with free characteristic 0 %, 5 %, 10 % ... 100 %	0.0 to 100.0	%
31. DEBA	Controller dead zone	Auto / 0.1 to 10.0	%
32. YA	Start of manipulated variable limit	0.0 to 100.0	%
33. YE	End of manipulated variable limit	0.0 to 100.0	%
34. YNRM	Manipulated variable scaling mech. travel/flow	MPOS / FLOW	
35. YCLS	"Tight shut-off" with man. var.		
	- None	no	
	- Only up	uP:	
	- Only down	do	
	- Up and down	uP do	
36. YCDO	Value for "tight shut-off", down	0.0 to 100.0	%
37. YCUP	Value for "tight shut-off", up	0.0 to 100.0	%
38. BIN1 [4]	Function of binary input 1		
	None	OFF	
	NO		
	Only signal	on	
	Block configuring	bLoc1	
	Block config. and manual	bLoc2	
	Drive valve to ye	uP	
	Drive valve to ya	doWn	
	Block movement	StoP	
	NC		
	Only signal	-on	
	Drive valve to ye	-uP	
	Drive valve to ya	-doWn	
	Block movement	-StoP	

Parameter-name	Function	Parameter values	Dimen-sion
39. BIN2 [4]	Function of binary input 2		
	None	OFF	
	NO		
	Only signal	on	
	Drive valve to ye	uP	
	Drive valve to ya	doWn	
	Block movement	StoP	
	NC		
	Only signal	-on	
	Drive valve to ye	-uP	
	Drive valve to ya	-doWn	
	Block movement	-StoP	
40. AFCT [5]	Alarm function		
	None	oFF	
	min : max: normal	Mi:MA	
	inverted	M̄ī:M̄Ā	
	min : min: normal	Mi:Mi	
	inverted	M̄ī:M̄ī	
	max : max: normal	MA:MA	
	inverted	M̄Ā:M̄Ā	
41. A1	Response threshold for alarm 1	0.0 to 100.0	%
42. A2	Response threshold for alarm 2	0.0 to 100.0	%
43. ⌐FCT [5]	Function of alarm output		
	Fault: normal	⌐	
	inverted	-⌐	
	Fault + not Automatic: normal	⌐ nA	
	inverted	-⌐ nA	
	Fault + not Automatic + BI: normal	⌐ nAb	
	inverted	-⌐ nAb	
	(+ means logical OR operation)		
44. ⌐TIM	Monitoring time for setting of fault signal "Control devia-tion"	Auto / 0 to 100	s
45. ⌐LIM	Response threshold of fault signal "Control deviation"	Auto / 0.0 to 100.0	%
46. ⌐STRK	Limit for travel integral	0 to 1.00E9	
47. ⌐DCHG	Limit for change in direction	OFF / 1 to 1.00E9	
48. ⌐ZERO	Limit for zero limit monitoring	OFF / 0.0 to 100.0	%
49. ⌐OPEN	Limit for open limit monitor-ing	OFF / 0.0 to 100.0	%
50. ⌐DEBA	Limit for dead zone monitor-ing	OFF / 0.0 to 10.0	%
51. PRST	Preset (factory setting)	no / Strt / oCAY	
52. FSTY	Safety setting:		
	Parameterized safety setpoint	FSVL	
	Last setpoint	FSSP	
	Open exhaust air valve	FSAC	
53. FSTI	Monitoring time for setting of safety position	0 to 100	s
54. FSVL	Safety setpoint	0 to 100.0	%
55. STNR	Station number	0 to 126	
56. IDENT	Device mode (Ident No.)		
	- Multi-vendor	0	
	- Full functionality	1	

[1] Parameter only visible with "turn" or "WAY"; if "turn" is selected, 33 ° cannot be set.

[2] Parameter not visible if 1. YFCT = "turn", "LWAY" or "-ncST" has been selected.

[3] Interpolation points only appear if 9.SFCT=FrEE has been selected.

[4] NC means: action with opened switch or Low level. NO means: action with closed switch or High level.

[5] Normal means: High level without fault. Inverted means: Low level without fault.
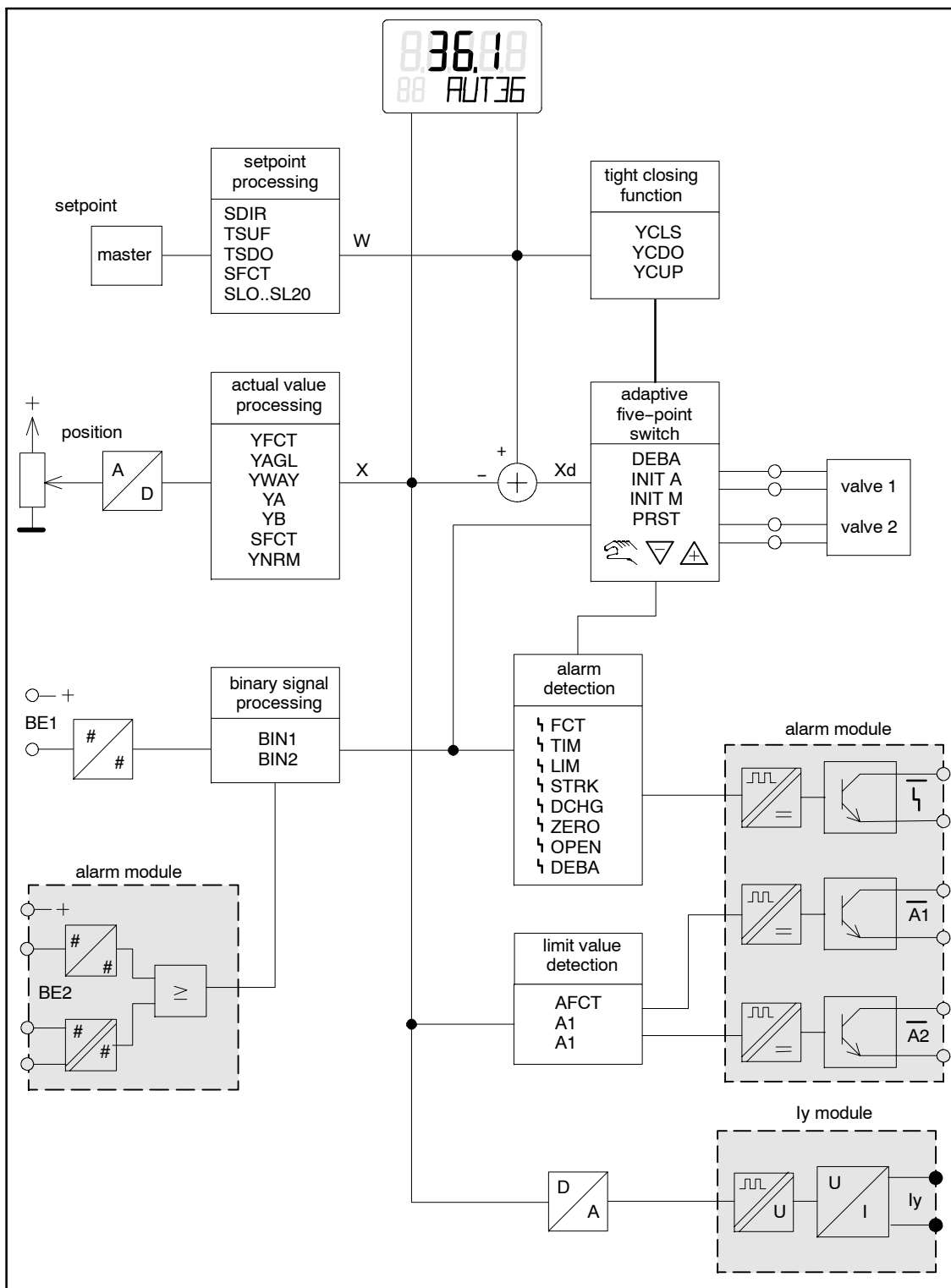
Figure 60   Configuration block diagram

Normally adjustment of the first three following parameters is completely sufficient to enable a positioner to be operated by a drive. 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 adjusted if an NCS is to be connected to a linear actuator with the position measured directly (linear) from the NCS .

- YFCT = ncSLL

  This must be adjusted if an NCS is to be connected to a linear actuator with the position converted by an arm into a part–turn movement.

☞ **NOTE**

After "LWAY, ncSt, –ncSt or ncSL, ncSLL" 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 8, page 25 and figure 9, page 26) **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 trans-mission. 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 74)

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 49, page 85 to figure 52, page 88).

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 78 and chapter 3.6.6, page 83.

☞ **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 five seconds.

6.SDIR	Setpoint direction

The setting of the setpoint direction serves to reverse the direction of action of the setpoint. It is used mainly in single–acting actuators with the safety position "up".

7.TSI	Setpoint ramp UP
	and
8.TSD	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 TSI = Auto the slower of the two travel times determined during initialization is used for the setpoint ramp. TSD is then ineffective.

12.SFCT	Setpoint function (see figure 61, page 103)

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   (9.SFCT = Lin, factory setting)
- equal percentage   1 : 25   (9.SFCT = 1 : 25)
- equal percentage   1 : 33   (9.SFCT = 1 : 33)
- equal percentage   1 : 50   (9.SFCT = 1 : 50)
- inverse equal percentage   25 : 1   (9.SFCT = n1 : 25)
- inverse equal percentage   33 : 1   (9.SFCT = n1 : 33)
- inverse equal percentage   50 : 1   (9.SFCT = n1 –: 50)
- freely adjustable   (9.SFCT = FrEE)

10.SL0 to 30.SL20   Setpoint turning points

A flow parameter can be assigned to the respective setpoint turning point 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.
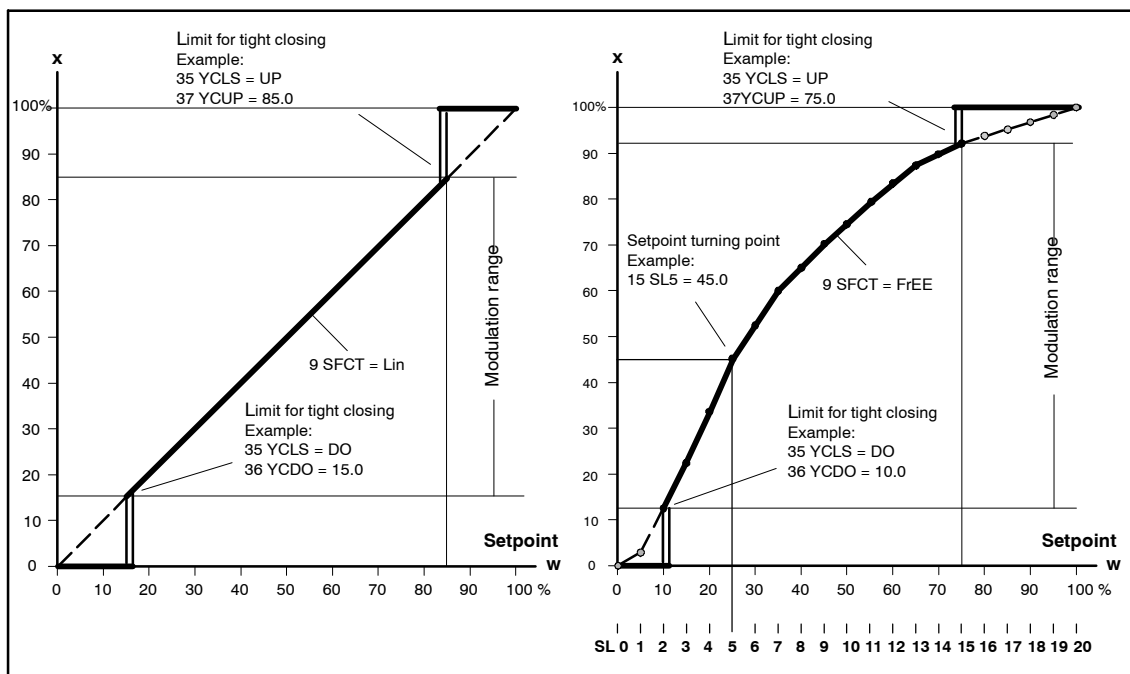
Figure 61   Setpoint characteristic, manipulated variable standardization and tight closing function

The setpoint turning point can only be input at You may only enter a strictly monotonous characteristic, and two consecutive vertex values must differ by at least 0.2 %.

31.DEBA
Dead zone of the controller

At dEbA = 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.

32.YA
Manipulated variable limiting start (see figure 61 and 62)
and
33.YE
Manipulated variable limiting end (see figure 61 and 62)

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.

34.YNRM
Manipulated variable standardization (see figure 61 and 62)

With limiting of the manipulated variable (by "32.YA" and "33.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 "32.YA" and "33.YE". The parameters "32.YA" and "33.YE" are displayed in the MPOS–scale.

The FLOW–scale is the standardization (0 to 100 %) to the range between "32.YA" and "33.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 Iy.

