

SIEMENS

SIPART PS2

6DR5xxx

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Manual

Edition 02/01

Electropneumatic Positioner for Linear and Rotary Actuators



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Information for the Operator

0

Dear customer,

Please read this manual before starting work!

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

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

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

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

Scope of delivery, see chapter 7, page 105.

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 Meaning of safety instructions and warnings

Safety information and warnings are intended to avert danger from the life and health of users and maintenance personnel and to prevent material damage. They are highlighted in this manual by the headings defined here. They are also marked by warning symbols next to where they appear. The headings used have the following meaning for the purposes of this manual and the product labels:



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

NOTICE

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



NOTE

indicates a reference to a possible advantage when this recommendation is followed.

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

- 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
- and, in the case of ex-proof equipment, are trained, instructed or authorized to perform work on electrical circuits of equipment subject to explosion hazard.



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.

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.

0.4 Use as intended

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

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

0.5 Technical Documentation

In addition to this manual, the following documentation is also supplied with the instrument:

- Leaflet "Operation – Concise Overview"
explains in visualized form the principle of operation and parameterization and automatic commissioning.
- "Operating Instructions"
contains the information required for assembly, connection and commissioning.

The following list contains all the documents available for these instruments:

Title	Language	Order No.
Operating Instructions	German/English	A5E00074600
	French/Italian/Spanish	A5E00074601
Manual	German	A5E00074630
	English	A5E00074631
Leaflet	German	A5E00074610
	English	A5E00074611
	French	A5E00074612
	Italien	A5E00074613
	Spanish	A5E00074614

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0.6 Warranty Information

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

0.7 Delivery Notes

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

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

For the scope of delivery please see Chapter 7.

0.8 Standards and Regulations

As far as possible, the harmonized European standards were used to specify and manufacture this equipment. If harmonized European standards have not been applied, the standards and regulations of the Federal Republic of Germany apply (see also the Technical Data in Chapter 6, page 101).

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

1.1 General information about the positioner

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

Purpose

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

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

Different mounting types are available for linear actuators:

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

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

Versions

The positioner is available for the following actuators:

- double-acting and
- single-acting

For following applications:

- potentially explosive or
- not potentially explosive applications.

Housing

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

The housing is available in three versions:

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

Degree of protection

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

Explosion Protection

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

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

Options

The positioner can be expanded with various options modules (chapter 2.5, page 25). The following modules are available in all:

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

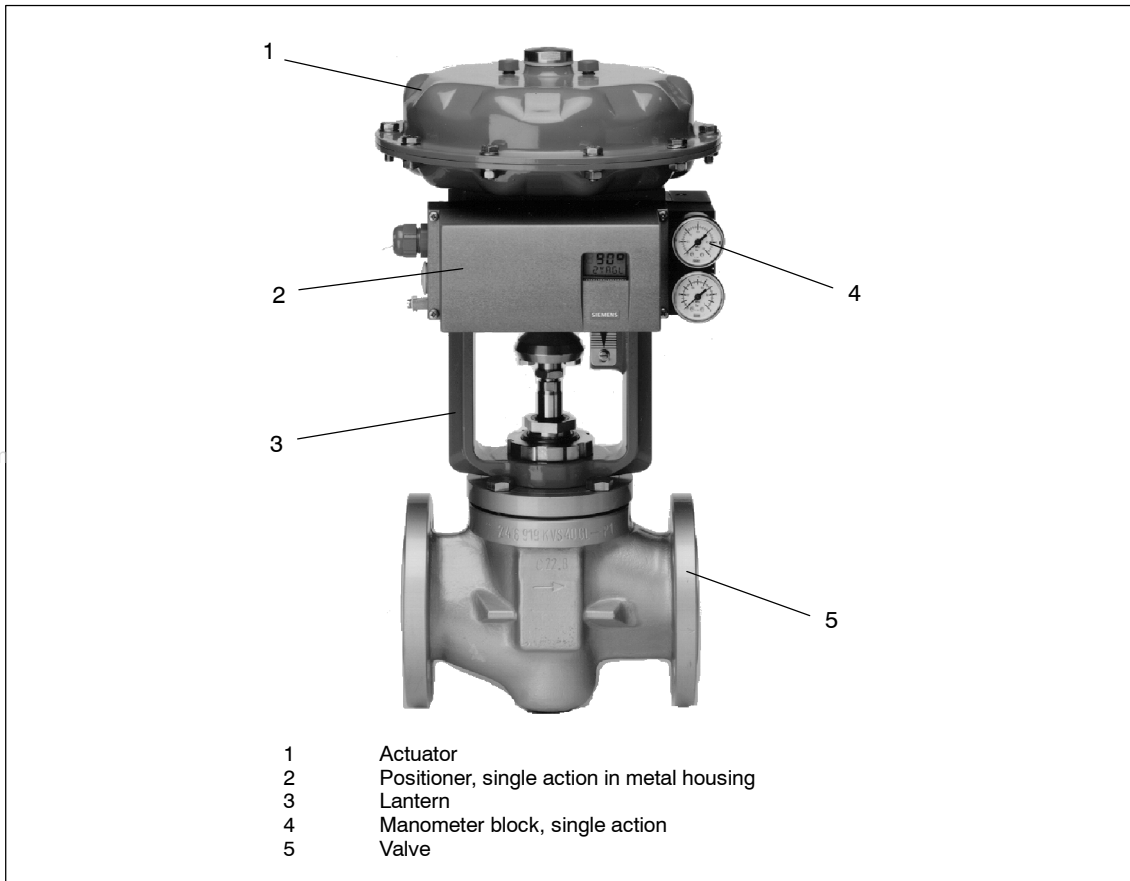
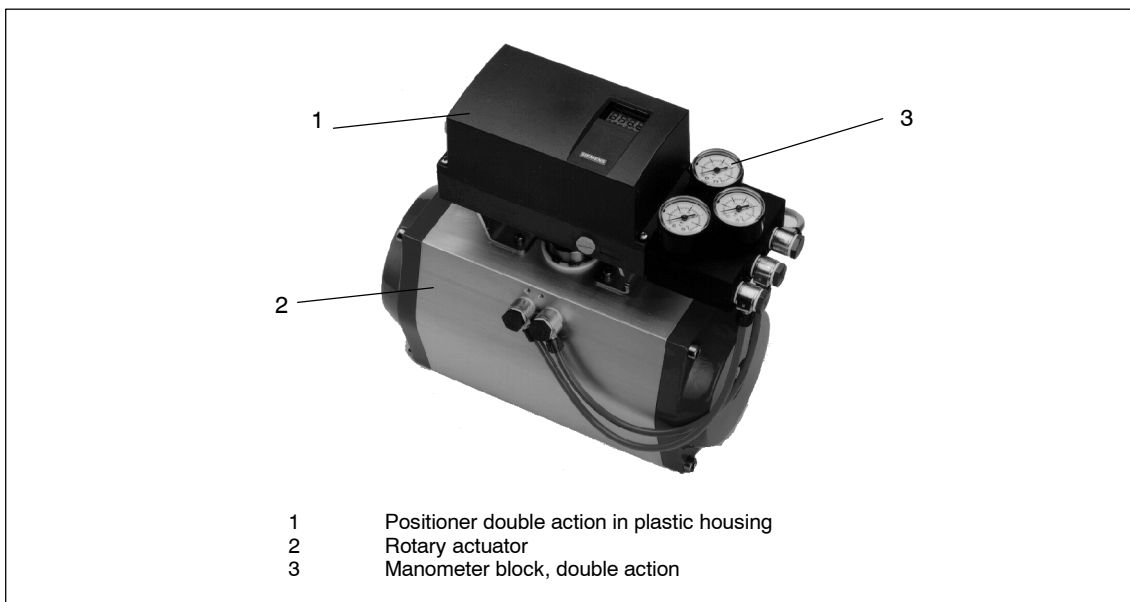
Accessories

- Manometer block: 2 or 3 manometers for single and double action positioners
- Add-on flange (NAMUR) for safety valve block
- Add-on sets for linear and rotary actuator

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.

Figure 1-1 Positioner mounted on **linear actuator** (single action)Figure 1-2 Positioner mounted on **rotary actuator** (double action)

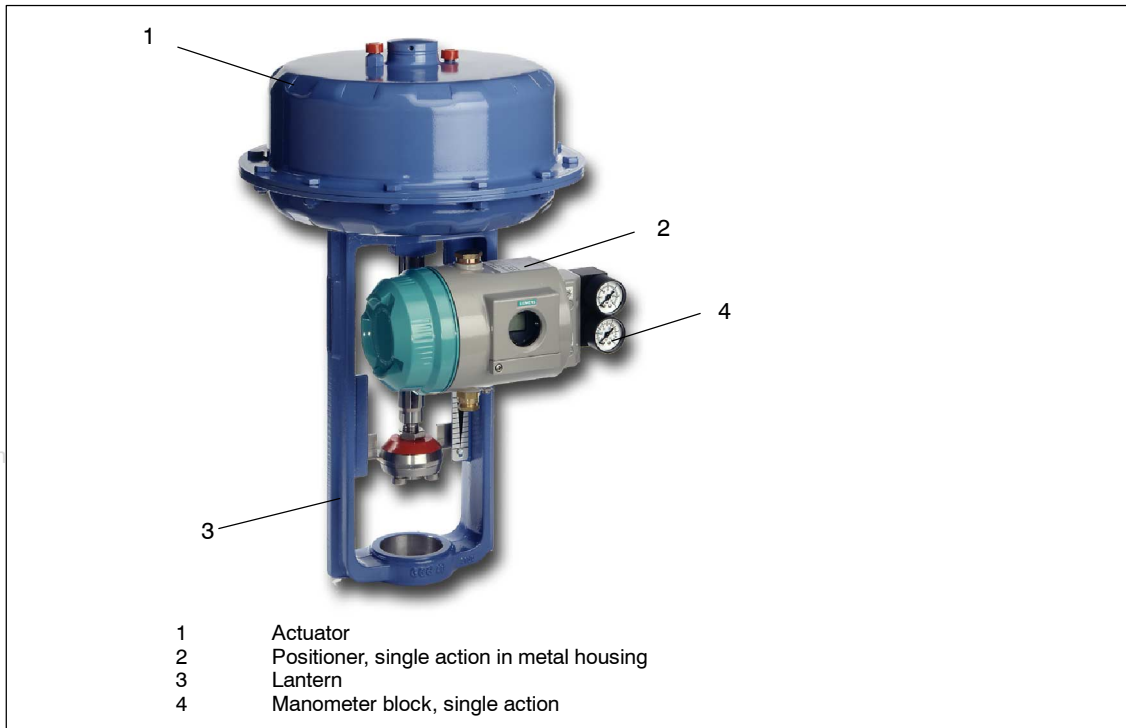


Figure 1-3 **Explosion proof** positioner mounted on **linear actuator** (single action)

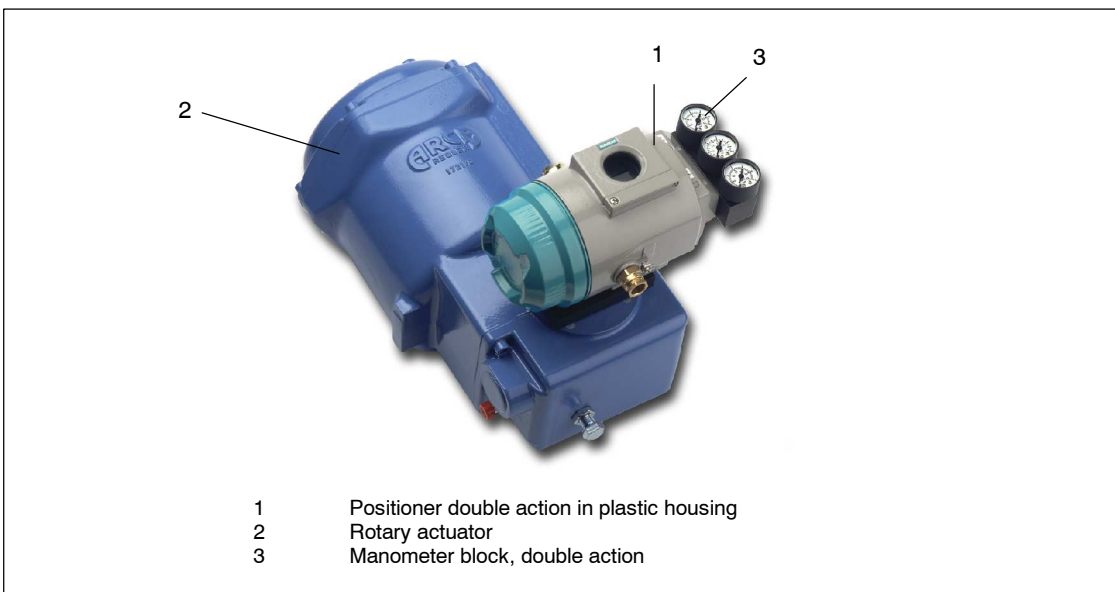


Figure 1-4 **Explosion proof** positioner mounted on **rotary actuator** (double action)

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

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2.1 Overview

Introduction

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

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

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

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

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

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

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

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

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

puts respond even when the power supply fails or the electronics are defective.

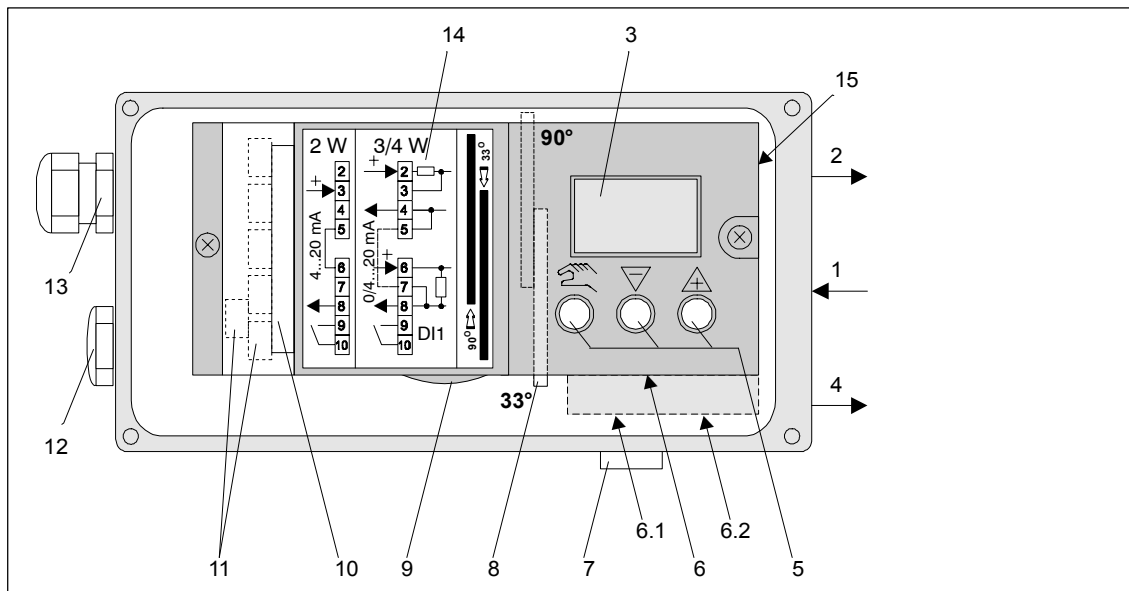
The actuator can also be blocked or driven to its final positions depending on the configuration for example by an external event via a digital input (DI2) on the alarm module.

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

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

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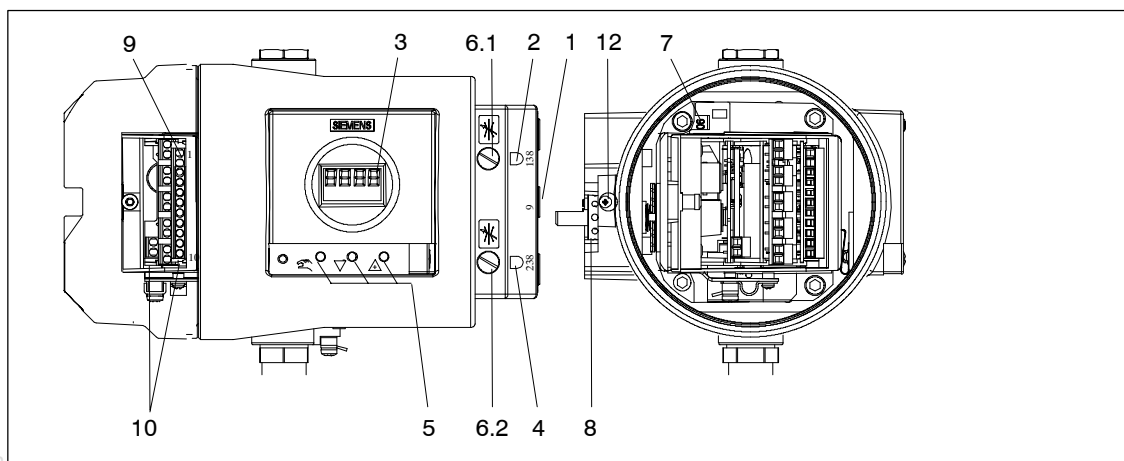
2.2 Instrument Components



- | | | | |
|-----|----------------------------------|----|-----------------------------|
| 1 | Input: Supply air | 7 | Silencer |
| 2 | Output: Actuating pressure Y1 | 8 | Transmission ratio selector |
| 3 | Display | 9 | Adjusting wheel slip clutch |
| 4 | Output: Actuating pressure Y2 *) | 10 | Terminals options modules |
| 5 | Operating keys | 12 | Dummy plug |
| 6 | Restrictor | 13 | Screw-type cable gland |
| 6.1 | Restrictor Y1 | 14 | Terminal plate on cover |
| 6.2 | Restrictor Y2 *) | 15 | Purging air switch |

*) in double-acting actuators

Figure 2-1 View of the positioner in normal version (cover open)



- | | | | |
|-----|----------------------------------|----|---|
| 1 | Input: Supply air | 7 | Transmission ratio selector
(only possible with positioner open) |
| 2 | Output: Actuating pressure Y1 | 8 | Adjusting wheel slip clutch |
| 3 | Display | 9 | Terminals standard controller |
| 4 | Output: Actuating pressure Y2 *) | 10 | Terminals options modules |
| 5 | Operating keys | 12 | Safety catch |
| 6.1 | Restrictor Y1 | | |
| 6.2 | Restrictor Y2 *) | | |

*) in double-acting actuators

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

2.2.1 Motherboard

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

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

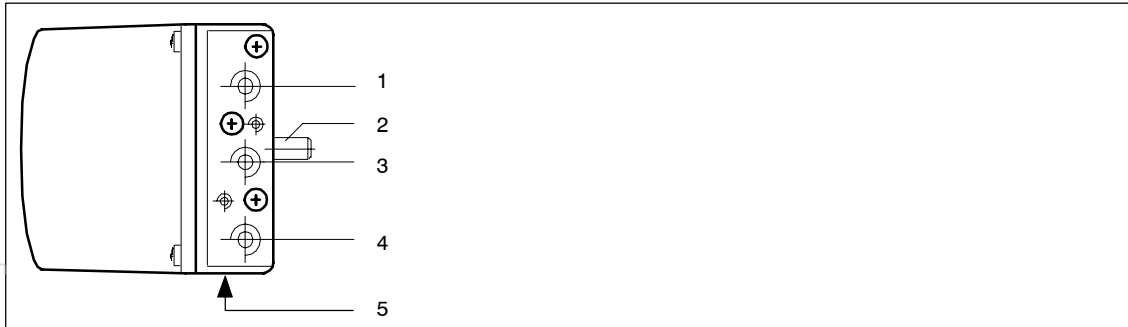
2.2.2 Electrical Connections

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

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

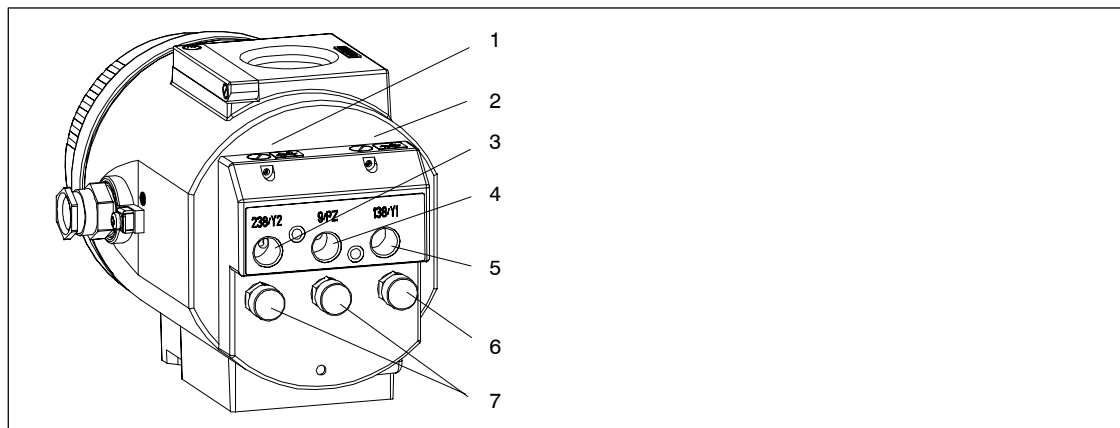
2.2.3 Pneumatic Connections

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



- 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 2-3 Pneumatic connection in normal version



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

*) in double-acting actuators

Figure 2-4 Pneumatic connection in explosion proof version

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

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

In the ex-factory state, these connections are sealed by screws (see figure 3-1, page 33, figure 3-3, page 34 and figure 3-4, page 35).

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

Figure 2-5, page 20 shows the pneumatic connection variants for the different actuator types, the positioning action and the safety position after power failure.

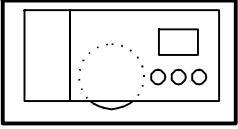
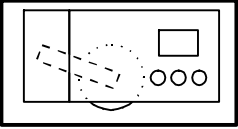
Positioning pressure Connection	Actuator type	Safety position after power failure		
		electrical	pneumatic	
Y1		Closed	Closed	<p>In rotary actuators the direction of rotation counterclockwise looking onto the actuating shaft of the valve is usually defined as "Open".</p>  <p>Closed Open</p>
Y1		Open	Open	
Y2		Open	Last position (before power failure)	
Y1		Closed		
Y1		Down	Down	 <p>up down</p>
Y1		Up	Up	
Y2		Up	Last position (before power failure)	
Y1		Down		

Figure 2-5 Pneumatic connection positioning

2.2.4 Mounting Kit

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

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

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

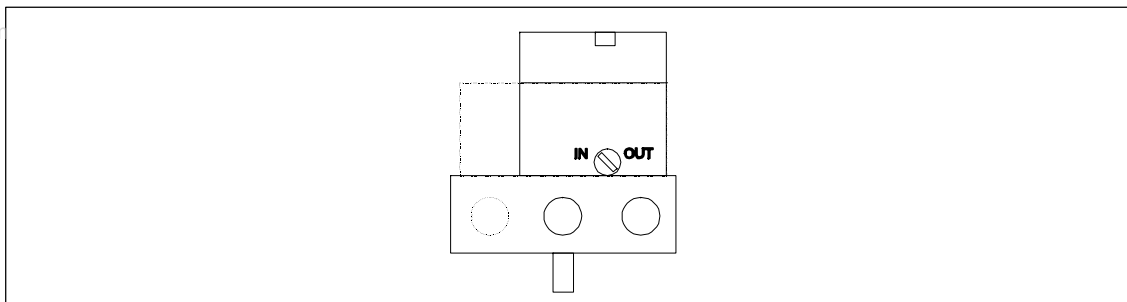


Figure 2-6 Purge air switch on the valve block, view of the positioner onto pneumatic connection side with cover open

2.2.6 Restrictors

In order to achieve floating times of > 0.5 s in small actuators, the air rate can be reduced with the restrictors Y1 and Y2 (figure 2-7, in explosion proof version, see figure 2-4, page 18). 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).

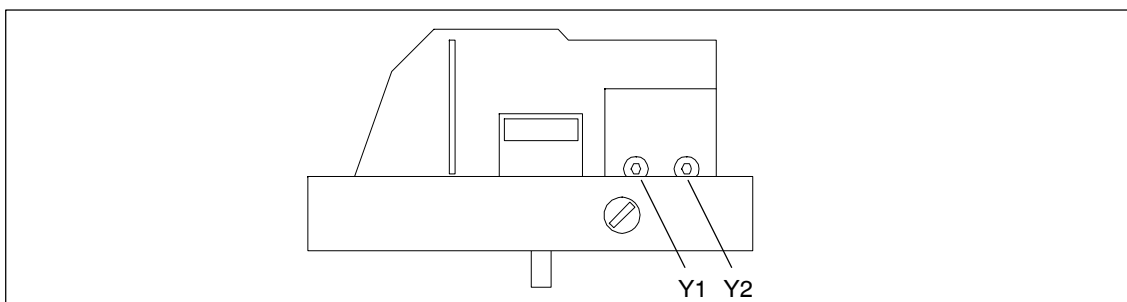


Figure 2-7 Restrictors

2.3 Method of Operation

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

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

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

The pneumatic actuators are available in single and double action versions. Only one pressure chamber is aerated or deaerated in the single action version. The resulting pressure operates against a spring. In the double action version, two pressure chambers are counteractive. In this case the one volume is deaerated when the other volume is aerated. See the block diagram figure 2-9, page 24.

