

Manual Edition 07/2003



sipart ps2

Elektropneumatic Positioner for
Linear and Rotary Actuators
6DR50xx/6DR51xx/6DR52xx/6DR53xx

SIEMENS

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SIPART PS2

6DR50xx

6DR51xx

6DR52xx

6DR53xx

Edition 07/2003

Manual

Electropneumatic Positioner for
Linear and Rotary Actuators

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

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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 119.

0.1 General information

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

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

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

The documentation supplied with the instrument is listed in Chapter 0.5.

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

Functionality, commissioning and operation are described in this manual.

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

0.2 Classification of Safety Related Notices

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



DANGER

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



WARNING

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



CAUTION

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

CAUTION

used without the safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in property damage.

NOTICE

indicates a potential situation which, if not avoided, may result in an undesirable result or state.



NOTE

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

0.3 Qualified Personnel

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

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

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



WARNING

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

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

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

Electrical safety depends only on the power supply equipment.

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

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

The specifications of the examination certificate valid in your country must be observed. Laws and regulations valid in your country must be observed for the electrical installation in explosions hazardous areas.

In Germany these are for example:

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

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

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

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



WARNING

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

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

0.4 Use as intended

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

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

0.5 Technical Documentation

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/Italien/Spanish	A5E00074601
Manual	German	A5E00074630
	English	A5E00074631
Leaflet	German	A5E00074610
	English	A5E00074611
	French	A5E00074612
	Italien	A5E00074613
	Spanish	A5E00074614

The following list contains all the documents available for explosion-proof version:

Title	Language	Order no.
Operating instructions	German/English	A5E00165376
	French/Italian/Spanish	A5E00165377
Leaflet	German	A5E00165371
	English	A5E00165372
	French	A5E00165373
	Italien	A5E00165374
	Spanish	A5E00165375

This document is also available in electronic form on the Internet under the address www.fielddevices.com.

0.6 Warranty Information

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

0.7 Delivery Notes

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

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

For the scope of delivery please see Chapter 7, page 119.

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 113).

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: <ul style="list-style-type: none">• 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	<ul style="list-style-type: none">• Manometer block: 2 or 3 manometers for single and double-acting positioners• Connection block (NAMUR) for safety valve block• Mounting kits for linear and rotary actuator For decentralized installation of the positioner and position sensor: <ul style="list-style-type: none">• External position detection system• Non-Contacting Position Sensor (NCS)
Environmental Protection	Only environmentally friendly materials have been used in the construction of the positioner. The technical manual is printed on chlorine-free bleached paper.

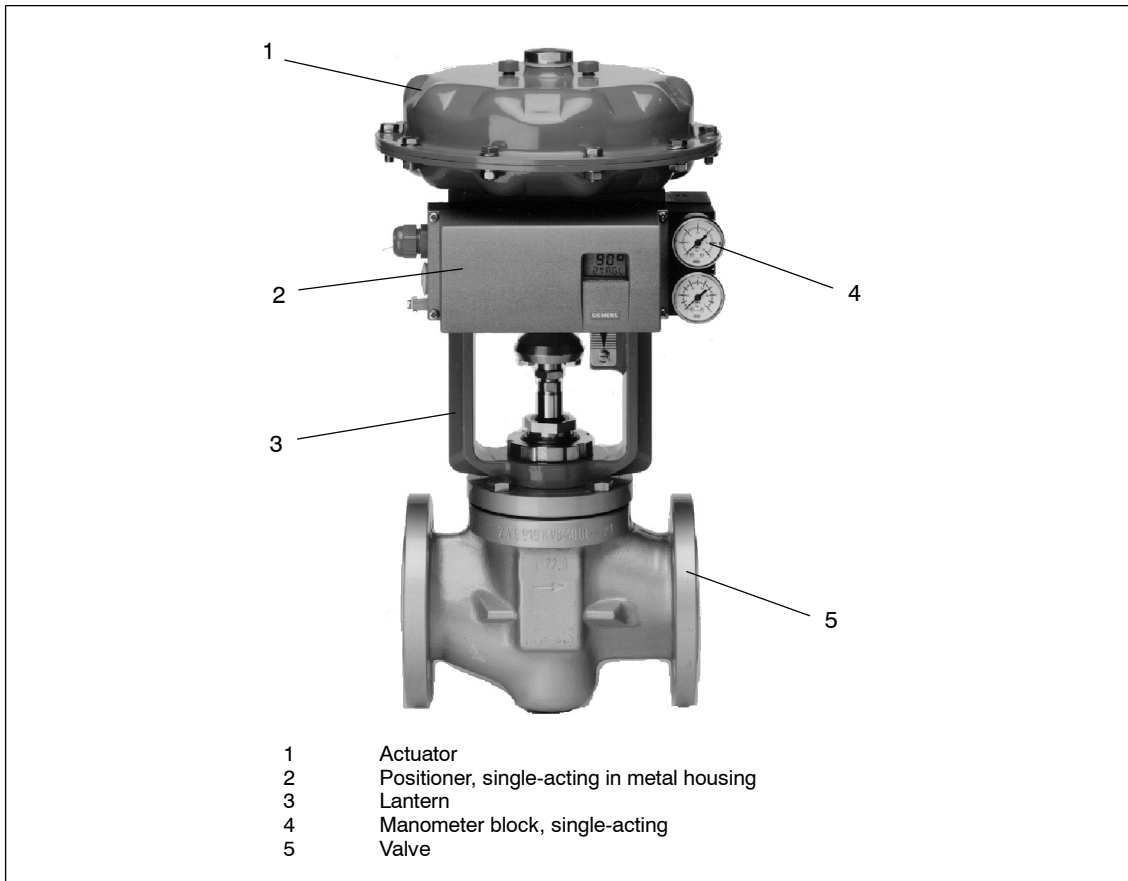


Figure 1-1 Positioner mounted on **linear actuator** (single-acting)

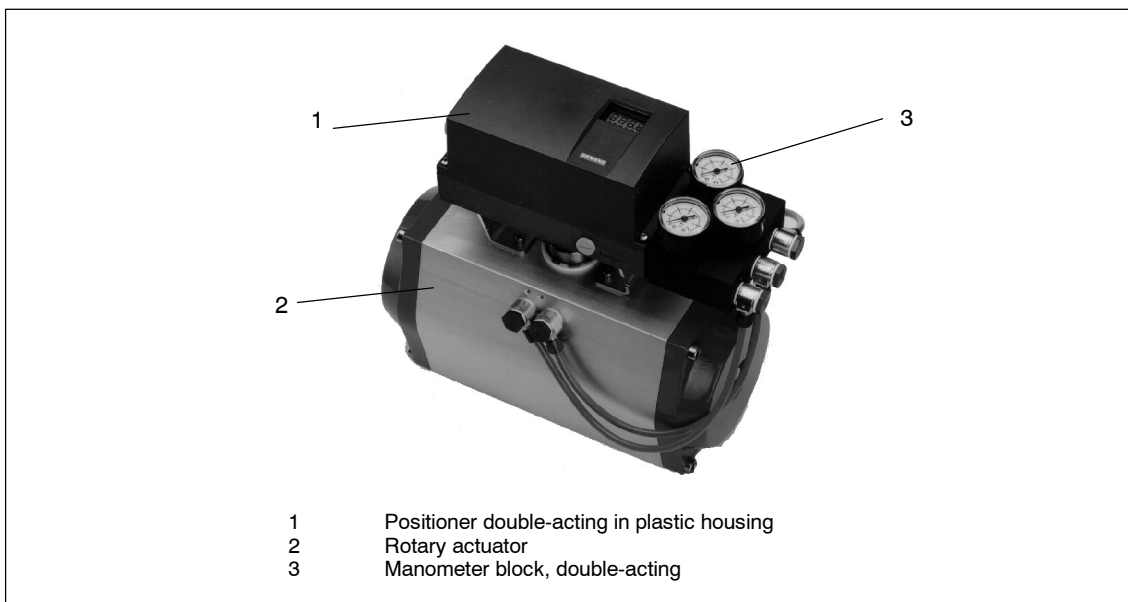


Figure 1-2 Positioner mounted on **rotary actuator** (double-acting)

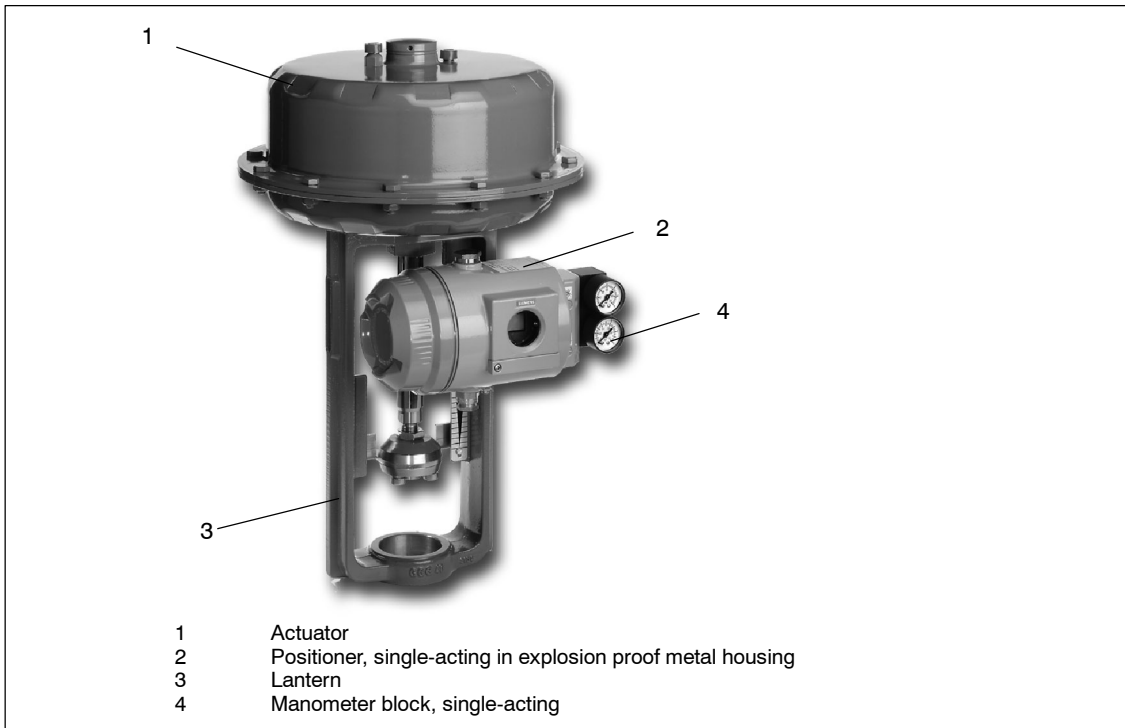


Figure 1-3 **Explosion proof** positioner mounted on **linear actuator** (single-acting)

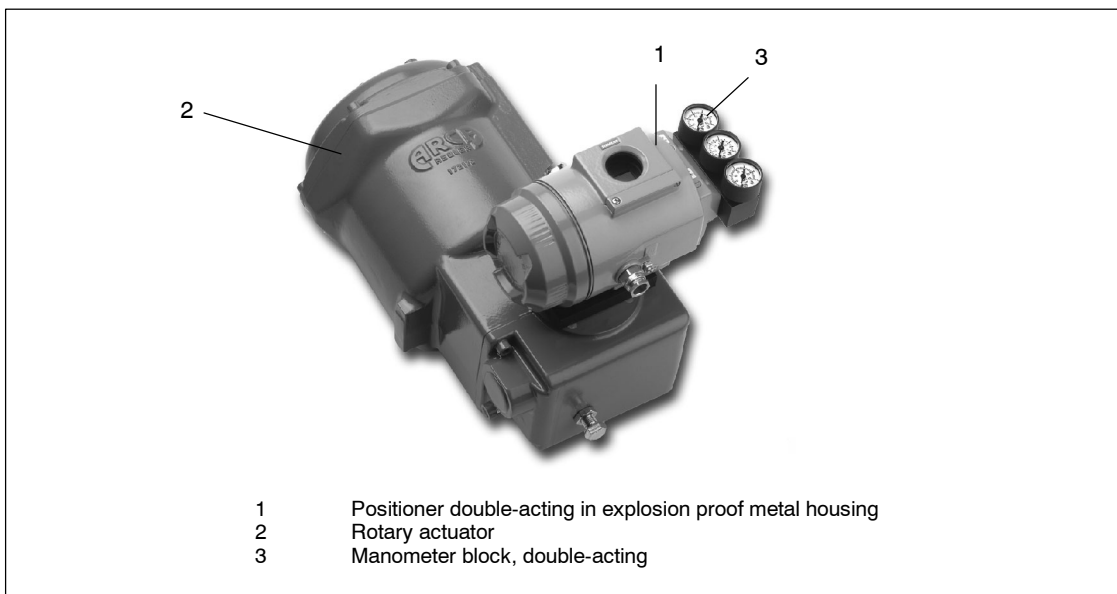


Figure 1-4 **Explosion proof** positioner mounted on **rotary actuator** (double-acting)

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

2.1 Overview

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 predictive five-point switch by the output variable $\pm\Delta y$ of which the integrated actuating valves are controlled with pulse length modulation.

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

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

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

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

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

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

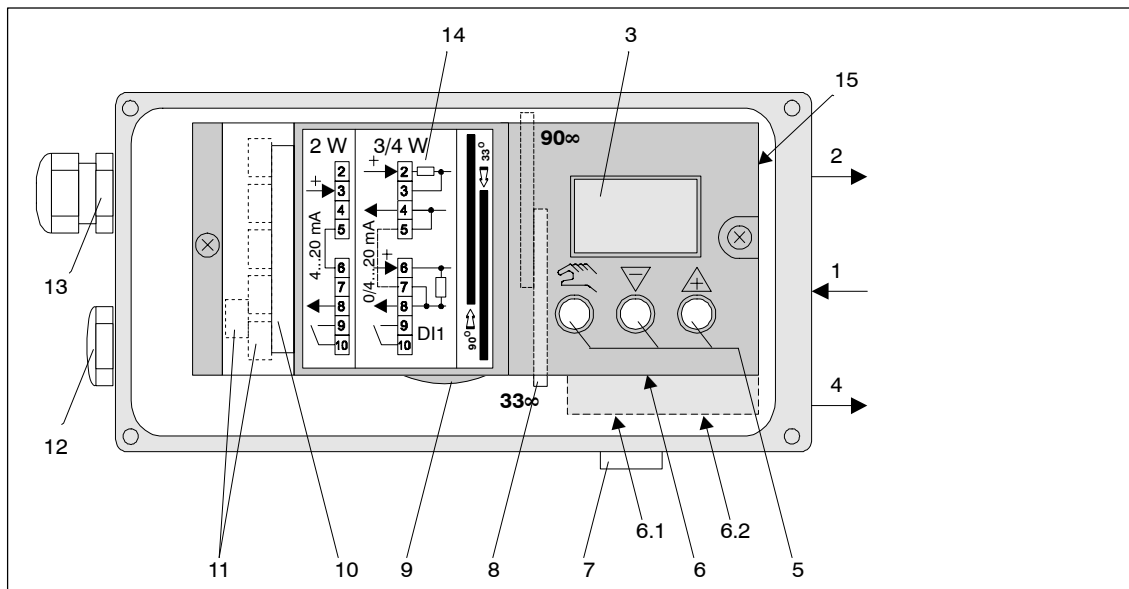
puts respond even when the power supply fails or the electronics are defective.

The actuator can also be blocked or driven to its final positions 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.

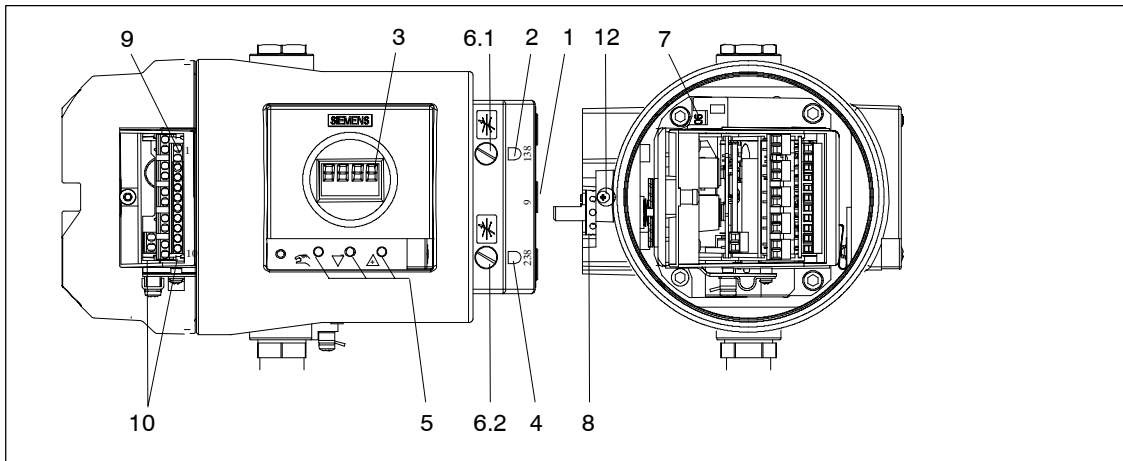
2.2 Instrument Components



- | | | | |
|-----|----------------------------------|----|-----------------------------|
| 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.

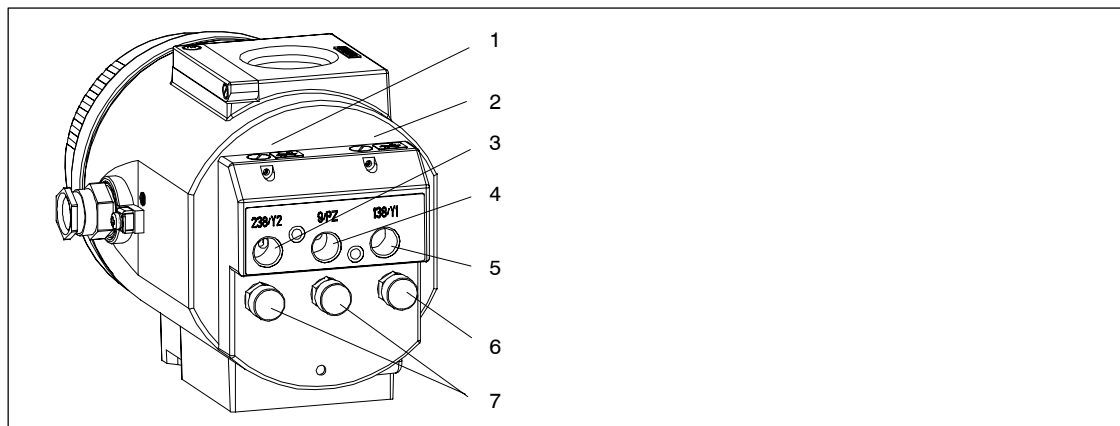
2.2.3 Pneumatic Connections

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

*) in double-acting actuators

Figure 2-4 Pneumatic connection in explosion proof version

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

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

In the ex-factory state, these connections are sealed by screws (see figure 3-1, page 35, figure 3-3, page 36 and figure 3-4, page 37).

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

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

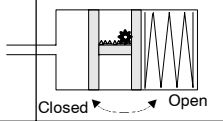


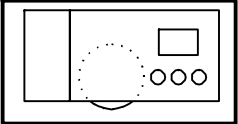
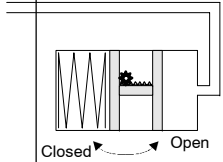


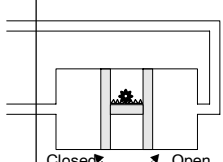

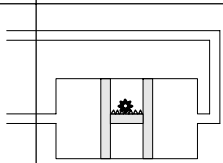


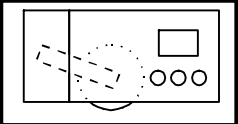
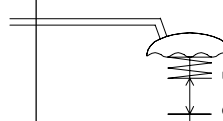
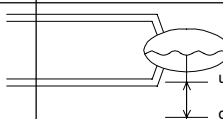
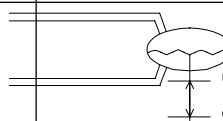
Positioning pressure Connection	Actuator type	Safety position after power failure		
		electrical	pneumatic	
Y1		Closed 	Closed 	<p>In rotary actuators the direction of rotation counterclockwise looking onto the actuating shaft of the valve is usually defined as "Open".</p>  <p>Closed Open</p>
Y1		Open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

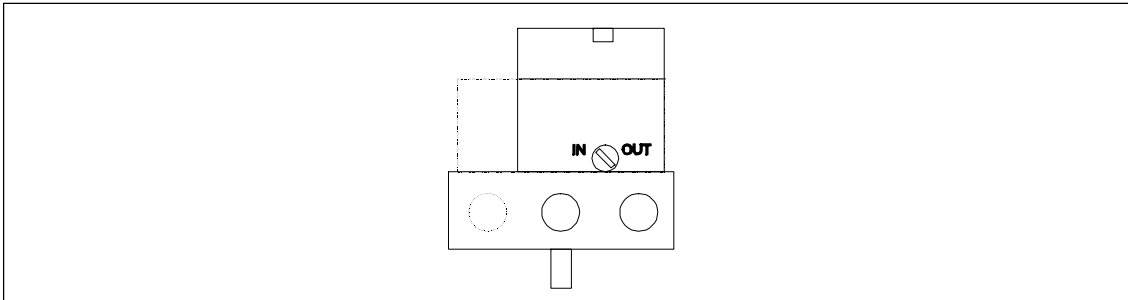


Figure 2-6 Purge air switch on the valve block, view of the positioner onto pneumatic connection side with cover open

2.2.6 Restrictors

In order to achieve travel times of > 1.5 s in small actuators, the air rate can be reduced with the restrictors Y1 and Y2 (figure 2-7, in explosion proof version, see figure 2-4, page 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).

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

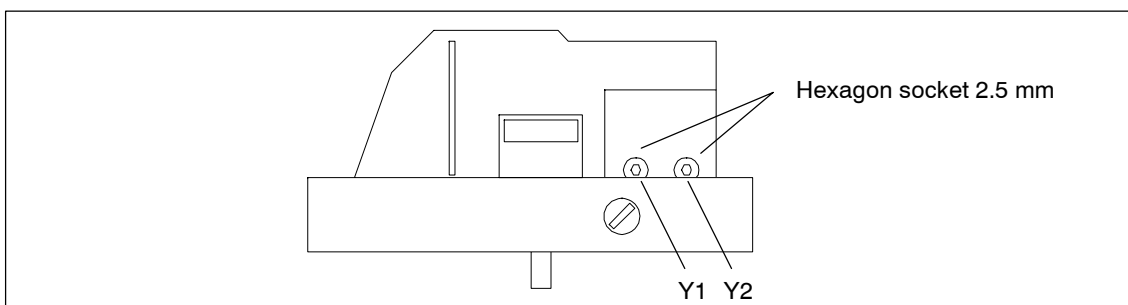


Figure 2-7 Restrictors

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

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

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

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

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

Figure 2-9, page 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.