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 %
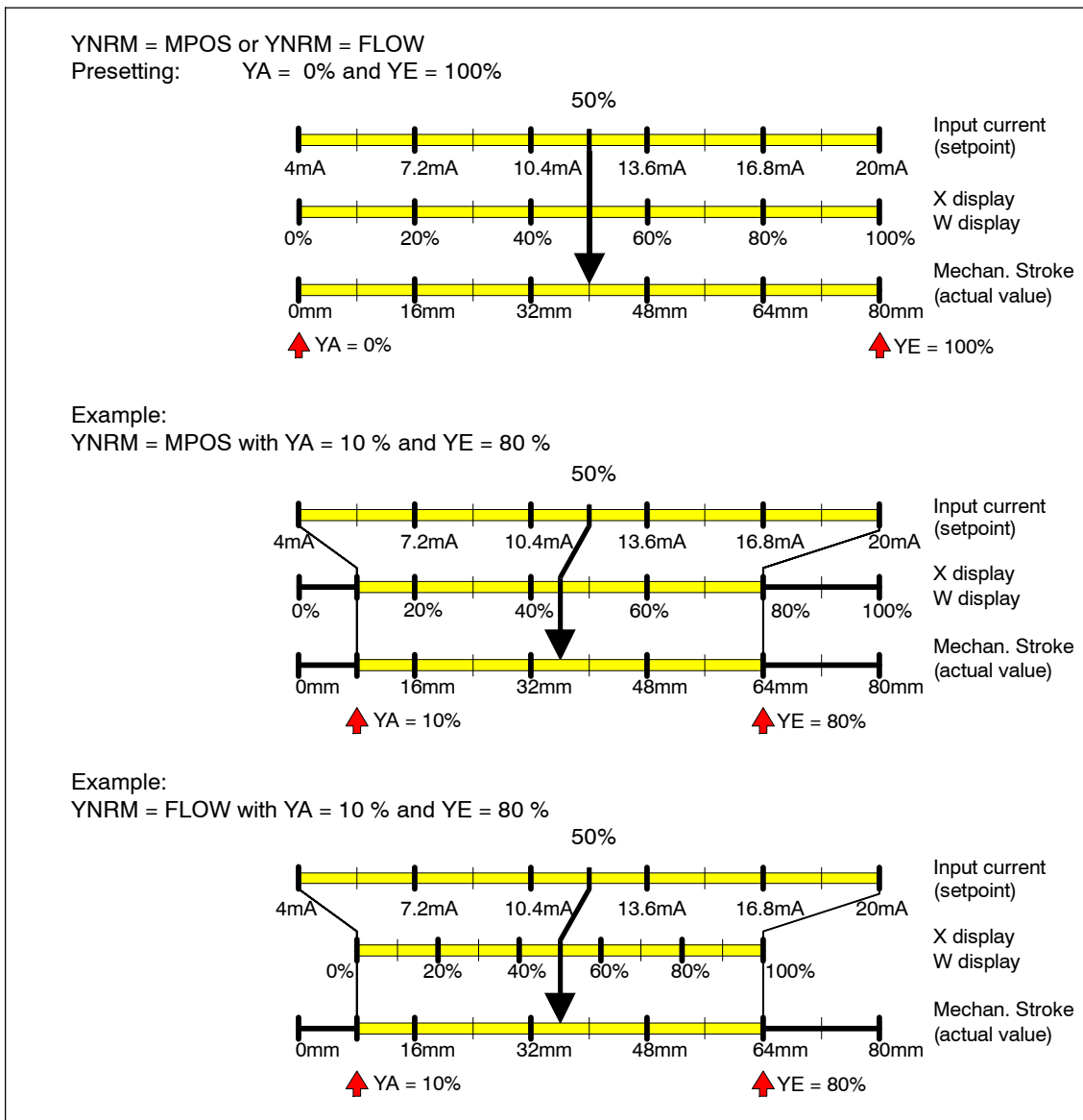
Figure 62   Dependence on the stroke of standardization and on YA and YE in the example of an 80 mm linear actuator

35.YCLS   Tight closing with manipulated variable

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 YCDO or above YCUP (figure 61, page 103).

☞   **NOTE**

When the tight closing function is activated, monitoring for the control deviation is switched off for the respective overflow direction (YCDO: < 0 %, YCUP: > 100 %) for parameter 45.ᴸLIM. We recommend parameter 48ᴸ ZERO and 49.ᴸ OPEN in the end positions for long–term monitoring.

| **36.YCDO** | Value for tight closing, bottom |
| **37.YCUP** | Value for tight closing, up |

☞ **NOTE**

YCDO must always be set to less than YCUP. The tight closing function has a fixed hysteresis of 1 %. "36.YCDO" and "37.YCUP" relate to mechanical stops and are independent of the settings of "6.SDIR" and "38.YDIR".

38.BIN1   Function binary input 1
and
39.BIN2   Function binary input 2

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 –on

  Binary messages of the periphery (e.g. pressure or temperature switches) can be read out via the communication interface or lead to responding of the fault message output by OR linking with other messages.

- BIN1 = bLoc1

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

- BIN1 = bLoc2

  If binary input 1 has been activated, manual operation is also locked in addition to the Configuration mode.

- BIN1 or BIN2 = uP or doWn (contact closes) or –uP or –doWn (contact opens).

  When the binary input is activated, the actuator drive controls the actuator in automatic mode through the values held in YA and YE.

- BIN1 or BIN2 (contact closes) = StoP or –StoP (contact opens).

  With activated binary input the piezo–valves are blocked in automatic mode 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 BI1: If the binary 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.

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".

40.AFCT   Alarm function

There are 6 setting capabilities available:

1. Min   Max
2. Min   Min
3. Max   Max
4. –Min   –Max   (inverted reporting)
5. –Min   –Min   (inverted reporting)
6. –Max   –Max   (inverted reporting)

	Alarm module		SIMATIC	
	A1	A2	MIN	MAX
A1 = 48	AFCT = MIN / MAX			
A2 = 52				
Travel = 45	Activated		Activated	
Travel = 50				
Travel = 55		Activated		Activated

	Alarm module		SIMATIC	
	A1	A2	MIN	MAX
A1 = 48	AFCT = –MIN / –MAX			
A2 = 52				
Travel = 45		Activated		Activated
Travel = 50	Activated	Activated	Activated	
Travel = 55	Activated		Activated	

	Alarm module		SIMATIC	
	A1	A2	MIN	MAX
A1 = 52	AFCT = MIN / MAX			
A2 = 48				
Travel = 45	Activated		Activated	
Travel = 50	Activated	Activated	Activated	
Travel = 55		Activated		Activated

	Alarm module		SIMATIC	
	A1	A2	MIN	MAX
A1 = 52	AFCT = –MIN / –MAX			
A2 = 48				
Travel = 45		Activated		Activated
Travel = 50				
Travel = 55	Activated		Activated	

Please note:

- the two limit values in the control system can be individually evaluated only when adjusting 1 or 4, because in the status reports READBACK and POS_D (chapter 5.3.2 page 141) the two limit values A1 and A2 are "or linked".

- the response of the two limit values in the status reports READBACK and POS_D cannot be recognized if the positioneris in manual mode.

- the direction of control action shown on the alarm module is reversed.

- the direction of control action is also reversed if A1 is set to greater than A2.

- the hysteresis of the limit value is 1 % as standard.

- in the factory setting "OFF" the output of both alarms A1 and A2 is deactivated.

41.A1	Response threshold alarm 1
	and
42.A2	Response threshold alarm 2

The alarm thresholds are related to the mechanical path (MPOS–scale).

43. ꞁFCT Function of the fault message output

If fault messages are used as a monitor for control non–conformities over a period of time, they will be triggered in addition by the following events also:

- Power failure

- Processor fault

- Actuator fault

- Valve fault

- Compressed air failure

- Responses of the limit values 46 to 50

Note that the fault message cannot be switched off, however it can be suppressed (factory setting), if the actuator is set to "non–automatic mode". If it is wished to generate fault messages here also, the parameter FCT must be set to "ꞁnA". In addition there is also the facility to "alternate" the fault message using the status of the binary inputs. For this, set the parameter FCT to ""ꞁnAb"".

Select the setting "–ꞁ" if the fault message is to be sent inverted on the alarm module or SIA module.

For more information on fault messages, see chapter 4.5.3 Online–– Diagnosis, page 113.

44. ꞁTIM 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 "45.ꞁLIM".

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

NOTE

If the control function to close tightly is activated, for parameter "45.ꞁ 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 "48.ꞁ ZERO" and "49. ꞁOPEN".

For more information on fault messages, see chapter 4.5.3 Online– Diagnosis, page 118.

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45. ↳LIM 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 "44.↳TIM" and "45.↳LIM" are both set to "Auto" (factory setting), the fault message is set if the slow step zone is not reached within a certain time. This time is 2 times the initialization travel time within 5 to 95% of the actuating path and 10 times this time outside 10 to 90% of the actuating path.

When the tight closing function is activated, monitoring for the control deviation is switched off for the respective overflow direction (YCDO: < 0 %, YCUP: > 100 %) for parameter 45.↳LIM. We recommend parameter 48.↳ZERO and 49.↳OPEN in the end positions for long–term monitoring.

46. ↳STRK Limit value for monitoring the travel integral (number of strokes)

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 113.

This monitoring function can not be deactivated.

47. ↳DCHG 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 113.

This monitoring function can be deactivated with the OFF setting (factory setting).

48. ↳ZERO 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 than 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 "35.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 113.

49. ꜔OPEN   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 then 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 "35.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.

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50. ꜔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 is activated.

Prerequisite for this function is the setting of the parameter"31.DEBA" = Auto. This monitoring function can be deactivated with the OFF setting (factory setting).

51.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.

52.FSTY   Safety position

This parameter is used to move the actuator into a set safety position if communication fails.

Three settings are possible

- FSVL

  the actuator must continue to control with the parameterized safety setpoint. This value will remain effective even after a loss of electrical power.

- FSSP

  the actuator must continue to control with the last effective setpoint

- FSAC (factory setting)

  here this outlet air valve is opened and the single–acting actuator moves to its final position by spring power.

53.FSTI   Monitoring time for moving to the safety position

If communications are lost, the positioner will move to the safety position after expiry of the set period of time.

54.FSVL   Safety setpoint

Specification for the safety setpoint

Note that the fail safe value FSVL of 0 % always refers to the mechanical position taken up when the actuator is depressurized. This is particularly important if the parameter SDIR is set to FALL (falling characteristic of the setpoint) and then at 0% setpoint 100 % mechanical position is expected.

55.STNR   Station number

So that the devices on the bus can be addressed separately, a separate station number must be set on each device.

56.IDENT   Device operating mode

The SIPART PS2 PA positioner recognizes two device operating modes for its behavior in relation to DP masters class1:

[0] profile conformity: exchangeable for positioners from other suppliers to PROFIBUS PA profile 3.0

[1] profile conformity with extensions: full scope of function of SIPART PS2 PA (condition as delivered)

☞ **NOTE**

Each device operating mode has a particular device master data file (GSD) assigned to it.

If the configuration of your PROFIBUS PA channel does not correspond to the device operating mode set, the device will not pick up the cyclic data exchange. The station number and device operating mode cannot be changed during communication with a master of class 1.

Successful establishment of communications with a cyclical master (chapter 5.3 page 139) can be recognized by the positioner responding to the set value from the master. A flashing decimal point in the top line of the display denotes an acyclic master (chapter 5.2 page 131).

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. In the third column the corresponding English term from which the abbreviation is derived is shown next to the German meaning unless this is self explanatory.

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 🖐. By pressing and holding the operation mode key and additionally pressing the decrement key ▽ you can select the diagnostic values in reverse order.

Certain values can be set to zero by pressing the increment key △ 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.

No.	Abbrevia-tion	Meaning	Displayable values	Unit	Rest poss.
1	STRKS	Number of strokes (**Str**o**ks**)	0 to 4.29E9	–	x
2	CHDIR	Changes of direction (**Ch**anges of **Dir**ection)	0 to 4.29E9	–	x
3	↳CNT	Fault counter (**Co**unter ↳)	0 to 4.29E9	–	x
4	A1CNT	Alarm counter 1 (**Alarm 1 Co**u**nt**er)	0 to 4.29E9	–	x
5	A2CNT	Alarm counter 2 (**Alarm 2 Co**u**nt**er)	0 to 4.29E9	–	x
6	HOURS	Operating hours (**Hours**)	0 to 4.29E9	Hours	
7	WAY	Determined actuating path (**Way**)	0 to 130	mm or °	
8	TUP	Travel time up (Travel **T**ime **Up**)	0 to 1000	s	
9	TDOWN	Travel time down (Travel **T**ime **Down**)	0 to 1000	s	
10	LEAK	Leakage (**Leak**age)	0.0 to 100.0	%	
11	P0	**P**otentiometer value below stop (**0**%)	0.0 to 100.0	%	
12	P100	**P**otentiometer value bottom stop (**100**%)	0.0 to 100.0	%	
13	IMPUP	Impulse length up (**Imp**ulse Length **Up**)	2 to 100	ms	
14	IMPDN	Impulse length down (**Imp**ulse Length **Down**)	2 to 100	ms	
15	DBUP	Dead zone up (**D**ead **B**and **Up**)	0.1 to 100.0	%	
16	DBDN	Dead zone down (**D**ead **B**and **Down**)	0.1 to 100.0	%	
17	SSUP	Slow step zone up (**S**low **S**tep Zone **Up**)	0.1 to 100.0	%	
18	SSDN	Slow step zone down (**S**low **S**tep Zone **Down**)	0.1 to 100.0	%	
19	TEMP	Current **temp**erature	–40 to 85	°C	
20	TMIN	**Min**imum **t**emperature ("drag pointer")	–40 to 85	°C	
21	TMAX	**Max**imum **t**emperature ("drag pointer")	–40 to 85	°C	
22	T1	Number of operating hours in **T**emperature range **1**	0 to 4.29E9	Hours	
23	T2	Number of operating hours in **T**emperature range **2**	0 to 4.29E9	Hours	
24	T3	Number of operating hours in **T**emperature range **3**	0 to 4.29E9	Hours	
25	T4	Number of operating hours in **T**emperature range **4**	0 to 4.29E9	Hours	
26	T5	Number of operating hours in **T**emperature range **5**	0 to 4.29E9	Hours	
27	T6	Number of operating hours in **T**emperature range **6**	0 to 4.29E9	Hours	

No.	Abbrevia–tion	Meaning	Displayable values	Unit	Rest poss.
28	T7	Number of operating hours in **T**emperature range **7**	0 to 4.29E9	Hours	
29	T8	Number of operating hours in **T**emperature range **8**	0 to 4.29E9	Hours	
30	T9	Number of operating hours in **T**emperature range **9**	0 to 4.29E9	Hours	
31	VENT1	Number of cycles pre–control**valve 1**	0 to 4.29E9	–	
32	VENT2	Number of cycles pre–control**valve 2**	0 to 4.29E9	–	
33	STORE	Store current values as "last maintenance" (press increment key for 5 s) (**Store**)	–	–	
34	PRUP	Prediction up	1 to 40	–	
35	PRDP	Prediction down	1 to 40	–	
36	WT00	Number of operating hours in distance class WT00	0 to 4.29E9	Hours	x
37	WT05	Number of operating hours in distance class WT05	0 to 4.29E9	Hours	x
38	WT10	Number of operating hours in distance class WT10	0 to 4.29E9	Hours	x
39	WT30	Number of operating hours in distance class WT30	0 to 4.29E9	Hours	x
40	WT50	Number of operating hours in distance class WT50	0 to 4.29E9	Hours	x
41	WT70	Number of operating hours in distance class WT70	0 to 4.29E9	Hours	x
42	WT90	Number of operating hours in distance class WT90	0 to 4.29E9	Hours	x
43	WT95	Number of operating hours in distance class WT95	0 to 4.29E9	Hours	x

Table 1   Overview diagnostic values

4.5.2 Meaning of the diagnostic values

1 STRKS

Number of strokes (total valve travel)

The actuator movements during operation are totaled and can be read here as number of strokes. Unit: 100% stokes, i.e. the distance between 0 to 100 % and backwards. 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 quarter of an hour 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–△.

4 A1CNT   Alarm counter 1
                   and
5 A2CNT   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 "40.AFCT". The counters can be reset to zero with the
increment key ⬠.

6 HOURS   Operating hours

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

7 WAY   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".

8 TUP   Travel time up
                   and
9 TDOWN   travel time down

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

10 LEAK   Leakage

The value of the leakage measurement in %/min. can be read off here.
This measurement may take place during the initialisation phase or
here in this diagnostic menu.