The control algorithm is an adaptive predicative five-point switch (see figure 2-8, page 23).

The valves are controlled with continuous contact at large control errors (fast action zone). At medium control errors the valve is controlled by pulse length modulated pulses (slow action 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 floating 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 hour during operation. These parameters can be read out and documented by the communication programs such as PDM and AMS. Conclusions as to the wear on the fitting can be drawn (diagnostic function) especially by comparing the old value with the currently determined values.

Figure 2-9, page 24 shows the block diagrams for single- and double-acting actuators with the linear actuator as an example.



NOTE

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

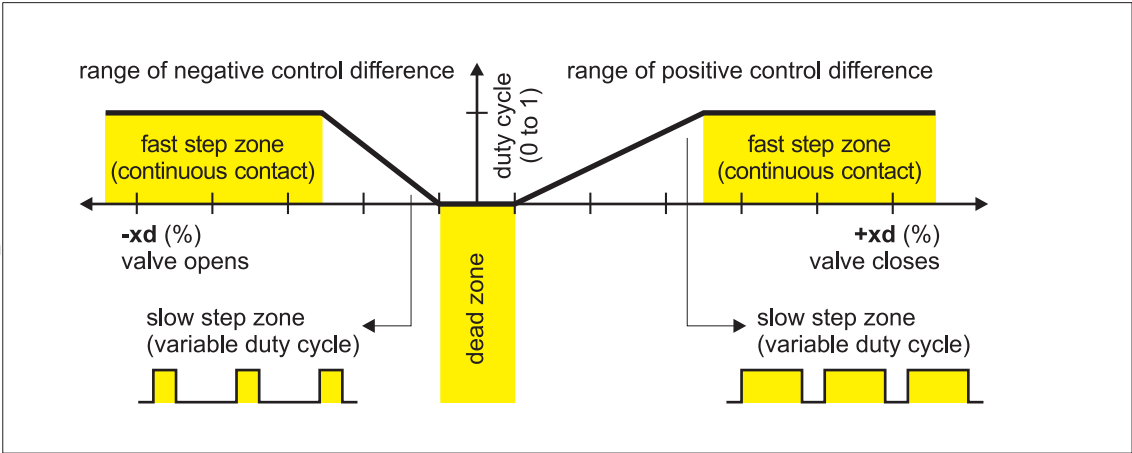
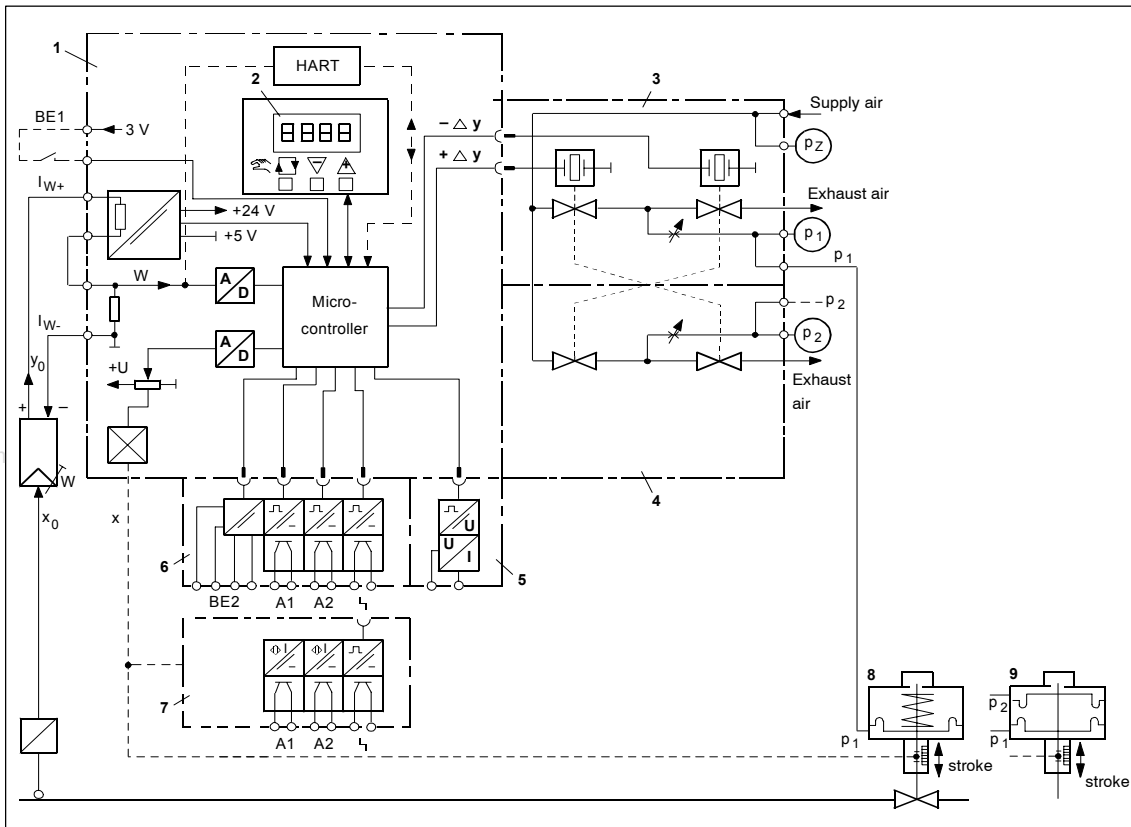


Figure 2-8 Method of operation five-point switch



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

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



NOTE

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

2.4 State as supplied

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

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

The pneumatic connections on the rear are sealed.

2.5 Options modules

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2.5.1 Options modules in normal and intrinsically safe versions

The options modules are protected and mechanically fixed by a module cover ((1), see figure 2-10, page 27 and figure 2-11, page 29).



NOTE

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

Opening the instrument

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

Disconnect or isolate the power supply cables.

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



NOTE

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

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

J_y-module

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

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

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

1. Remove all the electrical connections from the basic electronics (2).
2. Loosen the two fixing screws (2.1) of the basic electronics.
3. Snap out the basic electronic board by carefully bending the four holders.
4. Insert the SIA-module (7) from above up to the top pcb rail of the container.
5. Push the SIA module in the pcb rail of the container about 3 mm to the right.
6. Screw the special screw (7.1) through the SIA module into the axle of the positioner, please observe the following note:
The pins pressed into the actuating disc bearing must be adjusted to just before touching with the special screw. The actuating disc bearing and the special screw must then be turned simultaneously so that the pins slot into the special screw.
7. Place the insulating cover (10) over the SIA module underneath the surface of the basic electronics board at the container wall on one side. The recesses in the insulating cover must slot into the corresponding lugs on the container wall. Place the insulating cover on the SIA module by carefully bending the container walls.
8. Snap the basic electronics board into the four holders and screw it tight again with the two fixing screws (2.1).
9. Make all the electrical connections between the motherboard and the options with the ribbon cables provided and between the motherboard and potentiometers with the potentiometer cable.
10. Fix the enclosed module cover instead of the standard version with the two screws.
11. Select the plates which already exist on the standard version of the module cover from the set of plates enclosed. Stick the selected plates according to the standard version to the mounted module cover.
12. Make the electrical connections.

Setting the two limit values:

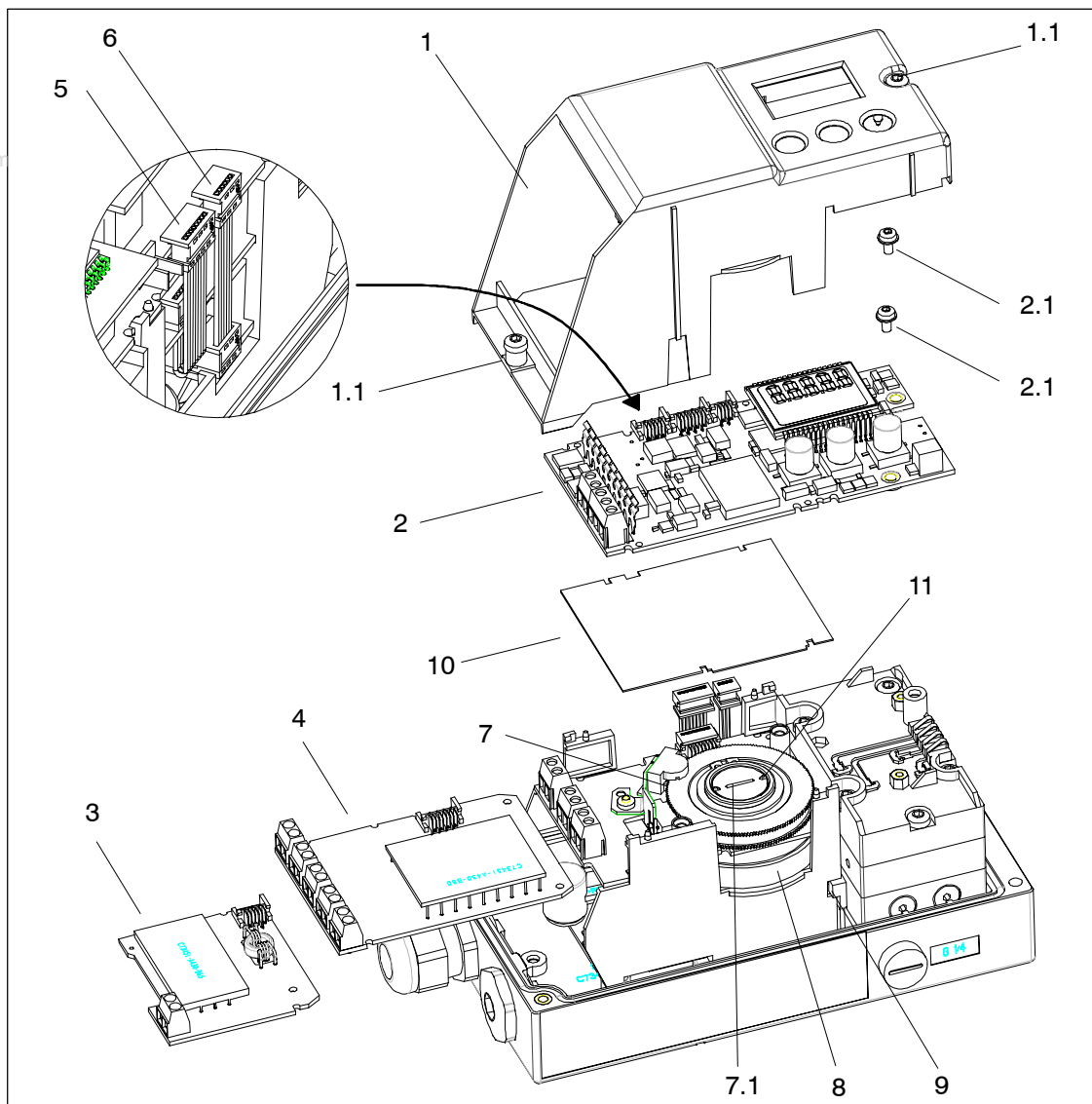
13. Drive the actuator to the first desired mechanical position.
14. Adjust the top actuating disc (for output terminals 41–42) by hand until the output level changes.

15. Drive the actuator to the second desired mechanical position.
16. Adjust the bottom actuating disc (for output terminals 51–52) by hand until the output level 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.



- | | | | |
|-----|--|-----|-----------------------------|
| 1 | Module cover | 7 | SIA-module |
| 2 | Motherboard | 7.1 | Special screw |
| 2.1 | Fixing screws | 8 | Adjusting wheel slip clutch |
| 3 | J _y -module with ribbon cable (6) | 9 | Transmission ratio selector |
| 4 | Alarm module with ribbon cable (5) | 10 | Insulating cover |
| 5 | Ribbon cable for alarm module | 11 | Actuating disk bearings |
| 6 | Ribbon cable for J _y -module | | |

Figure 2-10 Installation of Options Modules

2.5.2 Options modules in explosion proof version

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



NOTE

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



WARNING

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

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

Open the positioner

Disconnect or isolate the power supply cables first.

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

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

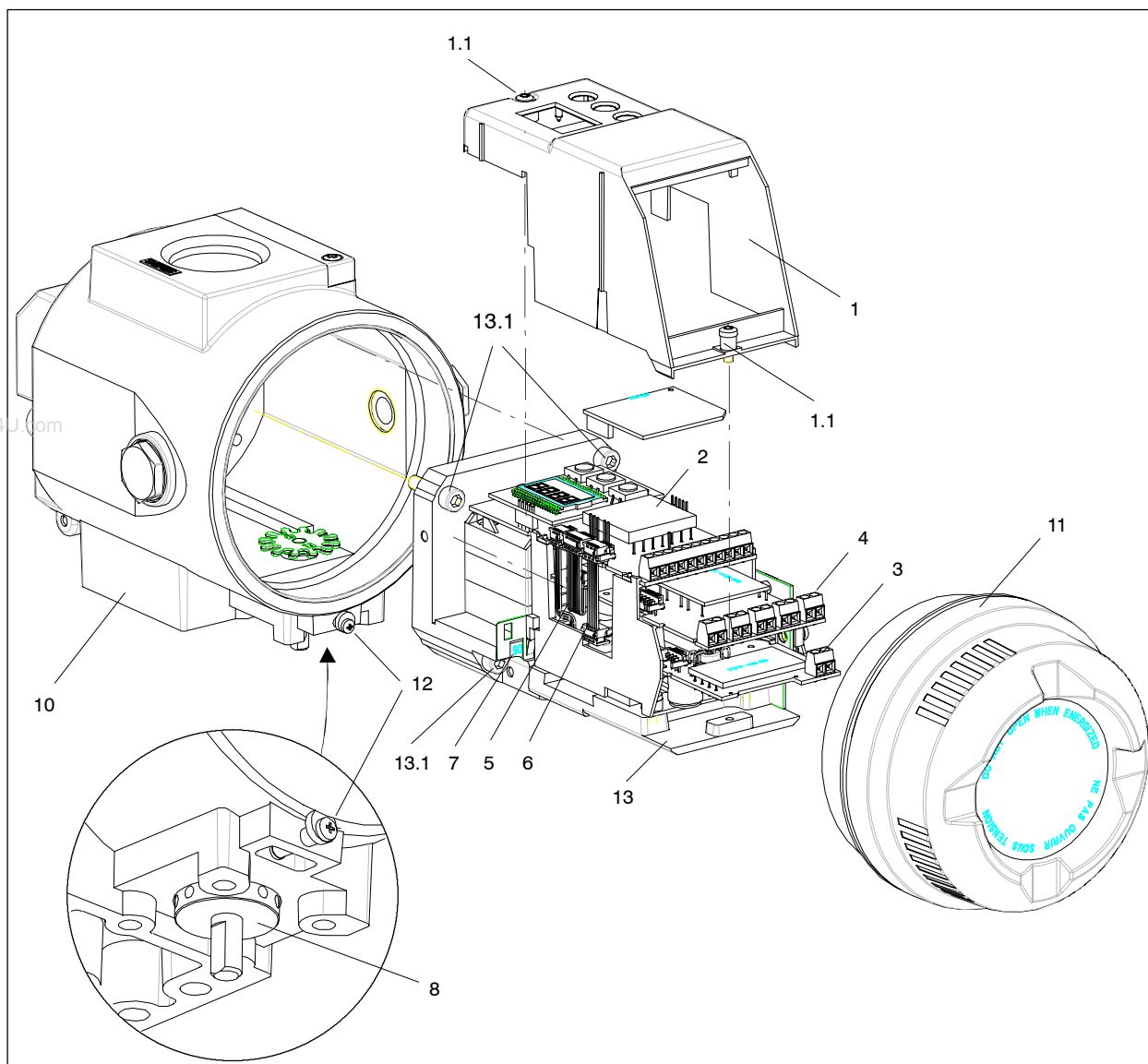
Remove the module cover (1). To do this, the two screws (1.1) must be removed with a screwdriver.



NOTE

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

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



- | | | | |
|-----|---|------|-------------------------------------|
| 1 | Module cover | 7 | Transmission ratio selector |
| 1.1 | Fixing screws | 8 | Adjusting wheel for slipping clutch |
| 2 | PA module | 10 | Housing |
| 3 | J _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 J _y module | 13.1 | Fixing screws |

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

2.5.3 HART-function

Function

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

The SPART PS2 is integrated in the following parameterization tools:

- Handheld communicator®
- PDM (Process Device Manager)
- AMS (Asset Management System; update in preparation)
- Cornerstone



NOTE

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

Communication is aborted by a power failure at the positioner.

2.5.4 Alarm module

Function

The alarm module contains

- 3 digital outputs and
- 1 digital input

The digital outputs serve to output fault messages and alarms. The configuration is described in chapter 4.4, page 79, 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 79, with the parameters 43.

The alarm module is available in two versions:

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

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

The outputs are potentially isolated from the basic circuit and each other.

The digital input is double.

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

These two inputs are designed as logic OR links.

Installation The alarm module is pushed in underneath the motherboard into the module rack up to the stop and connected by the enclosed 8-wire ribbon cable (5) to the motherboard (see figure 2-10, page 27).

2.5.5 J_y-module

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

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Installation The J_y- module is pushed in to the bottom compartment of the module rack up to the stop and connected by the enclosed 6-wire ribbon cable (6) to the motherboard (see figure 2-10, page 27).

2.5.6 SIA module

The SIA module contains:

- a digital output for outputting a group fault message (see alarm module)

The floating digital output is implemented as a self error reporting semiconductor output.

- two digital outputs for reporting two mechanically adjustable limit values (L1, L2) by slot initiators.

These two outputs are electrically independent of the rest of the electronics.

2.5.7 Accessories

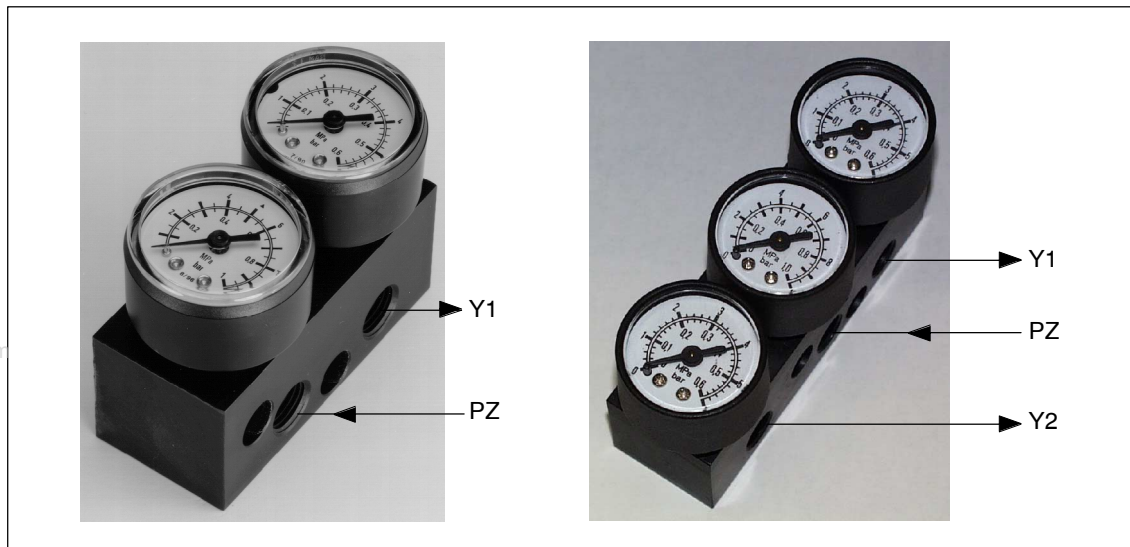


Figure 2-12 Manometer block (left for single-acting, right for double-acting actuators)

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.

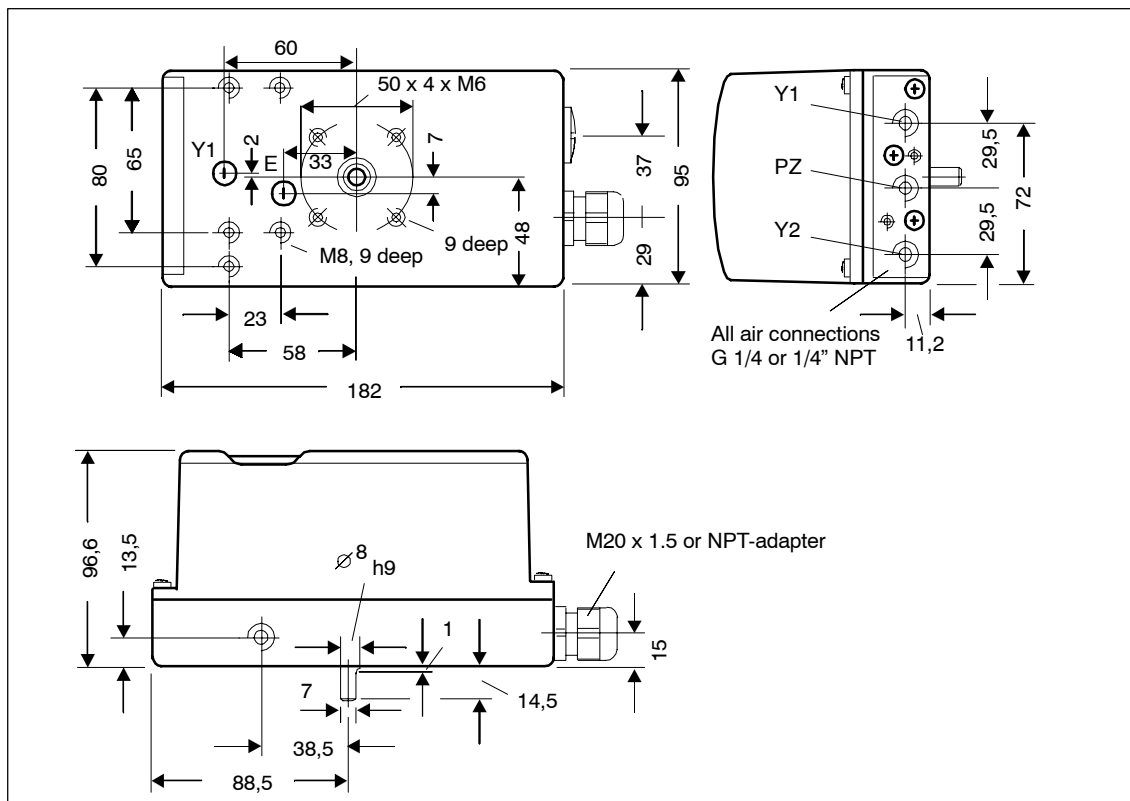
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3.1 Instrument identification (type key)

The order number of the positioner is printed on the rating plate and on the packaging. Compare this with the order number in chapter 7.1, page 105.

Installation of any modules required is described in chapter 2.5, page 25 of this technical manual.