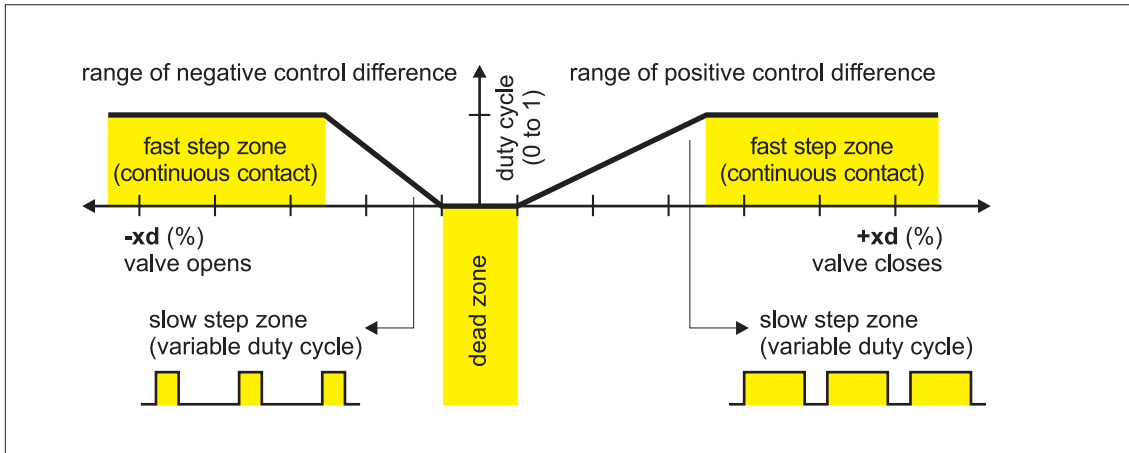
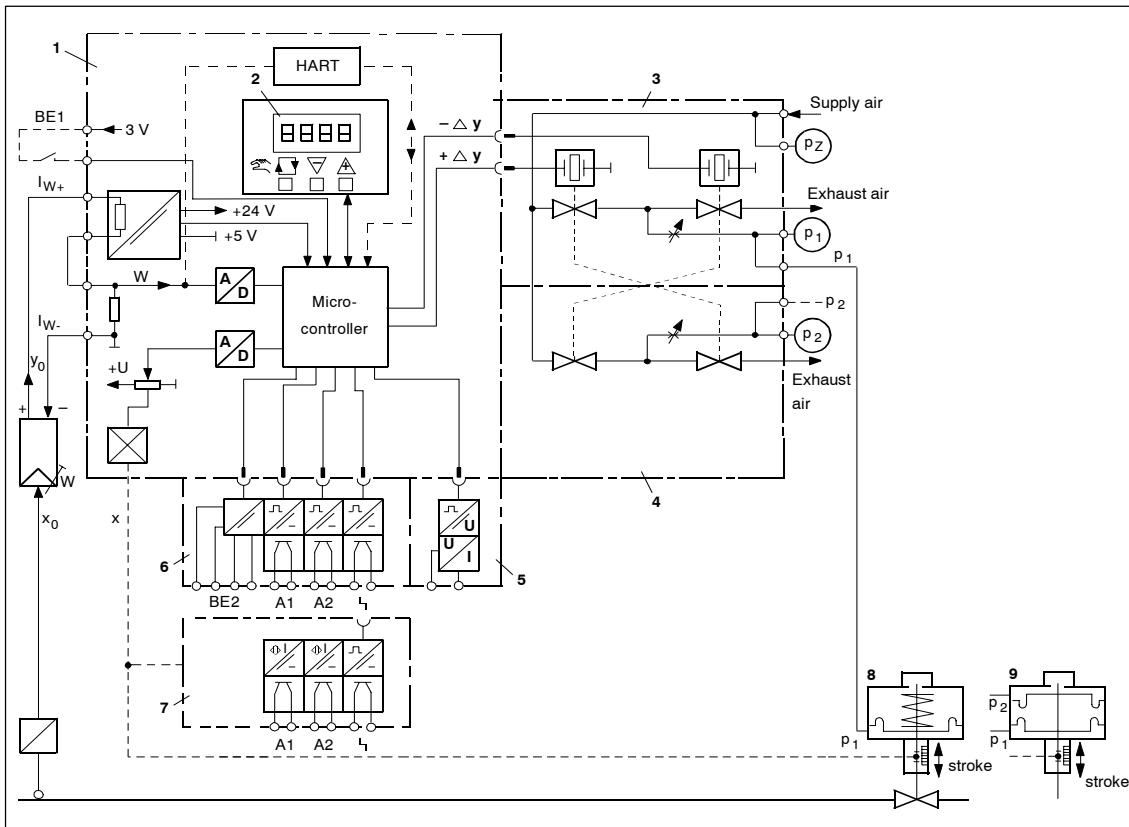


Figure 2-8 Method of operation five-point switch



- 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-acting positioner always built-in
- 5 Iy-module for positioner SIPART PS2
- 6 Alarm module for three alarm outputs and one digital input
- 7 SIA-module (Slot Initiator-Alarm-module)
- 8 Spring-loaded pneumatic actuator (single-acting)
- 9 Spring-loaded pneumatic actuator (double-acting)

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-acting versions are prepared at the factory as ordered.

The pneumatic connections on the rear are sealed.

2.5 Options modules

2.5.1 Options modules in normal and intrinsically safe versions

The options modules are protected and mechanically fixed by a module cover ((1), see figure 2-10, page 28 and figure 2-11, page 30).



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 (**Torque: 2 Nm**):

CAUTION

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

7. Place the insulating cover (10) over the SIA module underneath the surface of the basic electronics board at the container wall on one side. The recesses in the insulating cover must slot into the corresponding lugs on the container wall. Place the insulating cover on the SIA module by carefully bending the container walls.
8. Snap the basic electronics board into the four holders and screw it tight again with the two fixing screws (2.1).
9. Make all the electrical connections between the motherboard and the options with the ribbon cables provided and between the motherboard and potentiometers with the potentiometer cable.
10. Fix the enclosed module cover instead of the standard version with the two screws.
11. Select the plates which already exist on the standard version of the module cover from the set of plates enclosed. Stick the selected plates according to the standard version to the mounted module cover.
12. Make the electrical connections.

Setting the two limit values:



NOTE

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

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

15. Drive the actuator to the second desired mechanical position.
16. Adjust the bottom actuating disc (7.3) by hand until the output signal on terminals 51 and 52 changes.



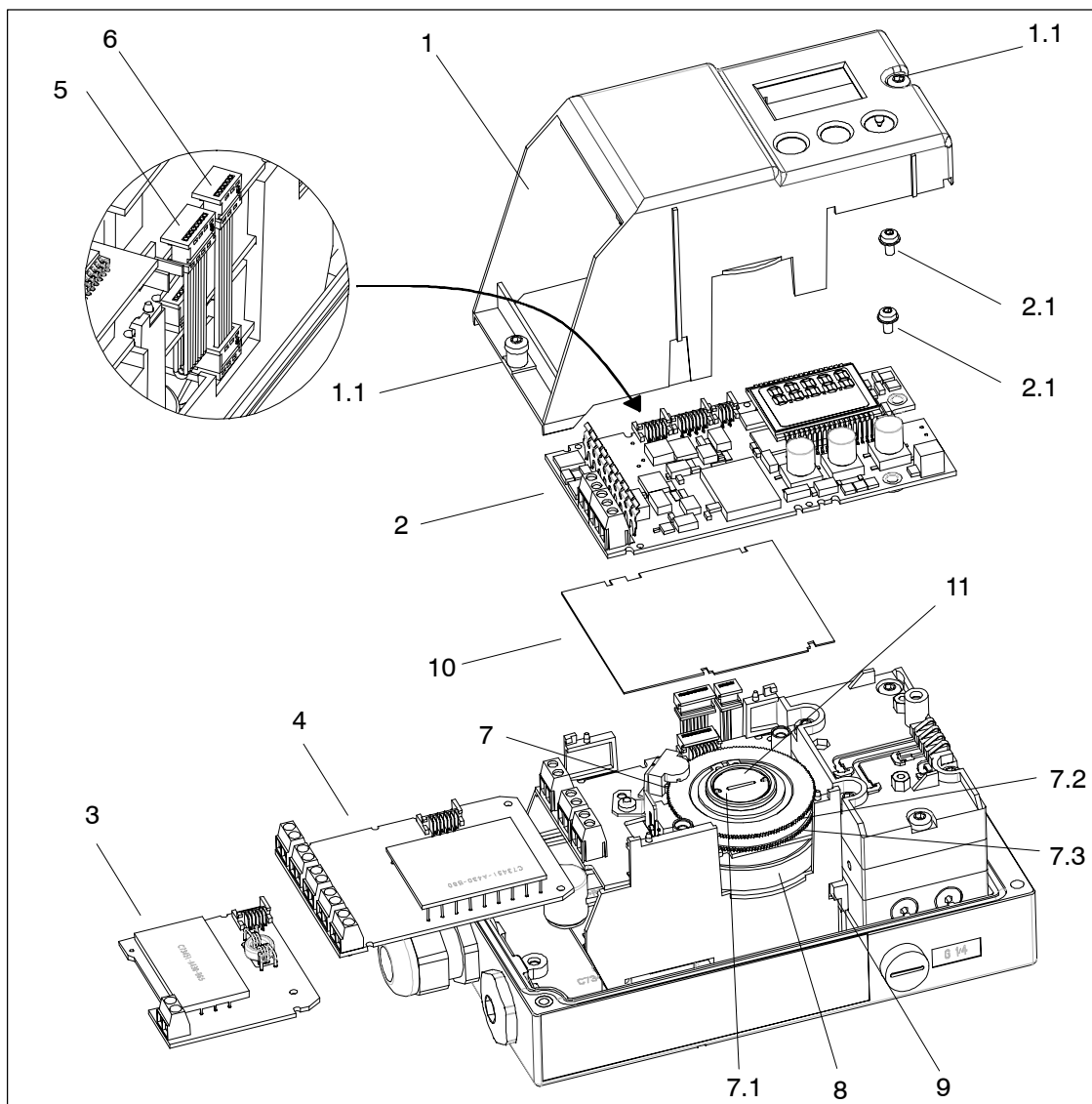
NOTE

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

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

**EMC filter module
for connection of
external position
sensor**

The positioner can also be driven by an external position sensor (potentiometer or NCS) (see page 40). An EMC filter module, order number C73451-A430-D23, is required for this.



- | | | | |
|-----|--|-----|---|
| 1 | Module cover | 7 | SIA-module |
| 1.1 | Fixing screws | 7.1 | Special screw |
| 2 | Motherboard | 7.2 | Actuating disc for A1 (terminals 41 and 42) |
| 2.1 | Fixing screws | 7.3 | Actuating disc for A2 (terminals 51 and 52) |
| 3 | J _y -module with ribbon cable (6) | 8 | Adjusting wheel slip clutch |
| 4 | Alarm module with ribbon cable (5) | 9 | Transmission ratio selector |
| 5 | Ribbon cable for alarm module | 10 | Insulating cover |
| 6 | Ribbon cable for J _y -module | 11 | Actuating disc bearings |

Figure 2-10 Installation of Options Modules

2.5.2 Options modules in explosion proof version

The options modules are protected and mechanically fixed by a module cover ((1), see figure 2-11, page 30).



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.

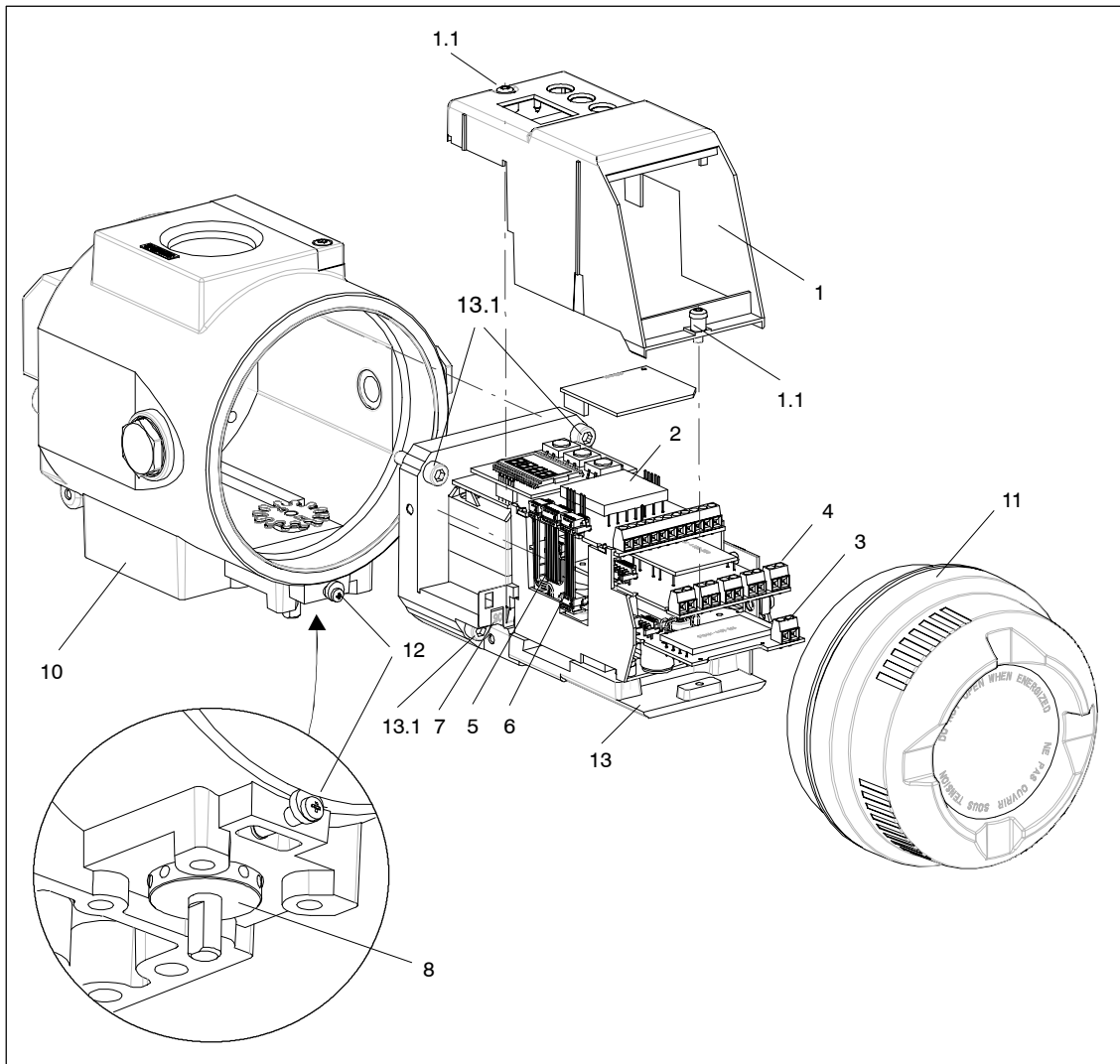
Remove the module cover (1). To do this, the two screws (1.1) must be removed with a screwdriver.



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 85, 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 85, 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 28).

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.

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 28).

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

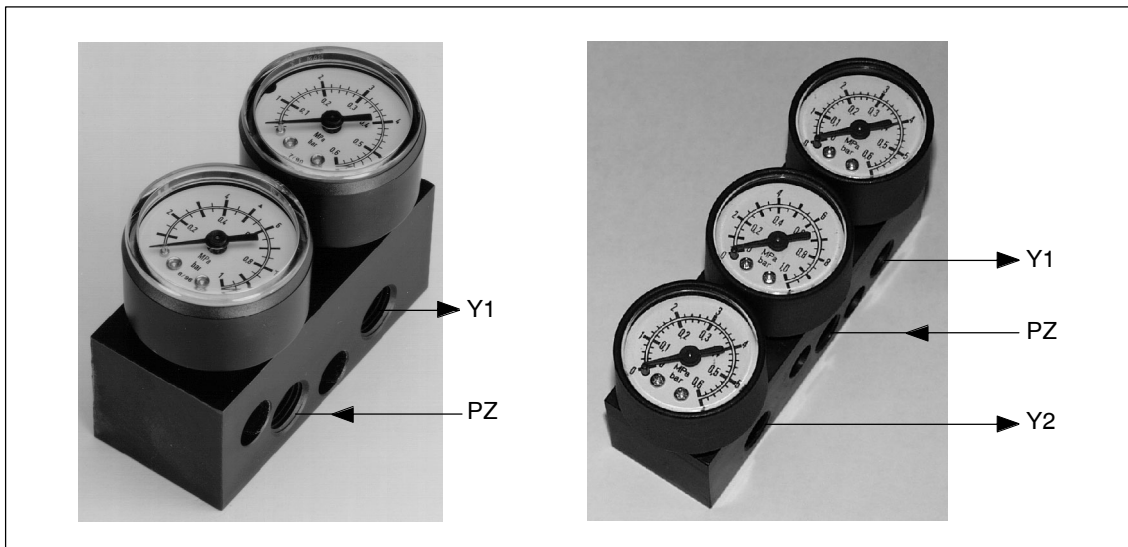


Figure 2-12 Manometer block (left for single-acting, right for double-acting actuators)

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.

3.1 Instrument identification (type key)

The order number of the positioner is printed on the rating plate and on the packaging. Compare this with the order number in chapter 7.2, page 121.