The leakage measurement starts when the increment key is pressed
for more than 5 s and then released. During the measurement, the
value of the current position or "tESt" is displayed interchangeably in
the upper line of the display. After 1 minute, the position change can be
read off in %/minute.

Note that the leakage measurement may only be started if the
positioner is in manual mode ("MAN"). If this is not the case, "noMAn"
is displayed in the upper line of the display.

11 P0   Potentiometer value bottom stop
                   and
12 P100   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.

13 IMPUP	Impulse length up
	and
14 IMPDN	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 tuned for special applications (see chapter 4.7 page 126).

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 "34.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 126).

| **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:

	T1	T2	T3	T4	T5	T6	T7	T8	T9
Tempera–ture range [°C]	≥ -30	≥ -30 < -15	≥ -15 < 0	≥ 0 < 15	≥ 15 < 30	≥ 30 < 45	≥ 45 < 60	≥ 60 < 75	≥ 75

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 (chapter 5.2.1, page 131), 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 126.

NOTE

All diagnostic values are updated every quarter of an hour to a non–volatile memory, so that in the event of a loss of electrical power only the events of the last hour will be lost.

36 WT00 to
43 WT95

Number of operating hours in distance class WT00 to 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:

Distance class	WT00	WT05	WT10	WT30	WT50	WT70	WT90	WT95
Setting range section	< 5 %	≥ 5 % <10 %	≥ 10 % <30 %	≥ 30 % <50 %	≥ 50 % <70 %	≥ 70 % <90 %	≥ 90 % <95 %	≥ 95 %

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.

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.

The following table 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.

Error code	Event	Parameter setting	Fault message disappears when ...	Possible causes
1	Remaining control error	always active	... the control error has disappeared again	Compressed air missing, actuator fault, valve fault (e.g. blockade).
2	Instrument not in automatic mode	43.ꟓFCT= ꟓnA or = ꟓnAB	... the instrument is brought into automatic mode	The instrument is configured or is in manual operation.

Error code	Event	Parameter setting	Fault message disappears when ...	Possible causes
3	Binary input BI1 or BI2 active	43.↳ FCT= ↳nAB and binary function BIN1 or BIN2 to "on"	... the binary input is no longer activated	The contact connected to the binary input has become active (e.g. stuffing box monitoring, excess pressure, temperature switch).
4	Limit value Number of strokes exceeded	46.↳STRK≠OFF	... the stroke counter is reset or the limit value increased	The total distance traveled by the actuator exceeded the set limit value.
5	Limit value change of direction exceeded	47.↳ DCHG≠OFF	... the change of direction counter is reset or the limit value increased	The number of changes of direction exceeded the set limit value.
6	Limit value bottom hard stop exceeded	48.↳ZERO≠OFF 35.YCLS = do or up do	... the deviation of the stop disappears or the instrument is re-initialized	Wear of the valve seat, deposits or foreign bodies in the valve seat, mechanical maladjustment, friction clutch maladjusted.
7	Limit value top hard stop exceeded	49.↳OPEN≠OFF 35. YCLS = up or up do	... the deviation of the stop disappears or the instrument is re–initialized	Wear of the valve seat, deposits or foreign bodies in the valve seat, mechanical maladjustment, friction clutch maladjusted.
8	Limit value dead zone adaptation exceeded	50.↳DEBA≠OFF 31.DEBA = Auto	... the limit value is dropped below again	Increased stuffing box friction, mechanical lots of the position feedback

Table 2 Events which can activate the fault message output

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 44.↳ TIM, monitoring time for setting the fault messages and 45.↳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 "43.↳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 Binary input BI1 or BI2 active

A fault message is generated when the binary input is activated at the the corresponding setting of the parameter "43.⌐FCT", function of the fault message output and the parameter "38.BIN1", function binary input 1. This may be a switch for stuffing box monitoring, a temperature switch or a limit value switch for example.

Binaryinput 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 "46.⌐STRK" and "47.⌐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 "48.⌐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 position tight closing bottom. 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 ("48.⌐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 "49.⌐OPEN". Activation of the tight closing top function (parameter "35.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 31.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 ("50.⌐DEBA", limit value for dead zone monitoring) which activates the fault message output when it is exceeded.

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):

	Upper line	Lower line	Meaning/Cause	Actions
CPU START	x	x	Report after connecting the electrical auxiliary power	•· Wait
P nnn.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 actuator 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 actuator travel	• Set transmission ratio selector to 90 degrees, in particular for part–turn actuators • Match effective arm length for thrust drives to measurement range
NOINI		x	Positioner not initialized	• Start initialization

Messages during initialization:

	Upper line	Lower line	Meaning/Cause	Actions
P–––·	x		See above	See above
RUN 1		x	Initialization started, part 1 active (direction of control action being determined)	• Wait
RUN 2		x	Initialization part 2 active (actuator travel check and determination of the end stops)	• Wait
RUN 3		x	Initialization part 3 active (determination and display of positioning times)	• Wait
RUN 4		x	Initialization part 4 active (determination the minimum positioning increment length)	• Wait
RUN 5		x	Initialization part 5 active (optimization of the behavior on transients)	• Wait until "FINSH" is displayed (initialization completed successfully) • Press "operating mode" key briefly to acknowledge or longer to quit configuration mode
YEND1		x	<u>only during manual initialization</u> first end position can be moved to	• Move to first end position using the "+" or "–" key • Press "operating mode" key to acknowledge

	Upper line	Lower line	Meaning/Cause	Actions
YEND2			<u>only during manual initialization</u> second end position can be moved to	• Move to second end position using the "+" or "–" key • Press "operating mode" key to acknowledge
RANGE		x	<u>only during manual initialization</u> End position or measurement span are outwith the permitted measurement range	• Using "+" and "–" keys move to the other end position and press "opera–ting mode" key to acknowledge, <u>or</u> • Adjust friction clutch until "**ok**" is displayed and press "operating mode" key to acknowledge <u>or</u> • Interrupt initialization by pressing the "operating mode" key, switch to P manual mode and correct the actuator travel and position sensing
ok			<u>only during manual initialization</u> permitted measurement range for end positions reached	• Press "operating mode" key to acknowledge, the remaining steps ("**RUN1**" to "**FINSH**") 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
↳ 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 MIDDL	x	x	Friction clutch misaligned; "P 50.0" no displayed when arm horizontal	• For thrust drives, 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)
↳ UP >		x	"UP" – tolerance range exceeded or inactive zone of potentiometer ent-ered	• Increase effective arm length with lin-ear actuators or set transmission ra-tio selector to 90 degrees • Press "operating mode" key briefly to acknowledge • Re–start initialization
↳90_95		x	Only applies to part–turn drives: Actuator 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
↳ U–d>		x	Measurement span "Up–Down" is insufficient	• Reduce effective arm length for thrust drives or set transmission ratio selec-tor to 33 degrees • Press "operating mode" key briefly to acknowledge • Re–start initialization
U nn.n **D–>U**	x	x	Display the positioning time "Up"	• Wait, <u>or</u> • To change the positioning time interrupt initialization with the "–" key, <u>or</u> • Activate the leakage test with the "+" key

	Upper line	Lower line	Meaning/Cause	Actions
d nn.n **U–>d**	x 	 x	Display the positioning time "Down"	• Wait, or • To change the positioning 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)	• Positioning 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 **LEAKG**	x 	 x	Leakage test active initialization interrupted with the "+" key during actuation speed display)	• Wait 1 minute • Continue with the "+" key
nn.n **°oMIN**	x 	 x	Value and units of results of the leakage test	• Remove leakage if value is too high. • Continue with the "+" key
nn.n **FINSH**	x 	 x	Initialization completed successfully, with display of the actuator 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:

	Upper line	Lower line	Automatic	Manual mode	P manual mode	Meaning/Cause	Actions
Cn **VER**	x 	 x				Software version	• Wait
Error **SL*nn***	x 	 x				Monoticity transgression of the free characteristic line at support point "n"	• Correct value
MA –– ––		x		x		No communication in manual mode Air discharge valve will be opened	• Press operating mode key to change to automatic mode • Check station address • Start communication
CPU **START**	x 	 x				Message after applying auxiliary electrical power	• Wait
HW / **ERROR**		x				Fault in the hardware	• Exchange electronics
NOINI		x			x	Positioner not initialized	• Start initialization
nnn.n	x		x	x		Setting actual value [in %] for initialized positioners. Flashing decimal point indicates communication with a class 2 master	
AU*nn*		x	x			Automatic mode (nn = setpoint)	
MA*nn*				x		Manual mode (nn = setpoint)	• Press operating mode key to change to automatic mode

	Upper line	Lower line	Auto-matic	Manual mode	P manual mode	Meaning/Cause	Actions
FS –– ––		x	x			Fail safe (air discharge valve opened). Possible causes • No communication with master • Target mode set to "MA" • Master sending incorrect status	• Correct station address • Set target mode to "automatic" with class 2 master • Send status "0x80" (good)
FS *nn*		x	x			Set to parameterized fail safe setting (cause: see above)	• see above
MM *nn*		x	x			Positioner is in "manual mode"	• Set target mode to "automatic" with class 2 master • Send status "0x80" (good)
LO *nn*		x	x			Positioner is in "local over-ride mode"	• Set target mode to "automatic" with class 2 master • Send status "0x80" (good)
OS ––		x	x			Positioner is in "out of ser-vice mode"	• Set target mode to "automatic" with class 2 master • Send status "0x80" (good)
oFL / 127.9	x		x	x		Display range exceeded. Possible causes: • Friction clutch <u>or</u> • Transmission ratio selector changed <u>or</u> • Positioner installed without reinitialization, having previously been fitted to another drive	• Adjust friction clutch so that when moving the drive the actual value display remains within 0.0 to 100.0 <u>or</u> • Change transmission ra-tio selector <u>or</u> • Carry out factory setting (preset) and initialization
EXSTP		x	x			Actuator stopped by binary input	
EX UP		x	x			Actuator moved by binary input to upper stop	
EXDWN		x	x			Actuator moved by binary input to lower stop	

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 is dependent particularly on the volume of the drive. Small values will lead to small actuation increments and frequent control drive activations. Note that if the value is too small no movement will result. If drive 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 drives.

17 Short step zone up
18 Short step zone down

The short step zone is the range in which the control variation between the fast step zone and the dead band. In this zone the drive 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 closely.

34 Prediction up
35 Prediction down These parameters operate on the damping factor and have the effect of adjusting 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.

It is recommended that the firstly an automatic initialization is performed and only thereafter that the positioner parameters are matched to 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.

4.8 Fault correction

Diagnostics indicator

	see	Table		
In which operating mode did the fault occur?				
• Initialization	3			
• Manual mode and automatic mode	4	5	6	7
Under which circumstances and conditions did the fault occur?				
• Wet environment (e.g. heavy rain or constant condensation)	4			
• Vibrating fittings	4	7		
• Under impact or shock (e.g. steam jets or breakaway flaps)	5			
• Damp (wet) compressed air	4			
• Dirty (contaminated with solid particles) compressed air	4	5		
When does the fault occur?				
• Constantly (reproducibly)	3	4	5	6
• Sporadically (not reproducible)	7			
• Usually after a certain operating period	4	5	7	

Fault description (symp-toms)	Possible cause(s)	Corrective actions
• Positioner comes to a halt in RUN 1	• Initialization started from the final stop <u>and</u> • Reaction time of max. 1 min. not waited • Network pressure not connected or too low	• Up to 1 min. waiting time required • Do not start initialization from an end stop • Confirm network pressure
• Positioner comes to a halt in RUN 2	• 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 4)	• Check settings: • See leaflet: Figure Device view (7) and parameters 2 and 3 • Check stroke setting on the lever • see Table 4
• Positioner comes to a halt in RUN 3	• Positioning times for up and down exceeded	• Open restrictor fully and/or set pressure PZ(1) to the highest permissible value • Use booster if necessary
• Positioner comes to a halt in RUN 5, does not reach FINISH (waiting time > 5 min)	• Play in the positioner, actuator, fittings system	• part–turn actuator: Check seating of the stud screw of the coupling wheel • Linear actuator: Check seating of the lever on the positioner shaft • Correct any other play between the actuator and the fittings

Table 3   Events which can activate the fault message output

Fault description (symptoms)	Possible cause(s)	Corrective actions
• CPU test blinks in the display of the positioner (ca. every 2 secs) • Piezo valve(s) do not switch	• Water in the valve manifold (from wet compressed air)	• 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 page 160.
• Actuator cannot be moved in manual or automatic mode, or only in one direction	• Dampness in the valve manifold	
• Piezo valve(s) do not switch (no soft clicking can be heard when the + or – keys are pressed in manual mode)	• Screw between cover hood and the valve manifold is not tight or the hood is jammed	• Tighten screw, or release cause of jamming when necessary
	• Dirt (swarf, particles) in the valve manifold	• Repair see page 160. New device with integrated fine filter which can be replaced and cleaned
	• Deposits on the contact(s) between the electronics board and the valve manifold can occur from abrasion through continuous stresses from strong vibrations	• Clean all contact surfaces with alcohol: when necessary bend the valve manifold contact springs back into place

Table 4

Fault description (symptoms)	Possible cause(s)	Corrective actions
• Actuator does not move	• Compressed air < 1.4 bar	• Set inlet air pressure to > 1.4 bar
• Piezo valve(s) do not switch (although a soft clicking can be heard when the + or – keys are pressed in manual mode)	• Restrictor(s) closed down (screw(s) at the right end stop)	• Open restrictor screw(s) (see leaflet, Figure "View of device (6)") by turning to the left
	• Dirt in the valve manifold	• Repair see page 160. New device with integrated fine filter which can be replaced and cleaned
• One piezo valve constantly switches in stationary automatic mode (constant setpoint) and in manual mode	• Pneumatic leak in the positioner, actuator system, start leak test in RUN 3 (Initialization)	• Fix leak in the actuator and/or supply line • If the actuator and supply line are intact: Repair see page 160 or new device
	• Dirt in the valve manifold (see above)	• See above

Table 5

Fault description (symptoms)	Possible cause(s)	Corrective actions
• The two piezo valve constantly switch alternately in stationary automatic mode (constant setpoint), actuator oscillates around a middle point	• Static friction on the packing glands of the fittings or actuator too high	• Reduce static friction or increase dead zone of positioner (parameter dEbA) until the oscillating movements stop.
	• Play in the positioner, actuator, fittings system	• Linear actuator: Check seating of the stub 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 fittings
	• Actuator too fast	• Increase positioning times by means of restrictor screws • If fast positioning times are required, increase dead zone (parameter dEbA) until the oscillating movements stop.