3.2 Dimensional drawings



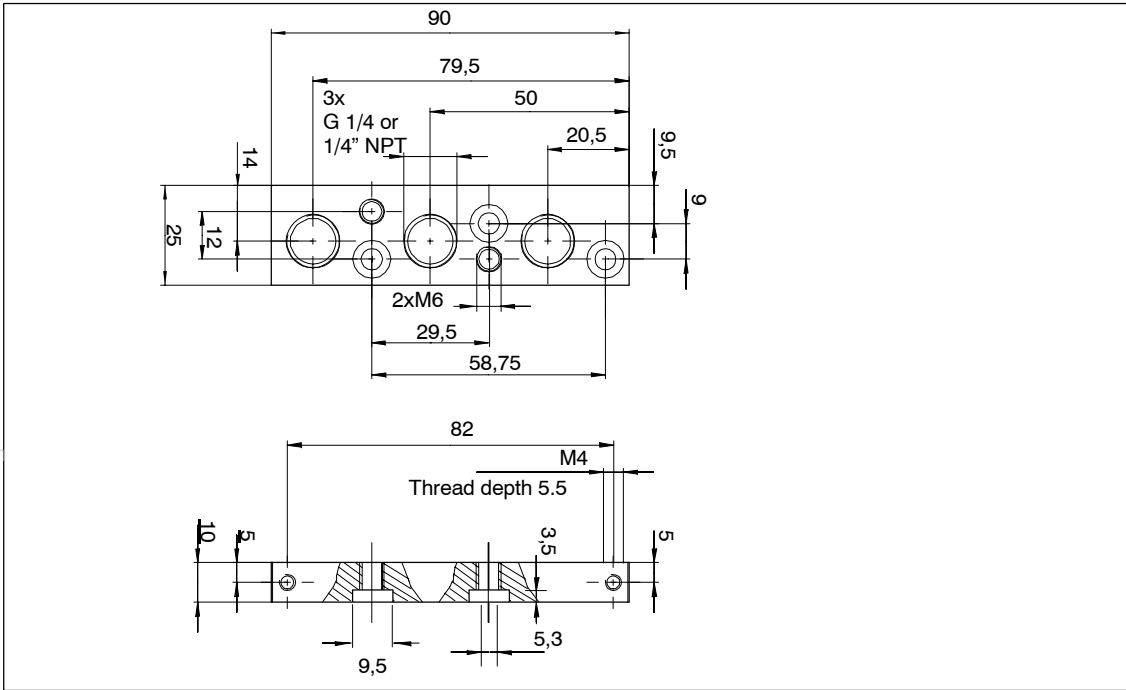


Figure 3-2 Dimensional drawing terminal strip for plastic housing

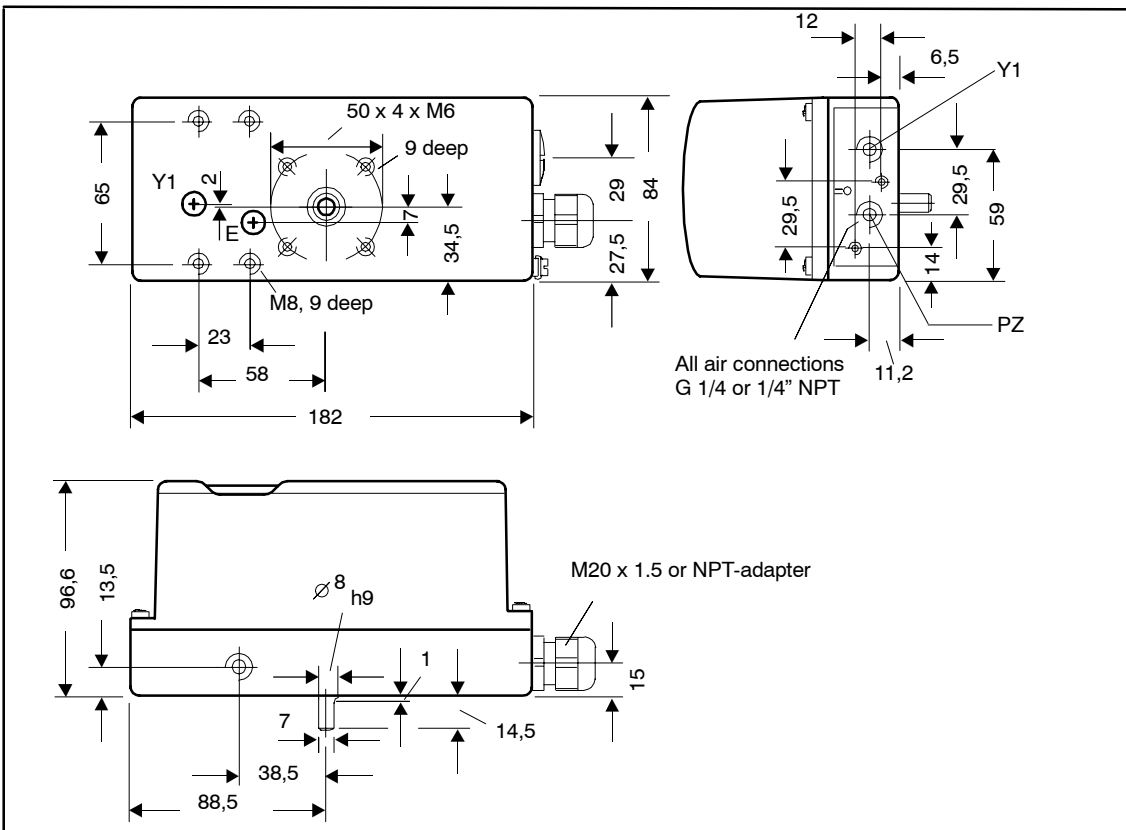


Figure 3-3 Dimensional drawing version metal housing 6DR5xx1

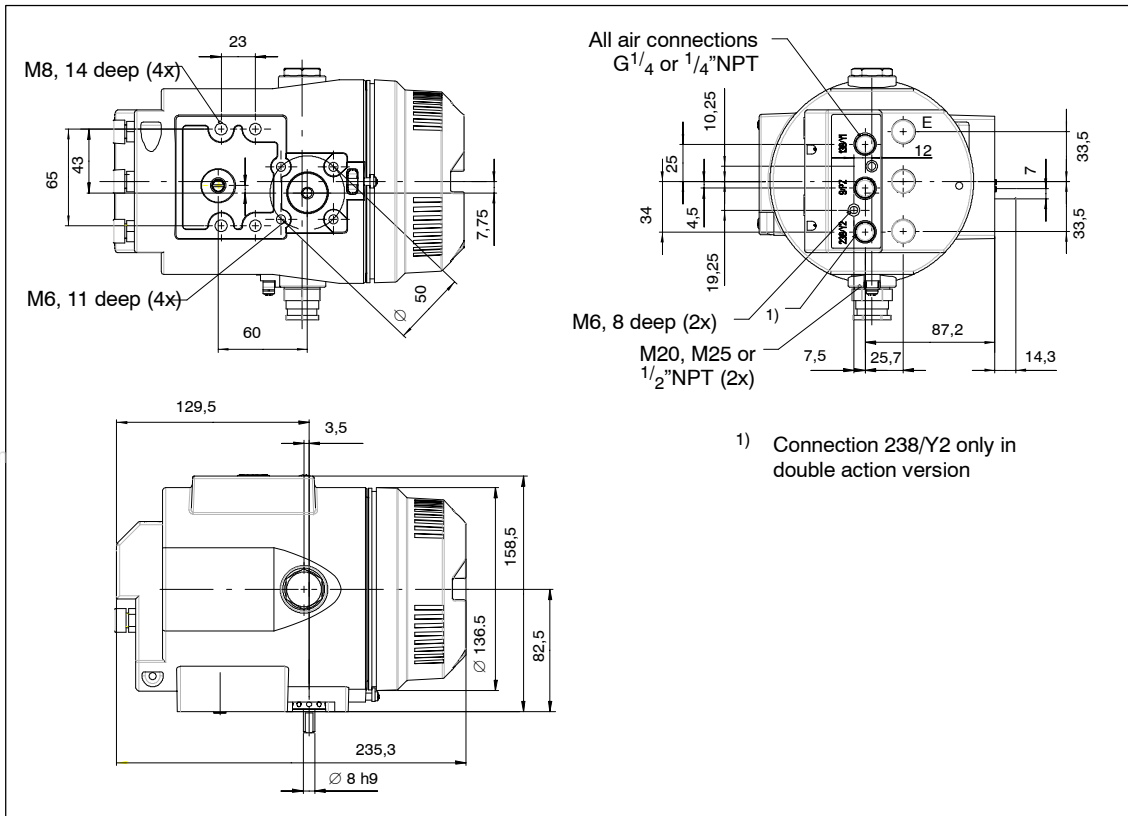


Figure 3-4 Dimensional drawing for positioner with metal housing in explosion proof version 6DR5x5

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. 48
3. Connection of pneumatic power supply see chapter 3.5, p. 56
4. Put into operation see chapter 3.6, p. 57

Please also observe the warning on page 48!



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 rotary actuators and the mounting kit "linear actuator" or integrated connection for linear actuators.

3.3.1 Instructions for using positioners in a wet environment

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

To prevent water getting into the instrument in normal operation (e.g. through the exhaust air openings) or the display being poorly legible, please avoid the unfavorable installation positions illustrated in figure 3-5.

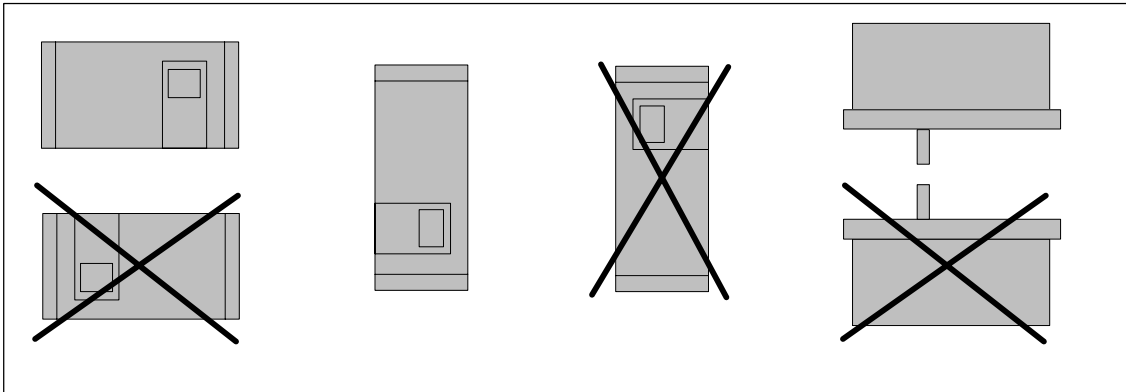


Figure 3-5 Favorable and unfavorable installation positions

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If conditions oblige you to operate the positioner in a unfavorable installation position, you can take additional precautionary measures to prevent penetration by water.



NOTE

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

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

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

Procedure

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

Assembly of the screw-type gland with plastic hose

- Unscrew the sinter bronze silencer from the exhaust air opening on the underside of the housing.
- Screw the screw-type gland mentioned above into the exhaust air opening.

- Mount the above mentioned plastic hose on the screw-type gland and check the good fit.
- Fix the plastic hose with a cable strap to the fitting so that the opening faces downwards.
- Make sure that the hose has no kinks and the exhaust air can flow out unhindered.

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

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Great acceleration forces which may be far beyond the specified data occur on fittings under great mechanical stress such as breaking flaps, heavily shaking or vibrating valves as well as "steam impacts". This may lead to maladjustment of the slip clutch in extreme cases.

Please use the positioner with reinforced slip clutch for such applications.

The increased torque requires a much greater force to actuate the slip clutch.

External displacement measurement

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 rotary actuators.

You require the following:

- The position displacement sensor unit (order no. C73451-A430-D78). This consists of a SIPART-PS2- housing with integrated slip clutch, built-in potentiometer and various dummy plugs and seals.
- The controller unit, any positioner version.
- The EMC filter plate, 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 plate must be installed in the SIPART-PS2 positioner. The installation instructions enclosed with the EMC filter plate explain how to assemble the components.
- A 3-wire cable for connecting the components.

This retrofit kit should always be used for the controller unit when any actuator-mounted potentiometer (resistance 10 kohms) is to be used instead of the position displacement sensor unit C73451-A430-D78.

3.3.3 Mounting kit "linear actuator" 6DR4004-8V and 6DR4004-8L

The scope of delivery of the mounting kit" linear actuator IEC 534 (3 mm to 35 mm)" are contained (ser. no. see figure 3-6, page 41):

Ser. no.	pieces	Designation	Note
1	1	NAMUR mounting kit bracket IEC 534	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)
5	1	Roll	Assembly with pin (4) 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
13	1	Spring	VD-115E 0.70 x 11.3 x 32.7 x 3.5
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
22	1	Guide washer	6.2 x 9.9 x 15 x 3.5

3.3.4 Assembly procedure (see figure 3-6, page 41)

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. Push the roll (5), spring (13) and guide washer (22) onto the pin (4).
4. Insert the pin in the lever (6) and assemble with nut (18), spring washer (14) and washer (12).
5. 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.
6. Assemble the hexagon socket cap screw (17), spring washer (16), washer (12) and square nut (19) on the lever.
7. Push the premounted lever onto the positioner axis up to the stop and fix with the hexagon socket cap screw (17).

8. Fit the mounting bracket (1) with two hexagon head screws (9), lock washer (10) and flat washer (11) on the rear of the positioner.
9. 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.
10. Hold the positioner with the mounting bracket on the actuator so that the pin (4) is guided within the pick-up bracket (2).
11. Tighten the pick-up bracket.
12. 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).
13. Secure positioner onto the yoke using the previously positioned mounting parts.



NOTE

Set the height of the positioner so that the horizontal lever position is reached as close to the stroke center as possible. You can use the lever scale as orientation. It must be guaranteed that the horizontal lever position is passed through within the stroke range.

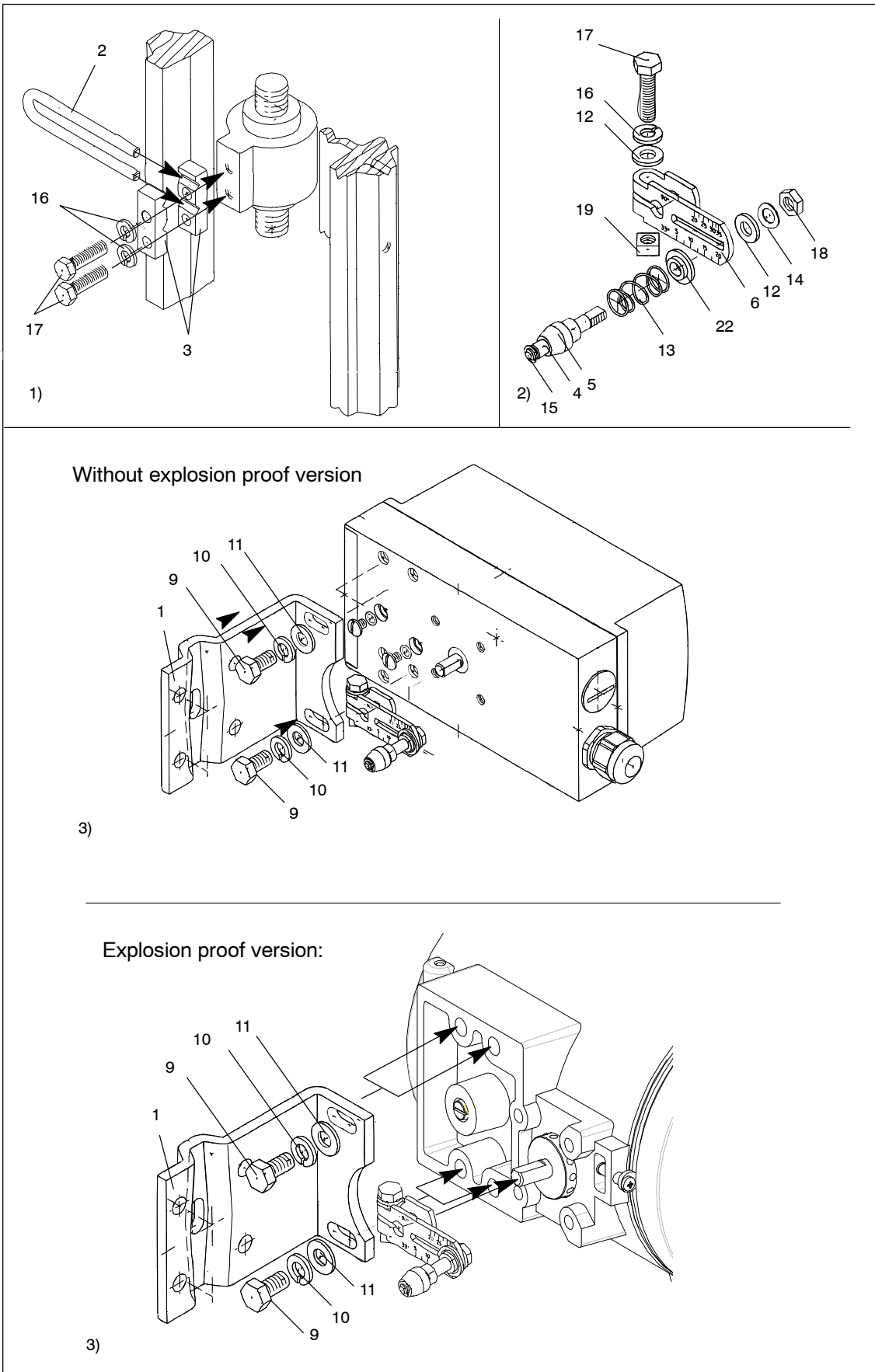


Figure 3-6 Assembly procedure (linear actuator)

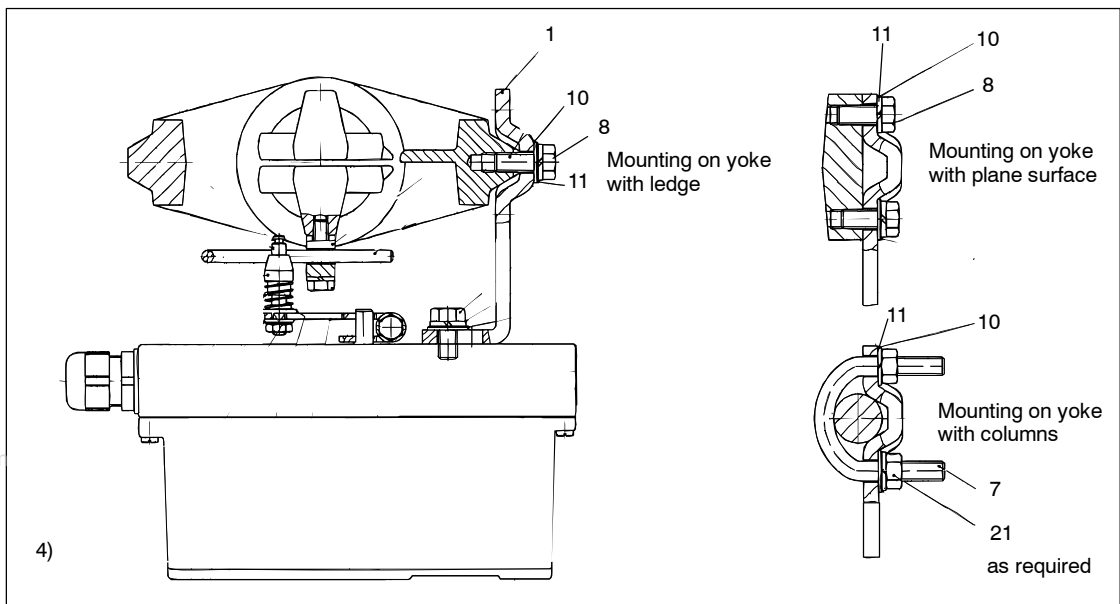


Figure 3-6 Assembly procedure (linear actuator) *continued*

3.3.5 Mounting kit "Rotary actuator" 6DR4004-8D

The *scope of delivery of the mounting kit "Rotary actuator"* contains (ser. no. see figures 3-7 and 3-8):

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 3-7 and figure 3-8)

1. Attach VDI/VDE 3845 mounting console ((9), actuator-specific, scope of delivery actuator manufacturer) onto rear of positioner and secure using hexagon head screws (14) and lock washers (15).
2. Adhere pointer (4.2) onto mounting console in the center of the centering hole.
3. Push the coupling wheel (2) onto positioner axis, pull back by about 1 mm and tighten the hexagon socket head screw (18) with the Allen key provided.
4. Place the carrier (3) onto the end of the actuator and secure using Fillister head screw (16) and washer (17).
5. Carefully place positioner with mounting console onto the actuator such that the pin of the coupling wheel engages in the 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 57: Drive the actuator to the end position and adhere scale (4.1) on the coupling wheel (2) according to direction of rotation and rotary actuator. *The scale is self-adhesive!*

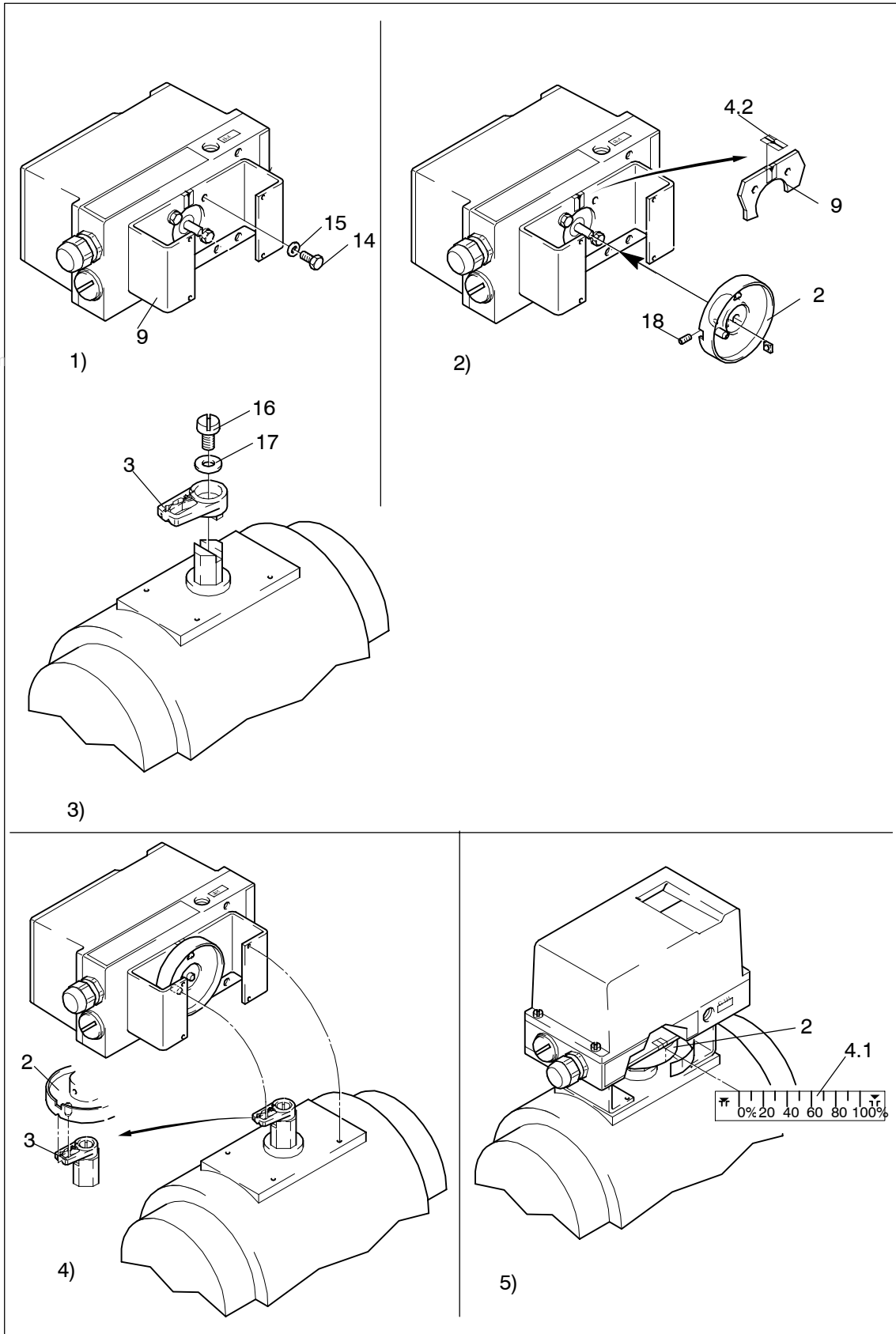


Figure 3-7 Assembly procedure (rotary actuator)