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

3.2 Dimensional drawings

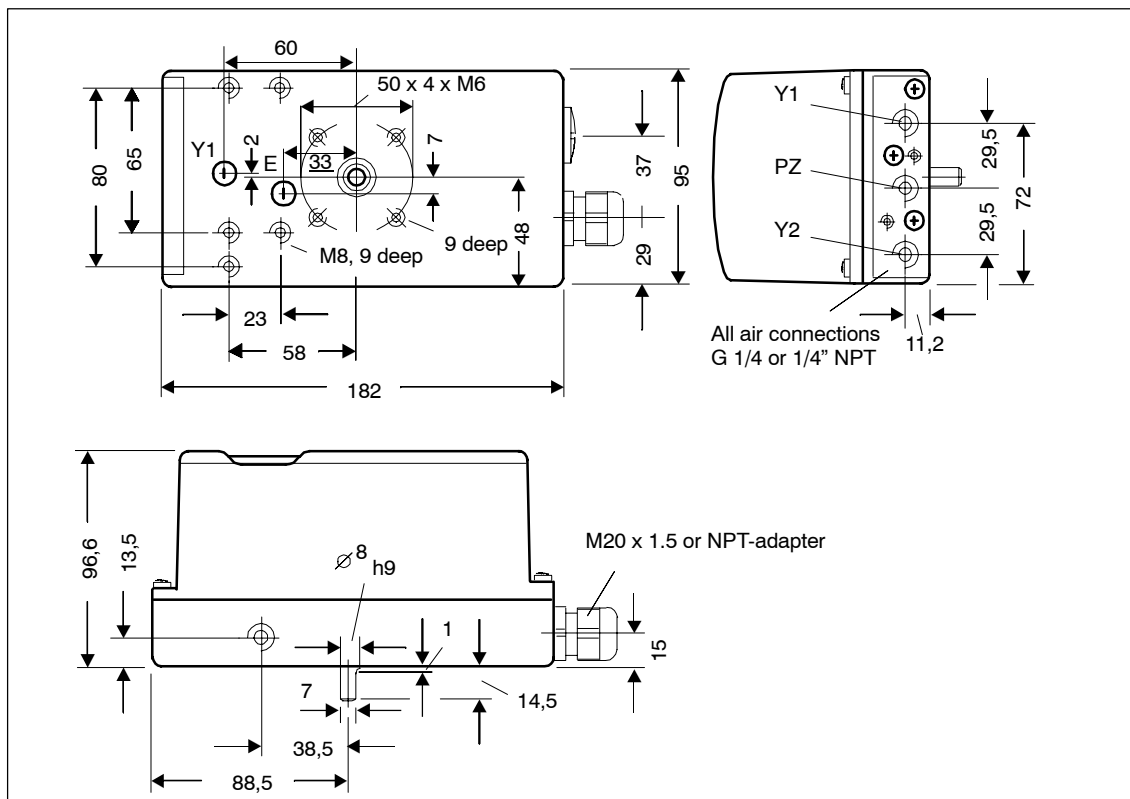


Figure 3-1 Dimensional drawing version plastic housing 6DR5xx0

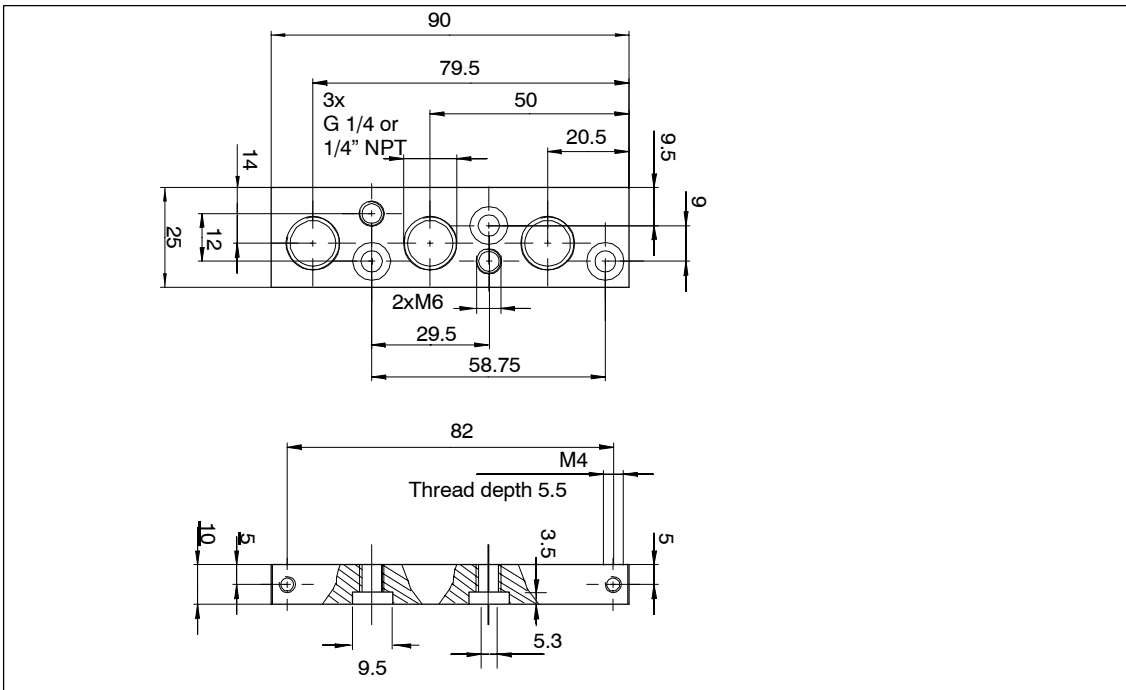


Figure 3-2 Dimensional drawing terminal strip for plastic housing

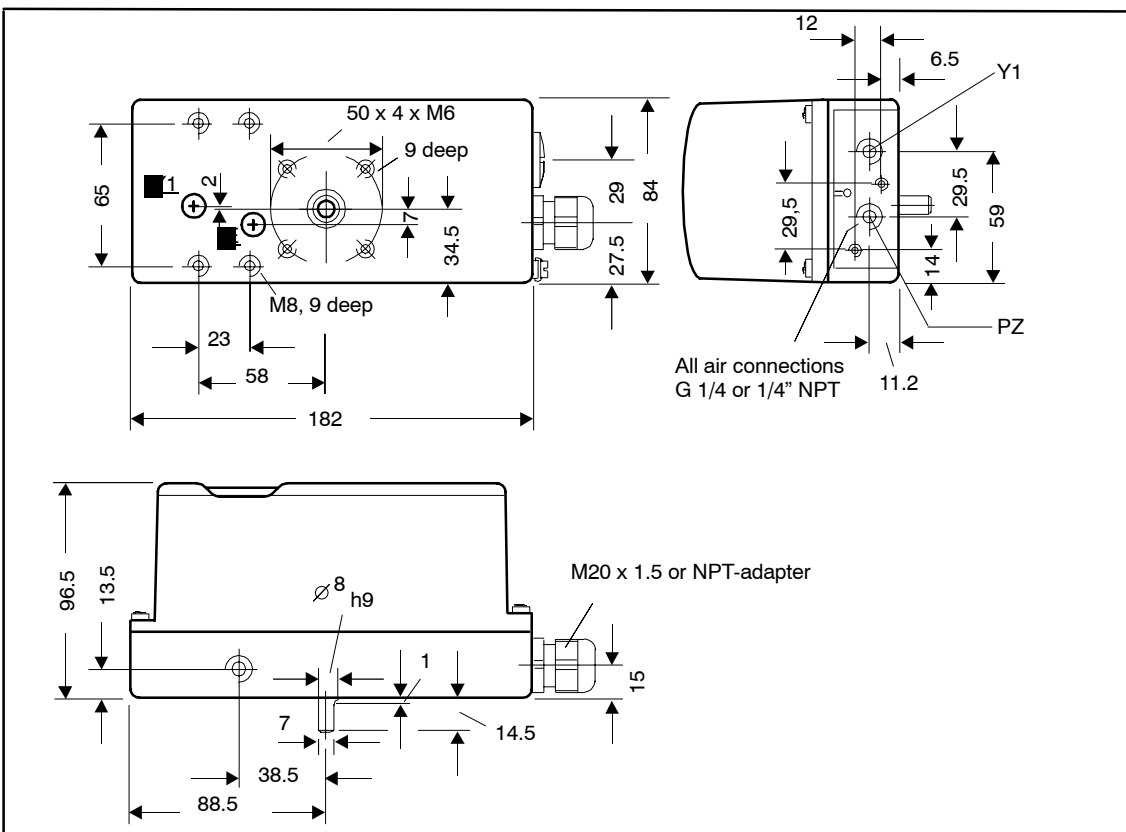


Figure 3-3 Dimensional drawing version metal housing 6DR5xx1

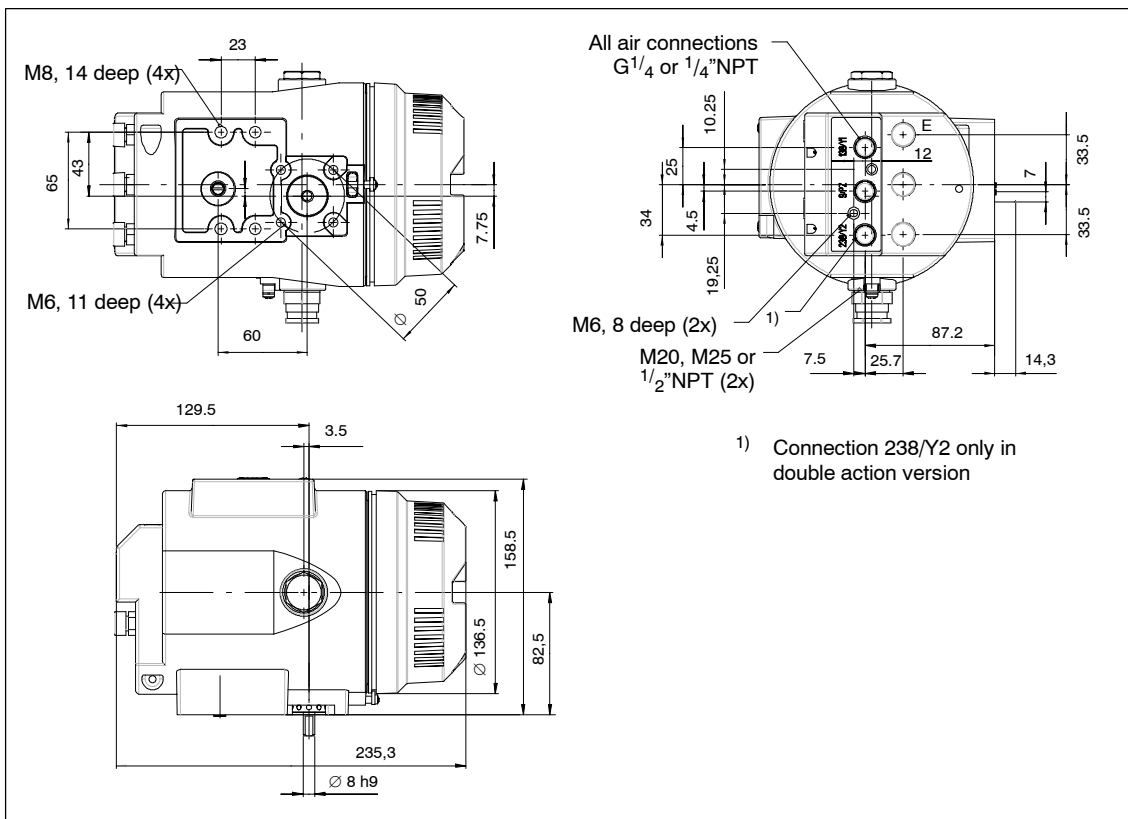


Figure 3-4 Dimensional drawing for positioner with metal housing in explosion proof version 6DR5x5

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. 50
3. Connection of pneumatic power supply see chapter 3.5, p. 62
4. Put into operation see chapter 3.6, p. 63

Please also observe the warning on page 51!



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.

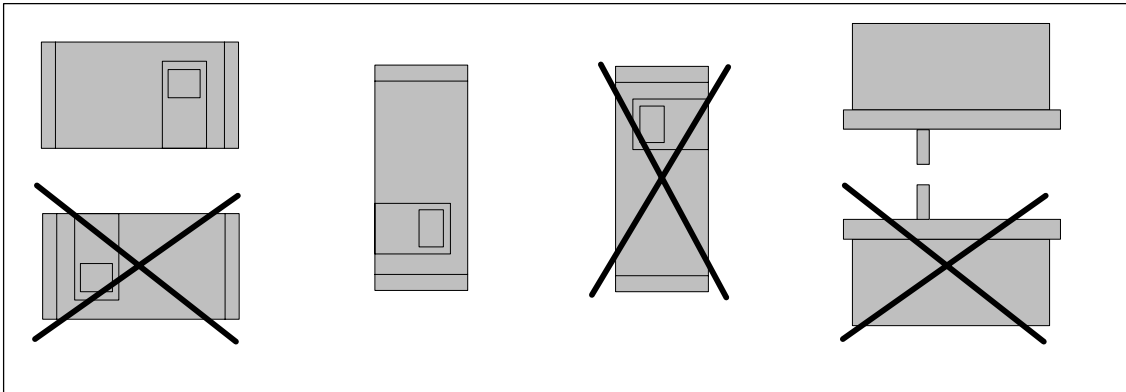


Figure 3-5 Favorable and unfavorable installation positions

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



NOTE

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

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

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

Procedure

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

Assembly of the screw-type gland with plastic hose

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

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

Fittings under heavy mechanical stresses such as from breakaway flaps, violently shaking or vibrating valves, or steam jets can be exposed to strong acceleration forces far above those specified. This can result, in extreme cases, to a shifting of the friction clutch.

For such cases the position controller equipped with a fixing device for the slip clutch with which adjustment due to the above mentioned influences can be prevented. The setting possibility is accessible below the black knurled wheel and is recognizable from slots on the yellow wheel. The zero point adjustment and the setting possibility of the slip clutch are identified by symbols on an additional plate (see figure 3-6, page 41).

Procedure

After you have mounted the position controller and commissioned it completely, you can set the slip clutch torque as follows:

- Plug a conventional 4 mm wide screwdriver into a slot in the yellow wheel.
- Then turn the yellow wheel to the left with the screwdriver until it snaps in audibly. This increases the torque of the slip clutch.
- A fixed slip clutch is recognizable from an approx. 1 mm wide gap between the yellow and black wheel.
- If you have to make a zero point setting, e.g. after changing the drive, please reduce the torque first by turning the yellow wheel to the right stop. After the zero point setting, you can fix the slip clutch as described above.

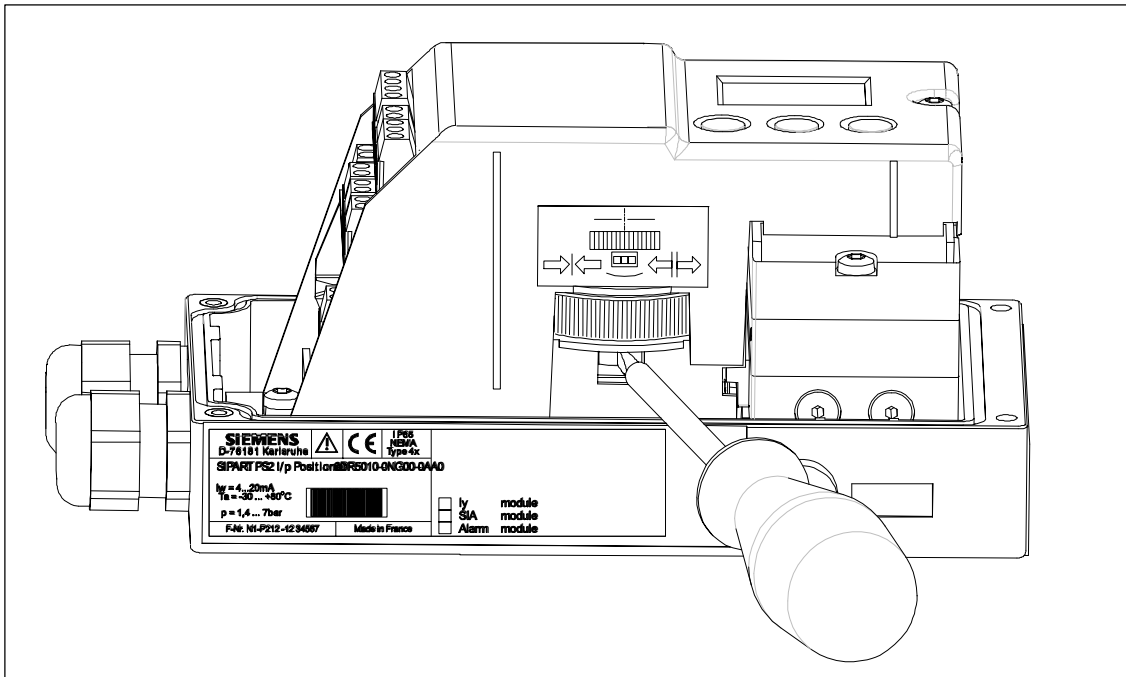


Figure 3-6 Fixing device for the slip clutch

External external travel detection

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

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

You require the following:

- The external position detection system (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.
- or a Non-Contacting Position Sensor (e.g. 6DR4004-6N)
- The controller unit, any positioner version.
- The EMC filter module, this is a set together with cable clips and M-20 screw-type cable gland and has the order number C73451-A430-D23. The EMC filter module must be installed in the positioner. The installation instructions enclosed with the EMC filter module explain how to assemble the components.
- A 3-wire cable for connecting the components.

This EMC filter module should always be used for the controller unit when any actuator-mounted potentiometer (resistance 10 kohms) is to be used instead of the external position detection system C73451-A430-D78.

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

The scope of delivery of the mounting kit" linear actuator IEC 534 (3 mm to 35 mm)" are contained (ser. no. see figure 3-7, page 44):

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)
6	1	Lever NAMUR	For stroke range 3 mm to 35 mm For stroke ranges > 35 mm to 130 mm (special delivery), lever 6DR4004-8L is required additionally
7	2	U bolt	Only for actuators with columns
8	4	Hexagon head screw	M8 x 20 DIN 933-A2
9	2	Hexagon head screw	M8 x 16 DIN 933-A2
10	6	Lock washer	A8 - DIN 127-A2
11	6	Flat washer	B 8,4 - DIN 125-A2
12	2	Flat washer	B 6,4 - DIN 125-A2
14	1	Spring washer	A6 - DIN 137A-A2
15	1	Lock washer	3.2 - DIN 6799-A2
16	3	Spring washer	A6 - DIN 127-A2
17	3	Socket cap screw	M6 x 25 DIN 7984-A2
18	1	Hexagon nut	M6 - DIN 934-A4
19	1	Square nut	M6 - DIN 557-A4
21	4	Hexagon nut	M8 - DIN 934-A4

Table 3-1 Scope of delivery of the mounting kit "linear actuator"

3.3.4 Assembly procedure (see figure 3-7, page 44)

1. Mount clamping assembly (3) with hexagon socket cap screws (17) and lock washer (16) on the actuator spindle.
2. Insert the pick-up bracket (2) into the recesses of the clamping assembly. Set the necessary length and tighten the screws so that the pick-up bracket can still be shifted.
3. Insert the pin in the lever (6) and assemble with nut (18), spring washer (14) and washer (12).
4. The value of the stroke range specified on the actuator or if this does not exist as a scaling value, the next greatest scaling value is set. The center of the pin must be in line with the scaling value. The same value can be set later under parameter 3.YWAY in commissioning to display the way in mm after initialization.
5. Assemble the hexagon socket cap screw (17), spring washer (16), washer (12) and square nut (19) on the lever.
6. Push the premounted lever onto the positioner axis up to the stop and fix with the hexagon socket cap screw (17).
7. Fit the mounting bracket (1) with two hexagon head screws (9), lock washer (10) and flat washer (11) on the rear of the positioner.
8. Selection of the row of holes depends on the width of the actuator yoke. The roll (5) should engage in the pick-up bracket (2) as close as possible to the spindle but may not touch the clamping assembly.
9. Hold the positioner with the mounting bracket on the actuator so that the pin (4) is guided within the pick-up bracket (2).
10. Tighten the pick-up bracket.
11. Position the mounting parts according to the type of actuator.
 - Actuator with ledge: Hexagon head screw (8), flat washer (11) and lock washer (10).
 - Actuator with plane surface: Four hexagon head screws (8), flat washer (11) and lock washer (10).
 - Actuator with columns: Two U bolts (7), four hexagon nuts (21) with flat washer (11) and lock washer (10).
12. Secure positioner onto the yoke using the previously positioned mounting parts.



NOTE

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

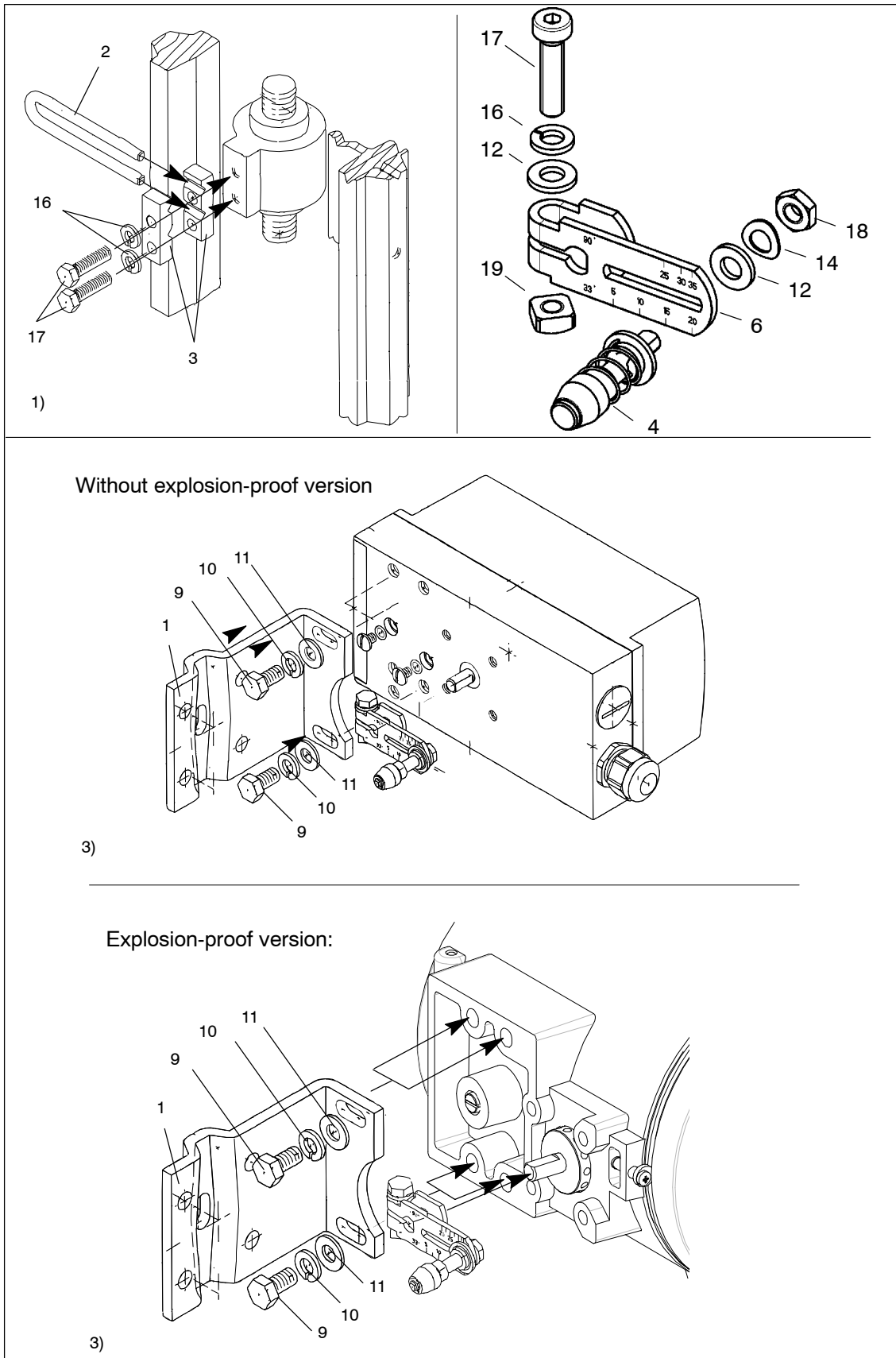


Figure 3-7 Assembly procedure (linear actuator)

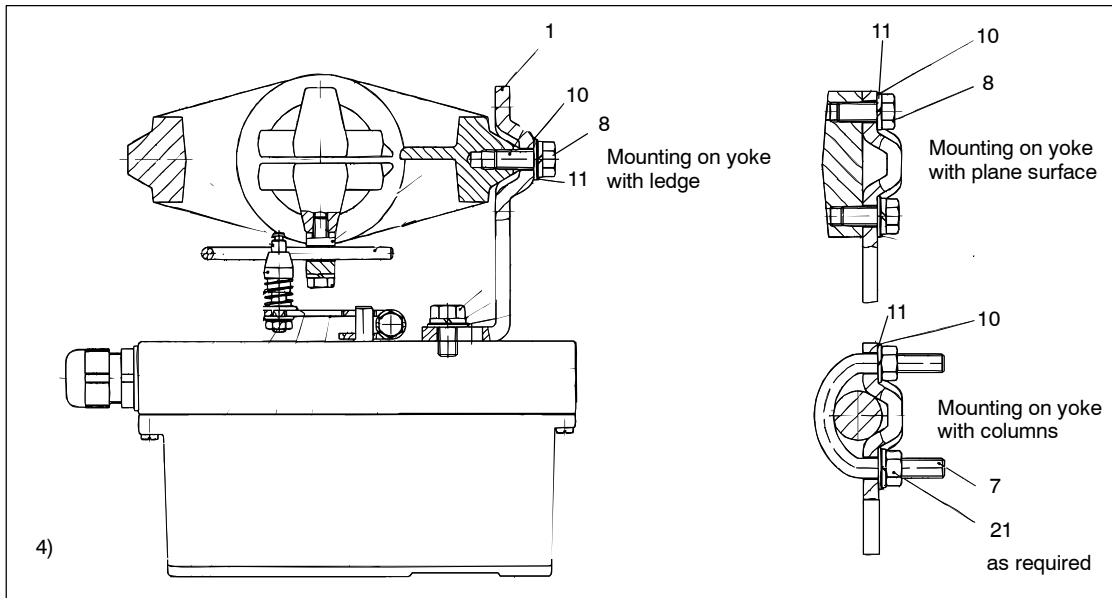


Figure 3-7 Assembly procedure (linear actuator) *continued*

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

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

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

Table 3-2 Scope of delivery of the mounting kit "rotary actuator"

3.3.6 Assembly procedure (see figure 3-8 and figure 3-9)

1. Attach VDI/VDE 3845 mounting console ((9), actuator-specific, scope of delivery actuator manufacturer) onto rear of positioner and secure using hexagon head screws (14) and lock washers (15).
2. Adhere pointer (4.2) onto mounting console in the center of the centering hole.
3. Push the coupling wheel (2) onto positioner axis, pull back by about 1 mm and tighten the hexagon socket head screw (18) with the Allen key provided.
4. Place the carrier (3) onto the end of the actuator and secure using Fillister head screw (16) and washer (17).
5. Carefully place positioner with mounting console onto the actuator such that the pin of the coupling wheel engages in the 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 63: 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!*