Table 6

Fault description (symptoms)	Possible cause(s)	Corrective actions
• 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 • Upgrade see page 160 mount reinforced friction clutch (order number C73451–A430–D14)
• 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 see page 160 • Prevention: Mount the positioner on rubber metal

Table 7

Functions/operation via PROFIBUS PA

5

5.1 System integration

The positioner can be controlled and monitored by acyclic and cyclic data transmission by a control system (master). So that the positioner can be in communication as slave with the master, its address must be set up in advance.

The PROFIBUS address is factory set to 126. This can be changed at the device (chapter 4.4 page 97) or with a parameter tool such as the SIMATIC PDM or by HW configuration over the bus.

5.2 Acyclic data transmission

Acyclic data transmission is mainly used for transmitting parameters during commissioning, maintenance, batch processes, or for displaying further variables which do not take part in cyclic user data traffic.

Data traffic occurs between a class–2 Master and the field device with so–called C2 connections. So that several class–2 Masters can simultaneously access the same positioner, the device supports up to four C2 connections. However, you must ensure that they are not writing to the same data.

Acyclic data transmission is best performed with the SIMATIC PDM software package.

5.2.1 SIMATIC PDM

SIMATIC PDM is a software package for designing, parameterizing, commissioning, diagnosing and maintaining the positioner and other process devices.

SIMATIC PDM contains a simple process monitoring of the process values, alarms and status signals of the device.

With SIMATIC PDM the process device data can be

- displayed,

- adjusted,

- changed,

- compared,

- checked for plausibility

- administered and

- simulated

In general, we recommend the following procedure:

- First of all read the current settings from the device, by initiating the action "Load to PG/PC",

- Check the current settings,

- Check the required settings,

- Load the parameter settings into the device and also save the parameter settings offline.

In the PDM menu bar there are menu headers File, Device, View, Extras and Help. In the following description the device menu will be described in detail. Under these headers there are further submenus.

5.2.1.1 Allocate address

Here the positioner can be allocated a new address. Note that this can only be done if the slave is not yet in cyclical operation.

5.2.1.2 Load to device

and

5.2.1.3 Load to PG/PC

These can be performed simply by clicking on the respective symbol

(Icon) in the menu bar. .

" Load at PG/PC " allows the parameters of the positioner to be read, changed as necessary and then using " Load to device " sent to the positioner.

5.2.1.4 Read maintenance information

This gives information regarding the current values set during the last initialization of the positioner. By comparing them with reference values the values set during the last maintenance can be saved and the status of the fitting assessed.

To see the values displayed, open the "Device" menu and open the "Read maintenance information" submenu. Because there is so much information, these are divided amongst several registers:

- Maintenance information 1 and 2
  here the initialization values such as zero point P0, end value P100, positioning times etc. are displayed.

- Maintenance data
  gives information regarding number of strokes, changes of direction, fault messages etc. In addition limit values can be entered and transmitted to the device.

- Operating temperature
  displays the minimum, current and maximum temperature.

- Service times
  displays the total service time and the service times at different temperature bands.

- Static data revision number
  This parameter shows the revision issue of data associated with the respective PROFIBUS block. After each parameter change the revision issue in the respective PROFIBUS block is incremented.

5.2.1.5 Set maintenance information

This allows maintenance information to be saved and reset.

Open the "Device" menu and open the "Set maintenance information" submenu. The following registers are displayed:

- Save / reset maintenance information
  and
- Reset counter

To save the current initialization values, enter a valid date into the field "Date of SIPART maintenance" and then press the "Save maintenance information" key. This leads to a double column display of the maintenance information in the "Read maintenance information" menu (see above). If the positioner is subsequently re–initialized, the current values will be determined and these can be compared with the previously saved values.

By pressing the "Reset maintenance information" key, the "Values at the last maintenance' will be reset (cleared down). Resetting the maintenance parameters is done by setting the 'Date of last maintenance' to a nonsensical value (1.1.00). This deceives the PDM into believing that there is no 'last maintenance' data.
TIP: if a valid data is then re–input, the old values will once again be displayed.

Only by confirming the register "Reset counter" by pressing the "Reset maintenance counter" key will the following maintenance counters be reset:

- Number of 100% strokes (STRKS)

- Number of changes of direction (CHDIR)

- Number of fault messages (\CNT)

- Number of alarms 1 and 2 (A1CNT / A2CNT)

5.2.1.6 Operation

The following target modes (operating modes) are available:

- Automatic

- Manual

- Local overlay (LO))

- Not in service (OS)

Note that the target modes refer to the operating modes of the function blocks in the PROFIBUS PA block model and are not interchangeable with the positioner operating modes "Automatic" and "Manual".

The above target modes take effect when the positioner is in automatic operation (AUT). If the positioner is in manual mode (MAN) they will take effect only after a local changeover to automatic operation (AUT).

These target modes are saved in the positioner and are non–volatile in the event of power loss.

Automatic

Provided the positioner has not yet been linked in as a slave in cyclical operation, a cyclic setpoint can be sent to it using PDM.

Perform the following settings:

- Open the "Operating mode" register

- Set the target mode to "Automatic"

- Enter a value between 0 and 100% for the setpoint, quality "Good" and status "OK".

- Upload the settings into the positioner.

The positioner will now control to the desired setpoint until a cyclic master takes up communication with this slave or the positioner is locally set to manual mode.

☞ **NOTE**

Note that the positioner will respond after the transmission with the quality "Bad" and the status "value constant".

On leaving this target mode and if no further master sends a setpoint to the positioner, the positioner after the set monitoring period will adopt the parameterized fail safe value.

Manual

Even if cyclic communication is running, a setpoint can be sent to the positioner using PDM. For this precedence over the cyclical master must previously have been set up.

Perform the following settings:

- Open the "Operating mode" register

- Set the target mode to "Manual".

- Enter an initial value between 0 and 100%, quality "Good" and Status "OK".

- Upload the settings into the positioner.

The positioner will now control to the desired initial value and will report this in manual mode by showing "MM" in the display.

Note that in manual mode the initial value entered will be written without proportioning directly into the initial block of the positioner.

Set the positioner locally into manual mode and adjust the drive using the keys. The setpoint will then be set to the current readback. After switching back into automatic operation, the manual mode and the exact current setting will be maintained.

After a loss of electrical power the positioner will perform in manual mode according to the direction of control action of the drive on the set values for YA or YE.

☞ **NOTE**

For the cyclical master's setpoints to take effect again, the target mode must be set to "Automatic".

Local Overlay (LO)

To allow the drive to insist on maintaining the current position, the positioner can be set using the PDM to "Local Overlay". In this mode the positioner valves will not be activated, although they can detect any leakage. Perform the following settings:

- Open the "Operating mode" register

- Set the target mode to "Local Overlay (LO)".

- Upload the settings into the positioner.

Successful uploading will the reported in the positioner display by "LO".

On loss of electrical power, the drive will discharge the air and remain in this position until power is restored.

NOTE

Return the device to the target mode "Automatic" in order to re–establish the effectiveness of the cyclic master setpoints.

Out of Service (O/S)

Irrespective of the cyclical communications the positioner can be taken out of service using the PDM.

CAUTION

To avoid personal injuries and equipment damage, note that this action will cause the drive air to be discharged.

Perform the following settings:

- Open the "Operating mode" register

- Set the target mode to "Out of Service (O/S)".

- Upload the settings into the positioner.

Successful uploading will be reported in the positioner display by "OS ––".

Even in this target mode the positioner can be switched locally into manual mode and the drive operated using the keys. The display will then show "MAN ––". After switching back into automatic mode the " Not in service mode" (display "OS ––") will be maintained.

After switching back into automatic mode the " Not in service mode" (display "OS ––") will be maintained.

After a loss of electrical power the drive will remain depressurized.

NOTE

For the cyclical master's setpoints to take effect again, the target mode must be set to "Automatic".

Simulation of readbacks

Simulation functions are of assistance during commissioning pieces of equipment and positioner. Process values can be generated without output of real positional values. Equally the outputs from the alarm modules and the position value of the Iy module will not be affected by them. The value range of the simulated process values can be fully exploited. Faults can also be simulated.

Perform the following settings:

• Open the "Simulation readbacks" register.

• Set the simulation to "Approved".

• Enter for the desired simulation value a value between 0 and 100%, quality "Good" and status "OK".

• Upload the settings into the positioner.

The positioner will now control to the master's setpoint, the feedback of the readback will however show the simulated value.

NOTE

After concluding the simulation, do not forget to restore the value to "Blocked" again.

5.2.1.7 Reset

Reset to factory settings

If the positioner settings have been changed set so that it can no longer fulfill its control task, this function allows the factory settings to be restored. All parameters with the exception of the PROFIBUS address are restored to the factory settings.

The reset is shown in the diagnostics report as "Restart performed". After this all parameters must be set afresh and an initialization performed.

Re-start (Warm start)

Warm start permits the positioner to be switched off and restarted. This means the communication will be broken off and then re–established.

This re–start will be shown by the diagnostic report "Re–start performed". If no measurement value is yet available, the automation and control system will show the status "Indeterminate, initial value, value constant".

Reset the PROFIBUS address to 126

If no other device in the system has the pre–set address 126, the PROFIBUS line can be extended to include this positioner whilst the automation and control systems are running. Following this, the address of the newly attached device should be changed to another value.

To remove an positioner from the PROFIBUS line, its address should be restored to 126 using this function, so that in future it can be linked into this or another system if necessary.

If a cyclic master is already in communication with the positioner, the address cannot be reset.

Operating lock

To prevent unwanted changes made by an acyclic master, the device can be write protected. To do this, enter the information "On" in the write protect submenu for the positioner.

5.2.1.8 Initialization parameters

In this menu the initialization parameters can be displayed, and also selectively changed. This should however be performed only by specialists (see chapter 4.7 page 126 "Optimizing the control data"). This function is also required if the electronics have to be changed but at that time no initialization can be undertaken (see chapter 3.7 page 89).

5.2.1.9 Self–calibration

Using SIMATIC PDM, you can also initialize the position controller for the first time.

This is initiated by going into the "Device" menu and then into the "Self–calibration" sub–menu. Press the "Start calibration" button in the window that is opened. A warning notice which you absolutely must adhere to in order to prevent personal or equipment damage will appear. Note that the self–calibration can also be started from the acyclic master, even if the position controller is in automatic mode and contains the set value from a cyclic master.

WARNING

Since you are not situated on-site, you must perform the respective safety procedures before starting the self–calibration to prevent damage to personnel or equipment.

You must also ensure that the self–calibration can only be aborted on the machine itself by activating the operating mode button or by cutting off the supply power.

The self–calibration is started after you have confirmed the warning notice. The progress can be viewed in the SIMATIC PDM window.

After the initialization is complete, the position controller will carry on working in the operating mode that the self–calibration was started in. If an error message is generated, the correction must be made on–site.

5.2.1.10 Write protection

After completing the commissioning, the write protect can be set to prevent an acyclic master from making unwanted changes. Locally the positioner parameters can however be changed just as they could previously.

To do this, enter the information "On" in the write protect submenu for the positioner. If anyone then attempts to write, the PDM will display the report "Communication aborted".

☞ **NOTE**

If "ON" has already been set using this "Hardware Write Protect" screen, the binary input 1 in the positioner will already be parameterized to "bLoc1" or "bLoc2" and active. This means that writing using PDM is inhibited.

5.3 Cyclic data transmission

Using cyclic data transmission, the user data relevant for process automation is transferred between the class 1 Master (control or automation system) and the positioner.

5.3.1 Configuration

Information on the input and output range, as well as the consistency of the cyclically transmitted data is defined in the **D**evice**M**aster**D**ata file (GSD file), tested with the device's configuration message and, if appropriate, declared to be valid. During the design, the user data which will be transmitted in cyclic operation is set. This means that it is possible to optimise the quantity of data to be transmitted. The GSD files for all common devices are already stored in the Siemens control system, however they are also accessible over the Internet and can be subsequently imported.

The files are available on the Internet at:

www.siemens.com/sipartps2

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

5.3.1.1 Configuring the user data

The user data which is made available to the control system or the open–loop control via the PROFIBUS depends on the desired configuration selected.

☞ **NOTE**

For STEP 7, the configuring tool is HW–Konfig. For STEP 5, it is COM_PROFIBUS.
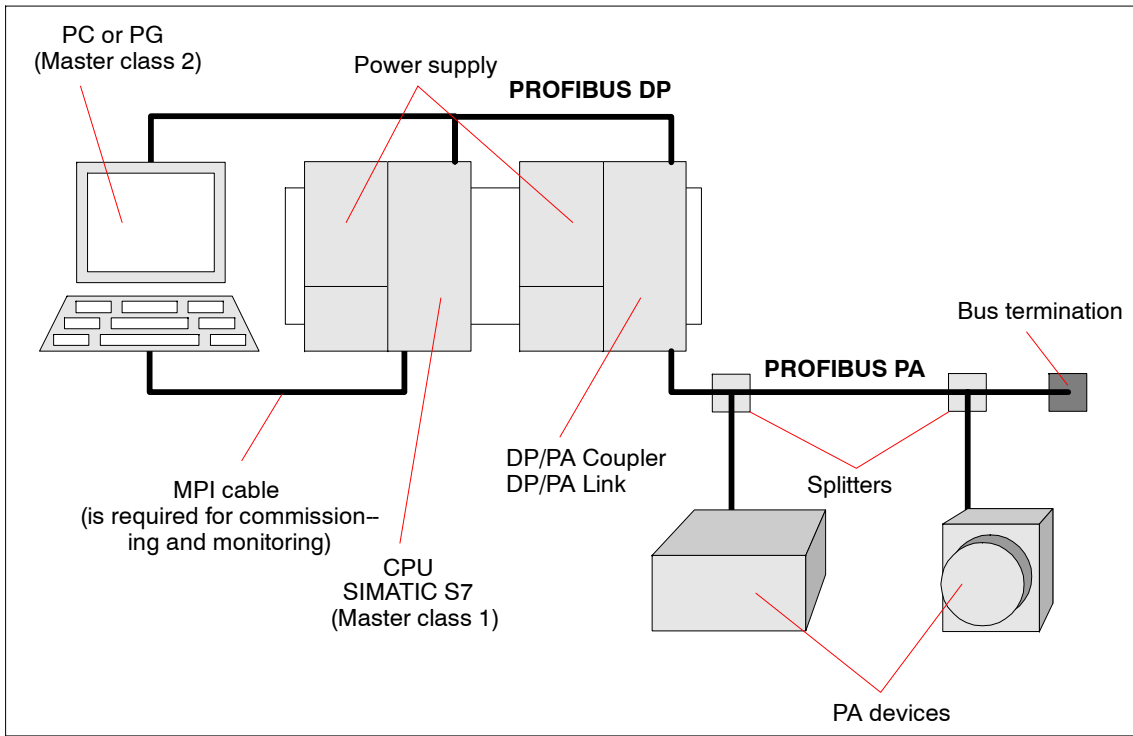
Figure 64   Example of a small PROFIBUS DP/PA system