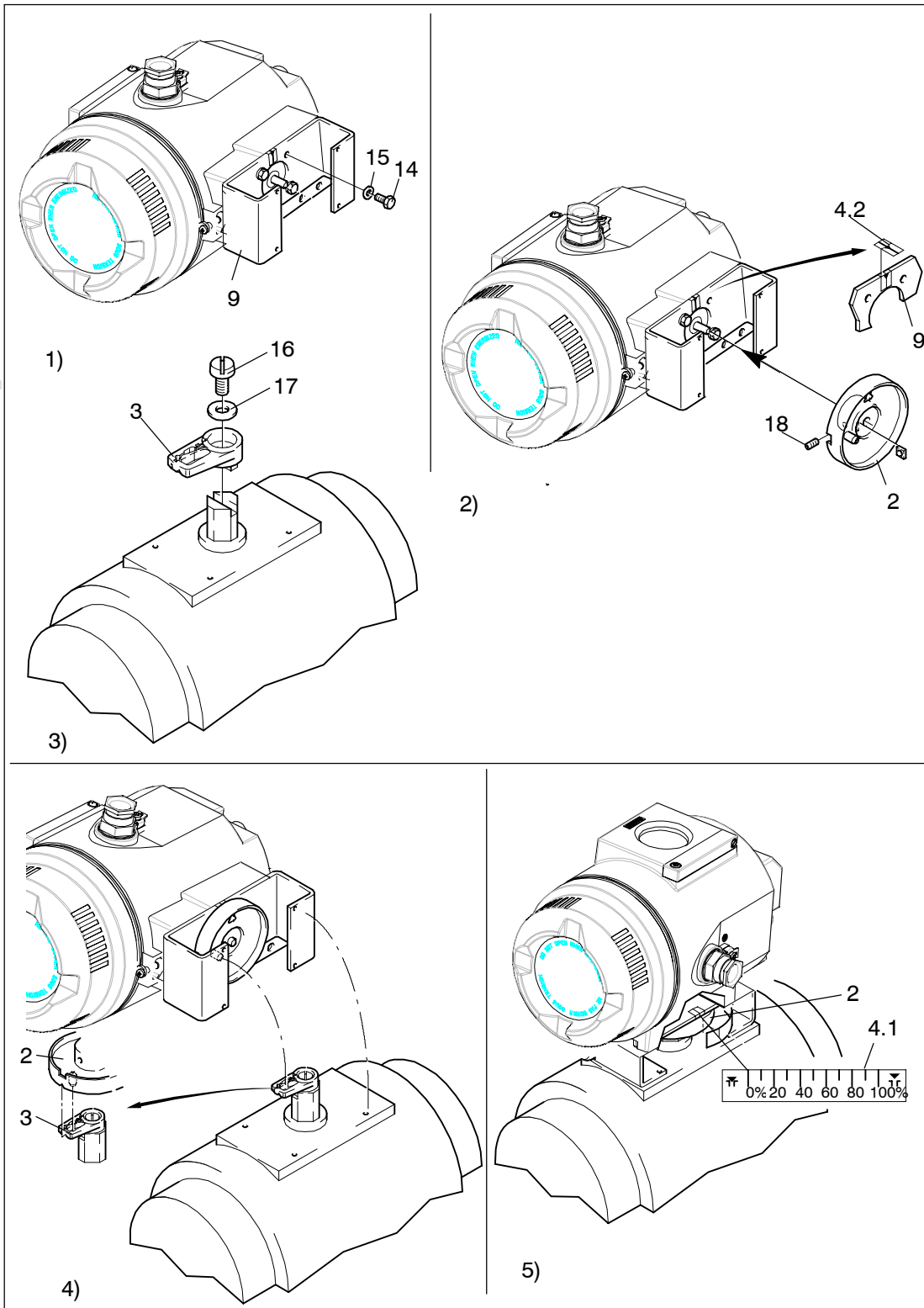
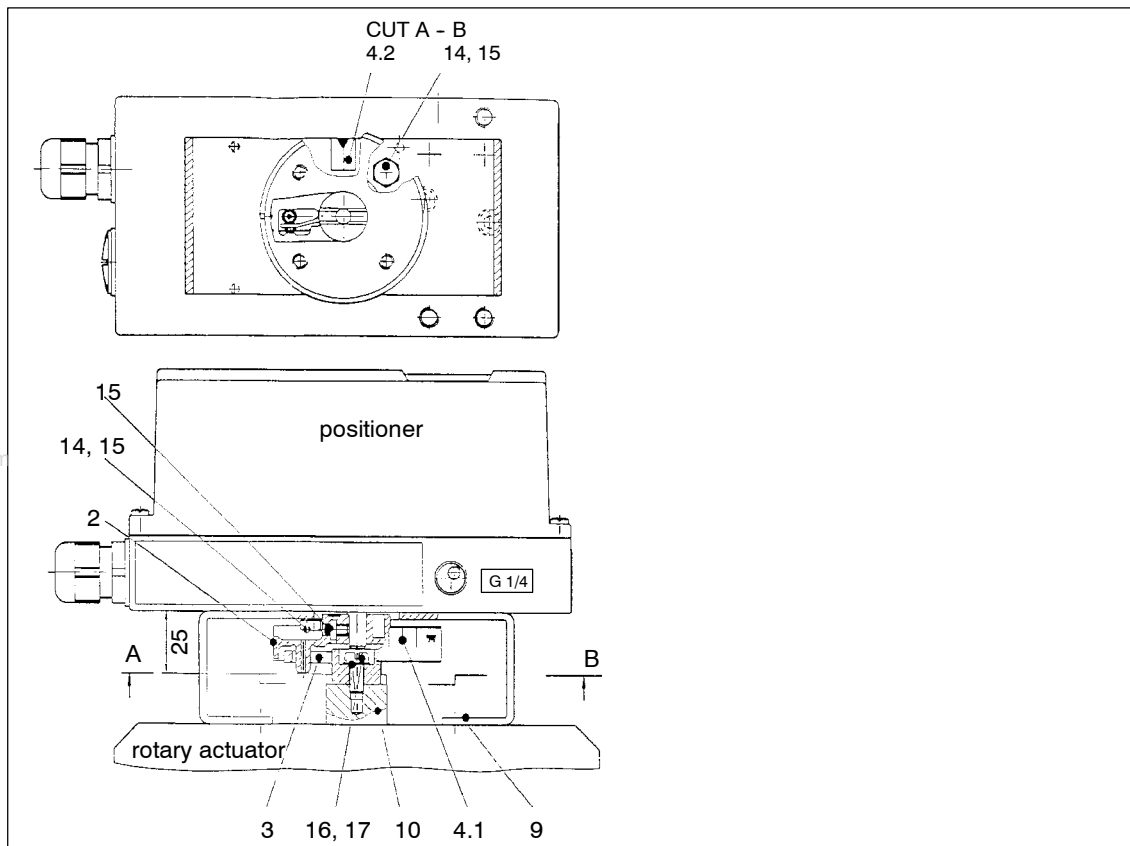


Figure 3-8 Assembly procedure for explosion proof version (rotary actuator)



- | | | | |
|-----|-------------------------------|----|------------------------------|
| 2 | Coupling wheel | 10 | Feedback shaft |
| 3 | Carrier | 14 | Hexagon head screw M6 x 12 |
| 4 | Multiple plate | 15 | Lock washer S6 |
| 4.1 | Scale | 16 | Fillister head screw M6 x 12 |
| 4.2 | Pointer mark | 17 | Washer |
| 9 | VDI/VDE 3845-mounting bracket | 18 | Hexagon socket head screw |

Figure 3-9 Mounted positioner for rotary actuator

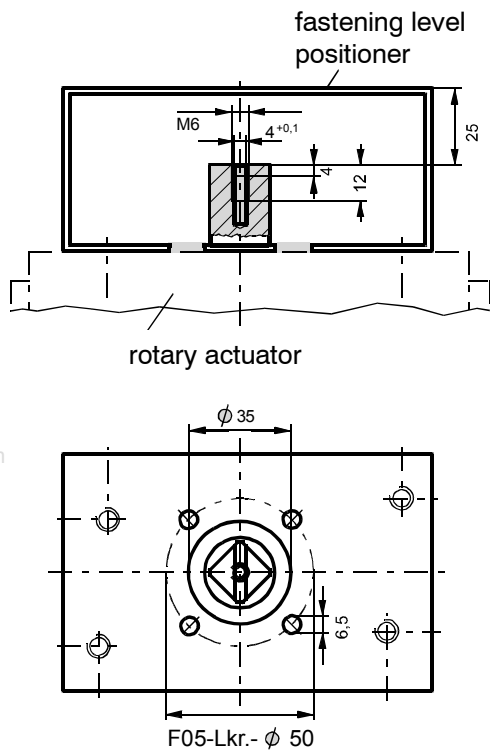


Figure 3-10 Attachment of rotary actuator, mounting console (scope of delivery actuator manufacturer), dimensions

3.4 Electrical Connection



NOTE

Any necessary options modules must be installed before electrical connection (see chapter 2.5, page 25).

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



WARNING

For the electrical installation, please observe the pertinent regulations, in hazardous areas particularly the rules and regulations for the installation and operation of systems in hazardous areas (e.g. in Germany: Elex V, VDE 0165)

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

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

The plastic housing is metal lined to increase the electromagnetic compatibility (EMC) against high frequency radiation. This screen is connected electrically to the threaded bushes shown in figure 3-11, page 49.

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

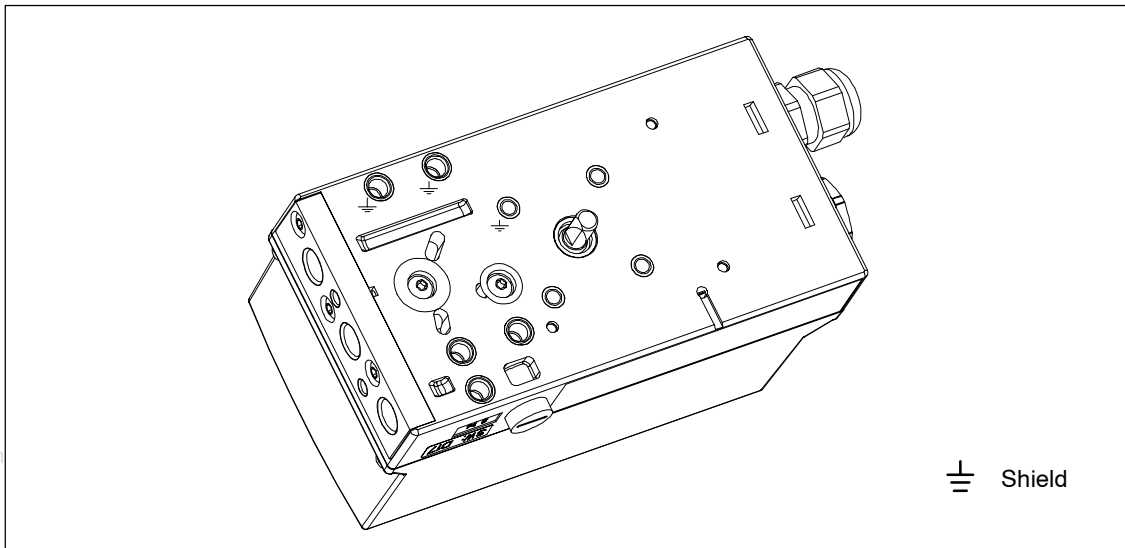


Figure 3-11 Base plate

3.4.1 Connection variants

3.4.1.1 Connection variant: not intrinsically safe

The electrical connection of the positioner can be made in the following ways:

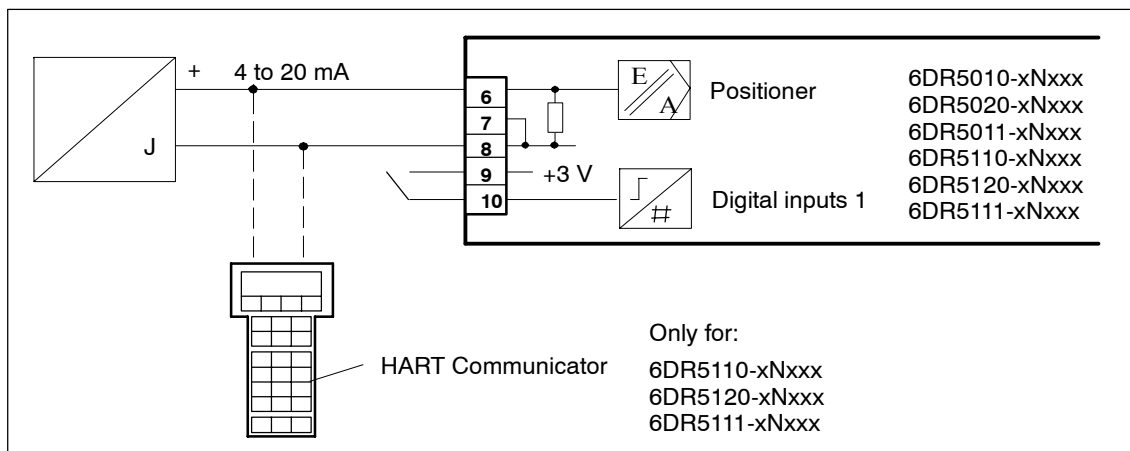


Figure 3-12 Two-wire connection **non Ex**



NOTE

The current $i_y \geq$ must be 3.6 mA to maintain the power supply.

Please also observe the warning on page 48!

3.4.1.2 Connection variant: intrinsically safe



NOTE

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

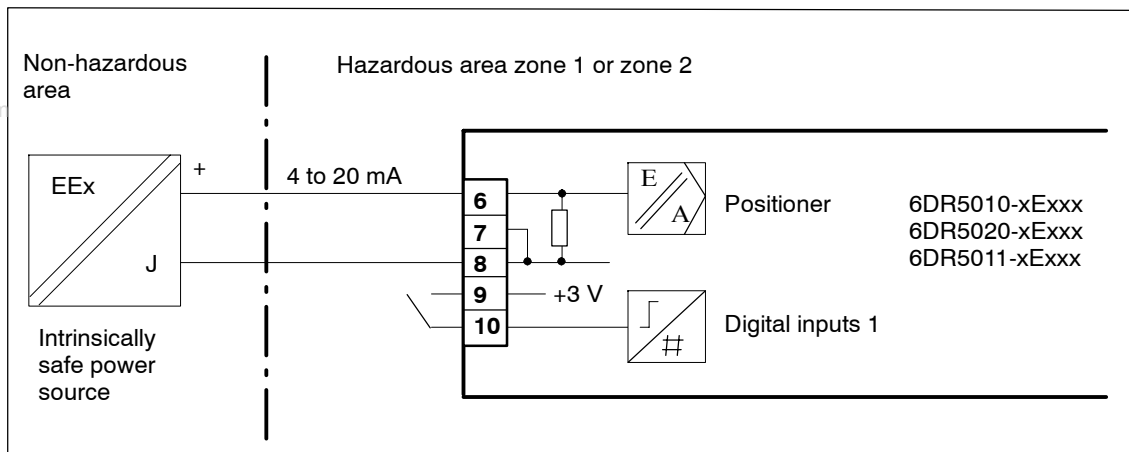


Figure 3-13 Two-wire connection standard controller 6DR50xx-xExxx (power supply from signal current)



NOTE

The current $i_y \geq$ must be 3.6 mA to maintain the power supply.

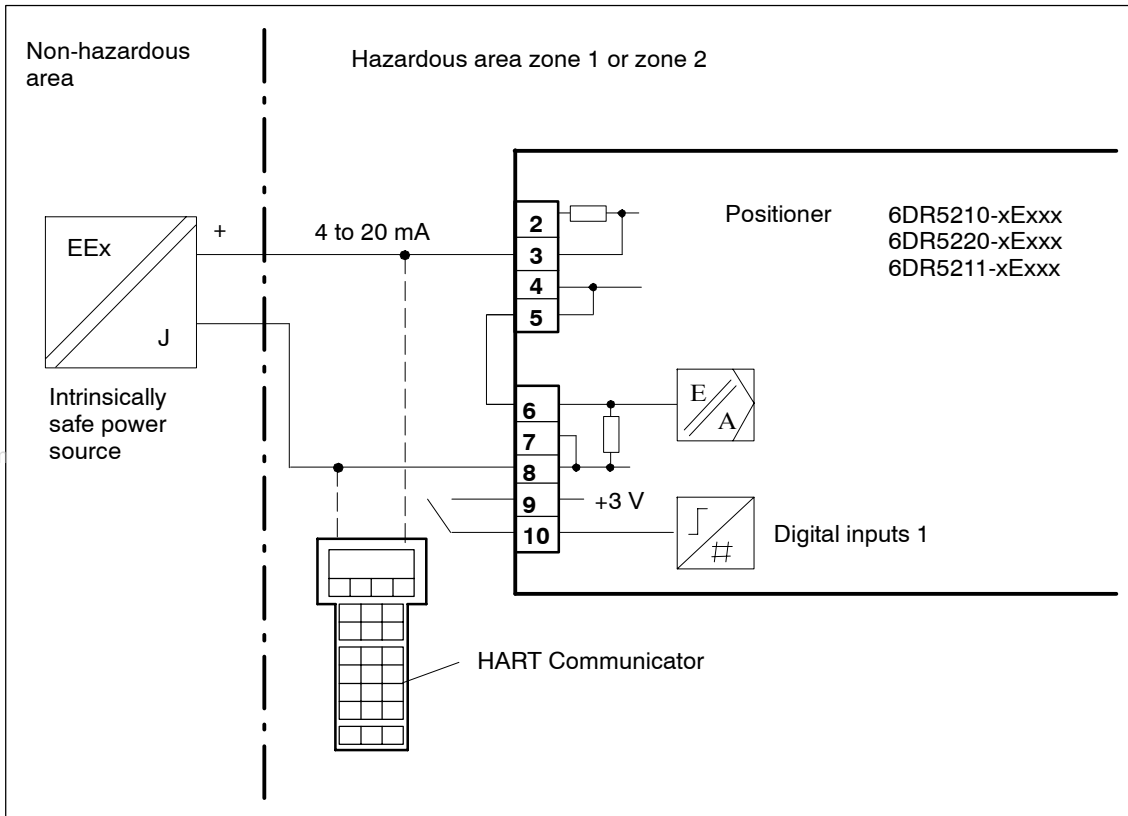


Figure 3-14 Two-wire connection standard controller 6DR52xx-xExxx

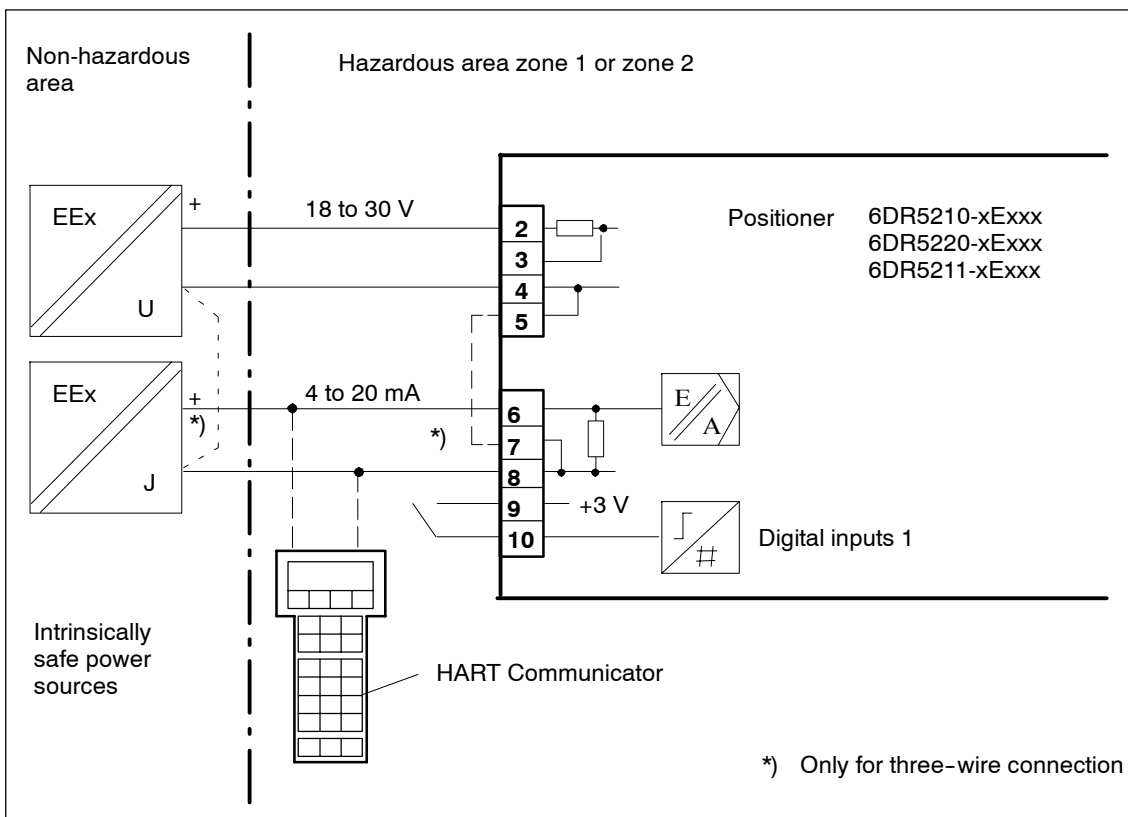


Figure 3-15 Three-/four-wire connection standard controller 6DR52xx-xExxx

Split-range

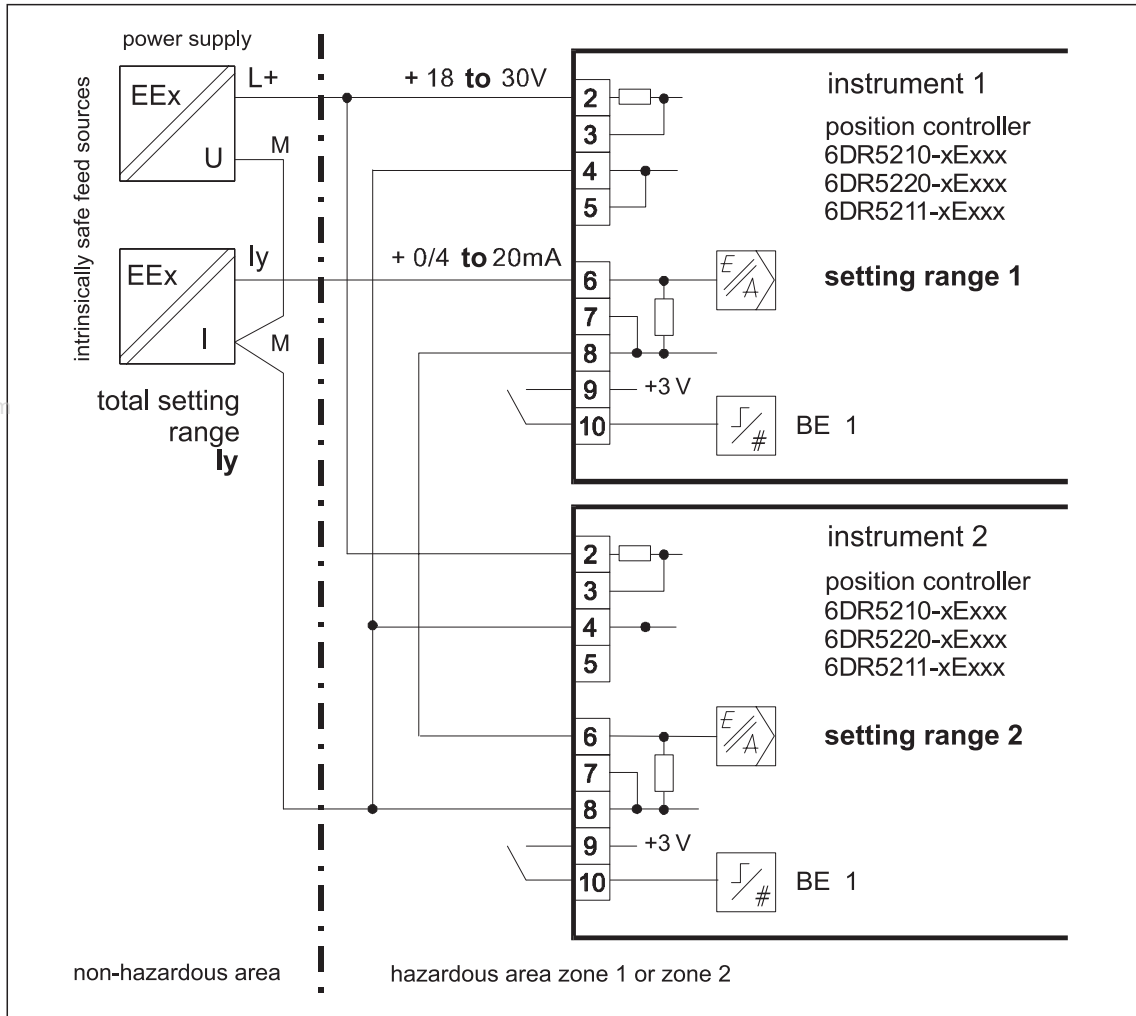


Figure 3-16 Series circuit of two positioners, e.g. split range (separate power supply)