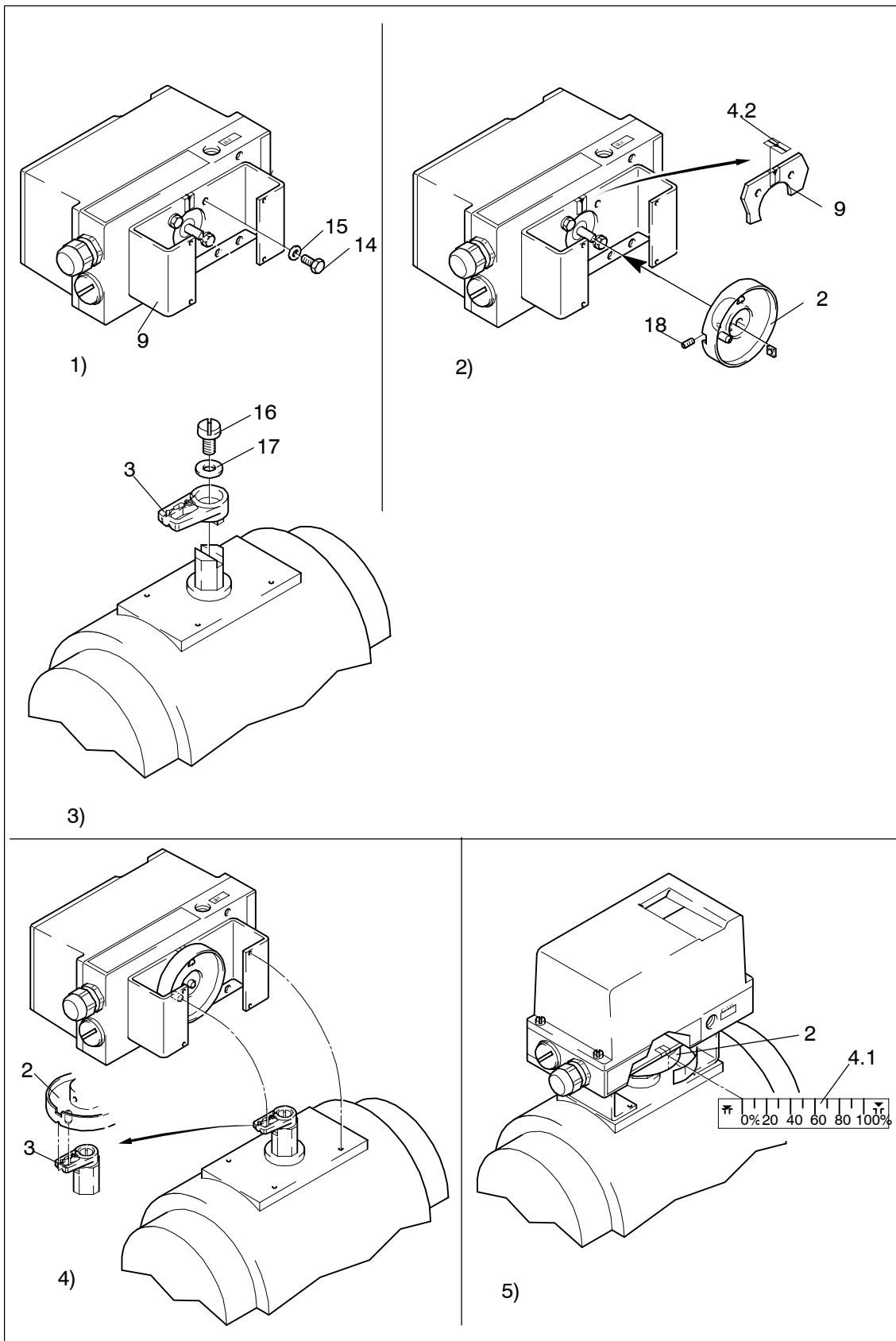


Figure 3-8 Assembly procedure (rotary actuator)

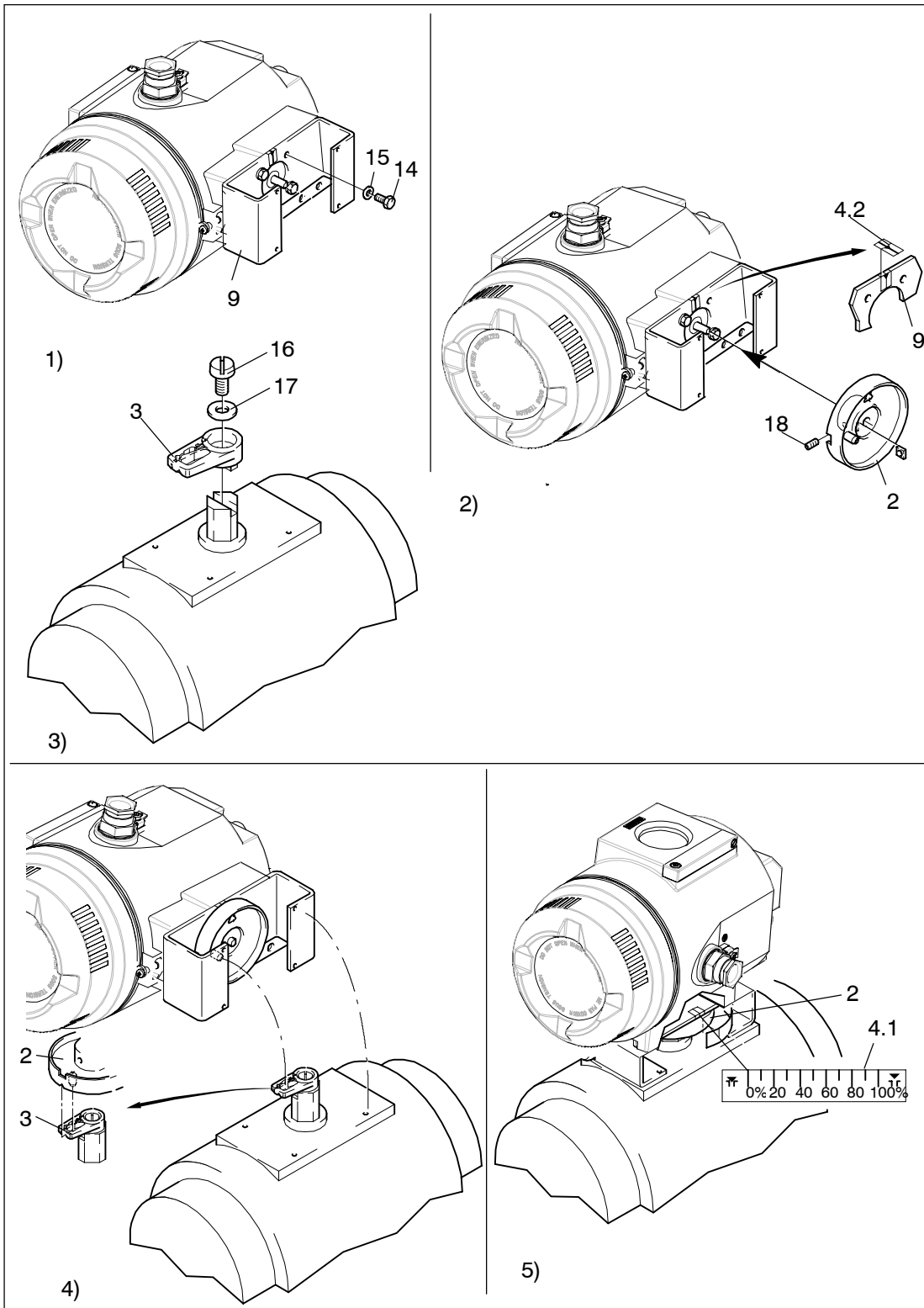
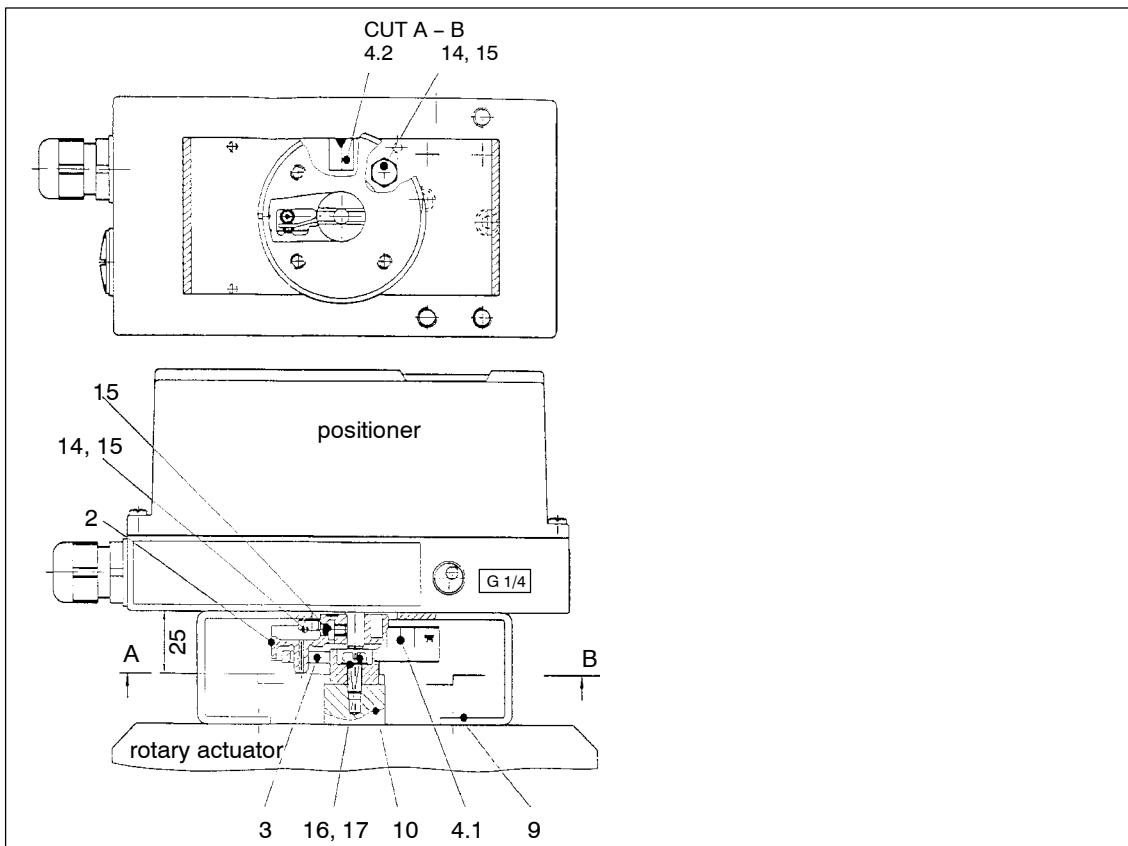


Figure 3-9 Assembly procedure for **explosion proof version** (rotary actuator)



- | | | | |
|-----|-------------------------------|----|------------------------------|
| 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 3-10 Mounted positioner for rotary actuator

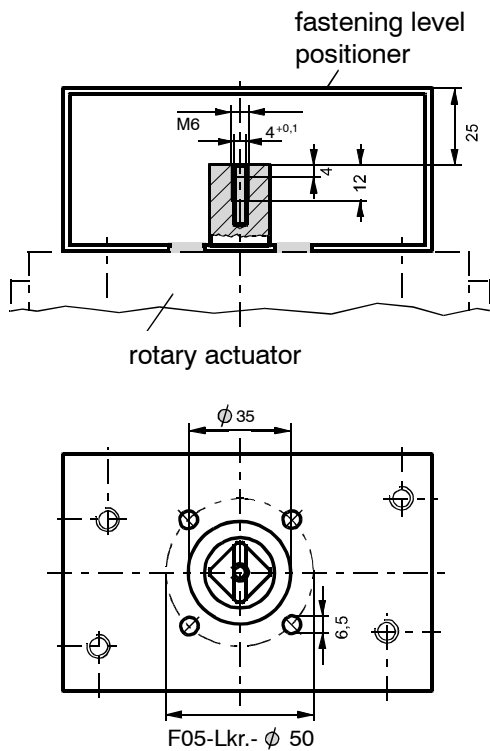


Figure 3-11 Attachment of rotary actuator, mounting console (scope of delivery actuator manufacturer), dimensions

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 closing the controller.



WARNING

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

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



WARNING

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

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

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

The plastic housing is metal lined to increase the electromagnetic compatibility (EMC) against high frequency radiation. This screen is connected electrically to the threaded bushes shown in figure 3-12, page 51.

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

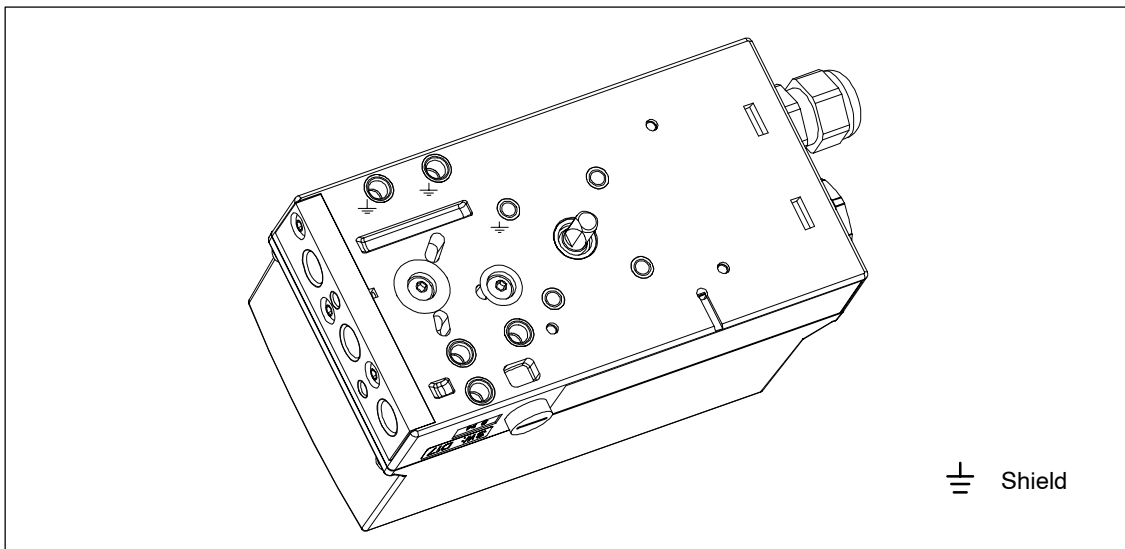


Figure 3-12 Base plate



NOTE

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

NOTE for use in zone 2:

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

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

NOTE for use in two-wire systems:

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

Always use a current source with a maximum output current of 20 mA.

To maintain the power supply, the input current must be ≥ 3.6 mA.