Here is a small STEP 7 program that established cyclic data transmission with the positioner with PROFIBUS PA.
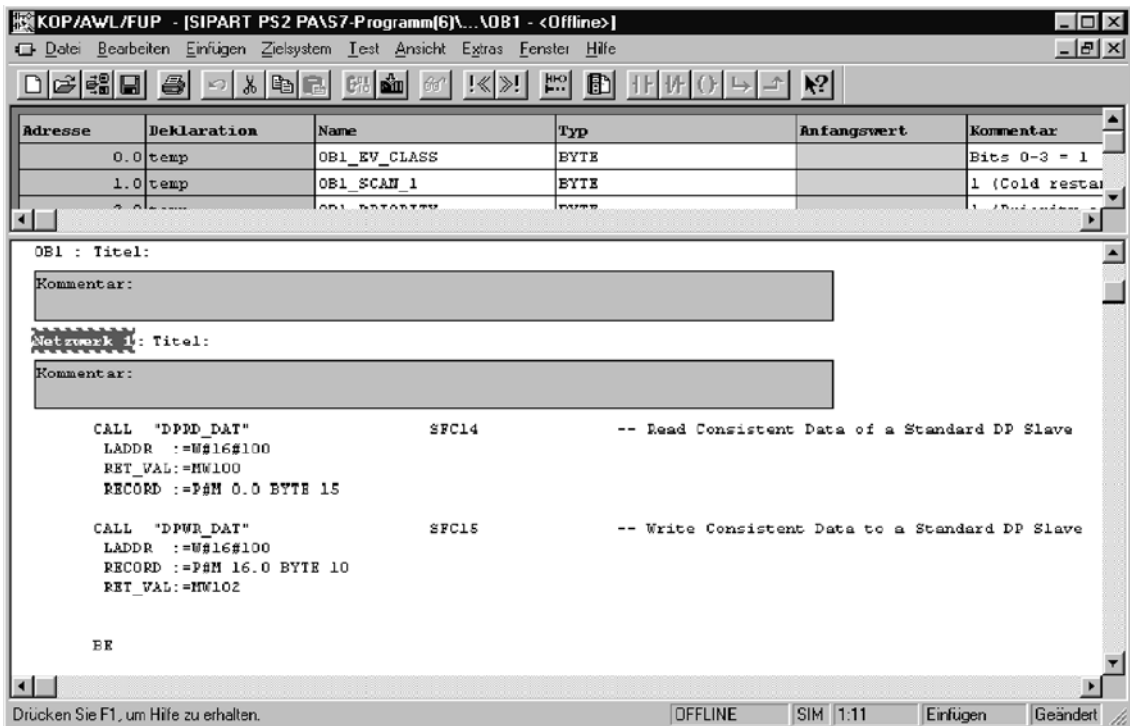
Figure 65   STEP 7 example program

In this example all fies supported by the device are transmitted in the input or output direction. 256 (W#16#100) is selected as the initial I/O address.

Legend

Byte 15

15 bytes of input data consisting of the following:

READBACK	5 Byte
RCAS_OUT	5 Byte
CHECKBACK	3 Byte
POS_D	2 Byte

Byte 10

10 bytes of output data consisting of the following:

SP	5 Byte
RCAS_IN	5 Byte

5.3.2 User data via PROFIBUS

The positioner can exchange a combination of the following cyclic useful data with the PROFIBUS.

German name	English name	Abbreviation	Direction from the point of view of the posi-tioner	Length in Byte	Consisting of
Sollwert	Setpoint	SP	Input	5	Value/Status
Istwert	Readback	RB	Output	5	Value/Status
Diskrete Pos-tion	Position dis-crete	POS_D	Input	2	Value/Status
Aktorzustand	Checkback	CB	Input	3	Value
Fernkaskade Eingang	Remote Ca-scade Input	RCAS_IN	Input	5	Value/Status
Fernkaskade Ausgang	Remote Ca-scade Output	RCAS_OUT	Input	5	Value/Status

Setpoint

The setpoint consists of a floating–point value (4 bytes and the associated status (1 byte, see below).

Readback

The readback indicates the position of the valve. The readback consists of a floating–point value (4 bytes) and the associated status (1 byte).

Position discrete

The discrete position of the valve is displayed as a value (1 byte) with the following meaning:
0 = not initialized
1 = valve closed
2 = valve open
3 = valve in intermediate state

There is a status for this value too (1 byte)

Checkback   The checkback is displayed bit–coded in 3 bytes:

	Bit	Meaning for "1"	Notes
0	0	Device in failsafe position	Position determined by parameter 46 (FSTY)
	1	Request for local operation	Reports that a key has been pressed
	2	Device is operated locally	Device locally parameterized (e.g. 1 YFCT) or is not initialized
	3	Emergency operation active	Device is in manual mode (display : Man or P)
	4	Deviation of the motion direction	Not required for the positioner
	5	Stop reached (valve not completely open)	Not required for the positioner
	6	Stop reached (valve not completely closed)	Not required for the positioner
	7	Operating timeout	Device cannot be adjusted (monitoring time and monitoring threshold exceeded, parameters 43 TIM and 44 LIM) due to lack of compressed air.
1	0	Valve is opened	Setting command "Supply air to actuator" sent
	1	Valve is closed	Setting command "Exhaust air from actuator" sent
	2	Parameters have been changed	Set a short time after quitting "Configuration mode", if one or more parameters have been changed
	3	Simulation operation	Simulation mode has been approved. Master class 2 can overwrite actual data values, e.g. for purposes of testing the response at the limits of the control system
	4	Is not preset in Profile 3	
	5	Fault in the contrl	Not required for the positioner
	6	Control inactive	Not required for the positioner
	7	Self test active	Not required for the positioner
2	0	Path integral exceededn	Will be set if the limit value set for travel integral is exceeded.
	1	Additional input active	Binary input 1 is activated
	2	Additional input active	Binary input 2 is activated

Remote cascade input

In remote cascade mode (actual mode = remote cascade), the remote cascade input is used as the setpoint. Remote cascade input consists of a floating-point value (4 bytes) and status (1 bytes).

Remote cascade output

This output provides the current setpoint in AUTO mode and remote cascade. The status is used especially for the transition from AUTO to remote cascade.

In conjunction with the parameter input variable (primary value scale) you cannot only set the setpoints to the positioner as a percentage of the valve position but also in physical quantities such as cubic meters per day or liters per minute. It is also possible to adapt the readbacks to this scaling.

Status

The status provides information about the quality of the input or output value.

The format of the status is always

7	6	5	4	3	2	1	0
Quality		Additional information				Limit value bits	

Quality

0: bad

1: uncertain

2: good

3: good (cascade)

Grenzwertbit

0: good

1: lower limit value reached, exceeded or limited to lower limit value

2: upper limit value reached, exceeded or limited to upper limit value

3: value is fixed, no measured value

Additional information

The additional information depends on the quality.

7	6	5	4	3	2	1	0	Meaning
0	0	0	0	0	0	s. a.		bad
0	0	0	0	1	1	s. a.		device fault
0	0	0	1	0	0	s. a.		sensor fault
0	0	0	1	1	1	s. a.		bad, out of service
0	1	0	0	0	0	s. a.		uncertain
0	1	0	0	0	1	s. a.		uncertain, last useful value
0	1	0	0	1	0	s. a.		uncertain, substituted value
0	1	0	0	1	1	s. a.		uncertain, initial value
1	0	0	0	0	0	s. a.		good
1	0	0	0	0	1	s. a.		good, active block alarm (change of parameters)
1	0	1	0	0	0	s. a.		good, go into failsafe position (command)
1	1	0	0	0	0	s. a.		good (cascade)
1	1	0	0	0	1	s. a.		good (cascade), initialization confirmed
1	1	0	0	1	0	s. a.		good (cascade), initialization requested
1	1	0	0	1	1	s. a.		good (cascade), not requested
1	1	0	1	1	0	s. a.		good (cascade), local operation has priority
1	1	0	1	1	1	s. a.		good (cascade), device is in failsafe position
1	1	1	0	0	0	s. a.		good (cascade), go into failsafe position (command)

Possible combinations of useful data and position in the address space.

For communication of cyclic useful data between the master and the positioner you can select a combination of values during configuration:

SP
Setpoint

Output (master view)

Initial address	0	
	1	SP –
	2	Floating–point number
	3	
	4	SP – status

RCAS_OUT, RCAS_IN
Remote cascade output, remote cascade input

Input (master view)

Initial address	0	
	1	RCAS_OUT –
	2	Floating–point number
	3	
	4	RCAS_OUT – status

Output (master view)

Initial address	0	
	1	RCAS_IN –
	2	Floating–point number
	3	
	4	RCAS_IN – status

READBACK, POS_D, SP
Readback, position discrete, setpoint

Input (master view)

Initial address	0	
	1	READBACK –
	2	Floating–point number
	3	
	4	READBACK – status
	5	POS_D
	6	POS_D – status

Output (master view)

Initial address	0	
	1	SP –
	2	Floating–point number
	3	
	4	SP – status

Checkback, SP   Checkback, setpoint

Input (master view)

Initial address	0	
	1	CHECKBACK
	2	

Output (master view)

Initial address	0	
	1	SP –
	2	Floating–point number
	3	
	4	SP – status

READBACK,   Readback, position discrete, checkback, setpoint
CHECKBACK,
POS_D, SP

Input (master view)

Initial address	0	
	1	READBACK –
	2	Floating–point number
	3	
	4	READBACK – status
	5	POS_D
	6	POS_D – status
	7	
	8	CHECKBACK
	9	

Output (master view)

Initial address	0	
	1	SP –
	2	Floating–point number
	3	
	4	SP – status

**RCAS_OUT,
CHECKBACK,
RCAS_IN**

Remote cascade output, checkback, remote cascade input

Input (master view)

Initial address	0	
	1	RCAS_OUT –
	2	Floating–point number
	3	
	4	RCAS_OUT – status
	5	
	6	CHECKBACK
	7	

Output (master view)

Initial address	0	
	1	RCAS_IN –
	2	Floating–point number
	3	
	4	RCAS_IN – status

**READBACK,
RCAS_OUT,
POS_D, CHECK–
BACK, SP,
RCAS_IN**

Readback, remote cascade output, position discrete, checkback, setpoint, remote cascade input

Input (master view)

Initial address	0	
	1	READBACK –
	2	Floating–point number
	3	
	4	READBACK – status
	5	
	6	RCAS_OUT –
	7	Floating–point number
	8	
	9	RCAS_OUT – status
	10	POS_D
	11	POS_D – status
	12	
	13	CHECKBACK
	14	

Ouptut (master view)

Initial address	0	
	1	SP –
	2	Floating–point number
	3	
	4	SP – status
	5	
	6	RCAS_IN –
	7	Floating–point number
	8	
	9	RCAS_IN – status

5.3.2.1 Status

Status gives information regarding:

1. Whether the measured values can be used in the application program

2. The device status (self–diagnostics/system diagnostics)

3. Additional process information (process alarms)

The status byte coding is listed on the following pages. In addition, the possible causes of faults are listed together with remedies to resolve them.

Summary of status codes

Hex	Dez	Accompanying status code	PDM display	Cause	Action
00	00	READBACK, POS_D	bad	Will be used if no other infor–mation is to hand.Device not present or cyclic connection broken off. Will be generated by the DP/PA link.	Check the connection.
04	04	READBACK, POS_D	bad, configu–ration fault	The values obtained from the initialization run are unusable.	Perform initialization again. Check relevant parameter set-tings.
07	07	READBACK, POS_D	bad, configu–ration fault	The start and finish values on the entry range are the same.	Enter different start and finish values.
OC	12	READBACK, POS_D	bad, device fault	Permitted actuator travel exceeded	Check transmission ratio se-lector
OF	15	READBACK, POS_D	bad, device fault	Device has an irreparable fault e.g. memory fault)	Exchange the electronics
1C	28	READBACK, POS_D	bad, out of service	The controller is in the initialization phase	Wait until the end of the initialization phase

Hex	Dez	Accompanying status code	PDM display	Cause	Action
1F	31	READBACK, POS_D	bad, out of service, value constant	Function block has been disabled by command. Device will move to safety position	For normal operation reinstate target mode "AUTO"
47	71	READBACK, POS_D	uncertain, last useful value, value constant	Connection is disconnected or the SETPOINT status is not "Good". Positioner will move to safety position, the parameterized safety setting is set to "retain last valid value"	Check the connection and make sure that the SETPOINT (SP) is accompanied by a status of 80 hex., 128 decimal (Good)
48	75	READBACK, POS_D	uncertain, substituted value, value constant	Connection is disconnected or the SETPOINT status is not "Good". Positioner will move to safety position, the parameterized safety setting is set to "issue default value"	Check the connection and make sure that the SETPOINT (SP) is accompanied by a status of 80 hex., 128 decimal (Good)
4F	75	READBACK, POS_D	uncertain, iinitial value, value constant	After powering up an initial value is entered ion the device memory	Discard the value in the application program
53	83	READBACK, POS_D	uncertain, value uncertain	Device will be controlled locally	
80	128	SETPOINT (SP), READBACK, POS_D	Good	Normal operation	---
84	132	READBACK, POS_D	Good, update event	A parameter relevant to the device has been changed. This display will expire after 10 sec.	
8D	141	READBACK,	Good, alarm value fallen below	Out of tolerance below lower parameterized alarm limit. Alarm output A1 or A2 will be activated	---
8E	142	READBACK, POS_D	Good, alarm value exceeded	Out of tolerance above upper parameterized alarm limit. Alarm output A1 or A2 will be activated	---
A3	163	SETPOINT (SP)	Good, Go to Fail–Safe	Command to take up the safety position	For normal operation the status 80 hex., 128 decimal (Good) must be restored
A4	164	READBACK, POS_D	Good, maintenance requested	The travel integral limit value has been exceeded by the absolute travel integral	Perform maintenance and reset the reports using SIMATIC PDM

Table 9   Status codes

5.3.2.2   Diagnostics

As well as status information the device can also report active information regarding the device condition. Diagnostics are important information which can be used in an automation system purposes of determining remedial action.

To communicate diagnostic information standard mechanisms within the PROFIBUS–DP can be called upon and an active report made to the class 1 master. PROFIBUS–DP provides a protocol for this to convey information that is of higher precedence than operating data to the class 1 master.

The contents of the "Device Status" parameter from the physical block, together with information whether a change of status has occurred (event gained / event lost).

The diagnostics object comprises four bytes. For the positioner only the first two bytes are relevant.