3.4.1.3 Connection variant: Options in positioner in non-intrinsically safe and explosion proof version

Current output

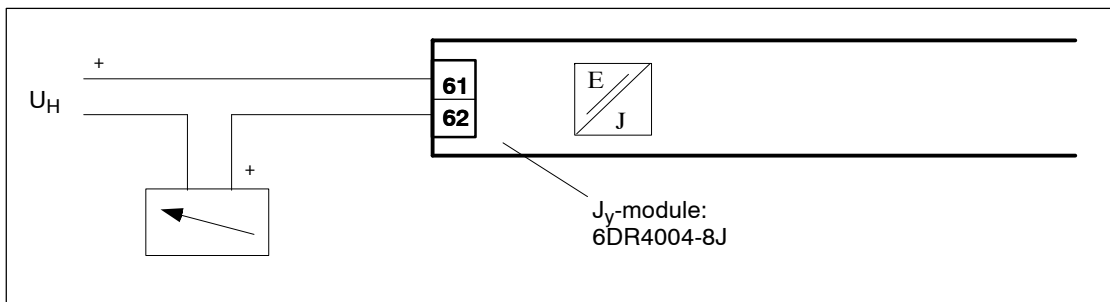


Figure 3-17 J_y -module 6DR4004-8J, non Ex

Digital inputs and outputs

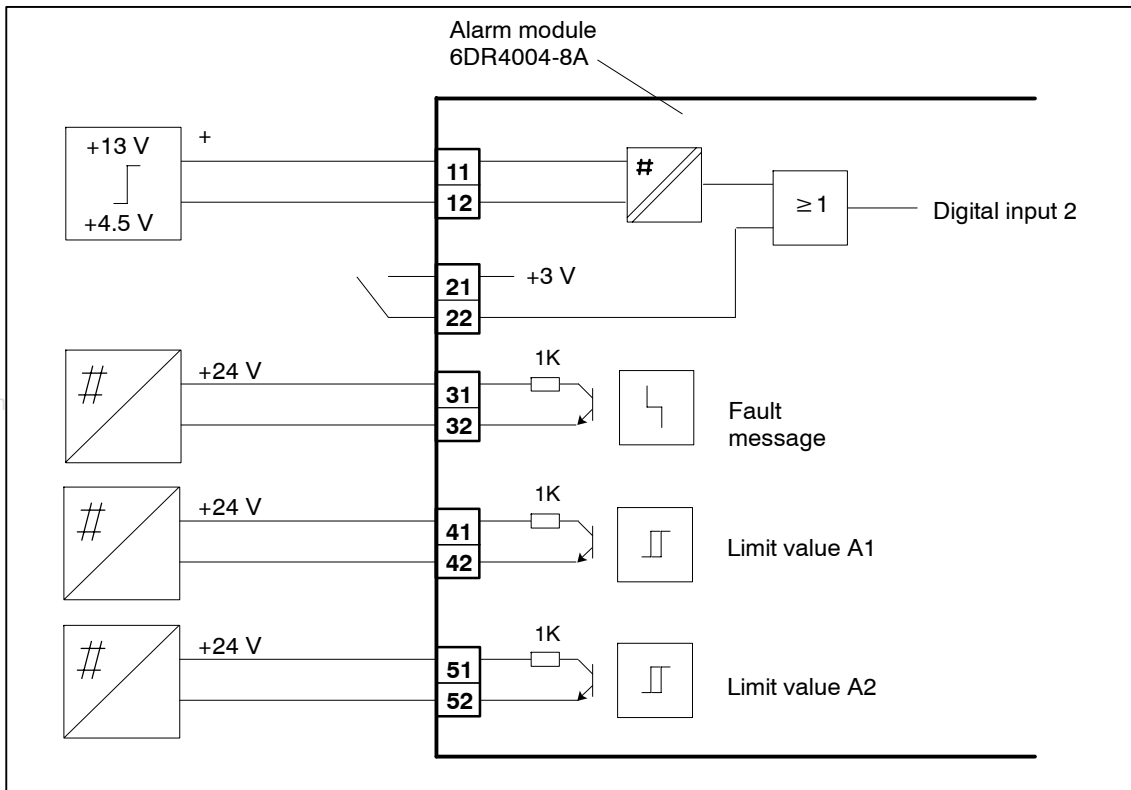


Figure 3-18 Alarm module non Ex

SIA module

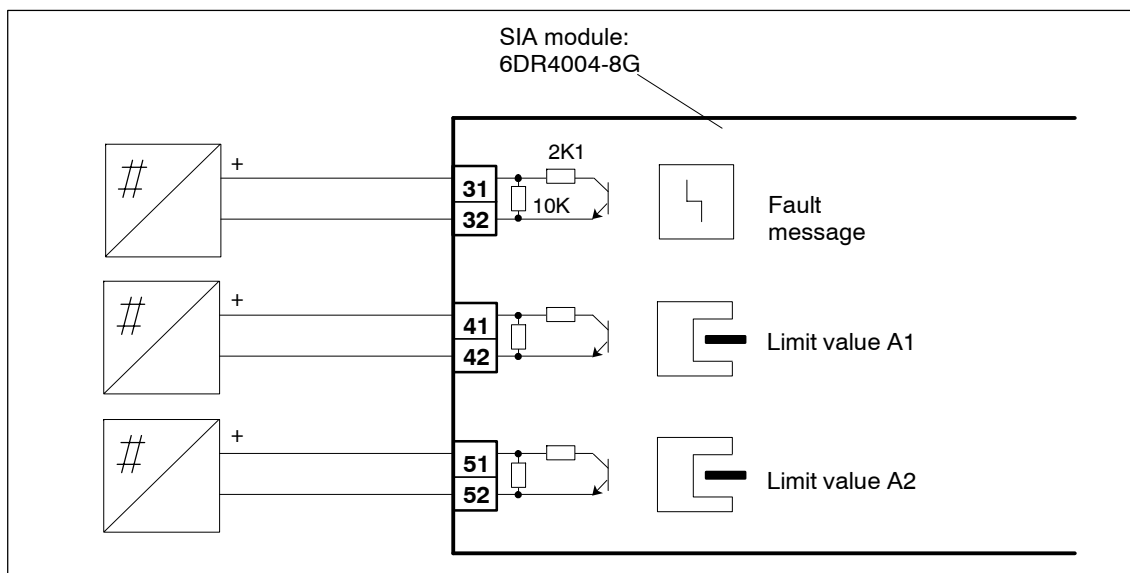


Figure 3-19 SIA module, non Ex

3.4.1.4 Connection variant: Options in the positioner in intrinsically safe version

Current output

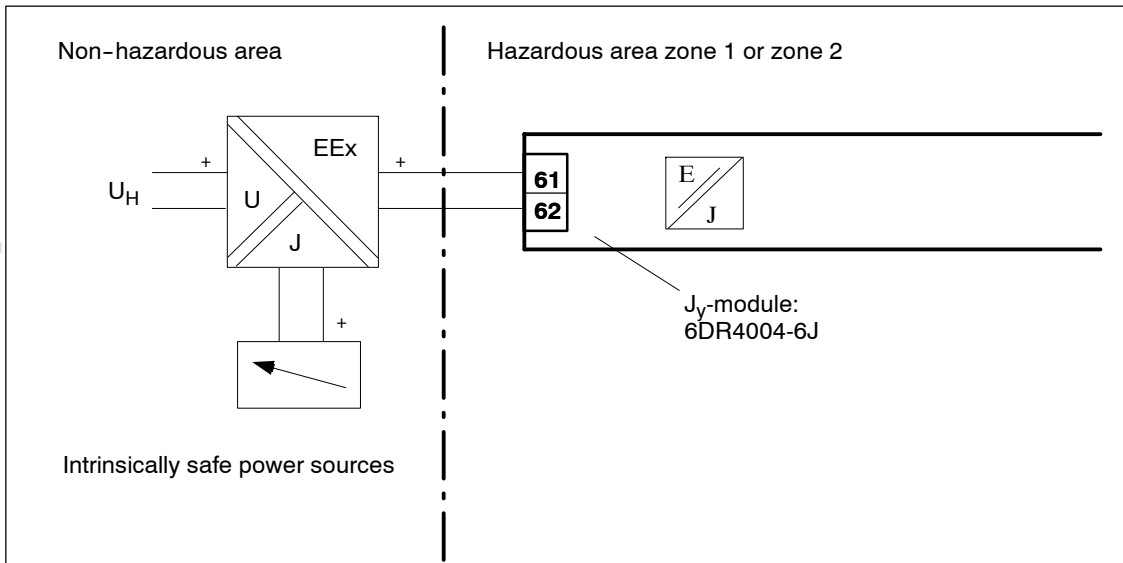


Figure 3-20 J_y -module 6DR4004-6J, Ex

Digital inputs and outputs

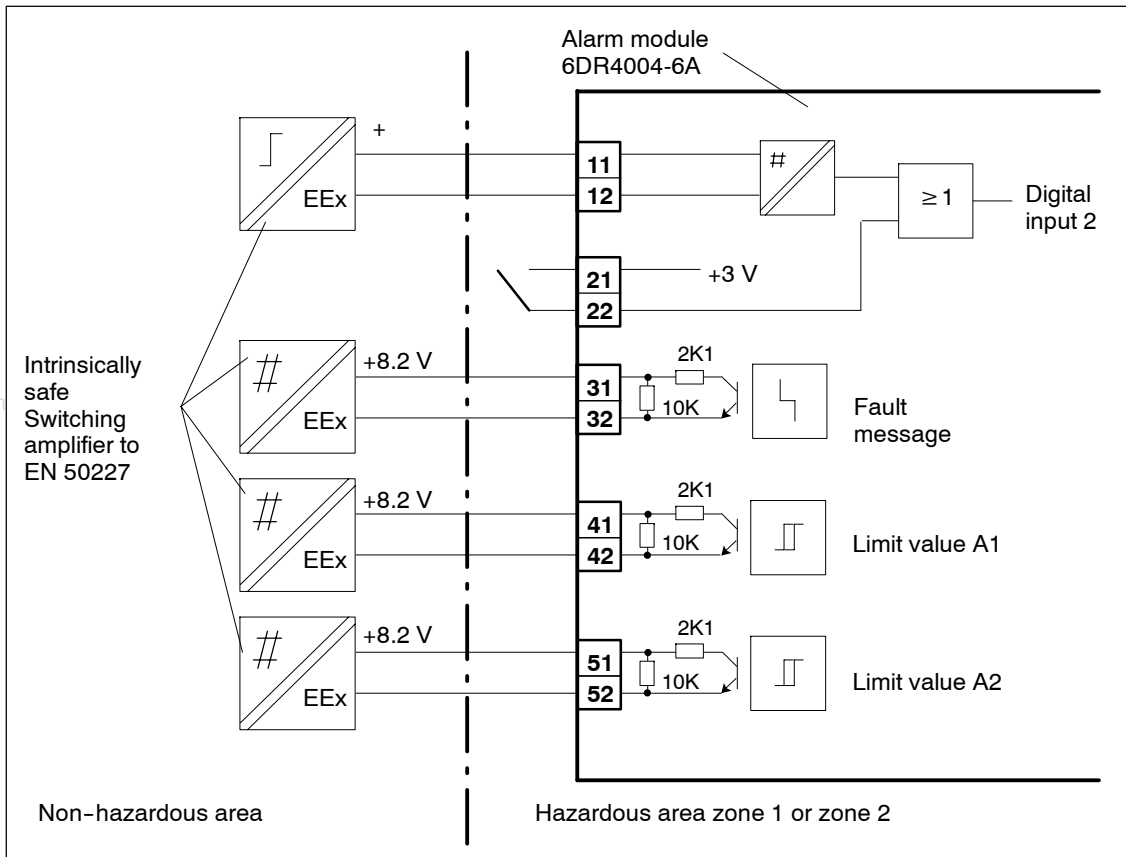


Figure 3-21 Alarm module 6DR4004-6A, Ex

Current output

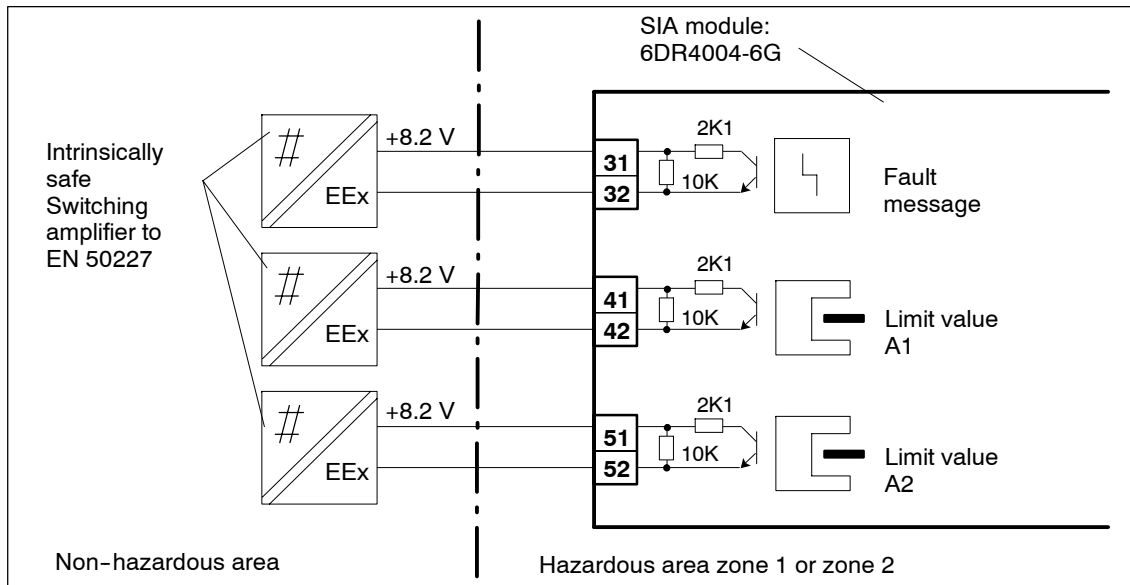


Figure 3-22 SIA module 6DR4004-6G, Ex

3.5 Pneumatic Connection



WARNING

For reasons of safety, the pneumatic power may only be supplied after assembly when the positioner is switched to operating level P manual operation with electrical signal applied (as-delivered state, see figure 4-4, page 76).



NOTE

Note the air quality! Oil-free industrial air, solid content < 30 µm, pressure dew point 20 K below the lowest ambient temperature.

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 2-3 and 2-4, page 18.

Safety position when the electric power supply fails:

single action: Y1 deaerated

double action: 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.

3.6 Commissioning

Due to the wide range of application possibilities the positioner must be adapted (initialized) to the respective actuator individually after assembly. This initialization can be effected in three different ways:

Automatic initialization

Initialization takes place automatically. Hereby the positioner determines the direction of action, the displacement 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 displacement path or angle of rotation of the actuator can be set manually, the other parameters are determined as in automatic initialization. This function is useful in actuators with soft limit stops.

Copying initialization data (positioner exchange)

In the devices with HART function the initialization data of a positioner can be read out and copied to another positioner. This enables a defective device to be changed without having to interrupt an ongoing process by initialization.

Only a few parameters need to be set in the positioner prior to initialization. The others are defaulted so that they do not normally need to be adjusted. You will have no problems with commissioning if you observe the following points.



NOTE

You go to the previous parameter by pressing the operation mode key and the decrement key simultaneously.

Without initialization the positioner is in operating mode P manual operation (this may also be reached by "PRST") - "NOINI" flashes.



NOTE

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

N.B.: The gear transmission switch can only be set when the positioner is open. Therefore check this setting before sealing 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 gear transmission switch (8, figure 2-1, page 16) in the positioner:

Stroke	Lever	Position of the gear transmission switch
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)

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2. Push the carrier pin (4, figure 3-6 (page 41) 2) onto the lever (6, figure 3-6, 2) to the scale position corresponding to the rated stroke or next highest position and screw the carrier pin tight with the nut (18, figure 3-6, 2).
3. Connect the actuator and the positioner with the pneumatic lines and supply pneumatic power to the positioner (figure 2-3 and 2-4, page 18).
4. Connect a suitable current or voltage source (see figure 3-12, page 49 and figure 3-13, page 50).
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 \triangle 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 slip clutch (8, figure 2-10, page 27) 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.


3.6.2 Automatic initialization of linear actuator

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

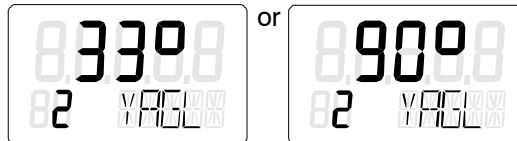
1. Press the operation mode key  for longer than 5 s. This brings you to the Configuration operating mode.

Display:



2. Switch to the second parameter by pressing the operation mode key  briefly.

Display:



NOTE

It is vital that this value corresponds to the setting of the transmission ratio selector (8, figure 2-1, page 16) (33° or 90°).


3. 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.

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 3-24, page 68 to figure 3-27, page 71).




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


Manual initialization procedure in linear actuator

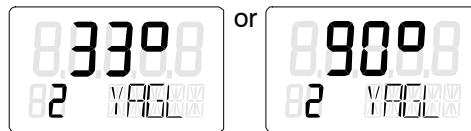
1. Make preparations as described in chapter 3.6.1, page 58 for linear actuator. In particular, make sure by manually driving the whole displacement path that the displayed potentiometer setting moves in the permissible range between P5.0 and P95.0.

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

Display:



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




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.

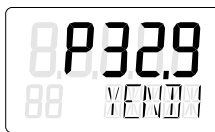
5. Switch on to the following display  by pressing the operation mode key twice:






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



7. After 5 s the display changes to:



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

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



Now move the actuator to the position which you want to define as the second end position with the increment Δ and decrement ∇ key. Then press the operation mode key \square . 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.



NOTE

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:



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 \square briefly. This brings you back to the Configuration operating mode.

To exit the Configuration mode, press the operation mode key \square 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 rotary actuator



NOTE

Very important: Switch the transmission ratio selector in the positioner (8, figure 2-1, page 16) to position 90° (normal angle for rotary actuator).

1. Mount the positioner with the appropriate mounting kit (see chapter 3.3.5, page 42).
2. Connect the actuator and the positioner with the pneumatic lines and supply pneumatic power to the positioner (figure 2-3 and 2-4, page 18).
3. Connect a suitable current or voltage source (see figure 3-12, page 49 and figure 3-13, page 50).
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 \triangle 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 rotary actuator

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

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



- Set the parameter with the ∇ -key to "turn"
Display:



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



- Switch on to the following display with the operation mode key \square :



- Start initialization by pressing the key \triangle for longer than 5 s.
Display:



During the initialization phase "RUN1" to "RUN5" appear one after another in the bottom display (see also structograms in figure 3-24, page 68 to figure 3-27, page 71).



NOTE

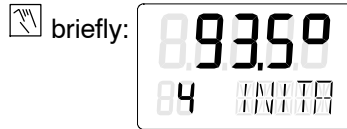
The initialization process may last up to 15 minutes depending on the actuator.


The initialization is complete when the following display appears:



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



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




NOTE

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

3.6.6 Manual initialization of rotary 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 initialization procedure in rotary actuators

1. Make preparations as described in chapter 3.6.4, page 64 for rotary 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 s. This brings you to the Configuration mode.


Display:



3. Set the parameter YFACT to “turn” with the decrement  key.

Display:




- Switch to the second parameter by pressing the operation mode key  briefly.

Display:



NOTE


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


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



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

After successful initialization the determined rotary 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)

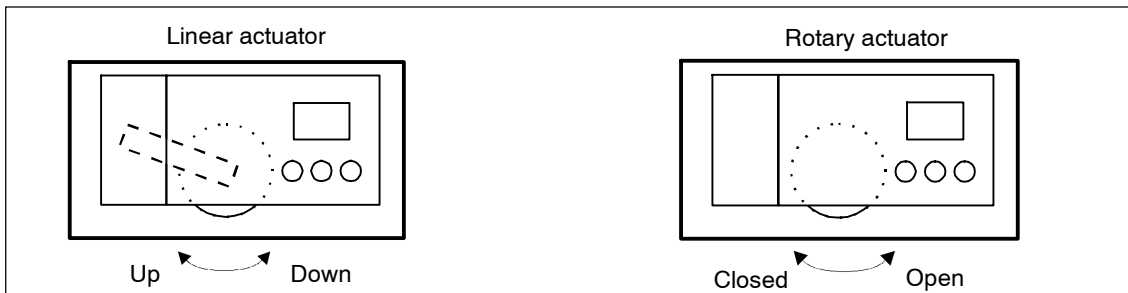


Figure 3-23 Direction of action of the actuators

The initialization procedure should be taken from the following structogram (figure 3-24 to figure 3-27). The terms Open/Closed and up/down in the structogram refer to the direction of action of the actuators as illustrated in figure 3-23.

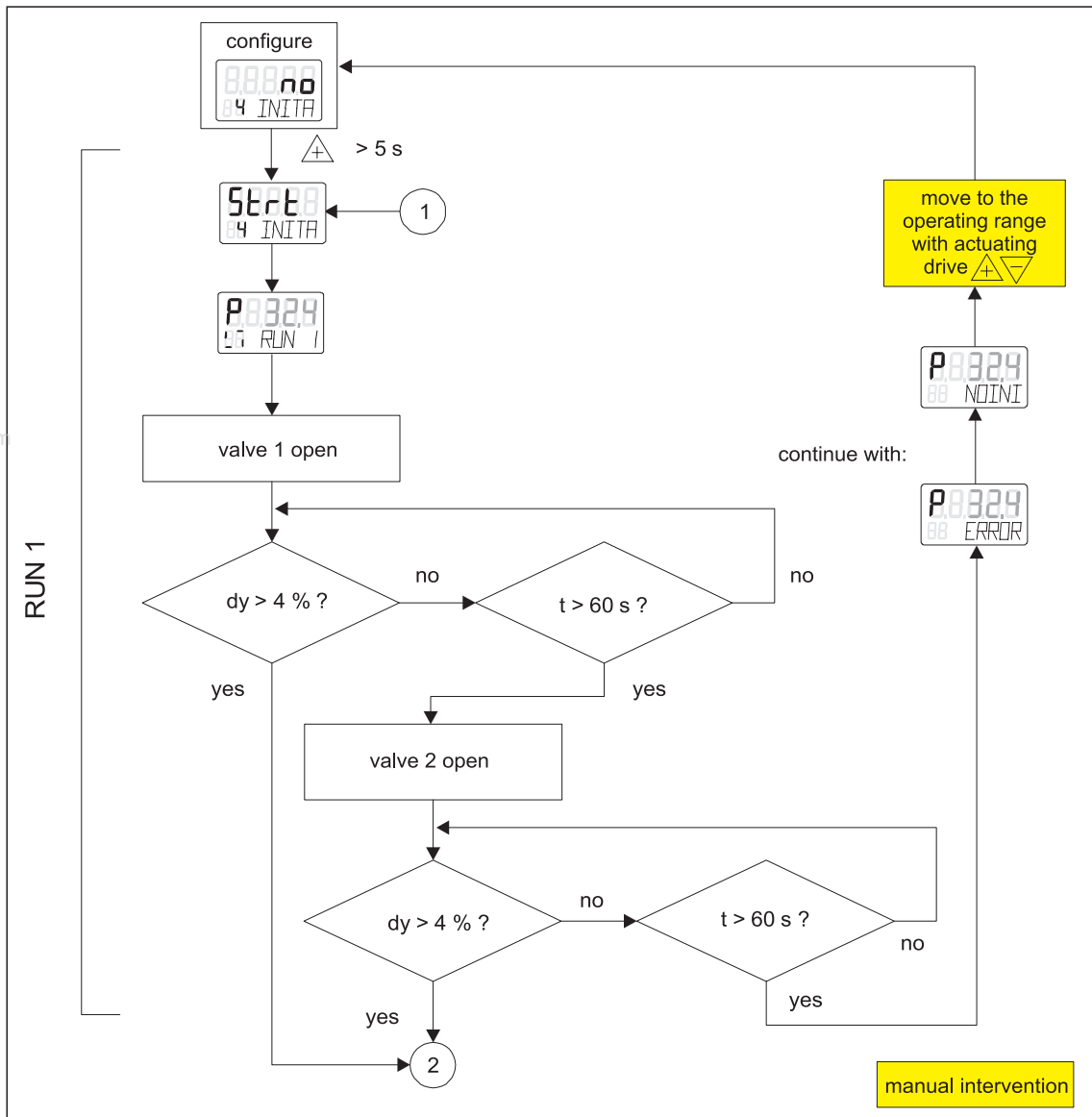


Figure 3-24 Automatic initialization, part 1

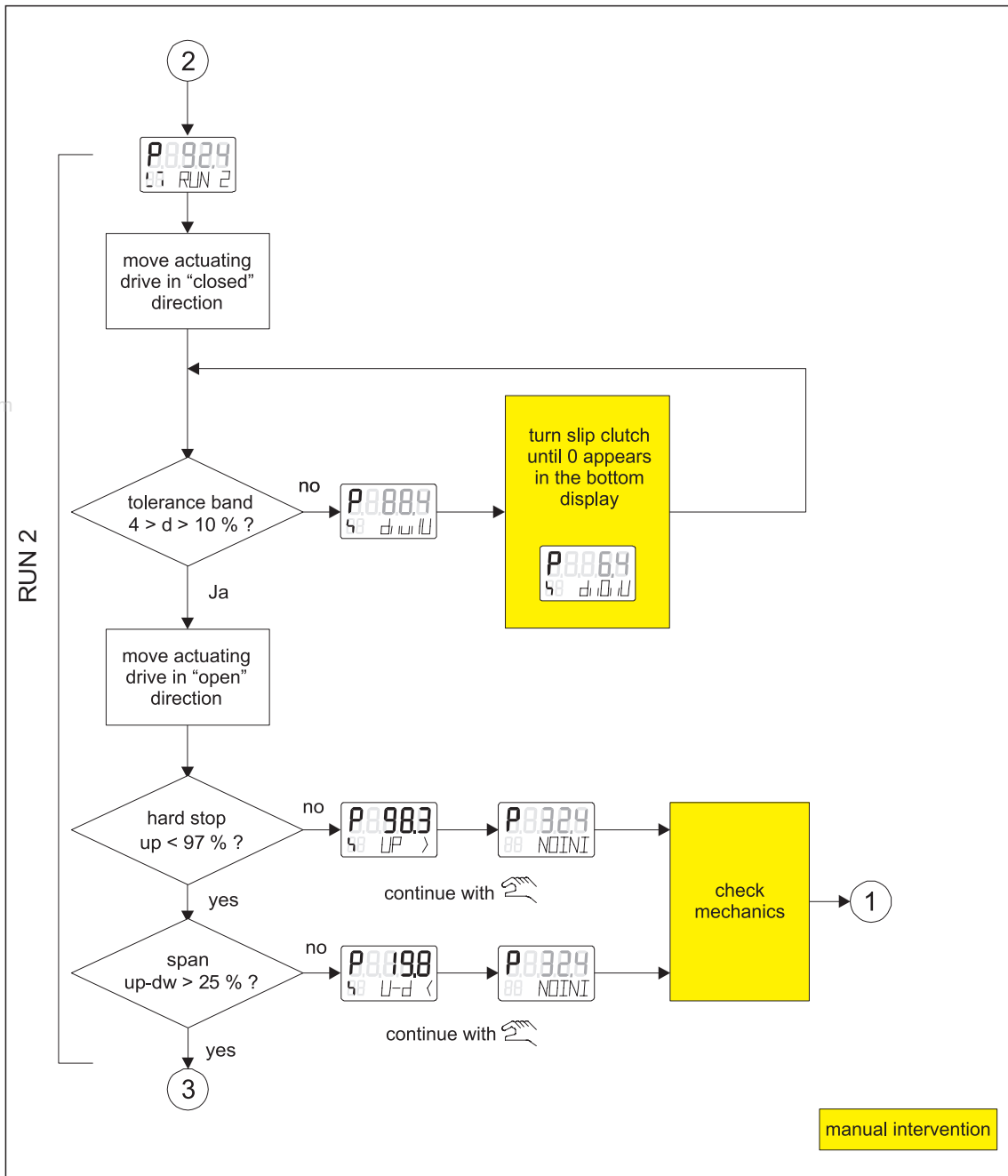


Figure 3-25 Automatic initialization part 2 (in rotary actuators)