3.4.1 Connection in non-intrinsically safe and explosion proof version

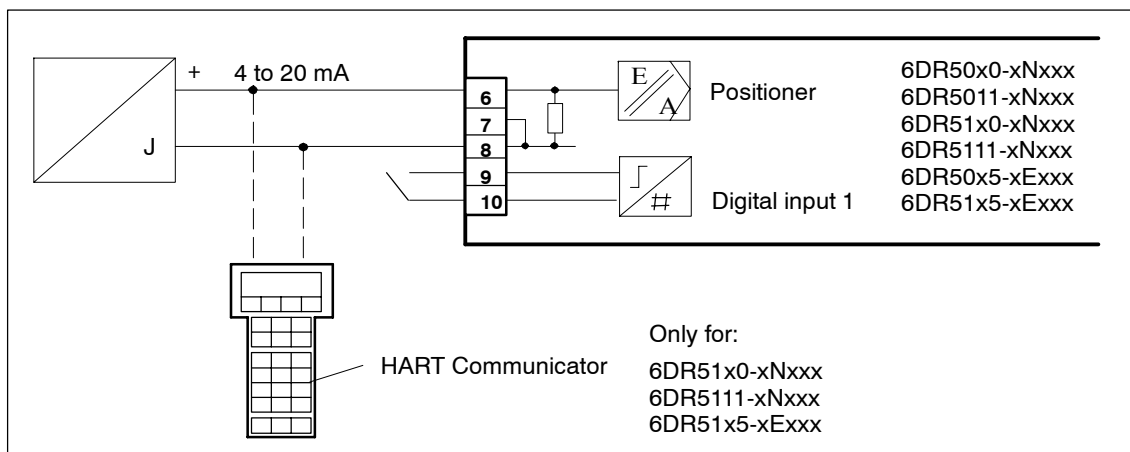


Figure 3-13 Two-wire connection

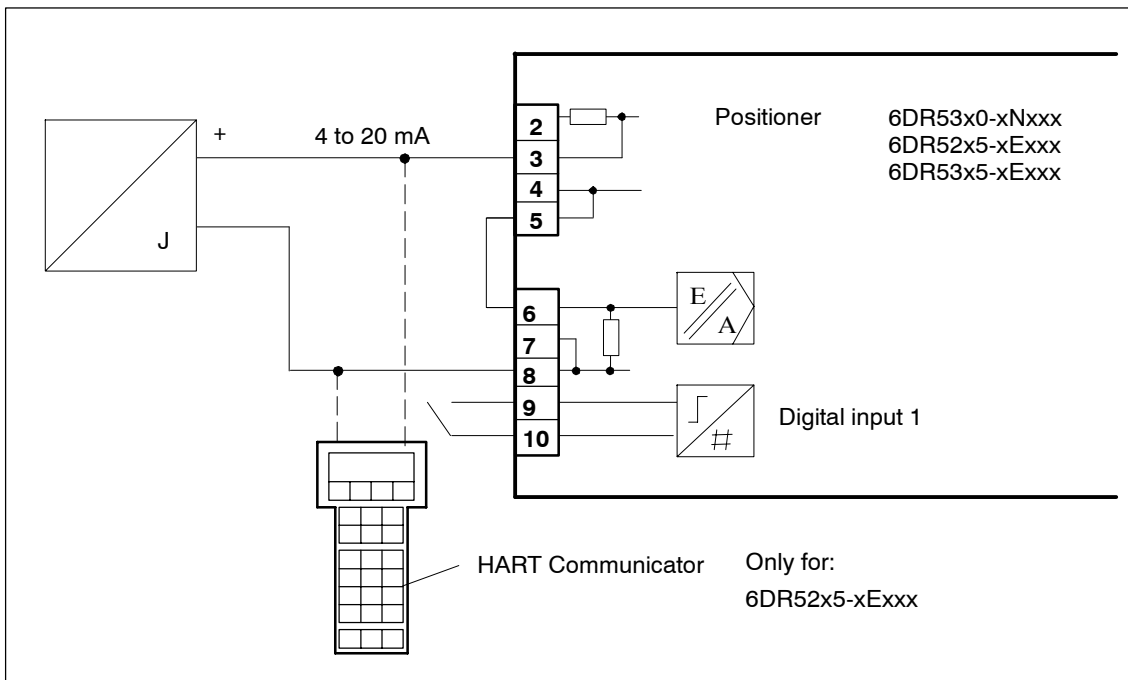


Figure 3-14 Two-wire connection

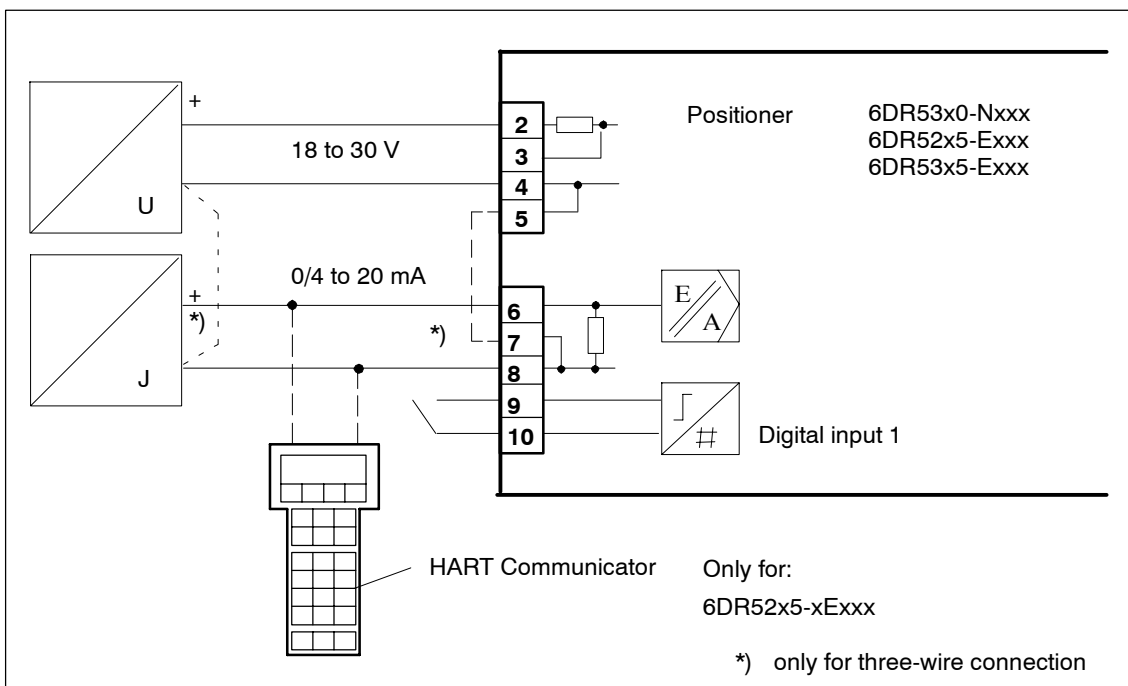


Figure 3-15 Three-/four-wire connection

Current output

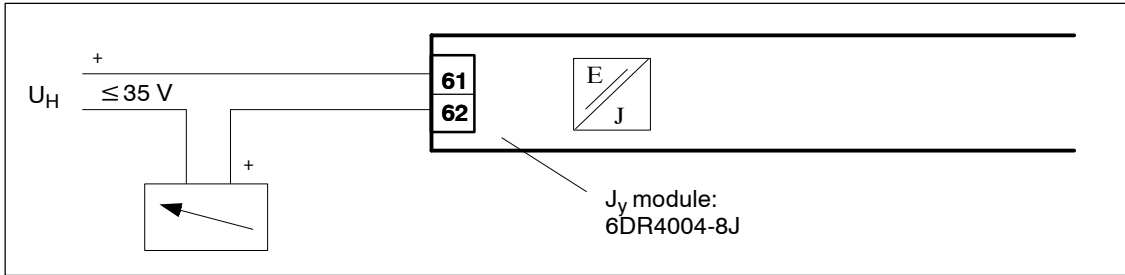


Figure 3-16 J_y module 6DR4004-8J

Digital inputs and outputs

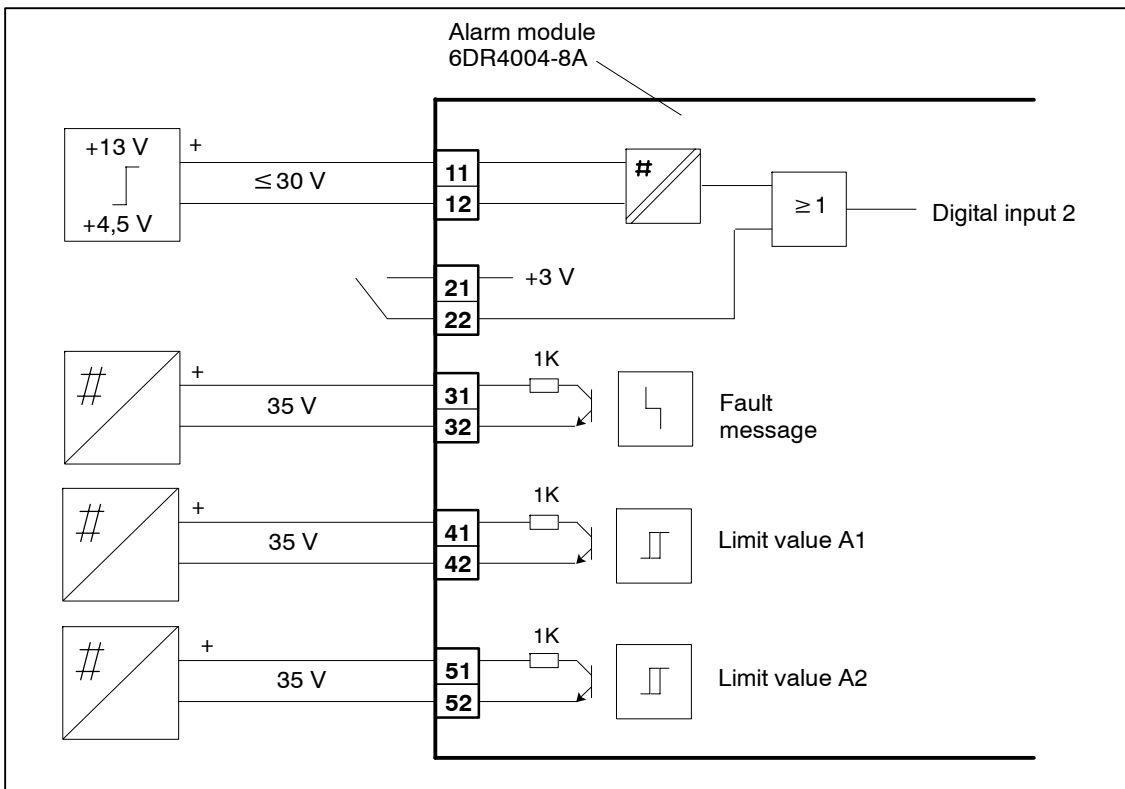


Figure 3-17 Alarm module 6DR4004-8A

SIA module

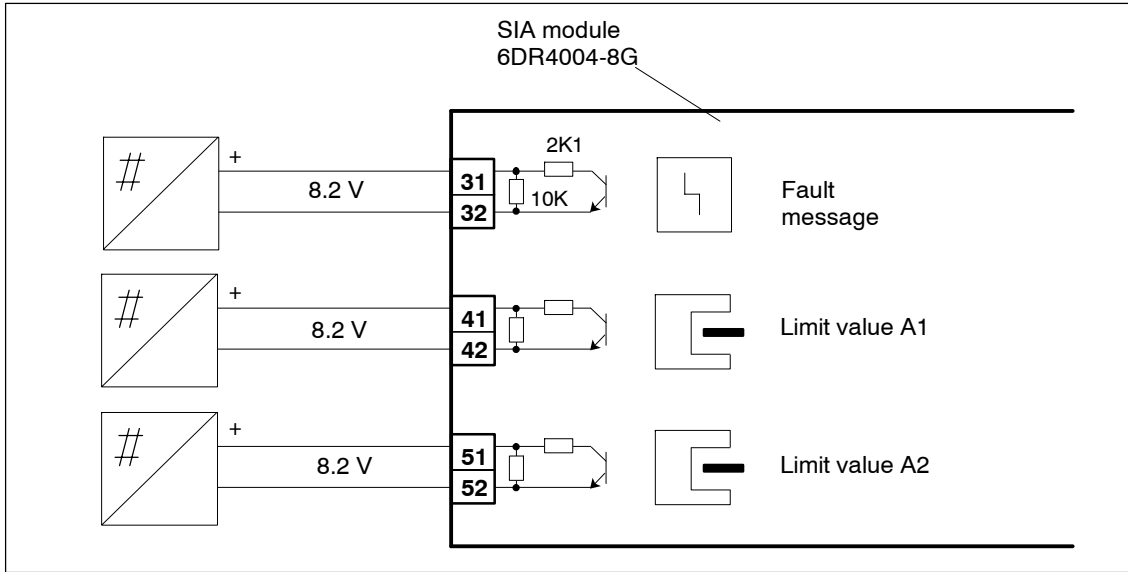


Figure 3-18 SIA module 6DR4004-8G

3.4.2 Connection in intrinsically safe version



NOTE

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

Standard controller

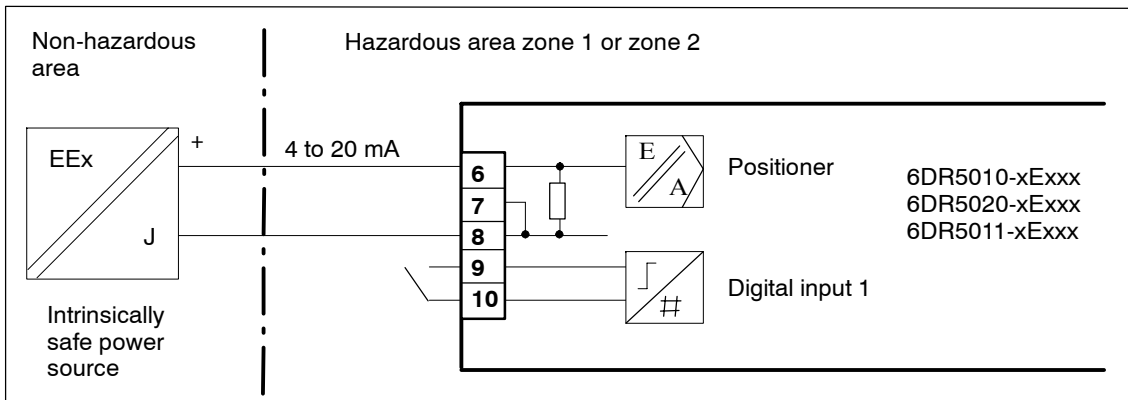


Figure 3-19 Two-wire connection, EEx i

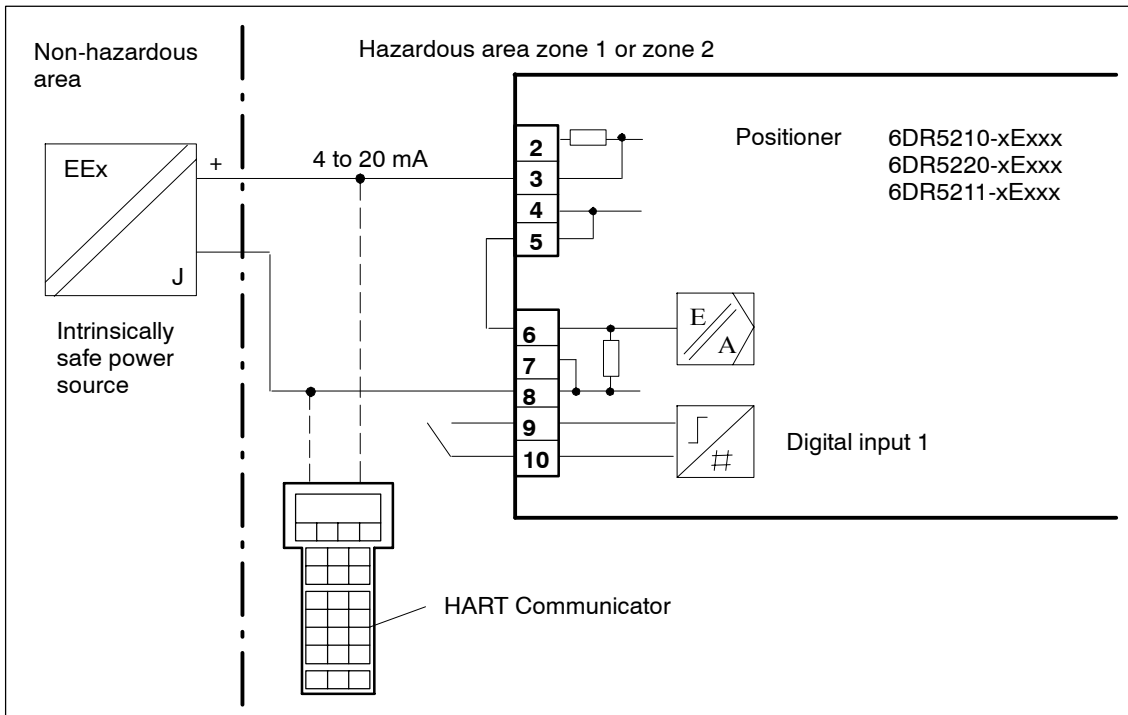


Figure 3-20 Two-wire connection, EEx i

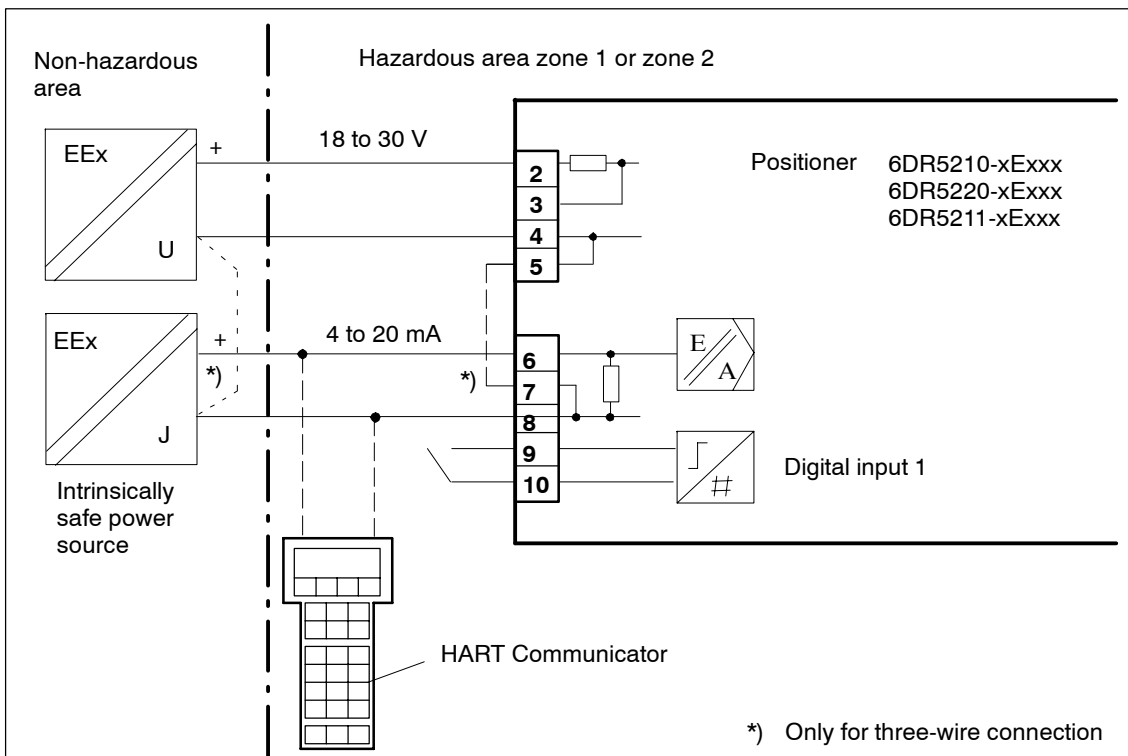


Figure 3-21 Three-/four-wire connection, EEx i

Split-range

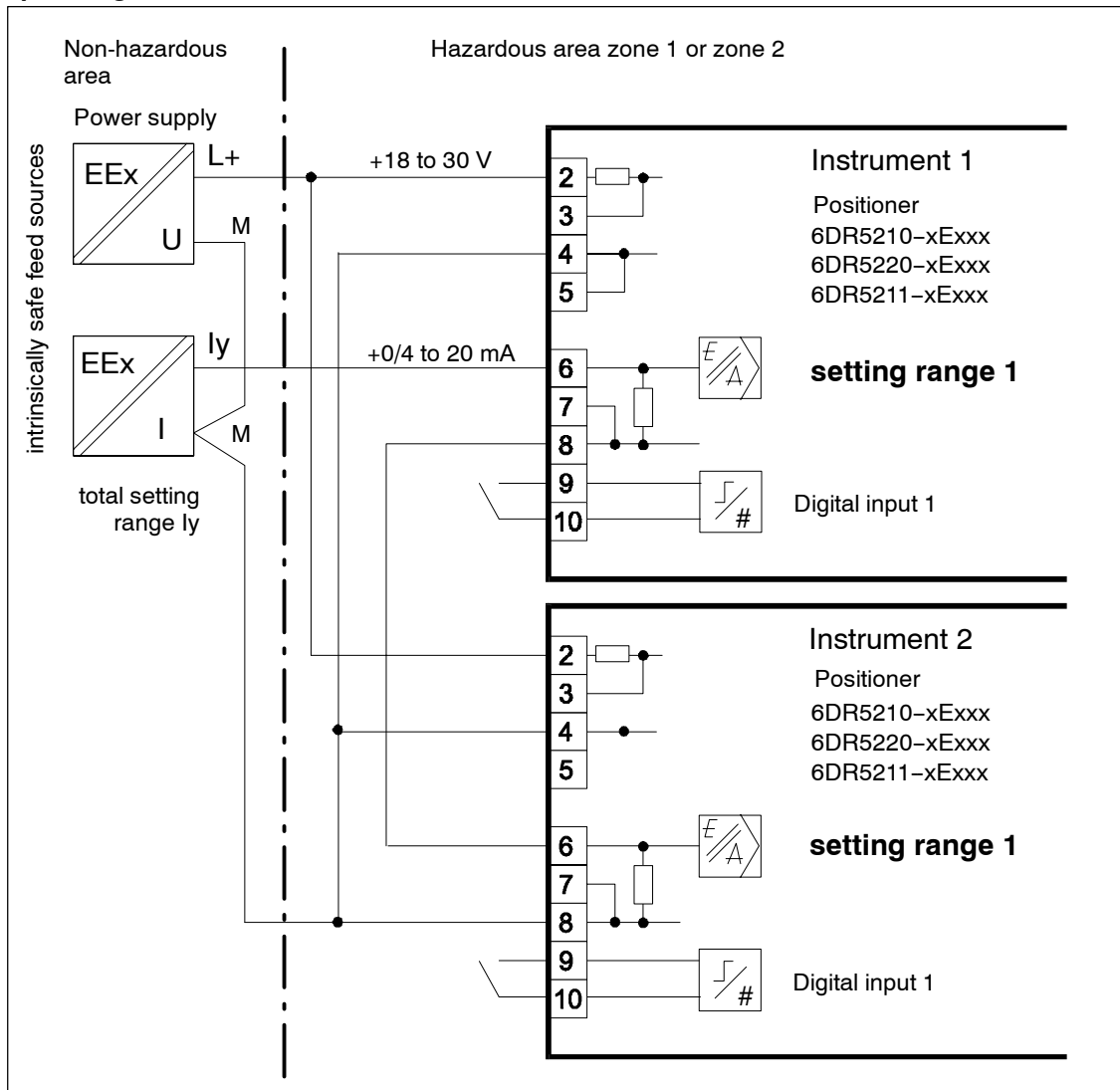


Figure 3-22 Series circuit of two positioners, e.g. split range (separate power supply), EEx i