5.3.3 Diagnostics acc. to PROFIBUS DP (DDLM_Slave_Diag)

The positioner provides diagnostic data in the following form:

Input
(master view)

Initial address	0	Station_status_1	Standard DP – diagnostics
	1	Station_status_2	
	2	Station_status_3	
	3	Diag_Master_Add	
	4	Ident_Number	
	5	Ident_Number	
	6	Header	Status coding acc. to DP/V1
	7	Status_Type	
	8	Slot_Number	
	9	Specifier	
	10	Diagnostics (0)	Diagnostics object of the physical block
	11	Diagnostics (1)	
	12	Diagnostics (2)	
	13	Diagnostics (3)	

Specifier

1: raised event

2: cleared event

Diagnostics

Byte	Bit	Meaning for "1"	Cause	Action
Byte 0	0	–		
	1	–		
	2	–		
	3	–		

Byte	Bit	Meaning for "1"	Cause	Action
	4	Memory error	During operation the memory is continually checked for check sum errors and read / write errors. If an error occurs, this report is generated.	Exchange the electronics.
	5	–		
	6	Device not initialized	The initialization run required for the device to function has not yet been successfully performed.	Perform initialization.
	7	Initialization fault	The values obtained from the initialization run are unusable	Perform initialization again. Check relevant parameter settings.
Byte 1	0	–		
	1	Compressed air supply fault	A response time fault has been detected. Most probably the compressed air supply has failed	Check the compressed air supply, check the supply connections.
	2	–		
	3	Restart executed (after 10 s goes to "0")	Electrical power connection made to the device, or a warm start has been triggered using SIMATIC PDM or the internal Watchdog has operated.	Check the cabling and the power source.
	4	Restart executed (after 10 s goes to "0")	The device will be restored to its factory settings.	
	5	Maintenance required	The travel integral limit value has been exceeded by the absolute travel integral	Perform maintenance and reset the reports using SIMATIC PDM.
	6	Invalid characteristic curve	The parameterized characteristic curve lacks the necessary mono–ticity, number of support points, or the x–values are not at 5% intervals etc., the original characteri–stic curve will continue to be used.	Check the support points.
	7	Identity number changed	The parameter "PROFIBUS Identity Number" has been changed during cyclic operation. The device reports the infringement of the Identity Number and displays a warning of imminent failure. If re–started without changing the equipment configuration the device will not longer be included in the cyclic operating data traffic.	Make a change to the equipment configuration data (change the GSD), so that it is consistent with the Identity Number held in the device.

Table 10   Diagnostics

☞   **NOTE**

The device status can be simulated using the SIMATIC PDM (chapter 5.2.1 page 131). This allows the reaction of the automation in the event of a fault to be checked.

5.3.4 Condensed Status

Each of the three process variables (FEEDBACK_VALUE, READBACK und POS_D) which the SIPART PS2 PA positioner sends to the Master is accompanied by a status. The "condensed status", however, redefines the meaning of this status. The user can reposition or reallocate the meaning of each diagnosis event to the diagnosis byte (DIAGNOSIS) and the quality status (status byte) (see Fig. 66). In this way, the user can emphasize the importance of the individual diagnosis events according to need, therefore minimizing the amount of status and diagnosis information.

The user can choose between the old meaning of the status according to the PROFIBUS PA profile and the new meaning. The status type (parameter COND_STATUS_DIAG) can be selected either in the Class 1 Master (see Fig. 67) or on the SIMATIC PDM user interface (see Fig. 68).

NOTE

The SIPART PS2 PA positioner supports the functionality of the adjustable status as of firmware D1 (Version 4.00.00).
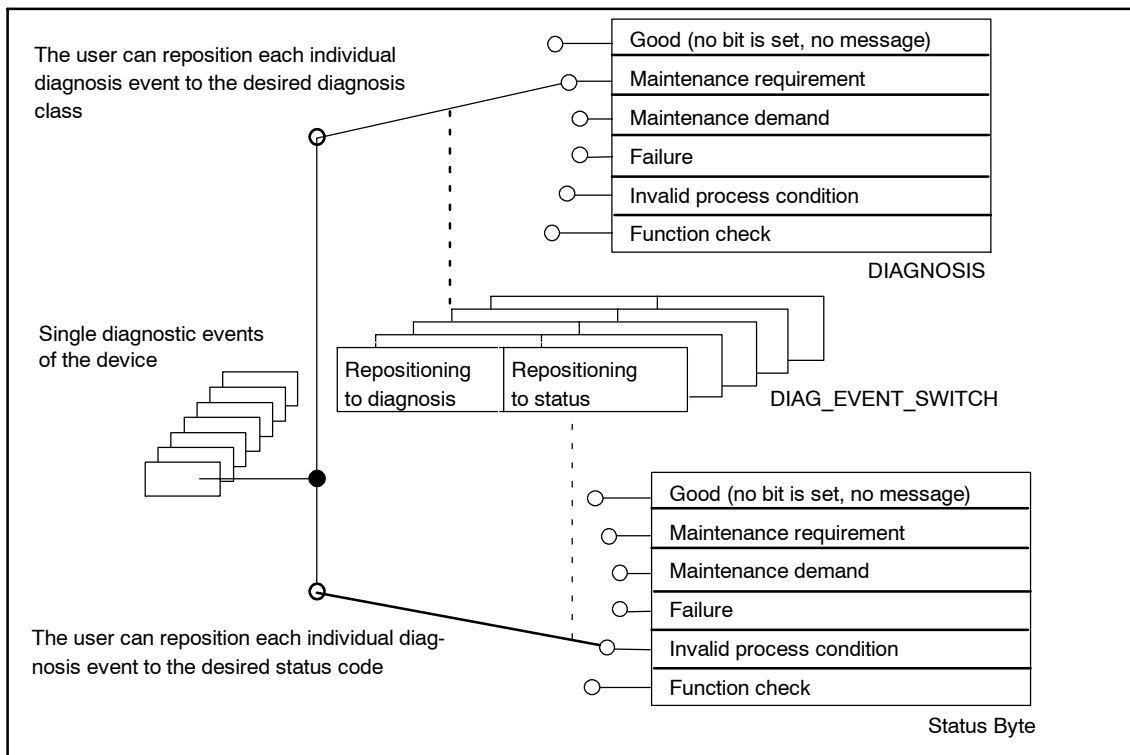
Figure 66   Repositioning the diagnosis event
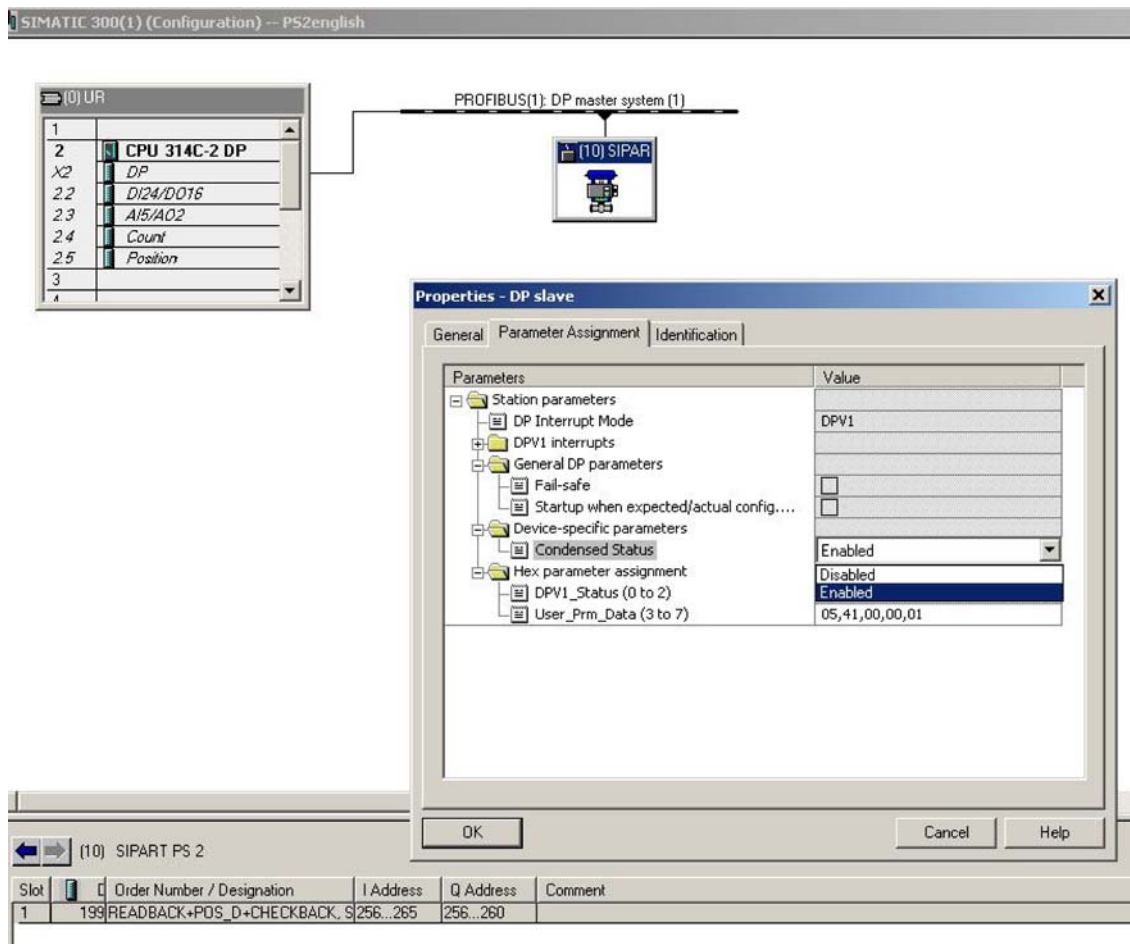
Figure 67   Choosing the status type when parameterizing the device according to the example HW–config
with SIMATIC S7
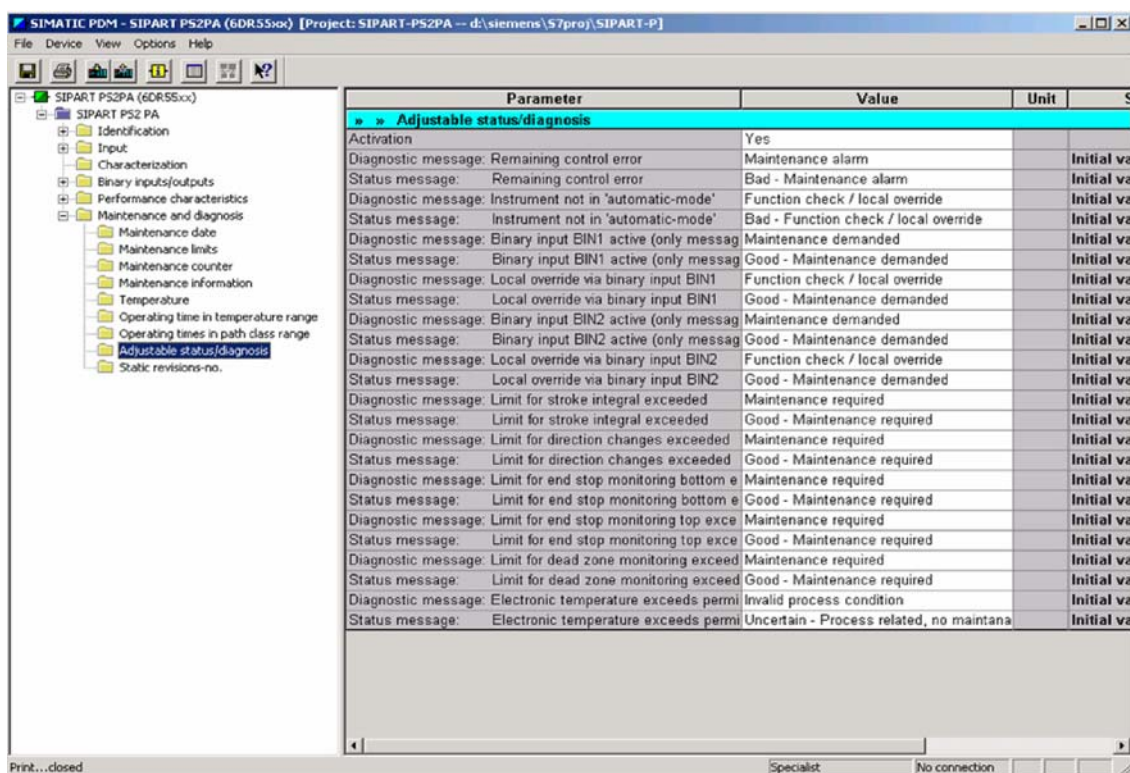
Figure 68   Selecting the status type when parameterizing the device according to the example
                 SIMATIC PDM

When evaluating the device's status and diagnosis messages by
means of SIMATIC PDM, the results are displayed on the user
interface as clear text and as a pictogram.

Table 11, page 154 shows the meaning of the pictograms and their
appearance.

Meaning	Icon	Priority
No diagnosis support		highest
Out of service		
Manual operation		
Simulation or substitute value		
Maintenance alarm		
Maintenance demand		
Maintenance requirement		
Configuration error		

Configuration warning		
Configuration changed		
Process value error		
Process value uncertain		
Process value out of tolerance		
Normal operation		lowest

Table 11   Icon definitions

Diagnosis events and status / DIAGNOSIS

As shown in Figure 66, each diagnosis event can influence both the variable's status and the bits in the DIAGNOSIS byte. If the parameter COND_STATUS_DIAG is activated, the parameter DIAG_EVENT_SWITCH defines the relationship between diagnosis events and the values for status and the DIAGNOSIS byte. Table 14 shows the default relationships. The Tables 12 und 13 show the configuration which is available for the diagnosis byte DIAGNOSIS and the quality status.

DIAGNOSIS bit	Meaning	Group
–	No bit is set	–
DIA_MAINTENANCE_REQUIRED	Check request	M
DIA_MAINTENANCE_ALARM	Immediate check request	M
DIA_MAINTENANCE_DEMANDED	Failure	M
DIA_INV_PRO_COND	Invalid process condition	P
DIA_FUNCTION_CHECK	Function check or local operation	F

Table 12   Usable DIAGNOSIS bits

Quality status	MEANING	Group
Good, ok	O.K.	–
Good, maintenance requirement	Maintenance demand	M
Good, maintenance demand	Immediate maintenance request	M
Uncertain, maintenance demand	Immediate maintenance request	M
Bad, failure	Failure	M
Uncertain, process related, no maintenance	Invalid process condition	P
Bad, process related, no maintenance	Invalid process condition	P
Bad, function check or local override	Function check	F
Good, function check or local override	Function check	F

Table 13   Usable quality status

The following two tables show the configurable diagnosis events. The available option is specified in the "Option" column. An "M", for example, means that only the DIAGNOSIS bits and the quality status with the option "M" are available. The meanings of "M", "F" and "P" have been defined in the two previous tables.