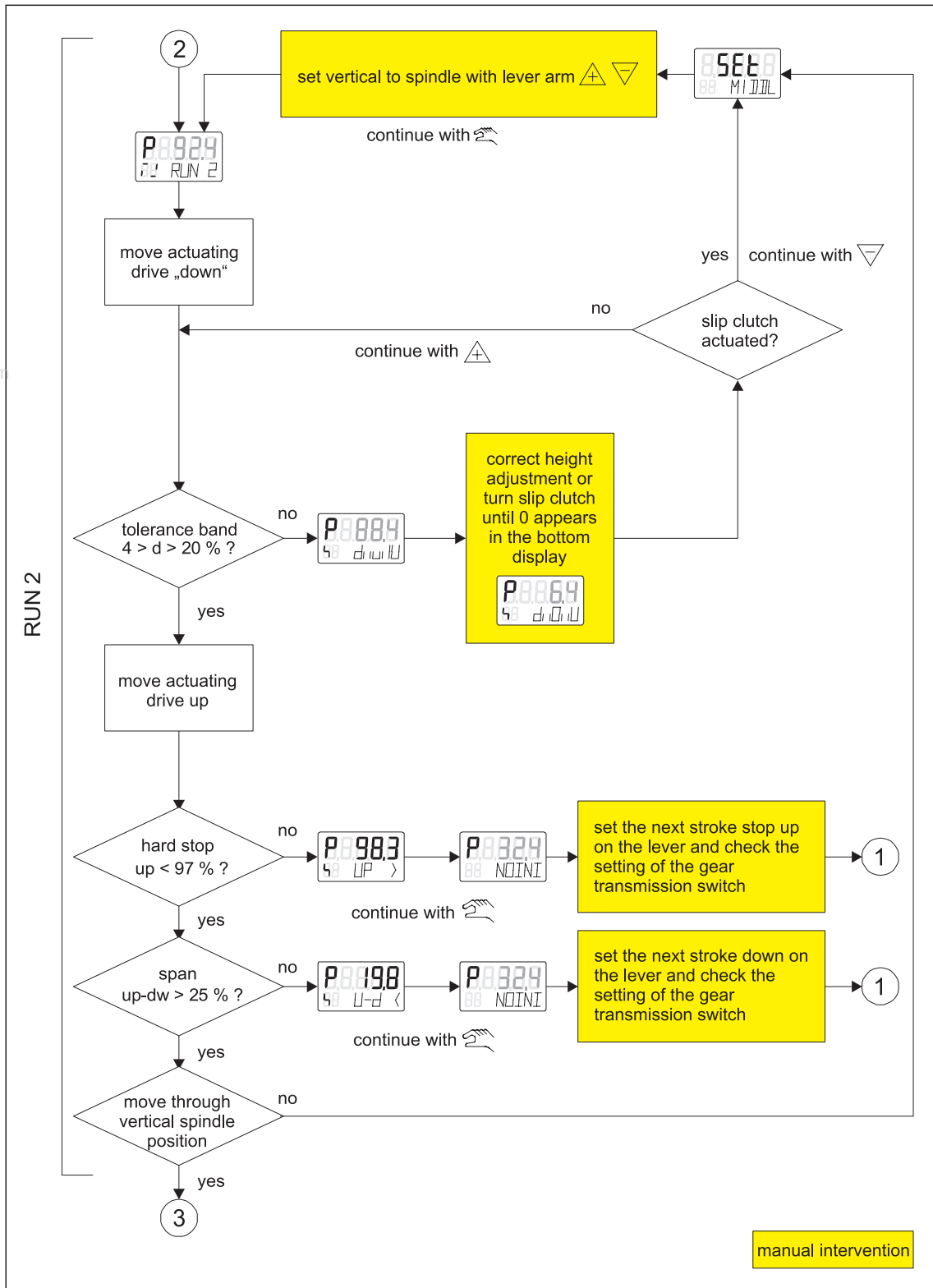


Figure 3-26 Automatic initialization part 2 (in rotary actuators)

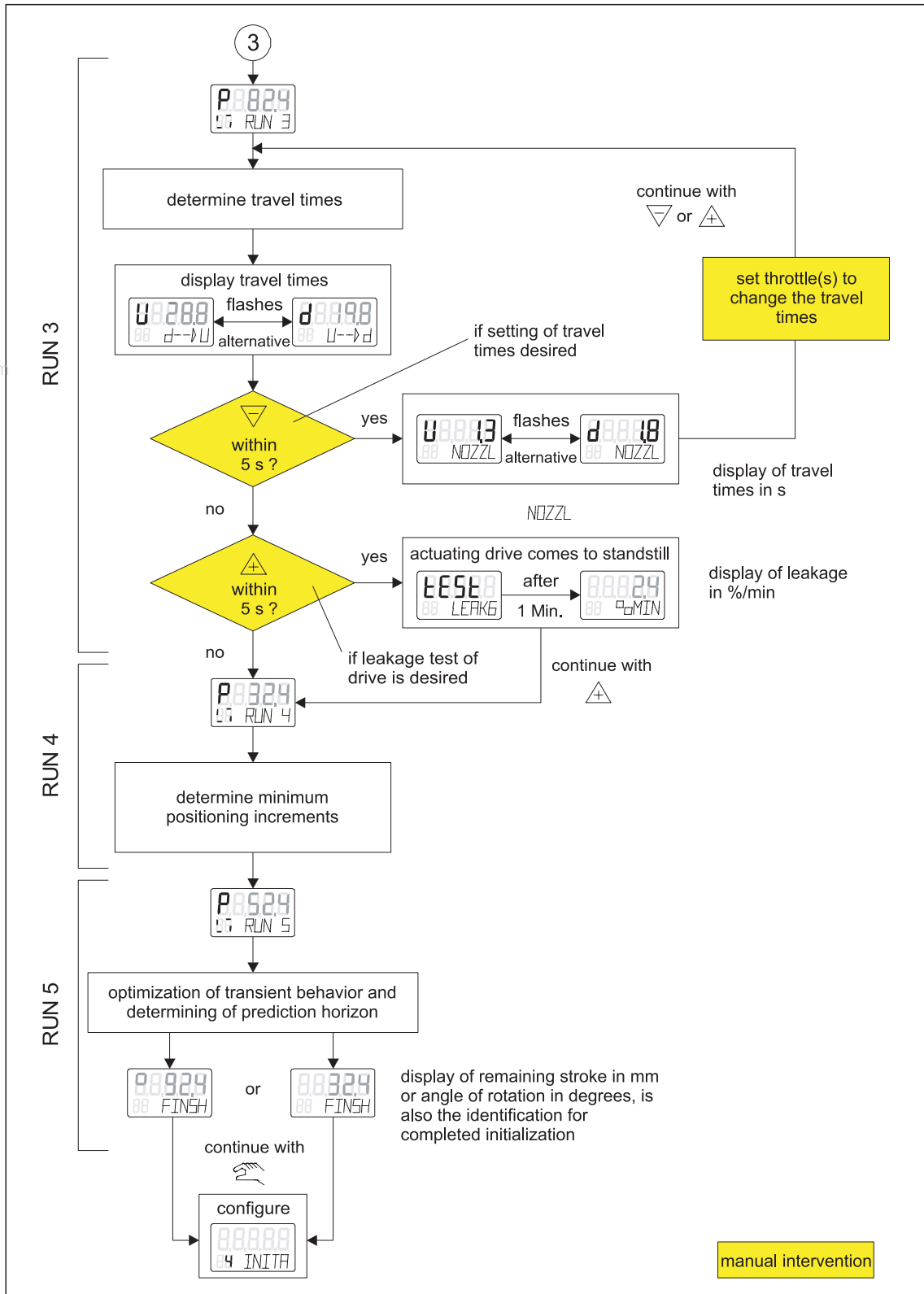


Figure 3-27 Automatic initialization, part 3

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 gear switch 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 slip clutch.
6. The positioner is now ready to operate.

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

The following chapter describes the operation of the positioner.

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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 76)



NOTE

If the positioner is operated in ranges with temperatures below $-10\text{ }^{\circ}\text{C}$ the liquid crystal display becomes sluggish and the display refresh rate is reduced considerably.

Figure 4-1 shows you the various display options.

4.2 Input keys

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



NOTE

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

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

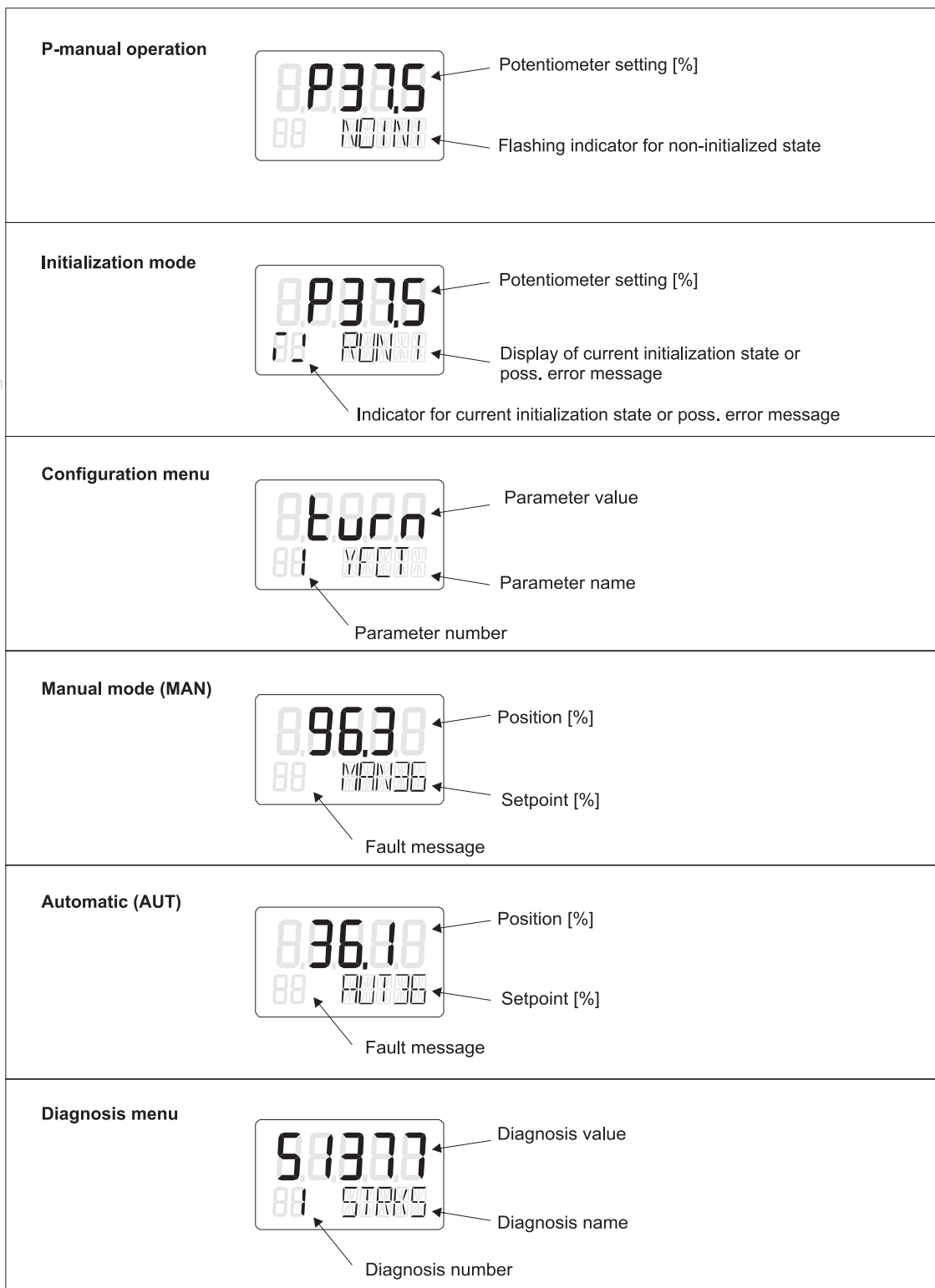
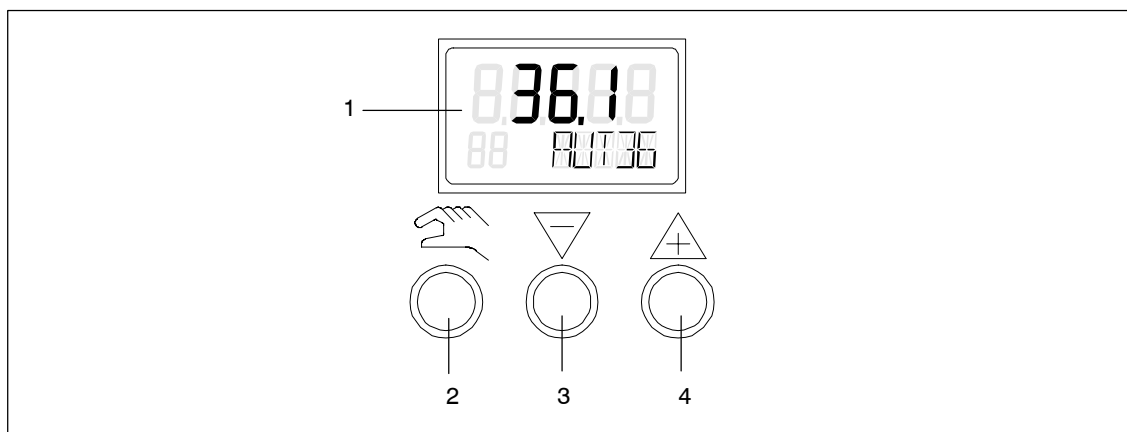


Figure 4-1 Meaning of the various display options



NOTE

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



- 1 Display
 2 Operation mode key
 3 Decrement key
 4 Increment key

Figure 4-2 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 ∇ 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 4-3 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 4-4 gives you an overview of the possible operating modes and the change between them.

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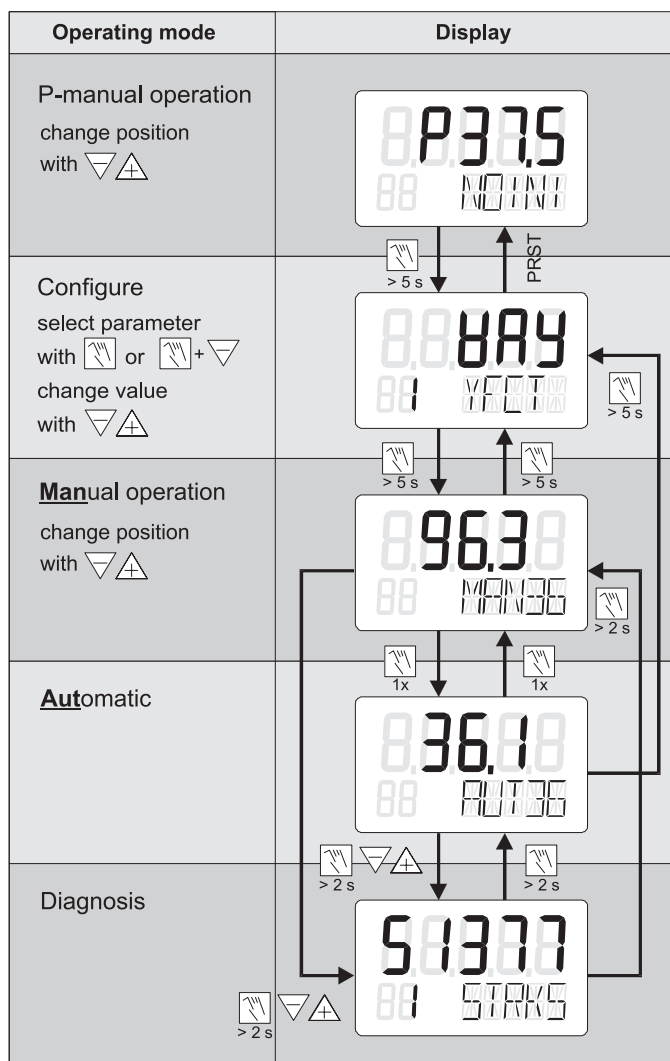


Figure 4-4 Change between the operating modes

**P-manual mode
(ex-factory state)**

The display of the positioner shows you the current potentiometer setting in the top line and "NOINIT" flashes in the second line. You can move the actuator with the decrement and increment key Δ . In order to adapt the positioner to your actuator, you have to change to the Configuration menu. See also chapter 3.6, page 57 "Commissioning".

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

**Configuration and
initialization**

To go to the Configuration menu, press the operation mode key \square for at least 5 seconds. In the Configuration menu you can adapt the positioner individually to your actuator and start initialization. Only a few parameters need to be set in the positioner prior to initialization. The others are defaulted so that they do not normally need to be adjusted. You can block the Configuration menu against manipulation by an appropriately parameterized and activated digital input. Which parameters you need to set and all other parameters are explained in chapter 4.4, page 78 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.

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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. Without a power failure you re-enter the configuration menu at the point you exited it when you call the Configuration menu again.

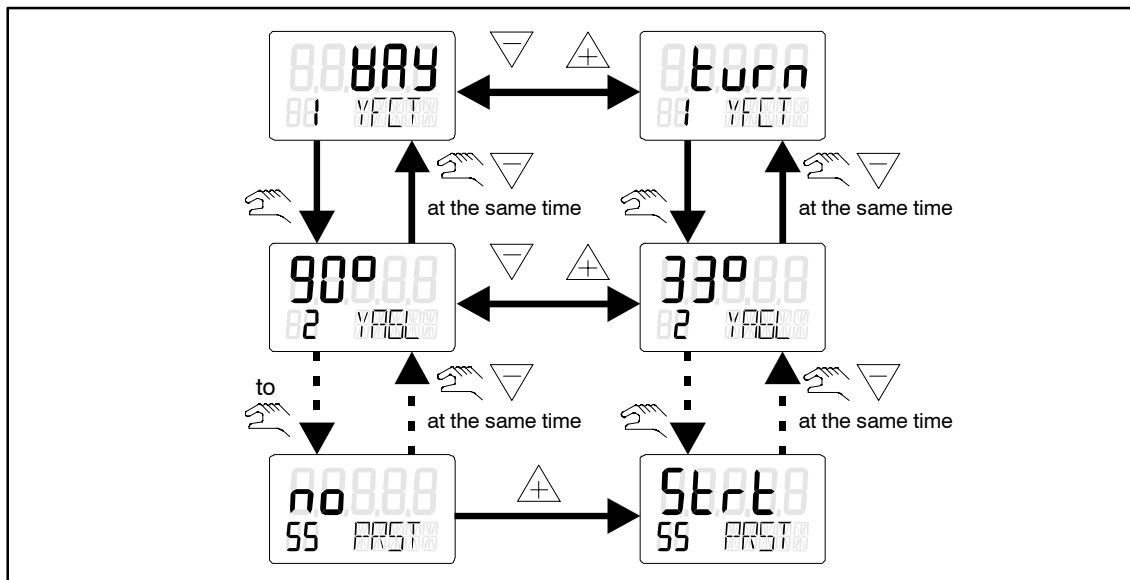


Figure 4-5 Overview: Configuration

Manual mode (MAN)

In this operating mode you can move the actuator with the decrement (∇) and increment keys (\triangle) 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 3-1, page 91).

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 90 for further information.



NOTE

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

4.4 Parameters

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

The parameter name is shown once in plain text and once as it appears in the display. The function of the parameter is described briefly in the "Function" column. In addition, the possible parameter values, the physical unit and the factory setting of the parameters are shown.

Parameter name	Display	Function	Parameter values	Unit	Factory setting	Customer setting	
1.YFCT	01 YFCT	Type of actuator	turn (part-turn actuator) WAY (linear actuator) LWAY (linear actuator without sine correction) ncSt (part-turn actuator with NCS) -ncSt (ditto, inv. direction of action)		WAY		
2.YAGL ¹⁾	02 YAGL	Rated angle of rotation of feedback Set transmission ratio selector (7) appropriately (see view of device)	90° 33°	Degrees	33°		
2) 3.YWAY	03 YWAY	Stroke range (optional setting) When used, the value must correspond with the set of the leverage ratio on the actuator Driver pin must be set to the value of the actuator travel or, if this value is not scaled, to the next larger scale value.	OFF ----- 5 10 15 20 (kurzer Hebel 33°) ----- 25 30 35 (kurzer Hebel 90°) ----- 40 50 60 70 90 110 130 (langer Hebel 90°)	mm	OFF		
4.INITA	04 INITA	Initialization (automatically)	noini no / ###.# Strt		no		
5.INITM	05 INITM	Initialization (manually)	noini no / ###.# Strt		no		
6.SCUR	06 SCUR	Current range of setpoint	0 to 20 mA 4 to 20 mA	0 MA 4 MA	4 MA		
7.SDIR	07 SDIR	Setpoint direction	rising falling	rISE FALL	rISE		
8.SPRA	08 SPRA	Setpoint for start of split range	0,0 bis 100,0	%	0,0		
9.SPRE	09 SPRE	Setpoint for end of split range	0,0 bis 100,0	%	100		
10.TSUP	10 TSUP	Setpoint ramp up	Auto 0 bis 400	s	0		
11.TSDO	11 TSDO	Setpoint ramp down	0 bis 400	s	0		
12.SFCT	12 SFCT	Setpoint function	Linear Equal-percentage 1:25, 1:33, 1:50 Inverse equal-percentage 1:25, 1:33, 1:50 Freely adjustable	Lin 1 - 25 1 - 33 1 - 50 n1 - 25 n1 - 33 n1 - 50 FrEE	Lin		
13.SL0 14.SL1 usw. bis 32.SL19 33.SL20	13 SLO (example)	Setpoint turning point at 0% to 5% 95% 100%	0,0 bis 100,0	%	0,0 5,0 usw. bis 95,0 100,0		
34.DEBA	34 DEBA	Dead zone of controller	Auto 0,1 bis 10,0	%	Auto		
35.YA	35 YA	Start of manipulated variable limiting	0,0 bis 100,0	%	0,0		
36.YE	36 YE	End of manipulated variable limiting	0,0 bis 100,0	%	100,0		
37.YNRM	37 YNRM	Standardization of manipulated variable	To mech. travel To flow	MPOS FLOW	MPOS		
38.YDIR	38 YDIR	Direction of manipulated variable for display	Rising Falling	rISE FALL	rISE		
39.YCLS	39 YCLS	Tight closing with manipulated variable	Without Top only Bottom only Top and bottom	no uP do uP do	no		
40.YCDO	40 YCDO	Value for tight closing, bottom	0,0 bis 100,0	%	0,5		
41.YCUP	41 YCUP	Value for tight closing, top	0,0 bis 100,0	%	99,5		
42.BIN1 ⁴⁾	42 BIN1	Function of BI 1 None Only message Block configuring Block configuring and manual Drive valve to position up Drive valve to position down Block movement	NO contact NO contact NO contact	OFF on bLoc1 bLoc2 uP doWn StoP	-on -uP -doWn -StoP	NC contact NC contact NC contact	OFF
43.BIN2 ⁴⁾	43 BIN2	Function of BI 2 None Only message Drive valve to position up Drive valve to position down Block movement	NO contact NO contact NO contact	OFF on uP doWn StoP	-on -uP -doWn -StoP	NC contact NC contact NC contact	OFF
44.AFCT ⁵⁾	44 AFCT	Alarm function Without A1=min, A2=max A1=min, A2=min A1=max, A2=max	normal normal normal	OFF fl, nR fl, fl, nR nR	-fl, nR -fl, nR -fl, nR	inverted inverted inverted	OFF
45.A1	45 A1	Response threshold of alarm 1	0,0 bis 100,0	%	10,0		
46.A2	46 A2	Response threshold of alarm 2	0,0 bis 100,0	%	90,0		
47.4FCT ⁵⁾	47 4FCT	Function of alarm output on fault Fault + not automatic Fault + not automatic + BI ("+" means logical OR operation)	normal normal normal	4 4nR 4nRb	-4 -4nR -4nRb	inverted inverted inverted	4
48.4TIM	48 4TIM	Monitoring time for fault message "control deviation"	Auto 0 bis 100	s	Auto		
49.4LIM	49 4LIM	Response threshold for fault message "control deviation"	Auto 0,0 bis 100,0	%	Auto		
50.4STRK	50 4STRK	Limit for stroke integral	OFF 1 bis 1.00E9		OFF		
51.4DCHG	51 4DCHG	Limit for direction change	OFF 1 bis 1.00E9		OFF		
52.4ZERO	52 4ZERO	Limit for end stop monitoring, bottom	OFF 0,0 bis 100,0	%	OFF		
53.4OPEN	53 4OPEN	Limit for end stop monitoring, top	OFF 0,0 bis 100,0	%	OFF		
54.4DEBA	54 4DEBA	Limit for dead zone monitoring	OFF 0,0 bis 10,0	%	OFF		
55.PRST	55 PRST	Preset (factory setting) "no" nothing activated "Strt" start of factory setting after pressing key for 5 s "oCAY" display following successful factory setting CAUTION: preset results in "NO INIT"	no Strt oCAY				

- 1) If "turn" is selected, you cannot set 33°
 2) Parameter does not appear if 1.YFCT=turn has been selected
 3) Turning points only appear with selection 12.SFCT = FrEE
 4) Alternatively "no" if initialization has not yet been carried out
 5) NC contact means: action with opened switch or Low level
 NO contact means: action with closed switch or High level
 6) Normal means: High level without fault
 Inverted means: Low level without fault

Figure 4-6 Parameter table of the positioner

1.YFCT

Positioning actuator type

Selection of used actuator: Linear actuator (WAY), rotary actuator (turn). The unlinearity which exists in linear actuators due to the conversion of linear movement to rotational movement is compensated by the positioner when 1.YFCT = WAY is selected.