Current output

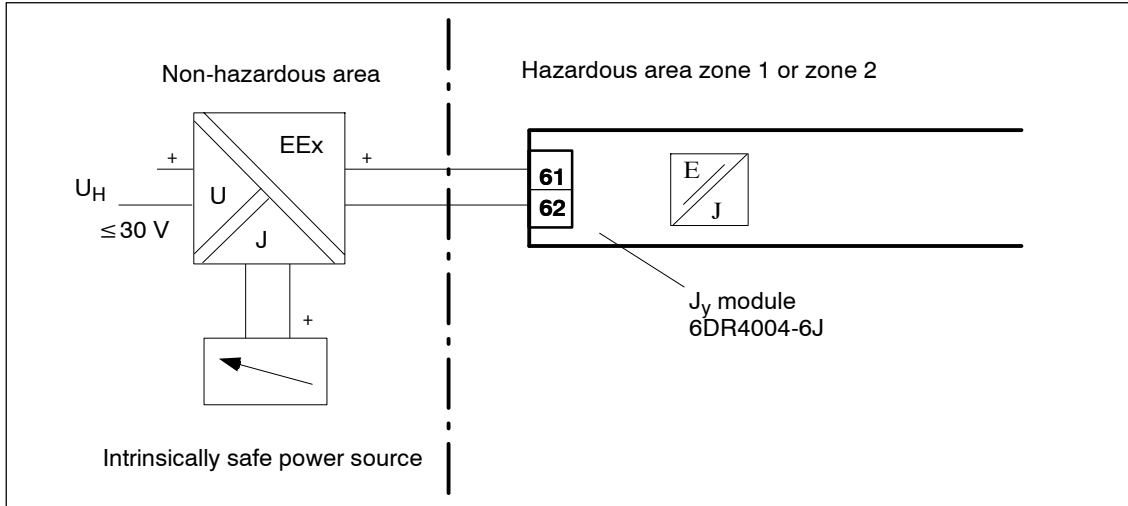


Figure 3-23 J_y-module 6DR4004-6J, EEx i

Digital inputs and outputs

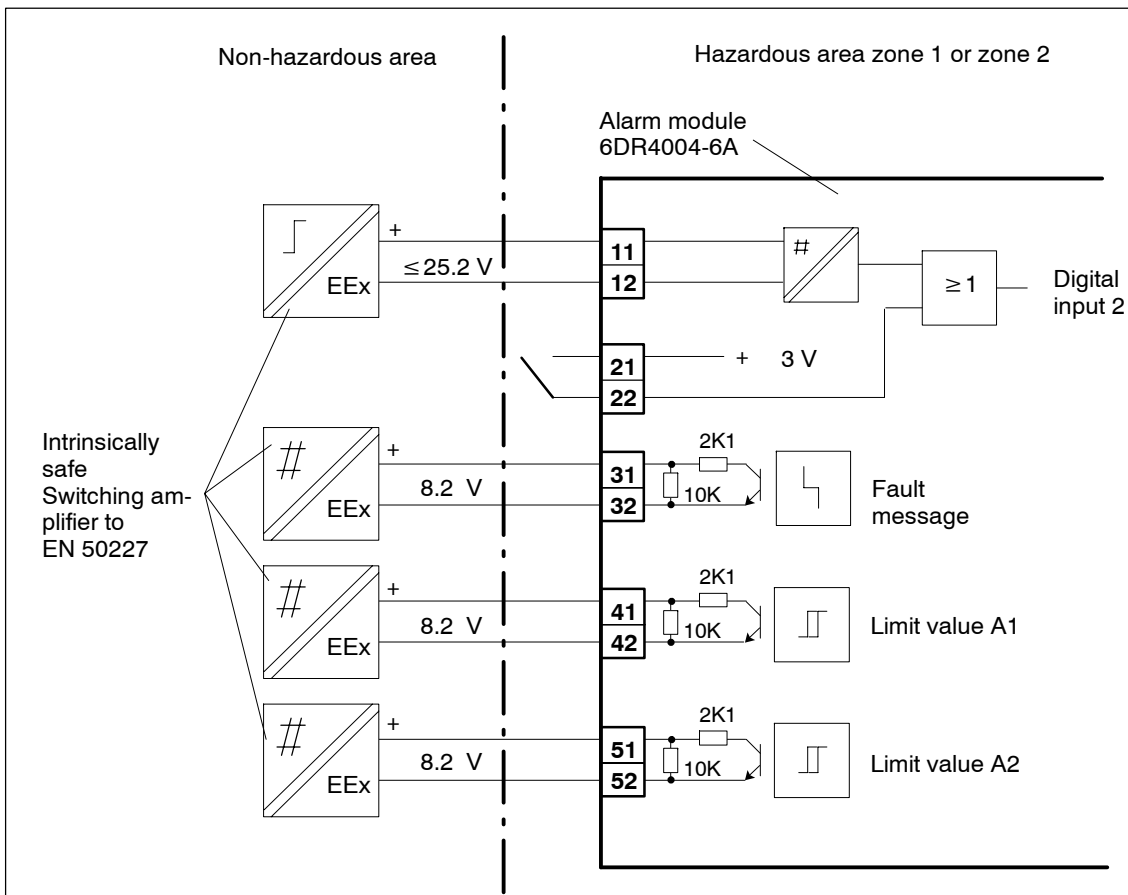


Figure 3-24 Alarm module 6DR4004-6A, EEx i

SIA module

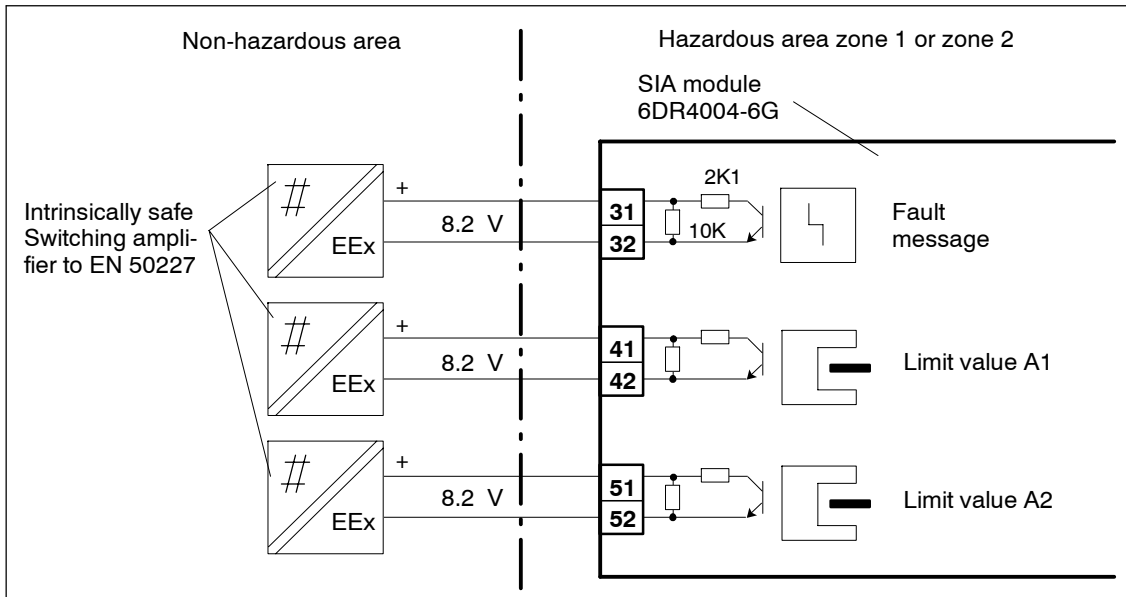


Figure 3-25 SIA module 6DR4004-6G, EEx i

3.4.3 Connection in type of protection “n” version

Standard controller

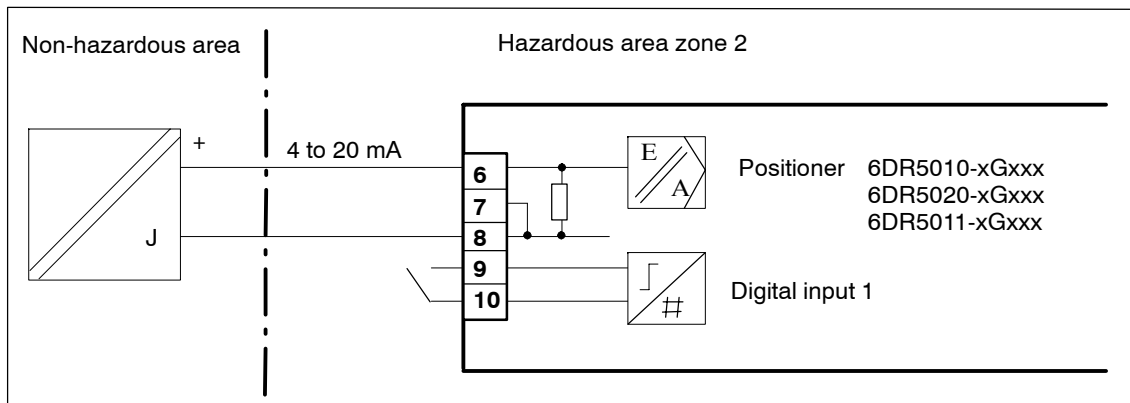


Figure 3-26 Two-wire connection, EEx n

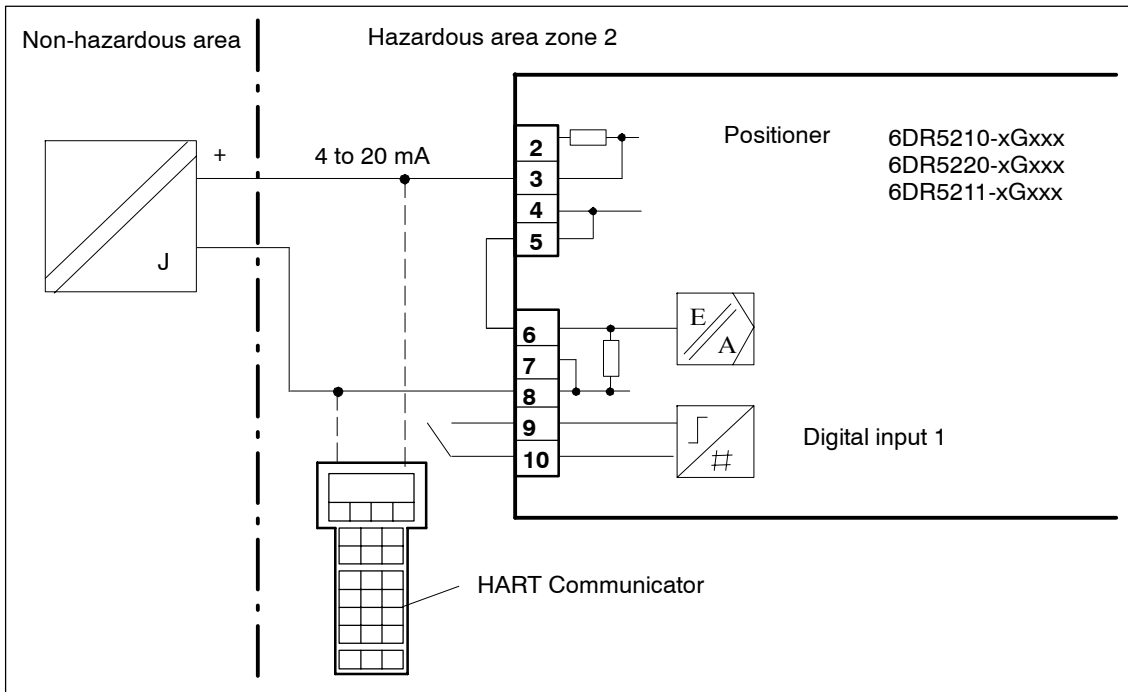


Figure 3-27 Two-wire connection, EEx n

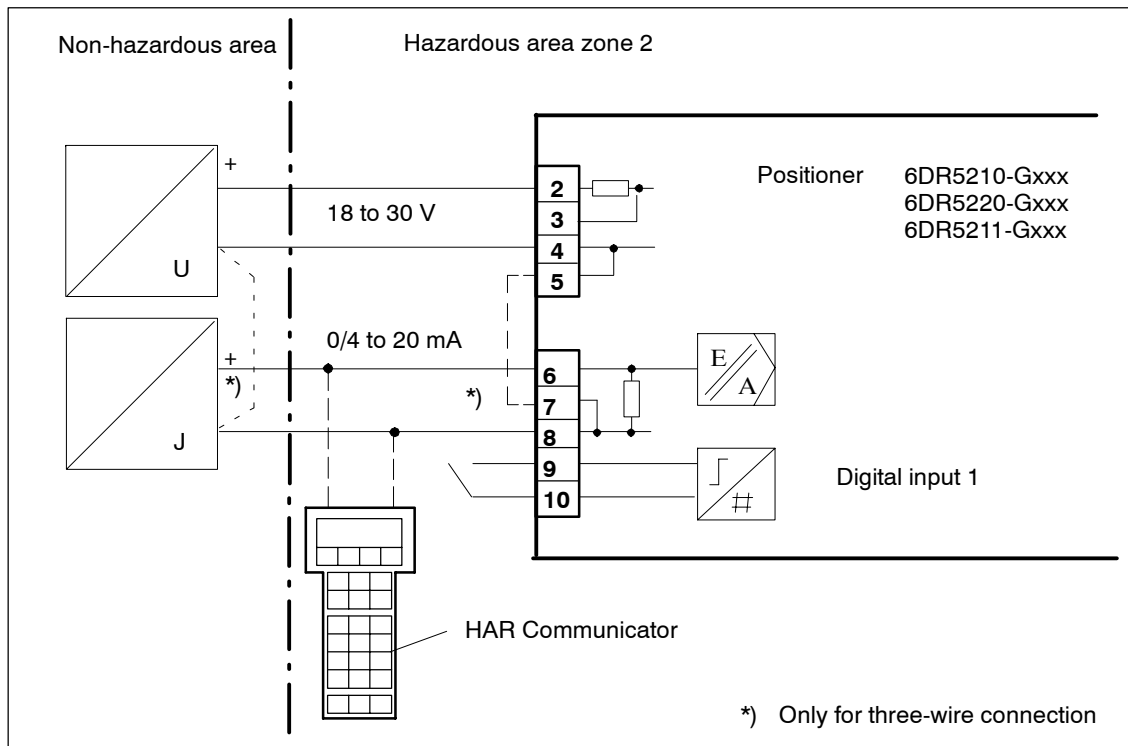


Figure 3-28 Three-/Four-wire connection, EEx n

Current output

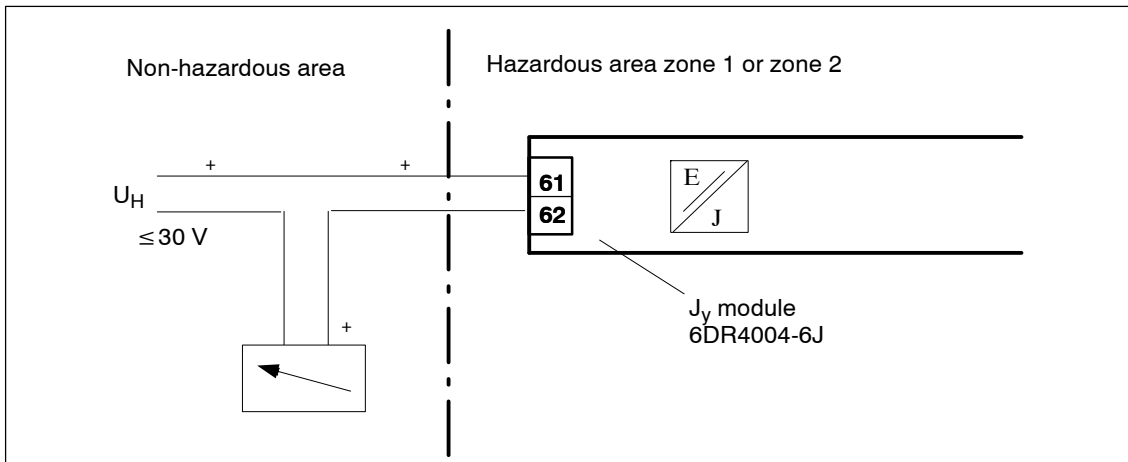


Figure 3-29 J_y-module 6DR4004-6J, EEx n

Digital inputs and outputs

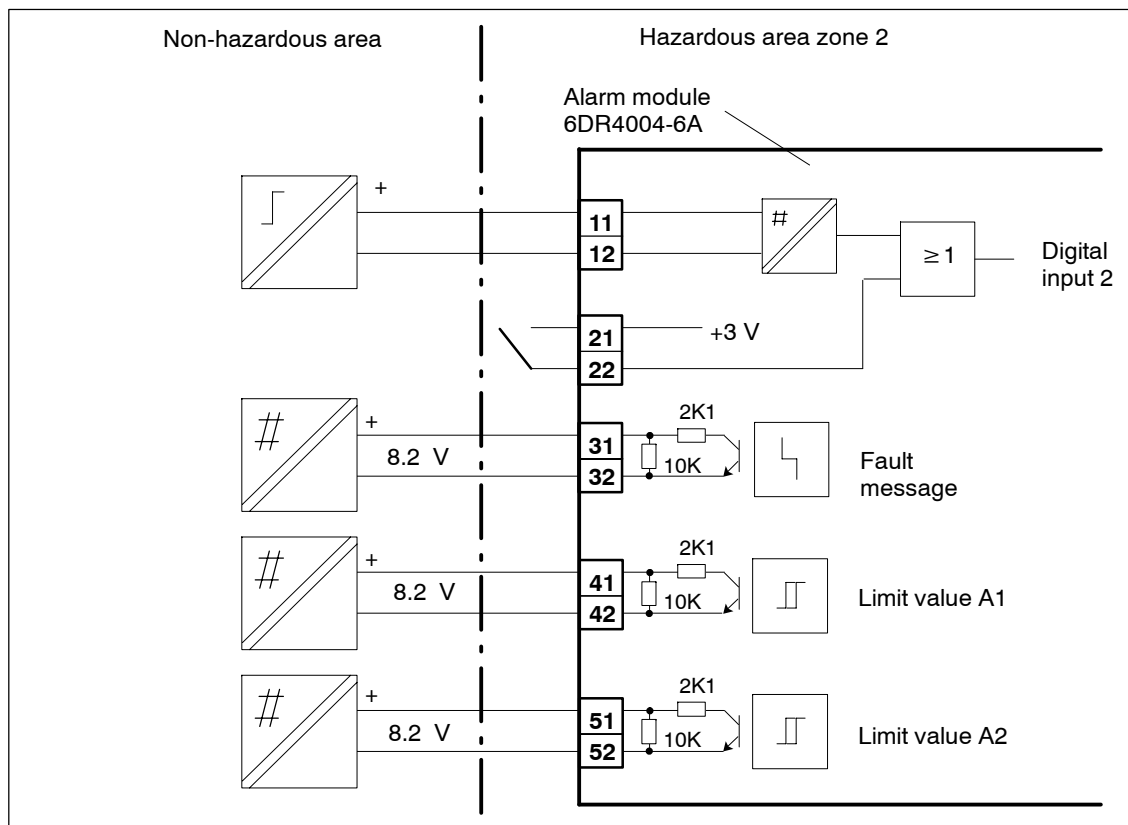


Figure 3-30 Alarm module 6DR4004-6A, EEx n

SIA module

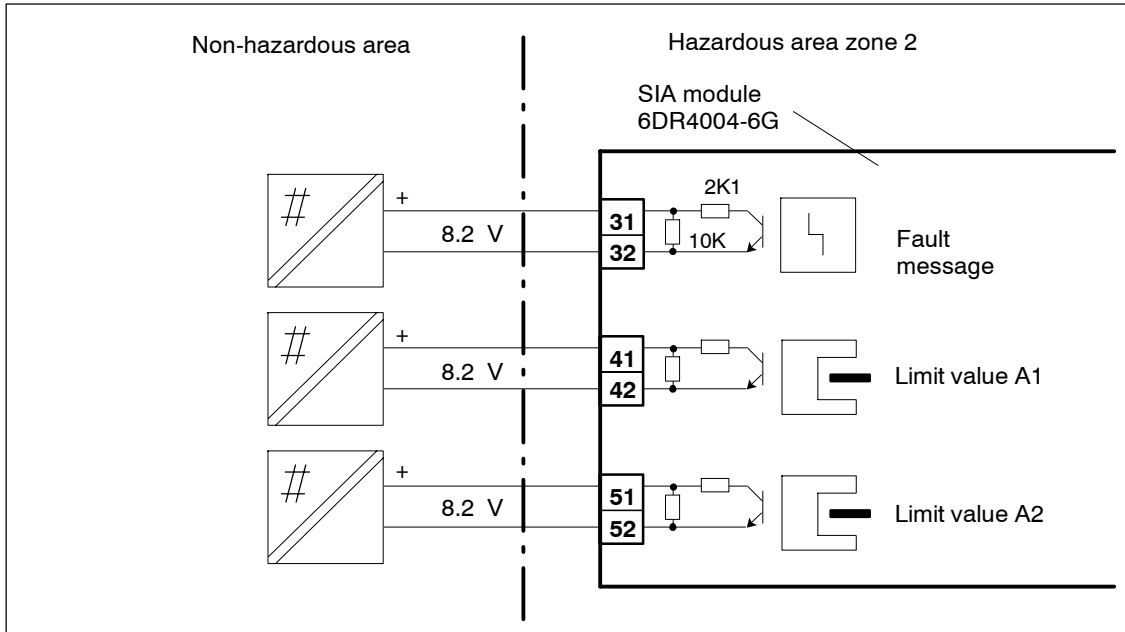


Figure 3-31 SIA module 6DR4004-6G, EEx n

3.5 Pneumatic Connection



WARNING

For reasons of safety, the pneumatic power may only be supplied after assembly when the positioner is switched to operating level P manual operation with electrical signal applied (as-delivered state, see figure 4-4, page 82).



NOTE

Note the air quality! Oil-free industrial air, solid content < 30 µm, pressure dew point 20 K below the lowest ambient temperature (chapter 7 “Technical Data”, page 119).

- 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-acting:	Y1	deaerated
double-acting:	Y1	Max. Actuating pressure (supply air pressure)
	Y2	deaerated
- Connect actuating pressure Y1 or Y2 (only in double-acting actuators) according to the desired safety position.
- Connect supply air to P_Z.



NOTE

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

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

3.6 Commissioning

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

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

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

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

This initialization can be effected in three different ways:

- **Automatic initialization**
Initialization takes place automatically. Hereby the positioner determines the direction of action, the stem travel and the angle of rotation, the travel times of the actuator one after the other and adapts the control parameters to the dynamic behavior of the actuator.
- **Manual initialization**
The stem travel or angle of rotation of the actuator can be set manually, the other parameters are determined as in automatic initialization. This function is useful in actuators with soft limit stops.
- **Copying initialization data (positioner exchange)**
In the devices with HART function the initialization data of a positioner can be read out and copied to another positioner. This enables a defective device to be changed without having to interrupt an ongoing process by initialization.

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

The possible operating modes and parameters, together with the adjustment capabilities and their effects are described in chapter 4 page 79 "Operation".



NOTE

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

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

3.6.1 Preparations for linear actuators

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

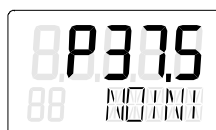


NOTE

Particularly important is the position of the transmission ratio selector (8, figure 2-1, page 16) in the positioner:

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

2. Push the carrier pin (4, figure 3-7 (page 44) 2) onto the lever (6, figure 3-7, 2) to the scale position corresponding to the rated stroke or next highest position and screw the carrier pin tight with the nut (18, figure 3-7, 2).
3. Connect the actuator and the positioner with the pneumatic lines and supply pneumatic power to the positioner (figure 2-3 and 2-4, page 18).
4. Connect a suitable current or voltage source (see figure 3-13, page 52 and figure 3-19, page 55).
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 28) 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:

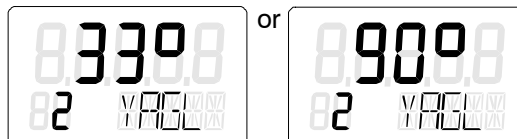
1. Press the operation mode key  for longer than 5 s. This brings you to the Configuration mode.

Display:



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

Display:



NOTE

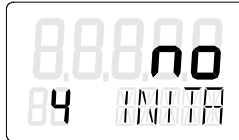
It is vital that this value corresponds to the setting of the transmission ratio selector (8, figure 2-1, page 16) (33° or 90°).


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

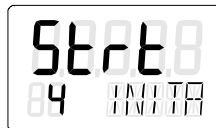


You only need to set this parameter if you want to have the total stroke in mm displayed at the end of the initialization phase. To do this, select the same value in the display to which you have set the carrier pin to the scale on the lever.

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 figure 3-33, page 74 to figure 3-36, page 77).




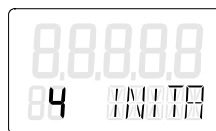
NOTE


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

The initialization is complete when the following display appears:



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



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



NOTE


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

3.6.3 Manual initialization of linear actuator

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


Manual initialization procedure in linear actuator

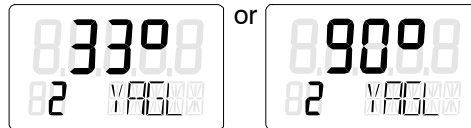
1. Make preparations as described in chapter 3.6.1, page 64 for linear actuator. In particular, make sure by manually driving the whole travel that the displayed potentiometer setting moves in the permissible range between P5.0 and P95.0.

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

Display:



3. Switch to the second parameter by pressing the operation 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 travel and the position detection according to step 1.

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



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



NOTE

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


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


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

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



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

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

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

3.6.4 Preparations for 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 45).
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 3-13, page 52 and figure 3-19, page 55).
4. The positioner is now in the operating mode "**P-manual operation**". The current potentiometer voltage (P) is displayed in % in the top line of the display, e.g.: "**P12.3**", and "**NOINI**" flashes in the bottom line:



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



NOTE

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


3.6.5 Automatic initialization of 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



2. Set the parameter with the -key to "turn"

Display:




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

Display:



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 in figure 3-33, page 74 to figure 3-36, page 77).




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  briefly:



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




NOTE

You can abort an ongoing initialization at any time by pressing the operation mode key. Your previous settings are retained. All the parameters are 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 travel 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 70 for rotary actuators. In particular, make sure by manually driving the whole travel that the displayed potentiometer setting moves in the permissible range between P5.0 and P95.0.
2. Press the operation mode key  for longer than 5 s. This brings you to the Configuration mode.
Display:



3. Set the parameter YFCT to “turn” with the decrement ∇ key.
Display:



4. Switch to the second parameter by pressing the operation mode key \square briefly.
Display:



NOTE

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

5. Switch on to the following display by pressing the operation mode key \square 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 \square briefly. This brings you back to the Configuration 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.

3.6.7 Automatic initialization (structograms)

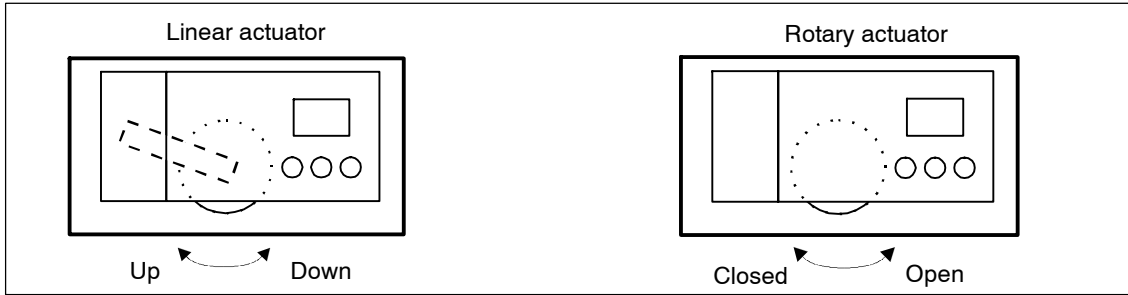


Figure 3-32 Direction of action of the actuators

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

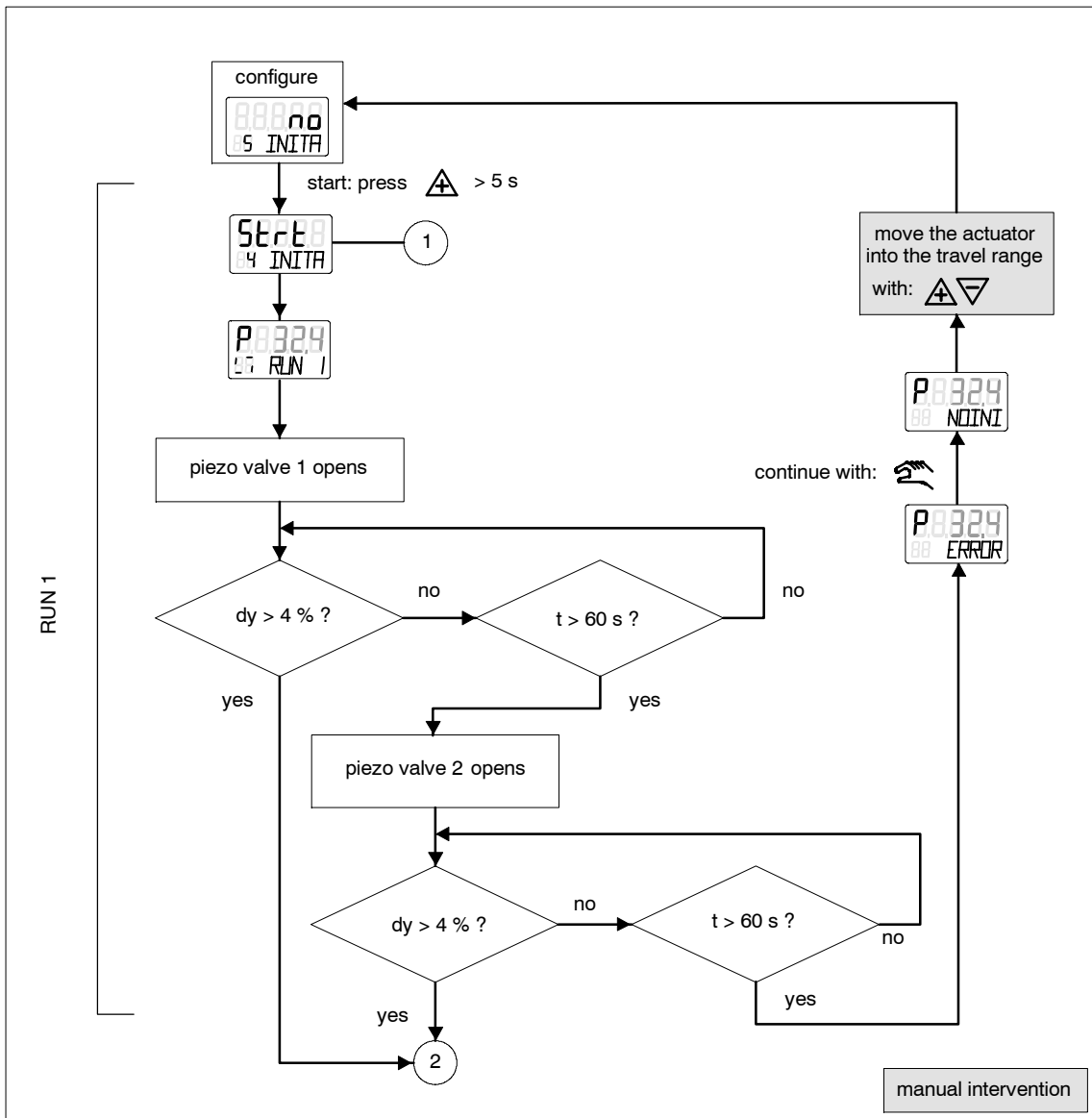


Figure 3-33 Automatic initialization, part 1

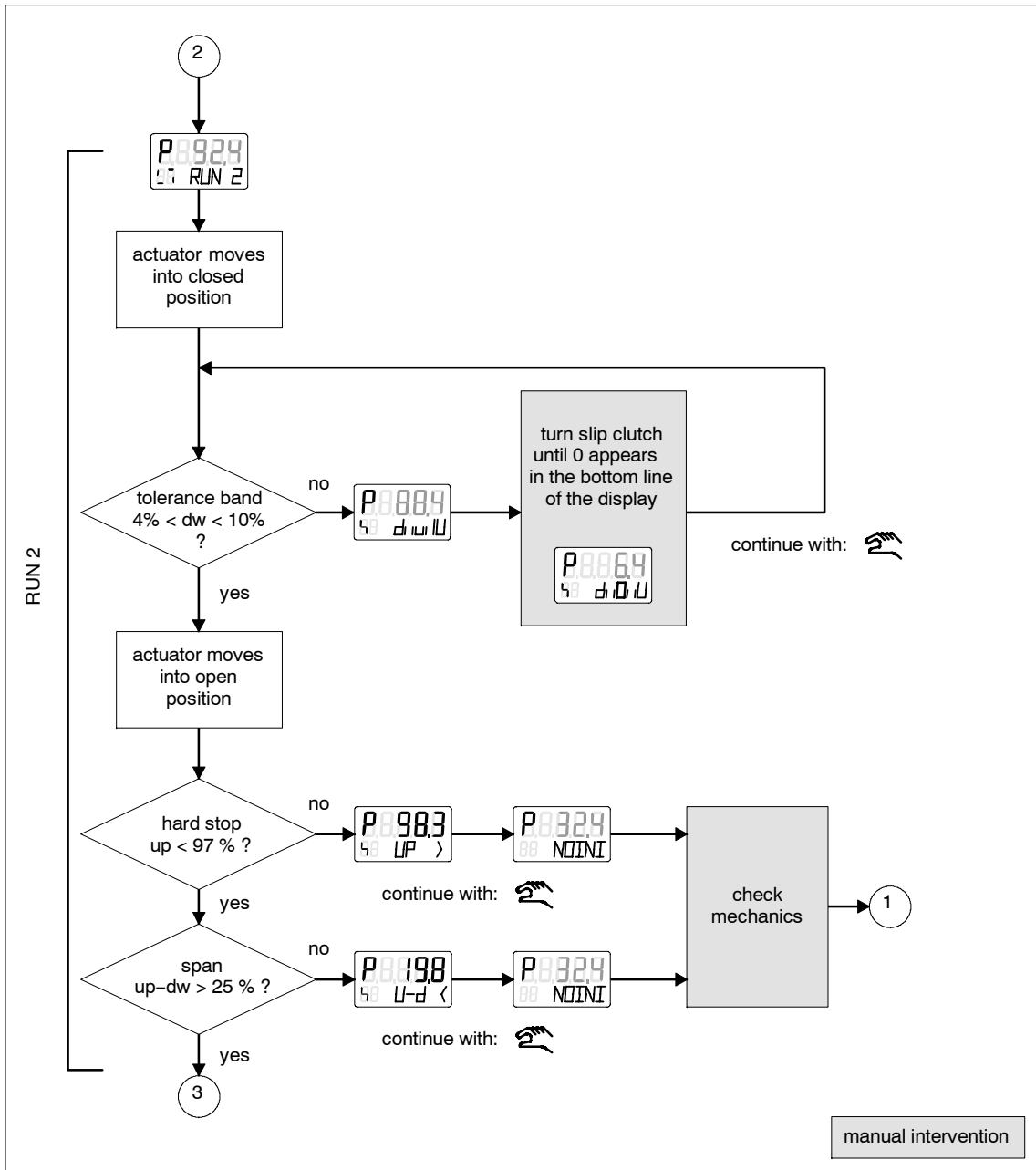


Figure 3-34 Automatic initialization part 2 (in rotary actuators)