Event	Default values of DIAG_EVENT_SWITCH		Possible selection (Group)
	Quality Status Code	DIAGNOSIS bit	
Run–time error of the drive	Bad, maintenance alarm	DIA_MAINTENANCE_ALARM	M
Device not in 'automatic mode'	Bad, function check	DIA_FUNCTION_CHECK	F
Binary input BIN1 is active (only signal)	Good, maintenance demand	DIA_MAINTENANCE_DE-MANDED	M,F,P
Action triggered by binary input 1	Good, maintenance demand	DIA_MAINTENANCE_ALARM	M,F,P
Binary input BIN2 is active (only signal)	Good, maintenance requirement	DIA_MAINTENANCE_DE-MANDED	M,F,P
Action triggered by binary input 2	Good, maintenance demand	DIA_MAINTENANCE_ALARM	M,F,P
Limit value for path integral (100% strokes) exceeded	Good, maintenance requirement	DIA_MAINTENANCE_RE-QUIRED	M
Limit value for direction changes exceeded	Good, maintenance requirement	DIA_MAINTENANCE_RE-QUIRED	M
Limit value for the bottom hard stop monitoring exceeded	Good, maintenance requirement	DIA_MAINTENANCE_DE-MANDED	M
Limit value for the top hard stop monitoring exceeded	Good, maintenance requirement	DIA_MAINTENANCE_RE-QUIRED	M
Limit values for dead zone monitoring exceeded	Good, maintenance requirement	DIA_MAINTENANCE_RE-QUIRED	M
Permissible temperature inside the device exceeded	Uncertain, process related	DIA_INV_PRO_COND	M,P

Table 14   Configurable diagnostic events and their default representation in status and DIAGNOSIS

Event	Fixed settings	
	Quality Status Code	DIAGNOSIS bit
Limit for A1 exceeded	Good, active critical alarm	DIAG_PROCESS_TOLERANCE
Limit for A2 exceeded	Good, active critical alarm	DIAG_PROCESS_TOLERANCE
Error in electronic of device	Bad, maintenance alarm	DIA_MAINTENANCE_ALARM
The device is not yet operational (not initialized)	Bad, maintenance alarm	DIA_MAINTENANCE_ALARM
The device is not yet operational (initializing error)	Bad, maintenance alarm	DIA_MAINTENANCE_ALARM
Function block out of service	Bad, passivated	
Function block out of service	Bad, passivated	
Device in MAN mode	Depends on simulated quality status	DIA_FUNCTION_CHECK

Simulation mode	Depends on simulated quality status	DIA_FUNCTION_CHECK
Device in TRACE mode	Depends on simulated quality status	DIA_FUNCTION_CHECK
Simulation: diagnosis	–	Depends on simulated value

Table 15   Non configurable diagnostic events and their representation in status and DIAGNOSIS

DIAGNOSIS and DIAGNOSIS_ EXTENSION

Each diagnosis event has its own bit in the parameters DIAGNOSIS_EXTENSION and ACTUAL_DIAGNOSIS_EXTENSION.

The parameter ACTUAL_DIAGNOSIS_EXTENSION always represents the original (unfiltered status) of the device and the parameter DIAGNOSIS_EXTENSION represents the filtered information.

The following table shows the position of the diagnosis event bits in the parameters DIAGNOSIS_EXTENSION and ACTUAL_DIAGNOSIS_EXTENSION

Diagnosis event	Byte	Bit
Other error	0	0
Local operation		1
Binary input BIN1 active		2
Action has been triggered via binary input BIN2		3
Binary input BIN2 is active		4
Action has been triggered via binary input BIN2		5
Device in failsafe position		6
Limit value for strokes exceeded		7
Limit values for direction change exceeded	1	0
Limit value for bottom hard stop monitoring exceeded		1
Limit values for top hard stop monitoring exceeded		2
Limit value for dead zone (\\DEBA) exceeded		3
The temperature range of the electronics exceeded/undershot		4
Reserved		5
Reserved		6
Reserved		7
Reserved	2	0
Reserved		1
Reserved		2
Reserved		3
Reserved		4
Limit value A1 exceeded		5
Limit value A2 exceeded		6
Memory error		7
Device not initialized	3	0
Initializing error		1
FB not operational		2
FB not operational		3
FB in manual mode		4

Simulation mode		5
Device in TRACE mode		6
Diagnosis simulation		7

Table 16   Position of the diagnosis event bits in the parameters DIAGNOSIS_EXTENSION and ACTUAL_DIAGNOSIS_EXTENSION

Service and maintenance

6

The positioner is largely maintenance–free. The positioners are fitted with filters in the pneumatic connections as protection against coarse particles of dirt. This dirt will be deposited under pressure on to the filter and 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 7

(see following pages)

Technical specifications

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)	Suitable only for floating contact; max. contact load < 5 mA with 3 V
Degree of protection[1]	IP66 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
Material	
• Housing	
- 6DR5..0-... (plastic)	Glass-fiber-reinforced Macrolon
- 6DR5..1-... (metal)	GD AISi12
- 6DR5..2-... (stainless steel)	Austenitic stainless steel mat. No. 1.4581
- 6DR5..5-... (metal, pressure-proof)	GK AISi12
• Pressure gauge block	Aluminium AIMgSi, anodized
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
	98.1 m/s² (321.84 ft/s²), 27 ... 300 Hz, 3 cycles/axis

• Bumping (half-sine) to DIN EN 60068-2-29/03.95	150 m/s² (492 ft/s²), 6 ms, 1000 shocks/axis
• Noise (digitally controlled) to DIN EN 60068-2-64/08.95	10 ... 200 Hz; 1 (m/s²)²/Hz (3.28 (ft/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)
• Metal casing, aluminium	Approx. 1.3 kg (1.30 kg)
• Metal casing, stainless steel	Approx. 3.9 kg (3.90 kg)
• Metal casing EEx d version	Approx. 5.2 kg (11.46 lb)
Dimensions	See Dimensional drawings
Climate class 4	To DIN EN 60721-3-4
• Storage[2]	1K5, but -40 ... +80 °C (1K5, but -40 ... +176 °F)
• Transport[2]	2K4, but -40 ... +80 °C (2K4, but -40 ... +176 °F)
• Operation[3]	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	
• 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 (ventilate actuator)[4]	
- 2 bar (29 psi)	4.1 Nm³/h (18.1 USgpm)
- 4 bar (58 psi)	7.1 Nm³/h (31.3 USgpm)
- 6 bar (87 psi)	9.8 Nm³/h (43.1 USgpm)
• Outlet air valve (ventilate actuator)[4]	
- 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

1) Impact energy max. 1 Joule for plastic/aluminium casing.
2) During commissioning at ≤ 0 °C (≤ 32 °F) make sure that the valves are flushed long enough with the dry medium.
3) At ≤ -10 °C (14 °F) the display refresh rate of the LCD is limited. Only T4 is permissible when using I_y module.
4) With EEx d version (6DR5..5-...) the values are reduced by approx. 20%

Technical specifications

SIPART PS2 PA	Basic device without Ex protection	Basic device with EEx-d protection (flameproof casing)	Basic device with EEx ia/ib protection	Basic device with EEx n protection
Explosion protection to EN 50014, EN 50020 and EN 50021	Without	EEx d II 2 G EEx d II C T4/T5/T6	EEx ia/ib II 2 G EEx ia/ib II C T6	EEx n II 3 G EEx nA L [L] II C T6
Mounting location		Zone 1 or zone 2	Zone 1	Zone 2
Permissible ambient temperature for operation At ≤ -10 °C (+14 °F) the display refresh rate of the LCD is limited. (for basic devices with Ex protection the following applies: Only T4 is permissible when using I_y module.)	-30 ... +80 °C (-22 ... +176 °F)	T4: -30 ... +80 °C (-22 ... +176 °F) T5: -30 ... +65 °C (-22 ... +149 °F) T6: -30 ... +50 °C (-22 ... +122 °F)		
Electrical data				
Input				
Power supply (terminals 6/7)	Bus-supplied			
Bus voltage	9 ... 32 V	9 ... 32 V	9 ... 24 V	9 ... 32 V
• Bus connection with FISCO supply unit, ia or ib group IIC or IIB		–		
- Max. supply voltage U_o	–	–	17.5 V	–
- Max. short-circuit current I_o	–	–	380 mA	–
- Max. power P_o	–	–	5.32 W	–
• Bus connection with barrier, ia or ib group IIC or IIB		–		
- Max. supply voltage (U_o)	–	–	24 V	–
- Max. short-circuit current (I_o)	–	–	250 mA	–
- Max. power P_o	–	–	1.2 W	–
Current consumption	10.5 mA ± 10%	10.5 mA ± 10%	10.5 mA ± 10%	10.5 mA ± 10%
Fault current	0 mA	0 mA	0 mA	0 mA
Effective internal inductance	–	–	$L_i ≤ 8$ μH	–
Effective internal capacitance	–	–	Negligible	–
Connection	–	–	Certified intrinsically safe circuit	–
Safety shutdown can be activated with coding bridge (terminals 81/82; electrically isolated from the basic device)				
• Input resistance	> 20 kΩ	> 20 kΩ	> 20 kΩ	> 20 kΩ
• Signal status "0" (shutdown active)	0 ... 4.5 V or unused	0 ... 4.5 V or unused	0 ... 4.5 V or unused	0 ... 4.5 V or unused
• Signal status "1" (shutdown not active)	13 ... 30 V	13 ... 30 V	13 ... 30 V	13 ... 30 V
• Effective Internal capacitance C_i	–	–	Negligible	–
• Effective internal inductance L_i	–	–	Negligible	–
• For connection to power supply with	–	–	Intrinsically safe	–
- Max. supply voltage U_i	–	–	< 30 V	< 30 V
- Max. short-circuit current I_i	–	–	<100 mA	<100 mA
- Maximum power P_i	–	–	< 1 W	–
Electrical isolation	Between basic device and the input for safety shutdown, as well as the outputs of the option modules	Between basic device and the input for safety shutdown, as well as the outputs of the option modules	The basic device and the input to the safety shutdown, as well as the outputs of the option modules, are individual, intrinsically-safe circuits	Between basic device and the input for safety shutdown, as well as the outputs of the option modules
Test voltage	840 V DC, 1 s	840 V DC, 1 s	840 V DC, 1 s	840 V DC, 1 s

SIPART PS2 PA	Basic device without Ex protection	Basic device with EEx-d protection (flameproof casing)	Basic device with EEx ia/ib protection	Basic device with EEx n protection
Communication	Layers 1 and +2 according to PROFIBUS PA, transmission technique according to IEC 1158-2; slave function; layer 7 (protocol layer) according to PROFIBUS DP, EN 50170 standard with the extended PROFIBUS functions (all data acyclic, manipulated variable, feedbacks and status also cyclic)			
C2 connections	Four connections to master class 2 are supported, automatic connection setup 60 s after break in communication;			
Device profile	PROFIBUS PA profile B, version 3.0, more than 150 objects			
Response time to master message	Typical 10 ms			
Device address	126 (when delivered)			
PC parameterizing software	SIMATIC PDM; supports all device objects. The software is not included in the scope of delivery			
Connections				
• Electric	Screw terminals 2.5 AWG28-12	Screw terminals 2.5 AWG28-12	Screw terminals 2.5 AWG28-12	Screw terminals 2.5 AWG28-12
	Cable gland M20 x 1.5 or ½-14 NPT	EEx d certified cable gland M20 x 1.5, ½-14 NPT or M25 x 1.5	Cable gland M20 x 1.5 or ½-14 NPT	Cable gland M20 x 1.5 or ½-14 NPT
• Pneumatic	Female thread G¼ DIN 45141 (¼-18 NPT)	Female thread G¼ DIN 45141 (¼-18 NPT)	Female thread G¼ DIN 45141 (¼-18 NPT)	Female thread G¼ DIN 45141 (¼-18 NPT)
External position sensor (potentiometer or NCS; as option)				
• U_o	–	–	< 5 V	< 5 V
• I_o	–	–	<75 mA	<75 mA
• I_s	–	–	<160 mA	<160 mA
• P_o	–	–	<120 mW	<120 mW
• Maximum permissible external capacitance C_o	–	–	< 1 µF	< 1 µF
• Maximum permissible external inductance L_o	–	–	< 1 mH	< 1 mH

▇ Technical specifications

Option modules	Without Ex protection (EEx d also)	With Ex protection EEx ia/ib	With Ex protection EEx n
Ex protection to EN 50014, EN 50020 and EN 50021	–	II 2G EEx ia/ib II C T4/T5/T6	II 3G EEx nA L [L] II C T6
Mounting location	–	Zone 1	Zone 2
Permissible ambient temperature for operation (For devices with Ex protection: Only in conjunction with the basic device 6DR5... -.E.... Only T4 is permissible when using I_y module)	-30 ... +80 °C (-22 ... +176 °F)	T4: -30 ... +80 °C (-22 ... +176 °F)[1] T5: -30 ... +65 °C (-22 ... +149 °F)[1] T6: -30 ... +50 °C (-22 ... +122 °F)[1]	
Alarm module	6DR4004-8A (without Ex protection)	6DR4004-6A (with Ex protection)	6DR4004-6A (with Ex protection)
Binary alarm outputs A1, A2 and alarm output			
Signal status High (not responded) Signal status Low* (responded) (* Low is also the status when the basic device is faulty or has not electric power supply)	Active, R = 1 kΩ, +3/-1%* Disabled, I_R < 60 µA (* When used in the flameproof casing the current consumption is limited to 10 mA per output.)	≥ 2.1 mA ≤ 1.2 mA (Switching threshold with supply to EN 60947-5-6: U_H = 8.2 V, R_i = 1kΩ)	≥ 2.1 mA ≤ 1.2 mA (Switching threshold with supply to EN 60947-5-6: U_H = 8.2 V, R_i = 1kΩ)
Internal capacitance C_i	–	≤ 5.2 nF	–
Internal inductance L_i	–	Negligible	–
Power supply U_H	≤ 35 V	–	–
Connection to power circuits with	–	intrinsically safe switching amplifier EN 60947-5-6 U_o ≤ 15.5 V DC I_k ≤ 25 mA, P ≤ 64 mW	U_i ≤ 15.5 V DC
Binary input BE2			
• Electrically connected to the basic device - Signal status 0 - Signal status 1 - Contact load	Floating contact, open Floating contact, closed 3 V, 5 µA	Floating contact, open Floating contact, closed 3 V, 5 µA	Floating contact, open Floating contact, closed 3 V, 5 µA
• Electrically isolated from the basic device - Signal status 0 - Signal status 1 - Natural resistance	≤ 4.5 V or open ≥ 13 V ≥ 25 kΩ	≤ 4.5 V or open ≥ 13 V ≥ 25 kΩ	≤ 4.5 V or open ≥ 13 V ≥ 25 kΩ
Static destruction limit	± 35 V	–	–
Internal inductance and capacitance	–	Negligible	–
Connection to power circuits	–	Intrinsically safe U_i ≤ 25.2 V	U_i ≤ 25.2 V DC
Electrical isolation	The 3 outputs, the input BE2 and the basic device are electrically isolated from each other		
Test voltage	840 V DC, 1 s	840 V DC, 1 s	840 V DC, 1 s
SIA module (not for EEx d version)	6DR4004-8G (without Ex protection)	6DR4004-6G (with Ex protection)	6DR4004-6G (with Ex protection)
Limit transmitter with slot-type initiators and alarm output	2-wire connection		
Ex protection	Without	II 2 G EEx ia/ib IIC T6	II 3 G EEx nA L [L] IIC T6
Connection	2-wire system to EN 60947-5-6 (NAMUR), for switching amplifier to be connected on load side		
2 slot-type initiators	Type SJ2-SN	Type SJ2-SN	Type SJ2-SN
Function	NC (normally closed)	NC (normally closed)	NC (normally closed)
Connection to power circuits with	nominal voltage 8 V Current consumption: ≥ 3 mA (limit value not responded) ≤ 1 mA (limit value responded)	Intrinsically safe switching amplifier EN 60947-5-6 U_i ≤ 15.5 V DC I_i ≤ 25 mA, P_i ≤ 64 mW	U_i ≤ 15.5 V DC P_i ≤ 64 mW
Internal capacitance	–	≤ 41 nF	–
Internal inductance	–	≤ 100 mH	–
Electrical isolation	The 3 outputs are electrically isolated from the basic device		
Test voltage	840 V DC, 1 s	840 V DC, 1 s	840 V DC, 1 s
Alarm output	See Alarm module	See Alarm module	See Alarm module

1) Only in conjunction with the basic device 6DR5...-E..... With Iy module only T4 permitted.