If an external, linear potentiometer is used for displacement measuring, "1.YFCT" is set to LWAY. However, no way is displayed after initialization.

Special case: Use this setting for rotary actuators with reverse direction of action as well.

When using a rotary actuator with NCS sensor for position detection, select 1.YFST = ncST or -ncST

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2.YAGL

Rated angle of rotation of the feedback shaft

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

33° for strokes ≤ 20 mm

90° for strokes > 20 mm

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

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



NOTE

The setting of the transmission ratio selector on the positioner (see figure 2-1, page 16 and figure 2-2, page 17) **must** correspond to the angle value selected under "2.YAGL".

3.YWAY

Lever arm transmission



NOTE

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

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

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

**NOTE**

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

4.INITA

Automatic initialization (see chapter 3.6, page 57)

By selecting “Strt” and pressing the increment key \triangle for at least 5 seconds, automatic initialization is started. The initialization process is displayed by “RUN 1” to “RUN 5” (see figure 3-24, page 68 to figure 3-27, page 71).

If the positioner is already initialized, it can be switched over to the uninitialized status without changing the other parameters by pressing the decrement key ∇ for 5 seconds.

5.INITM

Manual initialization

By selecting “Strt” and pressing the increment key \triangle for at least 5 seconds, manual initialization is started. The manual initialization process is described in chapter 3.6.6, page 66.

6.SCUR

Current range of the setpoint

The selection of the current range depends on the connection type. “0mA” (0 to 20 mA) is only possible in three-/four-wire connections (see figure 3-15, page 51).

7.SDIR

Setpoint direction (see figure 4-7, page 82)

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

8.SPRA

Split range start (see figure 4-7)
and

9.SPRE

Split range end (see figure 4-7)

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

- rising / falling
- falling / rising
- falling / falling
- rising / rising

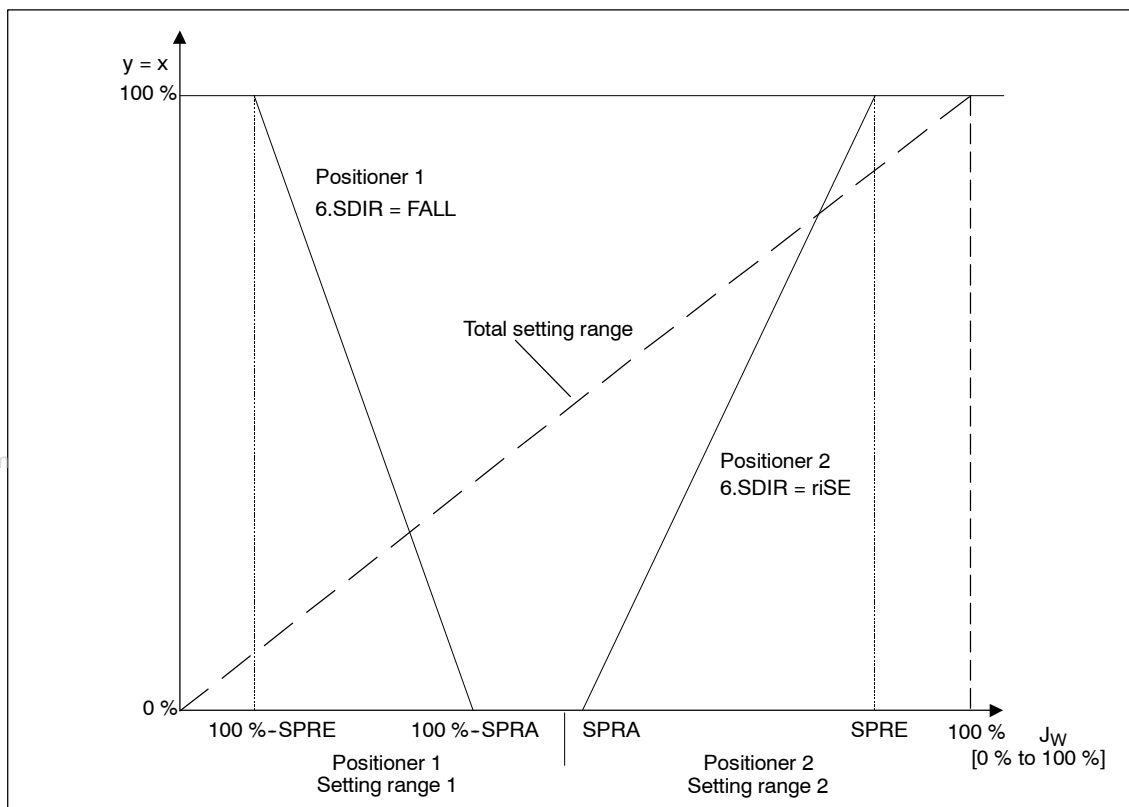


Figure 4-7 Example: Split range-operation with two positioners

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

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

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

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

- 12.SFCT Setpoint function (see figure 4-8, page 83)

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

- equal percentage 1 : 25 (12.SFCT = 1 - 25)
- equal percentage 1 : 33 (12.SFCT = 1 - 33)
- equal percentage 1 : 50 (12.SFCT = 1 - 50)
- inverse equal percentage 1 : 25 (12.SFCT = n1 - 25)

- inverse equal percentage 1 : 33 (12.SFCT = n1 -33)
- inverse equal percentage 1 : 50 (12.SFCT = n1 -50)

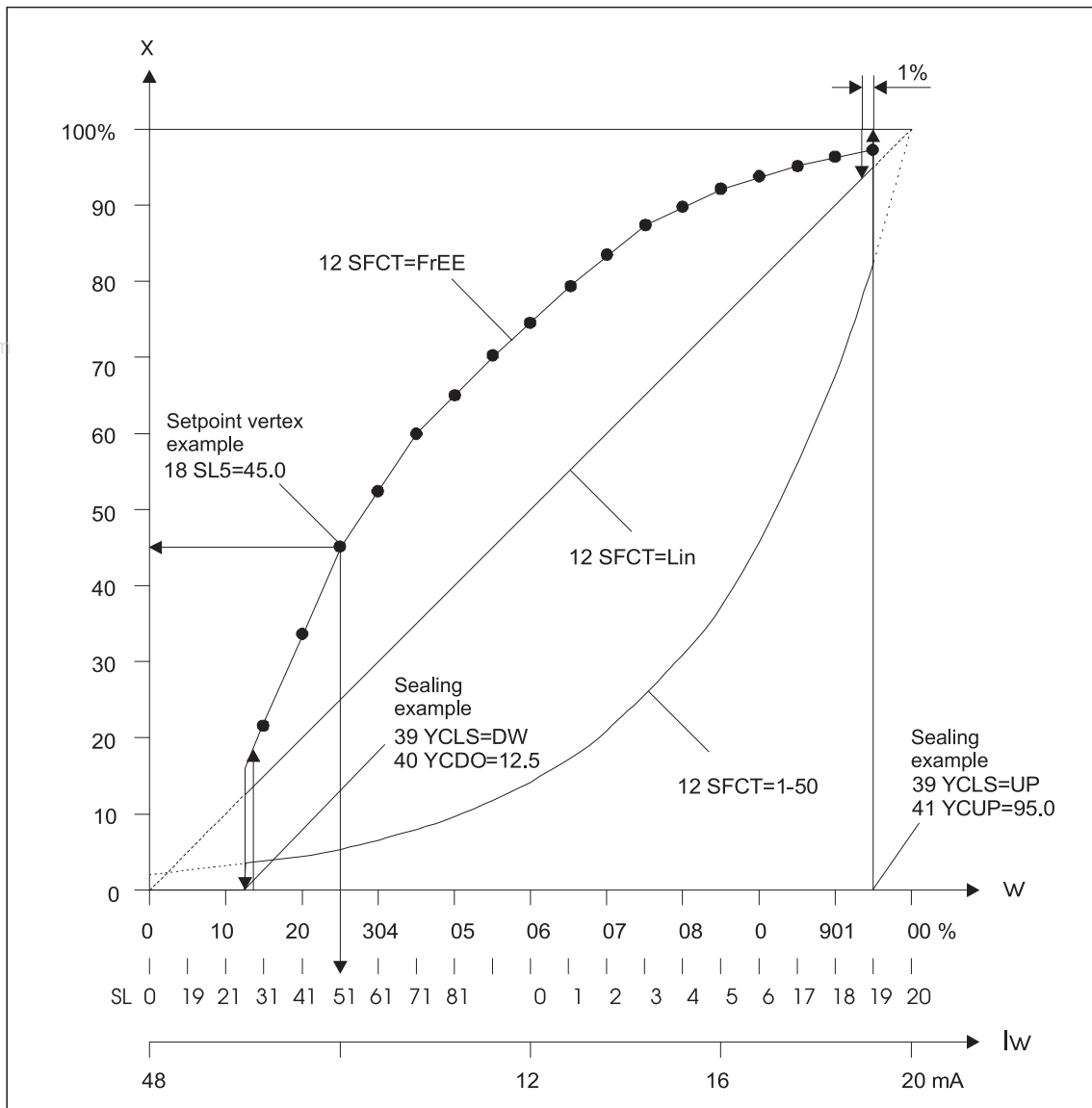


Figure 4-8 Setpoint characteristic, manipulated variable standardization and tight sealing function

13.SL0 to 33.SL20

Setpoint vertex points (see figure 4-8, page 83)

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

The setpoint vertex values can only be input at You may only enter a strictly monotonous characteristic, the vertex values of which differ by at least 0.2%. If the monotony condition has been infringed, an error message appears as soon as you want to exit "Configuration". If you need a falling characteristic you have to enter a rising characteristic and reverse the direction of action by entering 7.SDIR = fall.

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34.DEBA

Dead zone of the controller

At dEbA = AU to the dead zone in automatic operation is adapted continuously to the requirements of the control circuit. The dead zone is gradually increased on detecting a control oscillation. The reverse adaptation takes place by a time criterion.

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

35.YA

Manipulated variable limiting start (see figure 4-8 and 4-9) and

36.YE

Manipulated variable limiting end (see figure 4-8 and 4-9)

With the parameters "35.YA" and "36.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.

37.YNRM

Manipulated variable standardization (see figure 4-8 and 4-9)

With limiting of the manipulated variable (by "35.YA" and "36.YE") two different scalings are produced for the display and the position feedback via the current output (MPOS or FLOW).

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

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

To calculate the control difference, the setpoint is also shown in the appropriate scale on the display.

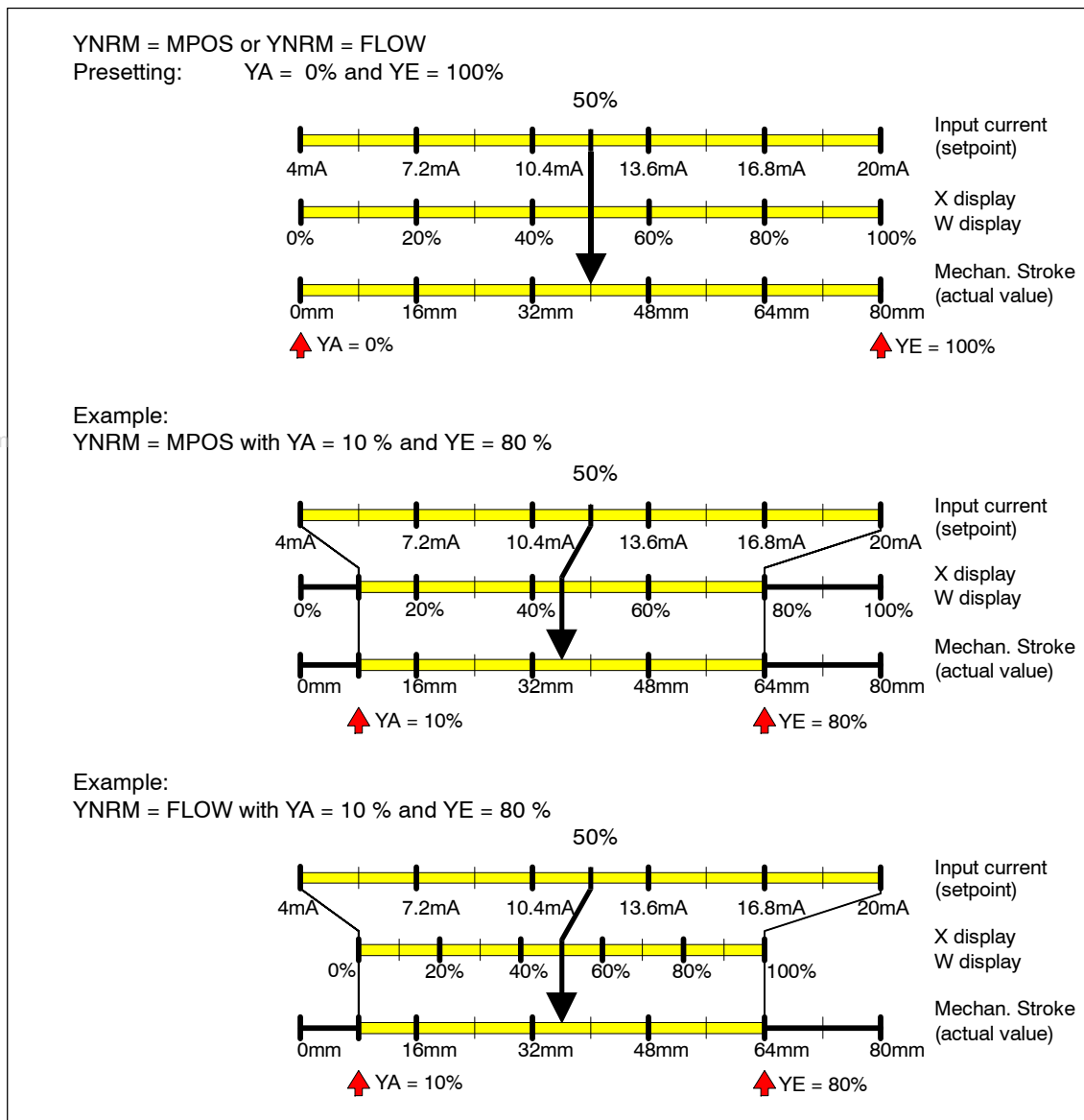


Figure 4-9 Dependence on the stroke of standardization and on YA and YE in the example of an 80 mmlinear actuator

38.YDIR

Manipulated variable direction of action

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

39.YCLS

Manipulated variable sealing (see figure 4-8, page 83)

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 sealing function can be activated on one side or for both limit positions. YCLS becomes active when the setpoint is below the value set with parameter "40.YCDO" or above that set with parameter "41.YCUP".

40.YCDO

Value for sealing bottom

When the sealing function bottom (see parameter“39.YCLS”is activated, it can be set below which setpoint the bottom sealing is activated with this parameter.

41.YCUP

Value for sealing top

When the sealing function top (see parameter“39.YCLS”is activated, it can be set above which setpoint the top sealing is activated with this parameter.

42.BIN1

Function digital input 1 (see figure 4-6, page 79)
and

43.BIN2

Function digital input 2 (see figure 4-6)

The parameters “42.BIN1” and “43.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

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

BIN1 = bLc1

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

BIN1 = bLc2

If digital input 1 has been activated, manual operation is also locked in addition to the Configuration operating level.

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

The actuator drives the linear actuator to the upper or lower stop when the digital input is activated with continuous contact.

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

With activated digital input the piezo-valves are blocked and the actuator remains in the last position. Leakage messages can then be executed without initialization function.

BIN1 or BIN2 = oFF (factory setting)

no function

special function of DI1: If the digital input 1 is activated in P manual operation by a jumper between terminals 9 and 10, "NOINI" or the 100times input current in mA is displayed alternately in the bottom line of the display.

If one of the above named functions is selected with the parameters “42.BIN1” and “43.BIN2” simultaneously, then “Blocking” has priority over “Up” and “Up” priority over “Down”.

- 44.AFCT** Alarm function
- The actuator can report the exceeding (max.) or dropping below (min) of a specified stroke or angle of rotation. The response of the alarms (limit contacts) is related to the MPOS-scaling (see figure 4-9, page 85). The alarms are reported by the alarm module (order no. 6DR4004-6A or -8A). In addition the alarms can be read out through the HART interface (optional).
- The direction of action of the digital outputs can be adapted from high active to low active sequence systems.
- 45.A1** Response threshold alarm 1
and
46.A2 Response threshold alarm 2
- The alarm thresholds are related to the mechanical path (MPOS-scale).
- 47. 4FCT** Function of the fault message output
- The fault message output serves as a group message for following faults:
- Control error (e.g. by actuator fault, valve fault, compressed air failure) with the parameters "48.4TIM" and "49.4LIM"
 - Positioner not in automatic mode
 - Digital input activated (see parameter "42.BIN1" and "43.BIN2")
 - Exceeding of a limit value (e.g. way integral or valve seat, see parameter 50 to 54)
- It also responds at:
- Power failure
 - Processor fault
- The direction of action of the digital outputs can be adapted from high active to low active sequence systems.
- 48. 4TIM** Monitoring time for setting the fault messages
- The set value (s) serves as a specification for the time within which the positioner must have reached the controlled state. The corresponding response threshold is specified with "49.4LIM".
- The fault message output is set on exceeding the set time.
- 49. 4LIM** Response threshold of the fault message
- Here a value (%) can be set for the permissible variable of control error for releasing the fault message.
- If the parameters "48.4TIM" and "49.4LIM" are both set to "Auto", the fault message is set if the short step zone is not reached within a certain time. This time is 5 times the initialization travel time within 5 to 95% of the actuating path and 10 times this time outside 10 to 90% of the actuating path.

50. 5 STRK

Limit value for monitoring the way integral

A limit value for the way integral can be set here. If the way integral exceeds the limit value, the fault message output (optional) is activated.

This function enables a preventive maintenance of the fitting, see also chapter 4.5 "Diagnostics", page 90.

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

51. 5 DCHG

Limit value for monitoring the change 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 90.

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

52. 5 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 sealing bottom. Activation of the sealing bottom function (parameter "39.YCLS") is therefore a prerequisite.

The fault message remains activated until either a subsequent monitoring remains within the tolerance or a new initialization is performed.

This monitoring function can be deactivated with the OFF setting (factory setting). See also chapter 4.5 "Diagnostics", page 90.

53. 5 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 than the specified tolerance related to its initialization value. Monitoring takes place when the valve is in sealing top. Activation of the sealing top function (parameter "39.YCLS") is therefore a prerequisite.

The fault message remains activated until either a subsequent monitoring remains within the tolerance or a new initialization is performed.

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

**NOTE**

But the monitors of the bottom and top hard stop do not only react to valve errors. Adjustment of the position feedback is also detected as an error if the tolerance values are exceeded as a result.

54. 4 DEBA

Limit value for monitoring the dead zone adaptation

The automatic adaptation of the dead zone can be monitored with this value (%). If the dead zone exceeds the set value, the fault message output (optional) is activated.

Prerequisite for this function is the setting of the parameter "34.DEBA" = Auto. This monitoring function can be deactivated with the OFF setting (factory setting).

55.PRST

Preset

Establishing the factory setting and resetting the initialization.

**NOTE**

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



4.5 Diagnosis


4.5.1 Diagnostic display

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

Table 3-1, page 91 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.	Abbreviation	Meaning	Displayable values	Unit	Rest poss.
1	STRKS	Number of strokes (Strokes)	0 to 4.29E9	-	x
2	CHDIR	Changes of direction (Changes of Direction)	0 to 4.29E9	-	x
3	HCNT	Fault counter (Counter)	0 to 4.29E9	-	x
4	A1CNT	Alarm counter 1 (Alarm 1 Counter)	0 to 4.29E9	-	x
5	A2CNT	Alarm counter 2 (Alarm 2 Counter)	0 to 4.29E9		
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 Time Up)	0 to 1000	s	
9	TDOWN	Travel time down (Travel Time Down)	0 to 1000	s	
10	LEAK	Leakage (Leakage)	0.0 to 100.0	%	
11	P0	Potentiometer value below stop (0%)	0.0 to 100.0	%	
12	P100	Potentiometer value bottom stop (100%)	0.0 to 100.0	%	
13	IMPUP	Impulse length up (Impulse Length Up)	2 to 100	ms	
14	IMPDN	Impulse length down (Impulse Length Down)	2 to 100	ms	
15	DBUP	Dead zone up (Dead Band Up)	0.1 to 100.0	%	
16	DBDN	Dead zone down (Dead Band Down)	0.1 to 100.0	%	
17	SSUP	Short step zone up (Short Step Zone Up)	0.1 to 100.0	%	
18	SSDN	Short step zone down (Short Step Zone Down)	0.1 to 100.0	%	
19	TEMP	Current temperature	-40 to 85	°C	
20	TMIN	Minimum temperature ("drag pointer")	-40 to 85	°C	
21	TMAX	Maximum temperature ("drag pointer")	-40 to 85	°C	
22	T1	Number of operating hours in Temperature range 1	0 to 4.29E9	Hours	
23	T2	Number of operating hours in Temperature range 2	0 to 4.29E9	Hours	
24	T3	Number of operating hours in Temperature range 3	0 to 4.29E9	Hours	
25	T4	Number of operating hours in Temperature range 4	0 to 4.29E9	Hours	
26	T5	Number of operating hours in Temperature range 5	0 to 4.29E9	Hours	
27	T6	Number of operating hours in Temperature range 6	0 to 4.29E9	Hours	

No.	Abbreviation	Meaning	Displayable values	Unit	Rest poss.
28	T7	Number of operating hours in Temperature range 7	0 to 4.29E9	Hours	
29	T8	Number of operating hours in Temperature range 8	0 to 4.29E9	Hours	
30	T9	Number of operating hours in Temperature range 9	0 to 4.29E9	Hours	
31	VENT1	Number of cycles pre-controlvalve 1	0 to 4.29E9	-	
32	VENT2	Number of cycles pre-controlvalve 2	0 to 4.29E9	-	
33	STORE	Store current values as "last maintenance" (press increment key for 5 s) (Store)	-	-	

Table 3-1 Overview diagnostic values

4.5.2 Meaning of the diagnostic values

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- 1 STRKS** Number of strokes
- The actuator movements during operation are totaled and can be read here as number of strokes. Unit: 100% stokes The value is written every hour 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 hour in a non-volatile memory. It can be reset to zero with the increment key .
- 3 hCNT** 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 "44.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	<p>Determined actuating way</p> <p>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".</p>
8 TUP	<p>Travel time up and travel time down</p> <p>These values show the travel times which have been determined during initialization. The unit is seconds.</p>
9 TDOWN	
10 LEAK	<p>Leakage</p> <p>If a leakage message has been output during initialization, the value of the leakage can be read here in %/min.</p>
11 P0	<p>Potentiometer value bottom stop and Potentiometer value top stop</p> <p>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.</p>
12 P100	
13 IMPUP	<p>Impulse length up and Impulse length down</p> <p>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.</p>
14 IMPDN	
15 DBUP	<p>Dead zone up and Dead zone down</p> <p>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".</p>
16 DBDN	
17 SSUP	<p>Short step zone up and Short step zone down</p> <p>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.</p>
18 SSDN	


- 19 TEMP** Current temperature
Current temperature in the positioner housing The sensor is on the electronics board.
- 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.