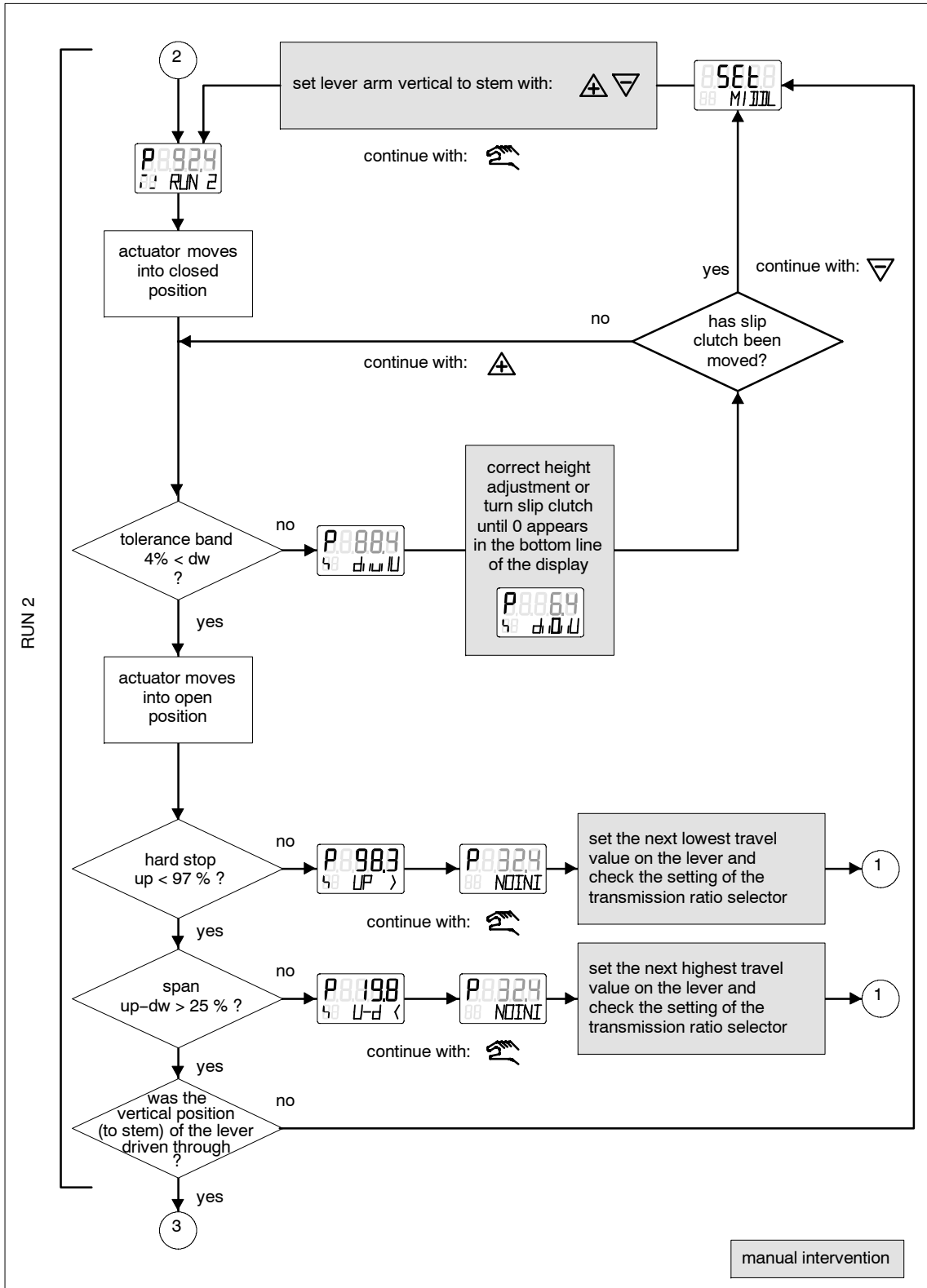


Figure 3-35 Automatic initialization part 2 (in linear actuators)

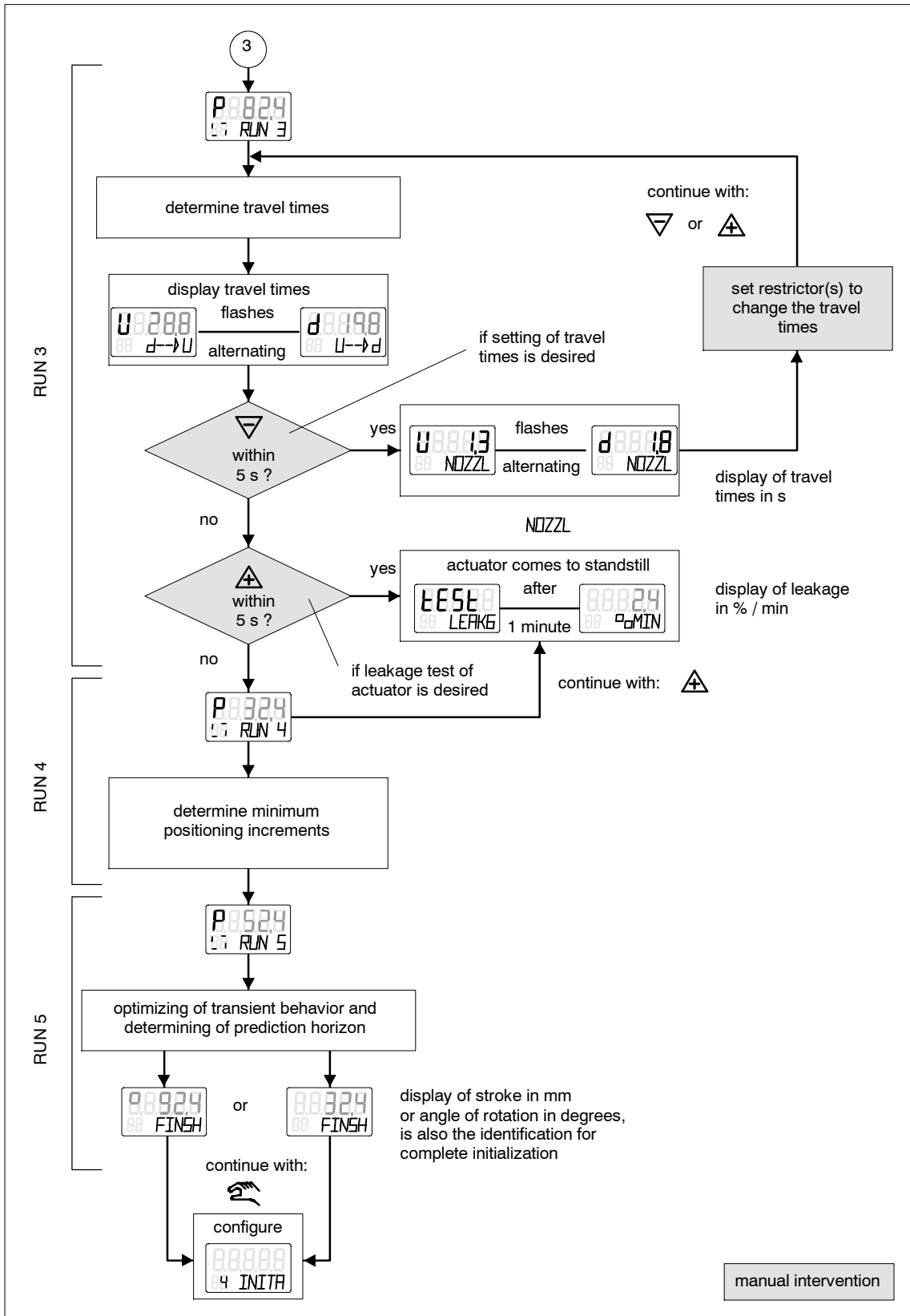


Figure 3-36 Automatic initialization, part 3

3.7 Copying initialization data (positioner exchange)

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

NOTICE

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

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

The following steps must be performed to exchange a positioner:

1. Read in and save instrument parameters and initialization data (determined in initialization) of the instrument to be replaced with PDM (**P**rocess **D**evice **M**anager). This step is unnecessary if the instrument has been parameterized with PDM and the data have already been stored.
2. Fix the actuator in its momentary position (mechanical or pneumatic).
3. Read and note the current position actual value of the positioner to be changed. If the electronics are defective, determine the current position by measuring on the actuator or valve.
4. Disassemble the positioner. Mount the lever arm of the positioner on the replacement instrument. Mount the replacement instrument on the fitting. Move the transmission ratio selector to the same position as the defective instrument. Copy the instrument data and initialization data from the PDM or handheld.
5. If the displayed actual value does not match the noted value of the defective positioner, set the correct value with the 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.

4.1 Display

The LC display has two lines whereby the lines have different segmentation. The elements of the top line consist of 7, those of the bottom line of 14 segments. The contents of the display depend on the selected operating mode (see chapter 4.3, page 82)



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. The meaning of further display capabilities is detailed in chapter 4.6 page 106.

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.

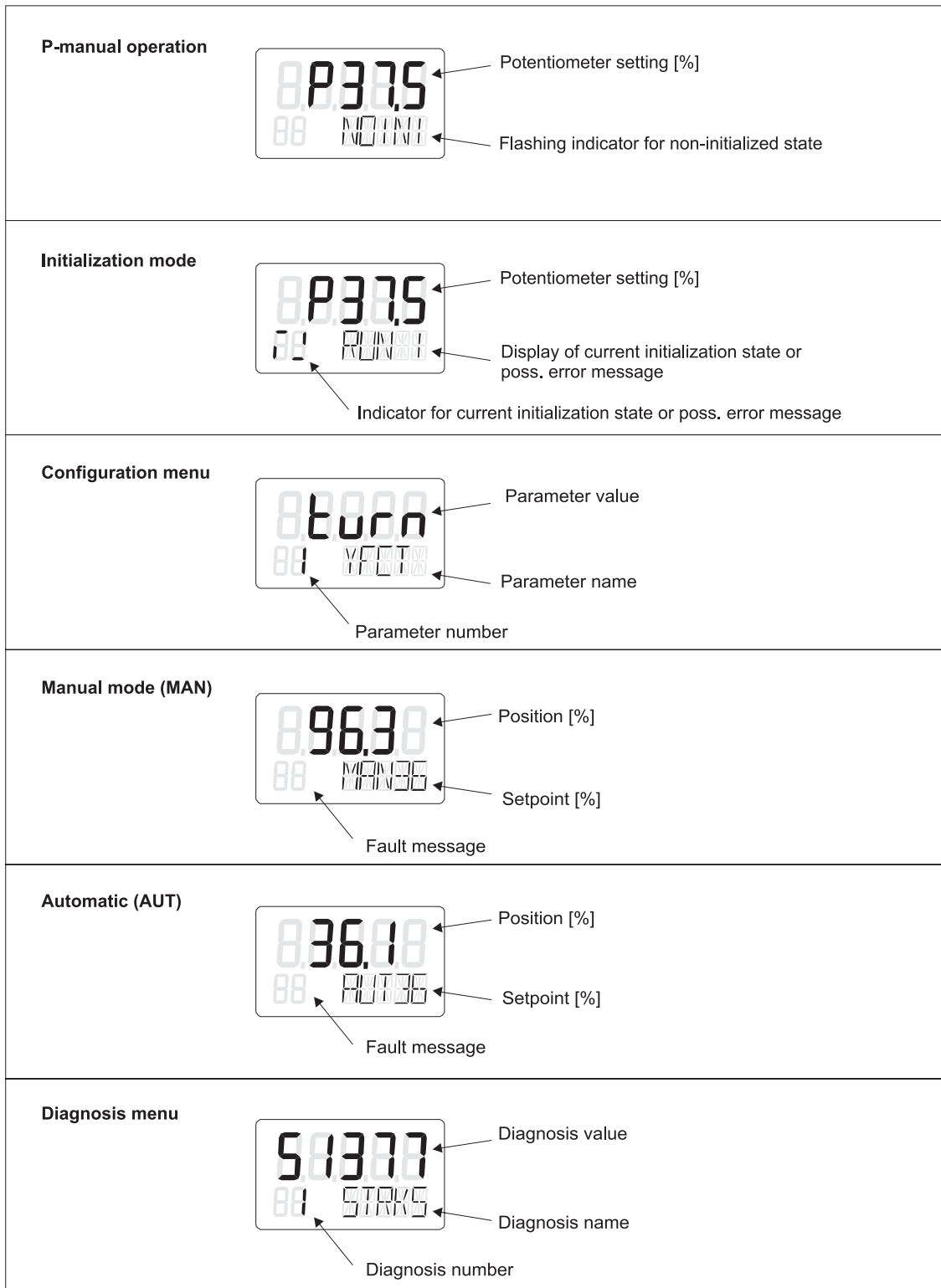
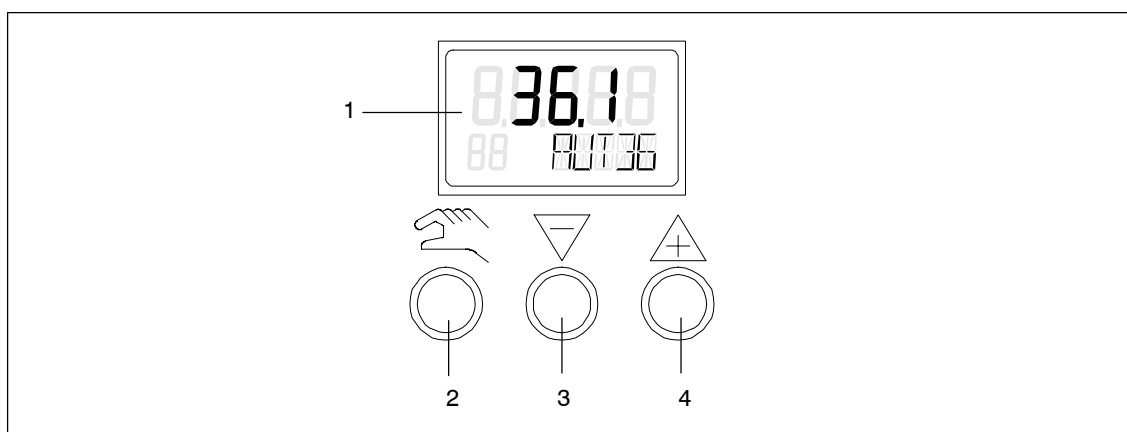


Figure 4-1 Meaning of the various display options



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  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.

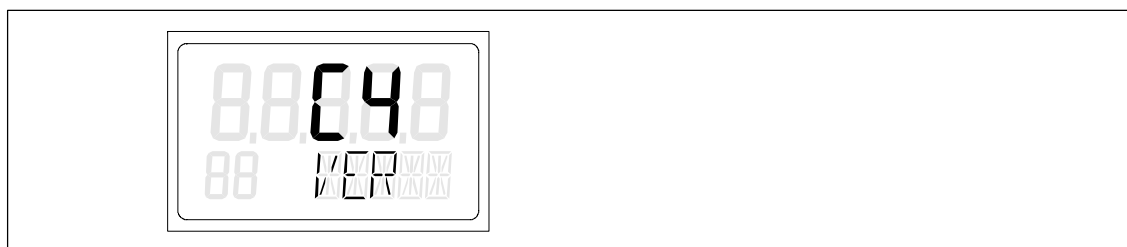


Figure 4-3 Firmware version, example: C4

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.

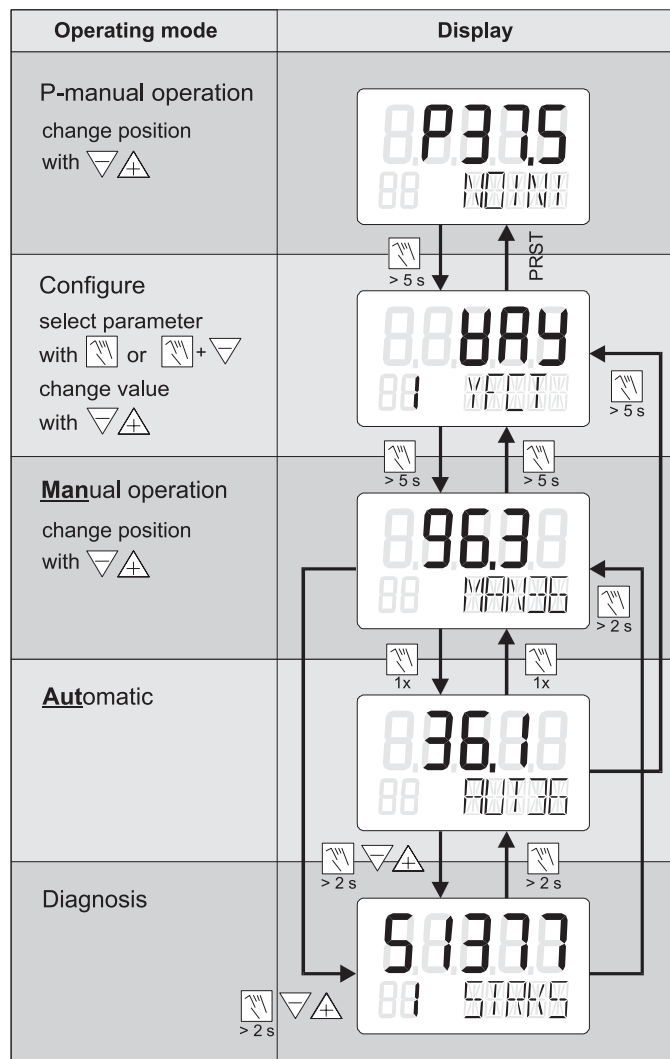


Figure 4-4 Change between the operating modes

**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 63 "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 84 Parameters.

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



NOTE

If the electric power supply fails during configuration, the positioner switches back to the first parameter after recovering the power supply, values which have already been parameterized are retained. Without a power failure you re-enter the configuration menu at the point you exited it when you call the Configuration menu again.

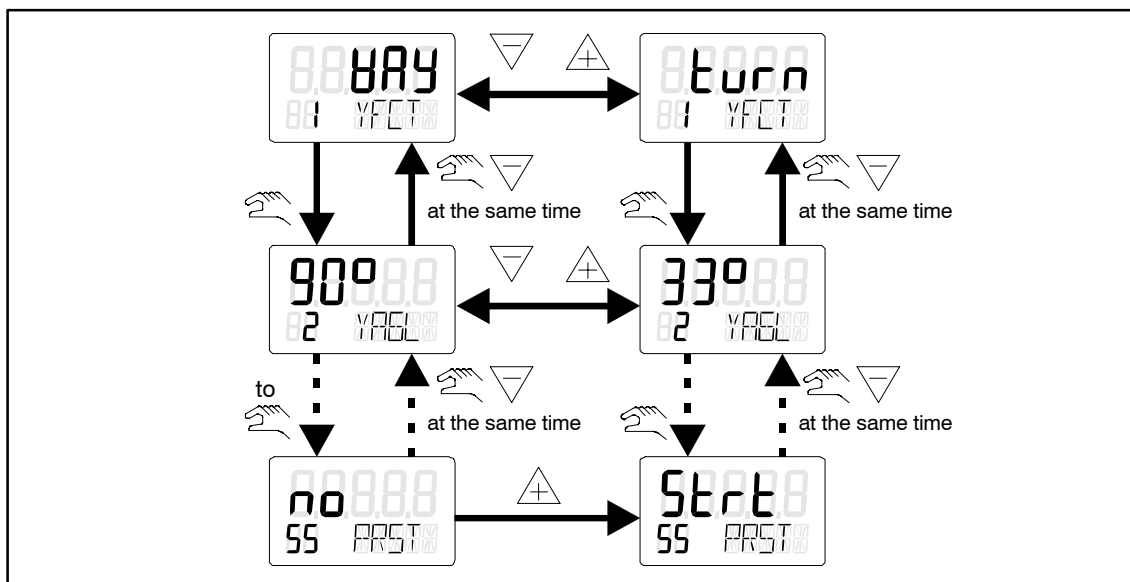


Figure 4-5 Overview: Configuration

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 4-1, page 99).

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 98 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.

The following configuration block diagram shows the effects of the parameters.