Accessory modules	Without Ex protection (EEx d also)	With Ex protection EEx ia/ib	With Ex protection EEx n
Limit value contact module	6DR4004-8K	6DR4004-6K	6DR4004-6K
Limit transmitter with mechanical ground contact and alarm output			
Ex protection	without	II 2 G EEx ia/ib IIC T6	II 3 G EEx nA L [L] IIC T6
Max. switching current AC/DC	4 A	Connection to intrinsically safe power circuits: $U_o \leq 30$ V $I_k \leq 100$ mA, $P_i \leq 750$ mW	Connection to intrinsically safe power circuits: $U_o \leq 30$ V $I_k \leq 100$ mA, $P_i \leq 750$ mW
Max. switching voltage AC/DC	250 V / 24 V	30 V DC	30 V DC
Internal capacitance C_i	–	Negligible	–
Internal inductance L_i	–	Negligible	–
Electrical isolation	The 3 outputs are electrically isolated from the basic device		
Test voltage	3150 V DC, 2s	3150 V DC, 2 s	3150 V DC, 2 s
Alarm module	See Alarm module	See Alarm module	See Alarm module
I_y module	6DR4004-8J (without Ex protection)	6DR4004-6J (with Ex protection)	6DR4004-6J (with Ex protection)
DC output for position feedback	2-wire connection	2-wire connection	2-wire connection
Nominal signal range i	4 ... 20 mA, short-circuit-proof	4 ... 20 mA, short-circuit-proof	4 ... 20 mA, short-circuit-proof
Total operating range	3.6 ... 20.5 mA	3.6 ... 20.5 mA	3.6 ... 20.5 mA
Power supply U_H	+12 ... +35 V	+12 ... +30 V	+12 ... +30 V
External load R_B [kW]	$\leq (U_H$ [V] - 12 V) /i [mA]	$\leq (U_H$ [V] - 12 V) /i [mA]	$\leq (U_H$ [V] - 12 V) /i [mA]
Transmission error	$\leq 0.3\%$	$\leq 0.3\%$	$\leq 0.3\%$
Temperature effect	$\leq 0.1\%$/10 K ($\leq 0.1\%$/18 °F)	$\leq 0.1\%$/10 K ($\leq 0.1\%$/18 °F)	$\leq 0.1\%$/10 K ($\leq 0.1\%$/18 °F)
Resolution	$\leq 0.1\%$	$\leq 0.1\%$	$\leq 0.1\%$
Residual ripple	$\leq 1\%$	$\leq 1\%$	$\leq 1\%$
Internal capacitance C_i	–	≤ 11 nF	–
Internal inductance L_i	–	Negligible	–
For connection to power circuits with		Intrinsically safe: $U_i \leq 30$ V DC $I_i \leq 100$ mA; $P_i \leq 1$ W (only T4)	$U_i \leq 30$ V DC $I_i \leq 100$ mA; $P_i \leq 1$ W (only T4)
Electrical isolation	Electrically isolated from the basic device	Electrically isolated from the basic device	Electrically isolated from the basic device
Test voltage	840 V DC, 1 s	840 V DC, 1 s	840 V DC, 1 s
NCS sensor			
(not for EEx d version)			
Position range			
• Linear actuator	3 ... 130 mm (0.12 ... 5.12 inch), to 200 mm (7.87 inch) on request	3 ... 130 mm (0.12 ... 5.12 inch), to 200 mm (7.87 inch) on request	3 ... 130 mm (0.12 ... 5.12 inch), to 200 mm (7.87 inch) on request
• Part-turn actuator	30° ... 100°	30° ... 100°	30° ... 100°
Linearity (after correction by SIPART PS2)			
• Linear actuator	± 1%	± 1%	± 1%
• Part-turn actuator	± 1%	± 1%	± 1%
Hysteresis	± 0.2%	± 0.2%	± 0.2%
Continuous working temperature	-40 ... +85 °C (-40 ... +185 °F), extended temperature range on request	-40 ... +85 °C (-40 ... +185 °F), extended temperature range on request	-40 ... +85 °C (-40 ... +185 °F), extended temperature range on request
Degree of protection of casing	IP68/NEMA 4X	IP68/NEMA 4X	IP68/NEMA 4X

Scope of delivery

<div style="text-align: right; font-size: 2em;">**8**</div>

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.

8.1 Ordering data

Selection and ordering data	Order No.
Electropneumatic positioner SIPART PS2, PS2 PA and PS2 FF	6 D R 5 ■ ■ ■ - 0 ■ ■ ■ ■ - ■ ■ A ■

Version

2-wire
• <u>Without</u> HART (4 to 20 mA) ▶	0
• With HART, <u>not</u> explosion-protected ▶ (except EEx d)	1

2-, 3-, 4-wire
• With HART, explosion-protected ▶	2
• <u>Without</u> HART, <u>not</u> explosion-protected ▶	3
PROFIBUS PA connection	5
FOUNDATION Fieldbus connection (not EEx n)	6

For actuator
Single-action ▶	1
Double-action ▶	2

Casing
Plastic ▶	0
Aluminum; only single-action ▶	1
Stainless steel; not for EEx d version: ▶ not FM/CSA and not EEx n	2
Aluminum; EEx d housing (flameproof)[1], not CSA ▶	5

Explosion protection
Without ▶	N
With explosion protection EEx ia/ib or EEx d (CENELEC/FM/CSA)	E
With explosion protection EEx n (CENELEC)	G

Connection thread electrical/pneumatic
M20 x 1.5 / G¼ ▶	G
½-14 NPT / ¼-18 NPT	N
M20 x 1.5 / ¼-18 NPT	M
½-14 NPT / G¼	P
M25 x 1.5 / G¼ (only EEx d version)[1]	Q
With PROFIBUS plug M12 / G¼[2]	R
With PROFIBUS plug M12 / ¼-18 NPT[2]	S
M20 x 1.5 / VDI/VDE 3847	V

Limit monitor
Installed, incl. 2nd cable gland[3]
Without ▶	0
Alarm module; electronic (6DR4004-.A)	1
SIA module; slot-type initiators (6DR4004-.G); not for EEx d version)	2
Limit value contact module (mechanical switching contacts (6DR4004-.K); not for EEx d version	3

Optional modules
Installed, incl. 2nd cable gland[3]
Without ▶	0
Iy module for position feedback signal (4 ... 20 mA) (6DR4004-.J)	1
EMC filter module for external position sensor (C73451-A430-D23), (not for EEx d version)	2
Iy module and EMC filter module for external position sensor, not for EEx d version	3

Selection and ordering data	Order No.
Electropneumatic positioner SIPART PS2, PS2 PA and PS2 FF	6 D R 5 ■ ■ ■ - 0 ■ ■ ■ ■ - ■ ■ A ■

Customer-specific design
Without ▶	0

Brief instructions
German/English ▶	A
French/Spanish/Italian	B

Mounted pressure gauge block
Without ▶	0
Single-action G¼	1
Double-action G¼	2
Single-action ¼-18 NPT	3
Double-action ¼-18 NPT	4

Further designs

Add "-Z" to Order No. and specify Order Code.

Version with stainless steel sound absorbers not for EEx d version; standard with stainless steel enclosures	A40
Customized preset bus address (max. 126) and/or software tag No. for PROFIBUS PA and FOUNDATION Fieldbus version, for plastic enclosures, for metal enclosures on request.	Y25

▶ Available ex stock

1) EEx d version without cable gland.

2) Not for EEx d, FM/CSA approval, EEx ia/ib (CENELEC) on request

8.2 Scope of delivery of options

Option	Bestellnummer
I$_y$ module without explosion protection	6DR4004-8J
I$_y$ module with explosion protection PTB [1] I$_y$ modulel with explosion protection FM [2]	6DR4004-6J 6DR4004-7J
Alarm module without explosion protection	6DR4004-8A
Alarm module with explosion protection PTB [1] Alarm module with explosion protection FM [2]	6DR4004-6A 6DR4004-7A
SIA module without explosion protection	6DR4004-8G
SIA module with explosion protection CENELEC and FM [1][2]	6DR4004-6G
Mechanical limit switch module without explosion protection	6DR4004-8K
Mechanical limit switch module with explosion protection CENELEC and FM [1][2][3]	6DR4004-6K

[1] EC–type examination certificates
[2] Approval Reports of Factory Mutual System
[3] In preparation

8.3 Scope of delivery of accessories

Accessories	Order number
Mounting kit set linear actuators IEC 534–6 including lever arm for 3 to 35 mm way	6DR4004–8V
Additional lever for > 35 to 130 mm way	6DR4004–8L
Mounting kit part–turn actuators VDI/VDE 3845	6DR4004–8D
Solenoid valve block for SAMSON actuator (integrated mounting)	6DR4004–1C
Manometer block single–acting	6DR4004–1M
Manometer block double–acting	6DR4004–2M
Solenoid valve block single–acting (NAMUR)	6DR4004–1B
Mounting set for SAMSON actuator (integrated mounting)	6DR4004–8S

NCS–Sensor
     non explosion–proof
     explosion–proof
     cable length 6 m (19.68 ft)
     for part–turn actuators
     for linear actuators up to 14 mm (0.55 inch) (on request)
     for linear actuators > 14 mm (0.55 inch)
	6DR4004–_ N _ _ 0
	6DR4004–8N
	6DR4004–6N
	6DR4004–_NN
	6DR4004–_N_10
	6DR4004–_N_20
	6DR4004–_N_30

EMC filter rmodule	C73451–A430–D23
External position detection system	C73451–A430–D78
Operating software SIMATIC PDM	on request

8.4   List of Spare Parts

Spare parts list: SIPART PS2 positioner			
	Description	Order No.	for version
	Cover (plastic enclosure) with screws (4 pcs) and seal	C73451–A430–D82	6DR4___ 6DR5___
	Cover (metal enclosure) with screws (4 pcs) and seal	C73451–A430–D83	6DR4___ 6DR5___
	Motherboard, two–wire without HART, without explosion protection	A5E00082459	6DR50__–_N 6DR40__–_N *)
	Motherboard, two–wire without HART, with explosion protection	A5E00082457	6DR50__–_E
	Motherboard, two–wire HART, without explosion protection	A5E00082458	6DR51__–_N 6DR40__–_N *)
	Motherboard, two–,three–,four–wire HART, with explosion protection	A5E00082456	6DR52__
	Motherboard Two–,three–,four–wire without HART, without expl. protect.	A5E00102018	6DR53__–_N 6DR40__–_N *)
	Motherboard PROFIBUS PA, without explosion protection	A5E00141523	6DR55__–_N.. 6DR41__–_N
	Motherboard PROFIBUS PA, with explosion protection	A5E00141550	6DR55__–_E 6DR41__–_E
	Motherboard FIELDBUS Foundation, without explosion proof	A5E00215467	6DR56__
	Motherboard FIELDBUS Foundation, with explosion protection	A5E00215466	6DR56__
	Pneumatic block (Valve single acting incl. seals and screws)	C73451–A430–D80	6DR4___ 6DR5___
	Pneumatic block (Valve double acting incl. seals and screws)	C73451–A430–D81	6DR4___ 6DR5___
	Potentiometer (complete)	C73451–A430–D84	6DR4___ 6DR5___

*) 6DR40.. can be used after having clarified whether application with two–wire or three–wire/four–wire input

Note: For accesories and option modules see Catalog FI 01 "Field Instruments for Process Automation"

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Appendix **10**

10.1 Literature and catalogs

No.	Title	Issued by	Order number
/1/	PNO guide PROFIBUS PA	PNO– Technologiefabrik Haid-und-Neu-Str. 7 D–76131 Karlsruhe	2.091
/2/	SIMATIC field technology package	Siemens AG	Internet address: http://www.ad.siemens.de:80 80/virlib/html_00/ doc/index.htm on: Profibus descriptions (free) / system description / PA system description, German
/3/	ST PI catalog PROFIBUS and AS Interface Field bus components	Siemens AG	E86060–K4660–A101–A3
/4/	ST 50 catalog SIMATIC SIMATIC S5/PC/505 Automation Systems	Siemens AG	E86060–K4650–A111–A7
/5/	ST 70 catalog SIMATIC S7/M7/C7 Automation Systems	Siemens AG	E86060–K4670–A111–A4
/6/	ST 80 catalog SIMATIC HMI Operating and monitoring products	Siemens AG	E86060–K4680–A101–A5
/7/	IK 10 catalog SIMATIC NET Communication networks	Siemens AG	E86060–K4710–A101–A7
/8/	ST PCS 7 catalog SIMATIC SIMATIC PCS 7 process control system	Siemens AG	E86060–K4678–A111–A2

10.2 Certificates

The certificates are enclosed as a collection of loose leaves in the operating instructions (or on CD).