- 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
Temperature 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 HART, e.g. with PDM, menu item Instrument→Store maintenance info. It is possible to compare the data of the last maintenance with the current data.

4.5.3 Online-Diagnosis

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

Table 3-2, page 94 shows which events can activate the fault message output, how the parameters must be set for this event to be monitored, when the fault message disappears again and where the possible causes of the fault lie.

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

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	47. \downarrow FCT = \downarrow nA or = \downarrow nAB	... the instrument is brought into automatic mode	The instrument is configured or is in manual operation.
3	Digital input DI1 or DI2 active	47. \downarrow FCT = \downarrow nAB and digital function BIN1 or BIN2 to "on"	... the digital 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	50. \downarrow STRK \neq 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	51. \downarrow DCHG \neq 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	52. \downarrow ZERO \neq OFF 39.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, slip clutch maladjusted.
7	Limit value top hard stop exceeded	53. \downarrow OPEN \neq OFF 39 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, slip clutch maladjusted.
8	Limit value dead zone adaptation exceeded	53. \downarrow OPEN \neq OFF 34.DEBA = Auto	... the limit value is dropped below again	Increased stuffing box friction, mechanical lots of the position feedback

Table 3-2 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 48.hTIM, monitoring time for setting the fault messages and 49.hLIM, response threshold of the fault message. As soon as the control error drops back below the response threshold, the fault message is reset.
- 2** **Monitoring automatic operation**
- A fault message is generated when the instrument is not in the automatic mode at the appropriate parameter setting “47.hFCT”. In this way the control system can be warned for example when the instrument has been switched to manual operation or Configuration on site.
- 3** **Digital input DI1 or DI2 active**
- A fault message is generated when the digital input is activated at the the corresponding setting of the parameter “47.hFCT”, function of the fault message output and the parameter “42.BIN1”, function digital input 1. This may be a switch for stuffing box monitoring, a temperature switch or a limit value switch for example.
- Digital input 2 (on the alarm module option) can be configured in the same way.
- 4** **Monitoring of number of strokes**
- 5** **Monitoring of number of changes of direction**
- The two values number of strokes and number of changes of direction are compared continuously with the limit values which are specified with the parameters “50.hSTRK” and “51.hDCHG”. The fault message output responds when exceeded. Both functions can be deactivated with the parameter setting “OFF”.
- 6** **Monitoring of the bottom hard stop (valve seat)**
- 7** **Monitoring of the top hard stop**
- Monitoring of the bottom hard stop is activated when the parameter “52.hZERO” 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 sealing position. The current position is compared with the one determined during initialization as a bottom end stop. Activation of the sealing bottom function (parameter “39.YCLS”) is therefore a prerequisite.
- Example: 3% is set as a value. Normally the setting 0% is adopted when sealed. If a value >3% or <-3% is determined instead, a fault is reported.

The fault message remains activated until either a subsequent monitoring remains within the tolerance or a new initialization is performed. The deactivation of the monitoring ("52.hZERO"=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 h. Activation of the sealing top function (parameter "39.YCLS") is therefore a prerequisite.

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Monitoring of the dead zone adaptation

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

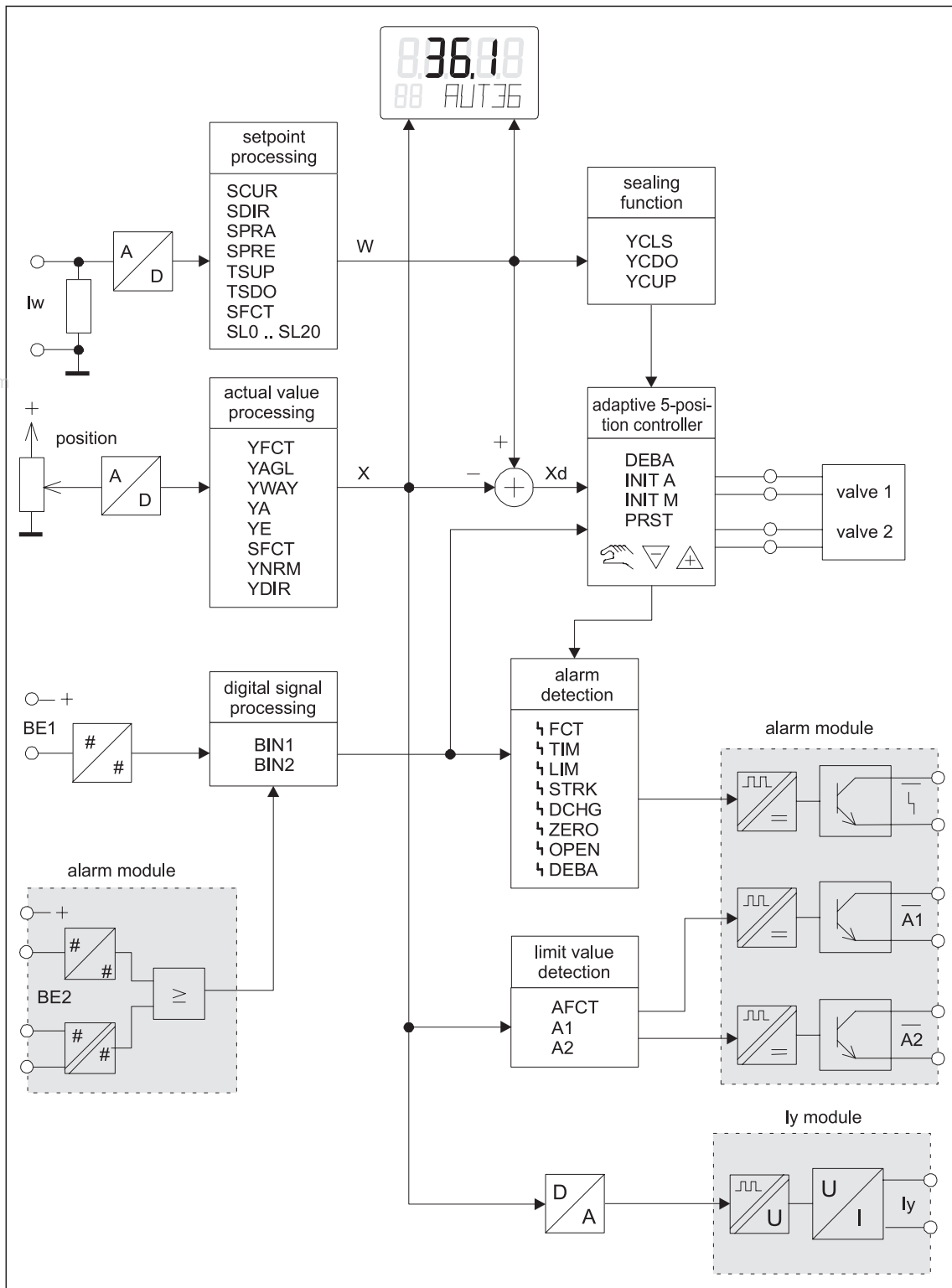


Figure 4-10 Configuration block diagram

The positioner is largely maintenance-free. The positioners are fitted with filters in the pneumatic connections as protection against coarse particles of dirt. If the pneumatic energy supply contains particles of dirt, the filters may clog and impair the function of the positioner. In this case the filters can be cleaned as follows.

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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.

Technical Data

6

General data for basic device 6DR5xxx-xx

Travel range (linear actuators)	3 to 130 mm (angle of feedback shaft 16 to 90°)
Angle or rotation (part-turn actuators)	30 to 100°
Installation	
• On linear actuators	Using mounting kit 6DR4004-8V and additional lever arm 6DR4004-8L if required on actuators according to IEC 534-6 (NAMUR) with ledge, columns or plane surface
• On part-turn actuators	Using mounting kit 6DR4004-8D on actuators with fixing platform according to VDI/VDE 3845 and DIN 3337: the mounting plate must be provided on the actuator side; shaft with nut and M6 female thread
Controller	
• Five-point switch	Self-adjusting
• Dead zone dEbA = Auto dEbA = 0.1 to 10%	Self-adjusting or fixed setting
• Controllable response time	≥ 1.5 s, reduced resolution with smaller positioning times
A/D converter	
• Scanning time	10 ms
• Resolution	≤ 0.05 %
• Transmission error	≤ 0.2 %
• Temperature influence	≤ 0.1 %/10 K
Binary input BI1 (connected electrically to I_w current input)	Can be used for floating contact
Contact rating	≤ 5 μA at 3 V
Degree of protection	IP 65 to EN 60 529
Mounting position	Any; in wet environment, pneumatic connections and exhaust opening not upwards
CE marking	
• Emitted interference	Conforms to EMC guideline 89/336 EEC in compliance with the following standards EN 50 081-1
• Noise immunity	EN 50 082-2 and NAMUR NE21 May 93
Material of:	
• Casing	
- 6DR5 0-... (plastic)	Glass-fiber-reinforced Macrolon
- 6DR5 1-... (metal)	GK-AISI7Mg
- 6DR5 5-... (metal)	GK-AISI7Mg
• Pressure gauge block	Aluminium AIMgSi, anodized
Resistance to vibration	10 g (up to 100 Hz)

Pneumatic data

Supply (inlet air)

- Pressure

Air quality according to ISO 8573-1

- Size and density of particulates
- Pressure dew point

- Oil concentration

Unrestricted flow of:

- Inlet air valve [Nm³/h]
- Outlet air valve [Nm³/h]

Valve leakage

Throttle ratio

Consumption of inlet air in stable state

Types of actuators

- In plastic casing
- In metal casing
- In flameproof casing

1.4 to 7 bar: sufficiently larger than max. actuator pressure (positioning pressure)

Class 2

Class 2 (min. 20 K below ambient temperature)

Class 2

At	2 bar	4 bar	6 bar
	4.1	7.1	9.8
	8.2	13.7	19.2

< 6 x 10⁻⁴ Nm³/h

Adjustable up to ∞ : 1

< 3.6 x 10⁻² Nm³/h

Single-action and double-action
Single-action
Single-action and double-action

SIPART PS2

Explosion protection to EN 50 014 and EN 50 020
 Mounting location
 Permissible ambient temperature for operation

EEx n II 3G Ex nV II T4 Zone 2	EEx ia/ib II G EEx ib II C T6 Zone 1
T4: -30 to +80 °C ¹⁾	T4: -30 to +80 °C ¹⁾ T5: -30 to +65 °C ¹⁾ T6: -30 to +50 °C ¹⁾

Electrical data

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Input

Two-wire system

- Rated signal range
- Current to maintain power supply
- Required load voltage U_B ($\cong \Omega$ at 20 mA)
 - Without HART
 - With HART
- Static destruction limit
- Internal capacitance C_i
- Internal inductance L_i
- Sources

Basic device without Ex protection	Basic device with Ex protection EEx ia/ib or Ex n
4 to 20 mA	4 to 20 mA
≥ 3.6 mA	≥ 3.6 mA
6.4 V ($\cong 320 \Omega$) 6.5 V ($\cong 325 \Omega$)	8.0 V ($\cong 400 \Omega$) 8.8 V ($\cong 440 \Omega$)
± 40 mA	-
-	≤ 15 nF
-	≤ 0.12 mH
-	Intrinsically-safe with $U_0 \leq 30$ V DC $I_k \leq 100$ mA $P \leq 1$ W

Three-wire/four-wire system (only 6DR52...)

- Power supply U_H
- Current consumption I_H
- Internal capacitance C_i
- Internal inductance L_i
- For connection to intrinsically-safe sources with

18 to 30 V DC	18 to 30 V DC
$(U_H - 7.5 \text{ V})/2.4 \text{ k}\Omega$ [mA]	$(U_H - 7.5 \text{ V})/2.4 \text{ k}\Omega$ [mA]
-	≤ 15 nF
-	≤ 0.12 mH
-	$U_0 \leq 30$ V DC $I_k \leq 100$ mA $P \leq 1$ W

Current input i_W

- Rated signal range
- Load voltage at 20 mA
- Internal capacitance C_i
- Internal inductance L_i
- For connection to intrinsically-safe sources with

0/4 to 20 mA	0/4 to 20 mA
1 V ($\cong 50 \Omega$)	1 V ($\cong 50 \Omega$)
-	≤ 15 nF
-	≤ 0.12 mH
-	$U_0 \leq 30$ V DC $I_k \leq 100$ mA $P \leq 1$ W

Electrical isolation

- Test voltage

840 V DC (1 s)	840 V DC (1 s)
----------------	----------------

Connections

- Electric
- Pneumatic

Screw terminals 2.5 AWG28-12 Cable bushing M20 or 1/2" NPT (see Ordering data)	Screw terminals 2.5 AWG28-12 Cable bushing M20 or 1/2" NPT (see Ordering data)
Female thread G1/4 DIN 45 141 or 1/4" 18 NPT (see Ordering data)	Female thread G1/4 DIN 45 141 or 1/4" 18 NPT (see Ordering data)

Binary input BI1

Weight, basic device

- Plastic casing
- Metal casing

Dimensions

Climatic class

- Storage
- Transport
- Operation
 - Without purging air
 - With purging air

See "General data", page 101

Approx. 0.9 kg
 Approx. 1.3 kg
 See Fig. 5/13
 To IEC 721
 1K5, but -40 to +80 °C²⁾
 2K4, but -40 to +80 °C²⁾
 3K3, but -30 to +80 °C¹⁾
 3K4, but -30 to +80 °C¹⁾

SIPART PS2 EEx d

Explosion protection to EN 50 014 and EN 50 018
 Permissible ambient temperature for operation

II 2G EEx d II C T6
 T4: -30 to +80 °C¹⁾
 T5: -30 to +65 °C¹⁾
 T6: -30 to +50 °C¹⁾

Electrical data

Input

Two-wire system

- Rated signal range
- Current to maintain power supply
- Required load voltage U_B
 - Without HART
 - With HART
- Static destruction limit

4 to 20 mA
 ≥ 3.6 mA
 6.4 V ($\cong 320 \Omega$)
 6.5 V ($\cong 325 \Omega$)
 ± 40 mA

Three/four-wire system

- Power supply U_H
- Current consumption I_H
- Static destruction limit

18 to 35 V DC
 $(U_H - 7.5 \text{ V})/2.4 \text{ k}\Omega$ [mA]
 ± 35 V

Current input i_W

- Rated signal range
- Load voltage at 20 mA
- Static destruction limit

0 or 4 to 20 mA
 1 V ($\cong 50 \Omega$)
 ± 40 mA

Electrical isolation

- Test voltage

Between U_H and I_W
 500 V (50 Hz, 1 min)

Connection

- Electric
- Pneumatic

Screw terminals 2.5 AWG28-12
 1/2" NPT³⁾ or M25 x 1.5³⁾ or M20 x 1.5
 Female thread G1/4 DIN 45 141 or 1/4" 18NPT

Binary input BI1

Weight, basic device

Dimensions

Climatic class

- Storage
- Transport
- Operation with purging air

See "General data", page 5/10
 Approx. 5.2 kg
 See Fig. 5/14
 To IEC 721
 1K5, but -40 to +80 °C²⁾
 2K4, but -40 to +80 °C²⁾
 3K4, but -30 to +80 °C²⁾

1) Limited refresh rate of LCD below -10 °C.
 2) When commissioning at ≤ 0 °C make sure that the valves are purged with the dry medium for a sufficiently long time.
 3) With EEx-d certified cable bushing.

Option modules	Without Ex protection	With Ex protection
Electrical data		
Explosion protection to EN 50 014 and EN 50 020	–	II2G EEx ia/ib II C T4/T5/T6 ¹⁾
Mounting location	–	Zone 1
Permissible ambient temperature for operation	-30 to +80 °C	T4: -30 to +80 °C T5: -30 to +65 °C T6: -30 to +50 °C
Alarm module		
<u>Binary alarm outputs $\bar{A}1$, $\bar{A}2$ and alarm output</u>	6DR4004-8A (without Ex protection)	6DR4004-6A (with Ex protection)
Signal status High (not triggered)	Conductive $R = 1 \text{ k}\Omega$, +3/-1 %	$\geq 2.1 \text{ mA}^2$
Signal status Low ³⁾ (triggered)	Non-conductive $I_R < 60 \mu\text{A}$	$\leq 1.2 \text{ mA}^2$
Internal capacitance C_i	–	$\leq 5.2 \text{ nF}$
Internal inductance L_i	–	Negligible
Power supply U_H	$\leq 35 \text{ V}$	–
Connection to intrinsically-safe switching amplifier to DIN 19 234	–	$U_o \leq 15.5 \text{ V DC}$ $I_k \leq 25 \text{ mA}$ $P \leq 64 \text{ mW}$
<u>Binary input BI2</u>		
• Electrically connected to basic device		Floating contact, open Floating contact, closed 3 V, 5 μA
- Signal status 0		
- Signal status 1		
- Contact rating		
• Electrically isolated from basic device		$\leq 4.5 \text{ V}$ or open
- Signal status 0		$\geq 13 \text{ V}$
- Signal status 1		$\geq 25 \text{ k}\Omega$
- Input resistance		
Static destruction limit	$\pm 35 \text{ V}$	–
Internal inductance and capacit.	–	Negligible
Connection to intrinsically-safe voltage source	–	$U_i \leq 25.2 \text{ V}$
Electrical isolation	The 3 outputs, the input BI2 and the basic device are electrically isolated from each other	
I_y module	6DR4004-8J (w/o Ex protection)	6DR4004-6J (with Ex protection, only for temp. class T1 to T4)
<u>Direct current output for position feedback</u>	Two-wire system	
Rated signal range i	4 to 20 mA, short-circuit-proof	
Operating range	3.6 to 20.5 mA	
Power supply U_H	+12 to 35 V	+12 to 30 V
External load R_B [k Ω]	$\leq (U_H [\text{V}] - 12 \text{ V}) / i [\text{mA}]$	
Transmission error	$\leq 0.3 \%$	
Temperature influence	$\leq 0.1 \%$ /10 K	
Resolution	$\leq 0.1 \%$	
Residual ripple	$\leq 1 \%$	
Internal capacitance C_i	–	$\leq 11 \text{ nF}$
Internal inductance L_i	–	Negligible
For connection to intrinsically-safe sources with		for T4
• U_i	–	$\leq 30 \text{ V}$
• I_i	–	$\leq 100 \text{ mA}$
• P_i	–	$\leq 1 \text{ W}$

SIA module	
<u>Limit monitor with slot-type initiators and alarm output</u>	6DR4004-8G or 6DR4004-6G (only for 6DR5...)
Connection	Two-wire system to DIN 19 234 (NAMUR), for series-connected switching amplifiers
2 slot-type initiators	Type SJ2-SN
Function	NC
Connection to intrinsically-safe switching amplifier, DIN 19 234	
Ex protection	EEx ia/ib IIC T4/T5/T6
EMC	See alarm module

1) Only in conjunction with the basic device 6DR5 ■ ■ ■ ■ - ■ ■ ■ ■.
 2) Switching thresholds with supply to DIN 19 234: $U_H = 8.2 \text{ V}$, $R_i = 1 \text{ k}\Omega$.
 3) Low is also the state if the basic device is faulty or without an electrical power supply.

Scope of Delivery

7

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.

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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.

7.1 Scope of delivery of standard controller

Versions	Housing	Valve	Ex-protection	Order numbers
SIPART PS2 2L without HART	Plastic housing	single action	non Ex	6DR5010-xNxxx-0AA0
	Plastic housing	double action	non Ex	6DR5020-xNxxx-0AA0
	Metal housing	single action	non Ex	6DR5011-xNxxx-0AA0
SIPART PS2 2L without HART	Plastic housing	single action	CENELEC/FM	6DR5010-xExxx-0AA0
	Plastic housing	double action	CENELEC/FM	6DR5020-xExxx-0AA0
	Metal housing	single action	CENELEC/FM	6DR5011-xExxx-0AA0
	Explosion proof housing	single action	CENELEC/FM	6DR5015-xExxx-0AA0*)
	Explosion proof housing	double action	CENELEC/FM	6DR5025-xExxx-0AA0*)
SIPART PS2 2L with HART	Plastic housing	single action	non Ex	6DR5110-xNxxx-0AA0
	Plastic housing	double action	non Ex	6DR5120-xNxxx-0AA0
	Metal housing	single action	non Ex	6DR5111-xNxxx-0AA0
SIPART PS2 4L with HART	Plastic housing	single action	CENELEC/FM	6DR5210-xExxx-0AA0
	Plastic housing	double action	CENELEC/FM	6DR5220-xExxx-0AA0
	Metal housing	single action	CENELEC/FM	6DR5211-xExxx-0AA0
	Explosion proof housing	single action	CENELEC/FM	6DR5215-xExxx-0AA0*)
	Explosion proof housing	double action	CENELEC/FM	6DR5225-xExxx-0AA0*)

- 2L corresponds to two-wire operation
- 4L corresponds to four-wire-operation
- x stands for sub-variant
- *) in preparation

7.2 Scope of delivery of options

Option	Order number
SIA module non Ex	6DR4004-8G
SIA module Ex (CENELEC / FM)	6DR4004-6G
Alarm module non Ex	6DR4004-8A
Alarm module Ex (PTB) ¹⁾ Alarm module Ex (FM) ²⁾	6DR4004-6A 6DR4004-7A
J _y -module non Ex	6DR4004-8J
J _y -module Ex (PTB) ¹⁾ J _y -module Ex (FM) ²⁾	6DR4004-6J 6DR4004-7J

¹⁾ EC-type examination certificate of the PTB (see appendix 3)

²⁾ Approval Report of Factory Mutual System (see appendix 3)

7.3 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 rotary 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
HART-modem	7MF4997-1DA
Operating software SIMATIC PDM	on request

Appendix

A

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A2 Literature and Catalog

No.	Title	Issued by	Order Number
/1/	SIMATIC NET Industrial Communication and Field Devices Catalog IK PI	Siemens AG	E86060-K6710-A101-A9-7600
/2/	SIMATIC SIMATIC PCS 7 Process Control System Catalog ST PCS 7	Siemens AG	E86060-K4678-A111-A3-7600

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A3 Conformity

EC Type Examination Certificate

- to follow -

Conformity Statement

- to follow -

FM Certificate

- to follow -

EC Declaration of Conformity

SIEMENS

**EG-Konformitätserklärung
EC Declaration of Conformity**

No. 1076.00 – 08/00

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Hersteller: Siemens AG.....
 Manufacturer:
 Anschrift: Östliche Rheinbrückenstr. 50; 76187 Karlsruhe
 Address: Bundesrepublik Deutschland
 Produkt- bezeichnung: SIPART PS2
 Product description: 6DR50xx-x&xxx
 6DR51xx-x&xxx HART - Version
 mit & = N,E.....

Das bezeichnete Produkt stimmt in der von uns in Verkehr gebrachten Ausführung mit den Vorschriften folgender Europäischer Richtlinien überein:

The product described above in the form as delivered is in conformity with the provisions of the following European Directives:

89/336/EWG Richtlinie des Rates zur Angleichung der Rechtsvorschriften der Mitgliedstaaten über die elektromagnetische Verträglichkeit (geändert durch 91/263/EWG, 92/31/EWG, 93/68/EWG und 93/97/EWG).

Council Directive on the approximation of the laws of the Member States relating to electromagnetic compatibility (amended by 91/263/EEC, 92/31/EEC, 93/68/EEC and 93/97/EEC)

CE-Kennzeichnung / CE marking : 08/00

Die Konformität mit den Richtlinien wird nachgewiesen durch die Einhaltung folgender Normen:
 Conformity to the Directives is assured through the application of the following standards:

Referenznummer Reference number	Ausgabedatum Edition	Referenznummer Reference number	Ausgabedatum Edition
EN 50081-1	März `93
EN 50082-2	März `95

Karlsruhe....., den / the 02.08.00.....

Siemens AG

GERHARDT
 Entwicklung, Kumpfmüller.....
 Name, Funktion
 Name, function
 Unterschrift
 signature

Fertigung, van Dycke.....
 Name, Funktion
 Name, function
 Unterschrift
 signature

Diese Erklärung bescheinigt die Übereinstimmung mit den genannten Richtlinien, ist jedoch keine Zusicherung von Eigenschaften.
 Die Sicherheitshinweise der mitgelieferten Produktdokumentation sind zu beachten.
This declaration certifies the conformity to the specified directives but contains no assurance of properties. The safety documentation accompanying the product shall be considered in detail.



1P A5E00074631



Q1

Siemens AG
Bereich Prozessinstrumentierung und -analytik
Geschäftsgebiet A&D PI
D-76181 Karlsruhe

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