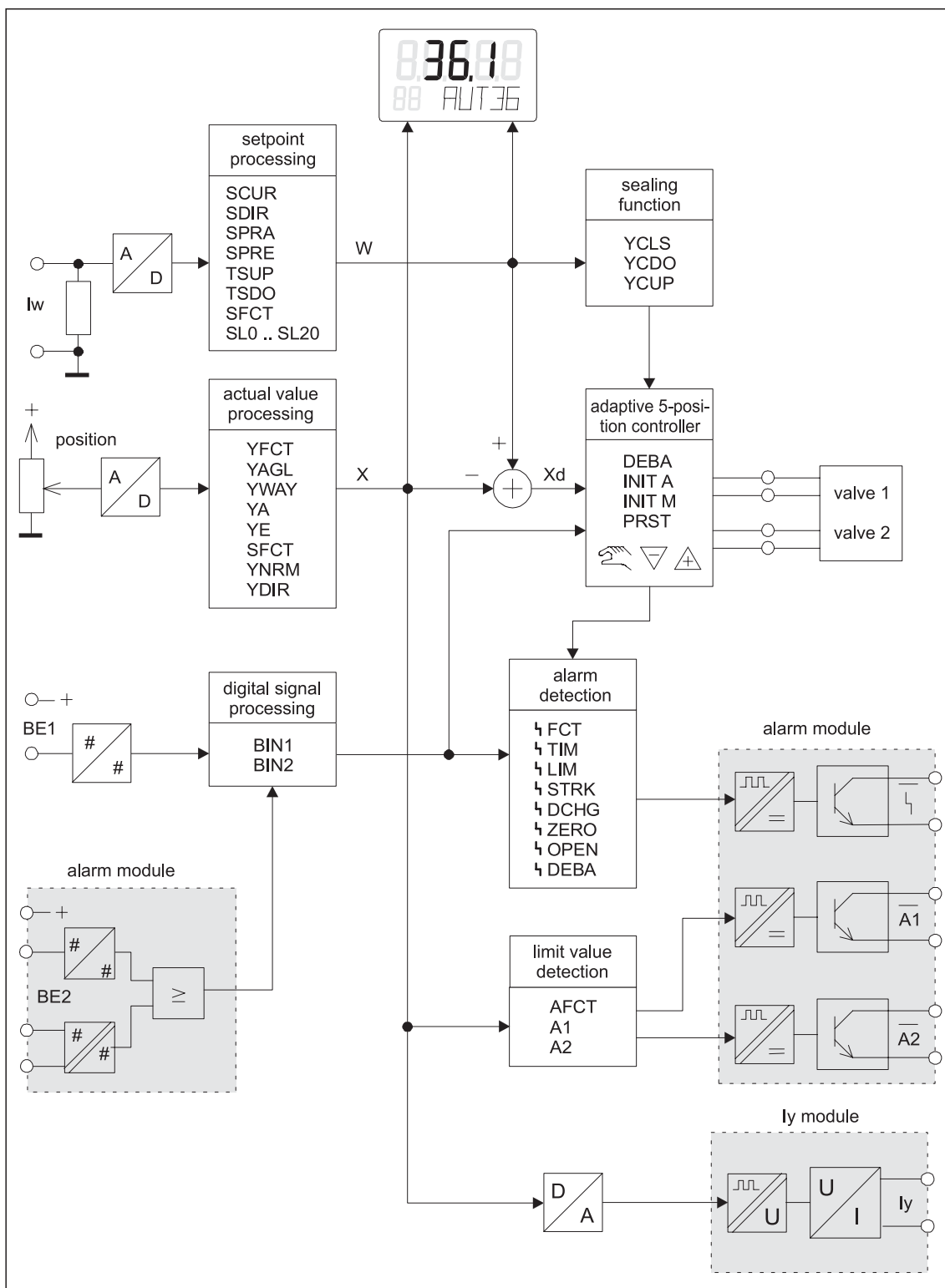


Figure 4-7 Configuration block diagram

Normally adjustment of the first three following parameters is completely sufficient to enable a positioner to be operated by a drive. If you wish to become familiar with all details of the positioner, try out incrementally the effects of the remaining parameters by selective trials.



NOTE

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

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

1.YFCT

Positioning actuator type

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

- YFCT = turn

This adjustment is necessary for the rotary actuator.

If "turn" is selected, the following parameter "2. YAGL" is automatically set to 90° and cannot be changed.

- YFCT = WAY (Factory setting)

This is necessary for a linear actuator. This allows the positioner to compensate for the non-linearity that arises due to the conversion of the linear movement of the linear actuator into the rotary movement of the feedback shaft. For this the positioner is factory set so that it shows between "P 49.0 and P 51.0" when the arm on the feedback shaft is vertical to the linear actuator spindle.

- YFCT = LWAY

This must be adjusted, if an external linear potentiometer is to be connected to a linear actuator.

TIP: use this adjustment also for rotary actuators with reverse direction of control action.

- YFCT = ncSt

Use this when an NCS is fitted to a rotary actuator.

- YFCT = -ncSt

This must be set when an NCS is used with a rotary actuator with reverse direction of control action.

- YFCT = ncSL

This must be set when an NCS is used with a linear actuator.



NOTE

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

2.YAGL

Rated angle of rotation of the feedback shaft

In 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 \leq 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 63)
- 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 3-33, page 74 to figure 3-36, page 77).
- 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 3.6.3, page 67 and chapter 3.6.6, page 72.
-
-  **NOTE**
- If the positioner has already been initialized, for INITA and INITM it is possible to transfer it to its non-initialized state without changing the remaining parameters by pressing the decrement key ∇ for 5 s.
-
- 6.SCUR** Current range of the setpoint
- The selection of the current range depends on the connection type. “0mA” (0 to 20 mA) is only possible in three-/four-wire connections (see figure 3-22, page 57).
- 7.SDIR** Setpoint direction (see figure 4-8, page 90)
- The setting of the setpoint direction serves to reverse the direction of action of the setpoint. It is used mainly for the split range mode and in single-acting actuators with the safety position “up”.
- 8.SPRA** Split range start (see figure 4-8)
and
- 9.SPRE** Split range end (see figure 4-8)
- The parameters “8.SPRA” and “9.SPRE” in connection with the parameter “7.SDIR” serve to restrict the active setpoint range. In this way split range tasks can be solved with the following characteristics.
- rising / falling
 - falling / rising
 - falling / falling
 - rising / rising

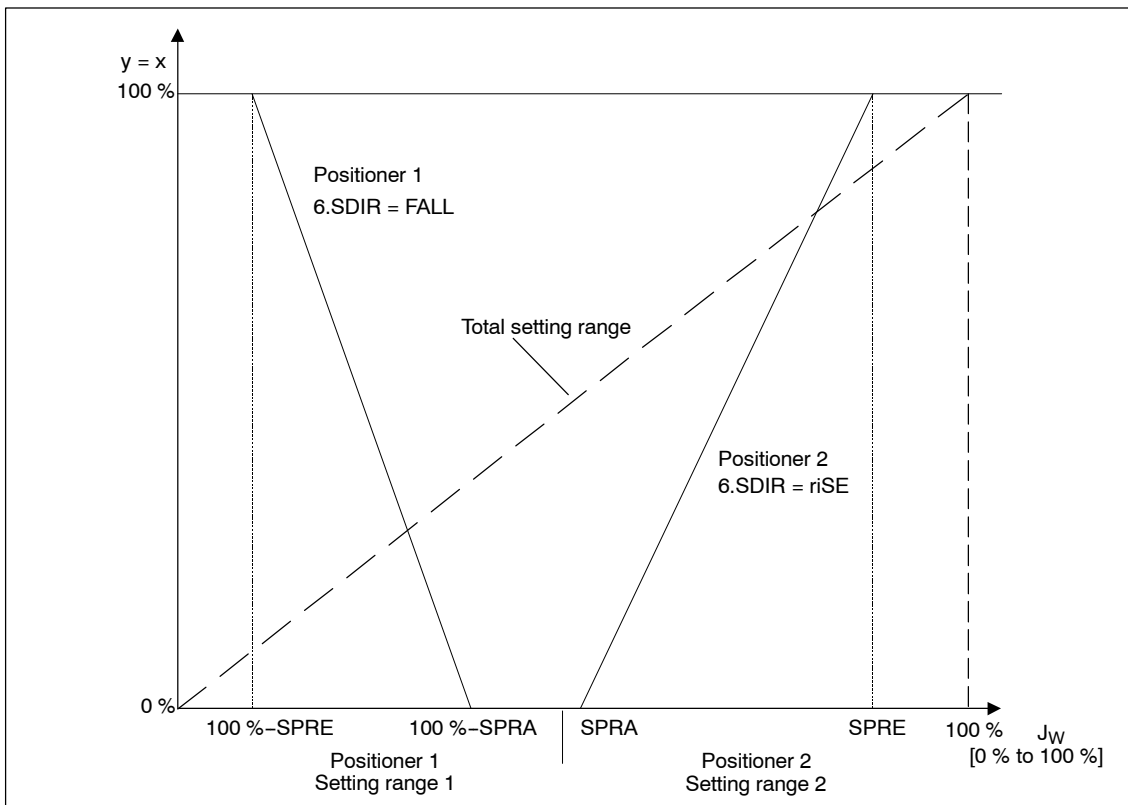


Figure 4-8 Example: Split range-operation with two positioners

10.TSUP Setpoint ramp UP
and

11.TSDO Setpoint ramp DOWN

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

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

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

12.SFCT Setpoint function (see figure 4-9, page 91)

Non-linear valve characteristics can be linearized with this function and any flow characteristics simulated in linear valve characteristics.

Six valve characteristics are stored in the positioner

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

13.SL0 to 33.SL20 Setpoint turning points

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

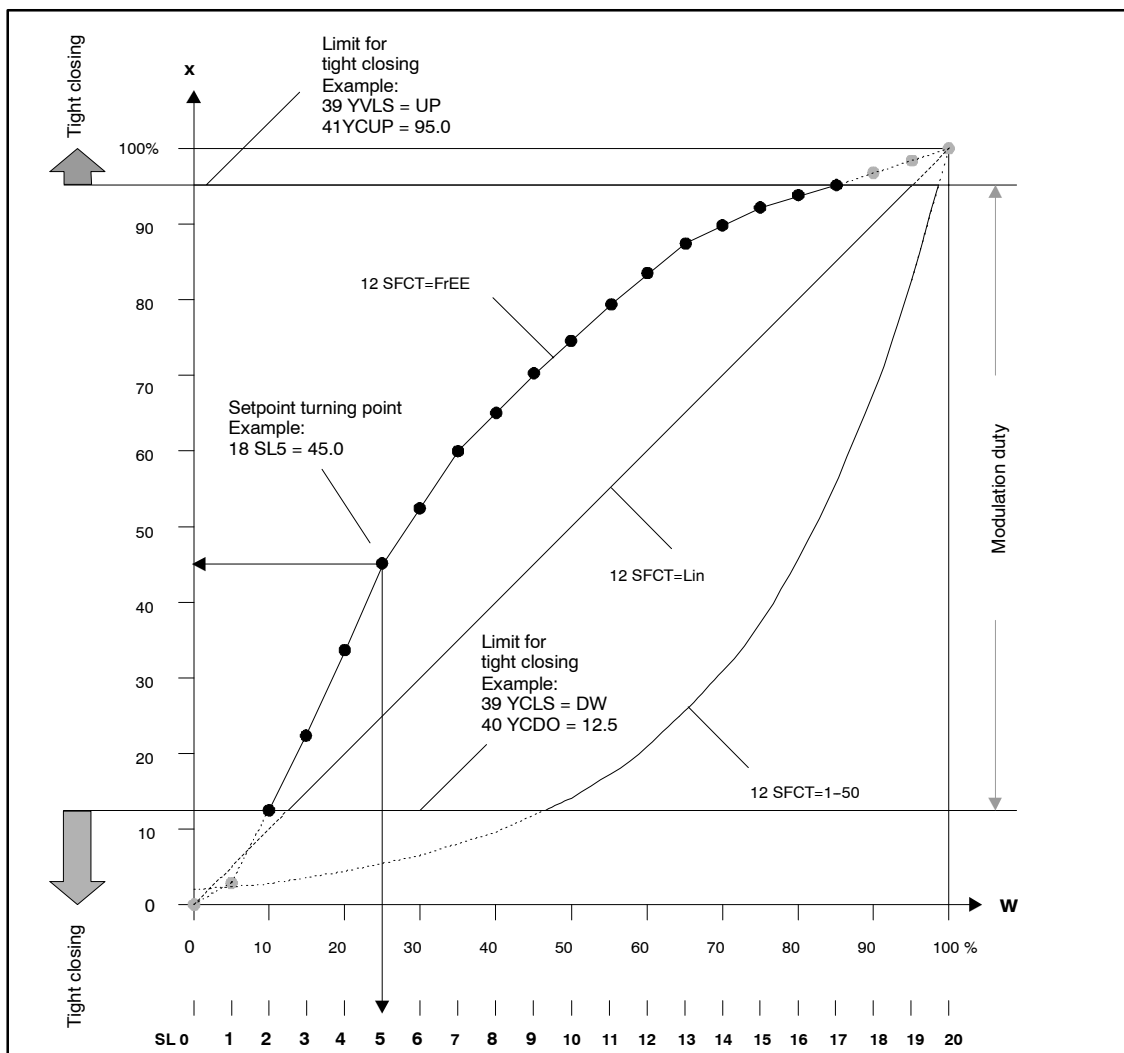


Figure 4-9 Setpoint characteristic, manipulated variable standardization and tight closing function

The setpoint vertex values can only be input at 12.SFCT=FrEE. You may only enter a strictly monotonous characteristic, and two consecutive vertex values must differ by at least 0.2 %.

34.DEBA

Dead zone of the controller

At 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 4-9 and 4-10) and

36.YE

Manipulated variable limiting end (see figure 4-9 and 4-10)

With the parameters "YA" and "YE" the mechanical actuating distance (from stop to stop) is limited to the set values. In this way the mechanical setting range of the actuator can be limited to the active flow and the integral saturation of the commanding controller avoided.



NOTE

YE must always be set to greater than YA.

37.YNRM

Manipulated variable standardization (see figure 4-9 and 4-10)

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

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

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

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

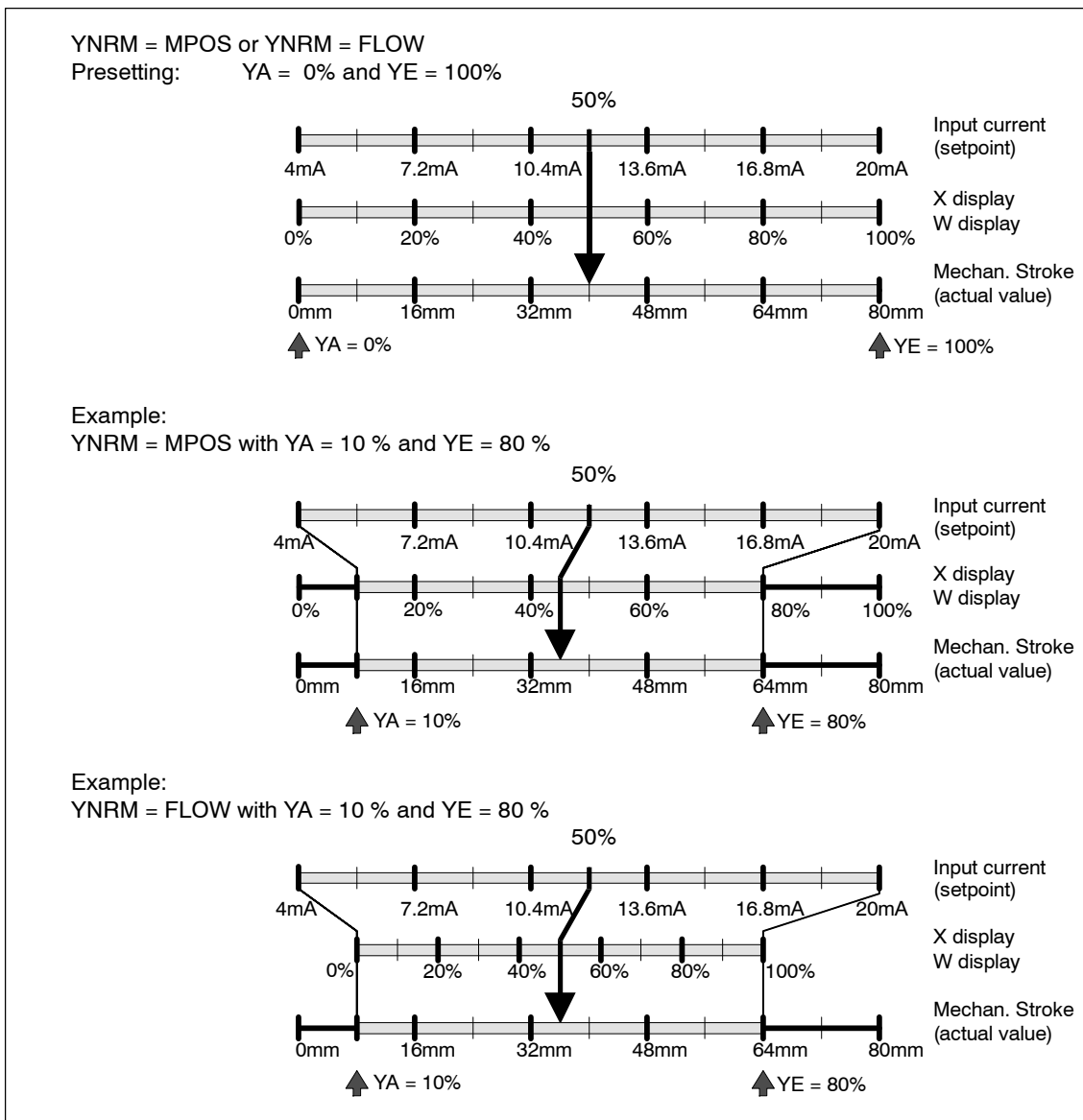


Figure 4-10 Dependence on the stroke of standardization and on YA and YE in the example of an 80 mm linear actuator

38.YDIR Manipulated variable direction of action

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

39.YCLS Tight closing with manipulated variable (see figure 4-9, page 91)

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

- 40.YCDO** Value for tight closing, bottom
and
41.YCUP Value for tight closing, top
-



NOTE

YCDO must always be set to less than YCUP.
The tight closing function has a fixed hysteresis of 1 %.

- 42.BIN1** Function digital input 1 (see figure 4-6, page 85)
and
43.BIN2 Function digital input 2 (see figure 4-6)

The parameters “BIN1” and “BIN2” can be set individually depending on the purpose. The direction of action can be adapted to an NCC or an NOC.

- BIN1 or BIN2 = on or –on

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

- BIN1 = bLoc1

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

- BIN1 = bLoc2

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

- BIN1 or BIN2 = uP or doWn (contact closes) or –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, , when the operating mode key is pressed the firmware version will be displayed. line of the display.

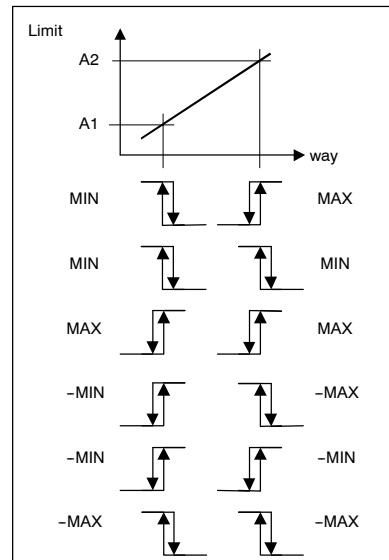
If one of the above named functions is selected with the parameters “BIN1” and “BIN2” simultaneously, then “Blocking” has priority over “Up” and “Up” priority over “Down”.

44.AFCT

Alarm function

The actuator can report the exceeding (max.) or dropping below (min) of a specified stroke or angle of rotation. The response of the alarms (limit contacts) is related to the MPOS-scaling (see figure 4-10, page 93). 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.



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

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

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

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

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. TIM** Monitoring time for setting the fault messages
- The set value (s) serves as a specification for the time within which the positioner must have reached the controlled state. The corresponding response threshold is specified with "49. LIM ".
- The fault message output is set on exceeding the set time.
- 49. LIM** Response threshold of the fault message
- Here a value (%) can be set for the permissible variable of control error for releasing the fault message.
- If the parameters 48 and 49 are both set to "Auto" (factory setting), the fault message is set if the short step zone is not reached within a certain time. This time is 5 times the initialization travel time within 5 to 95% of the travel and 10 times this time outside 10 to 90% of the travel.
- 50. 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 98.
- This monitoring function can be deactivated with the OFF setting (factory setting).
- 51. DCHG** Limit value for monitoring the changes of direction
- A limit value for the direction change counter can be set here. If this counter exceeds the limit value, the fault message output is activated.
- This function enables a preventive maintenance of the fitting, see also chapter 4.5 "Diagnostics", page 98.
- This monitoring function can be deactivated with the OFF setting (factory setting).
- 52. ZERO** Tolerance value for monitoring the bottom hard stop
- With this value a limit value (in percent related to the total mechanical distance) can be preset for the monitoring of the bottom hard stop. If this tolerance value is exceeded or dropped below of, the fault message output (optional) is activated.
- This function detects when the bottom stop has changed by more than the specified tolerance related to its initialization value. Monitoring takes place when the valve is in tight closing bottom. Activation of the tight closing bottom function (parameter "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 98.

53. 4 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 tight closing top. Activation of the tight closing top function (parameter "39.YCLS") is therefore a prerequisite.

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

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

**NOTE**

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

54. 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.

The following table shows an overview of the displayable values.

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

The respective next diagnostic value can be selected with the operation mode key . 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	0 to 4.29E9	-	x
2	CHDIR	Changes of direction	0 to 4.29E9	-	x
3	HCNT	Fault counter	0 to 4.29E9	-	x
4	A1CNT	Alarm counter 1	0 to 4.29E9	-	x
5	A2CNT	Alarm counter 2	0 to 4.29E9	-	x
6	HOURS	Operating hours	0 to 4.29E9	Hours	
7	WAY	Determined travel	0 to 130	mm or °	
8	TUP	Travel time up	0 to 1000	s	
9	TDOWN	Travel time down	0 to 1000	s	
10	LEAK	Leakage	0.0 to 100.0	%	
11	P0	Potentiometer value lower stop (0 %)	0.0 to 100.0	%	
12	P100	Potentiometer value upper stop (100 %)	0.0 to 100.0	%	
13	IMPUP	Impulse length up	2 to 100	ms	
14	IMPDN	Impulse length down	2 to 100	ms	
15	DBUP	Dead Band Up	0.1 to 100.0	%	
16	DBDN	Dead Band Down	0.1 to 100.0	%	
17	SSUP	Short step zone up	0.1 to 100.0	%	
18	SSDN	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	
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	


No.	Abbreviation	Meaning	Displayable values	Unit	Rest poss.
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)	–	–	
34	PRUP	Prediction up	1 to 40	–	
35	PRDN	Prediction down	1 to 40	–	
36	WT00	Number of operating hours in distance class WT00	0 to 4.29E9	Hours	x
37	WT05	Number of operating hours in distance class WT05	0 to 4.29E9	Hours	x
38	WT10	Number of operating hours in distance class WT10	0 to 4.29E9	Hours	x
39	WT30	Number of operating hours in distance class WT30	0 to 4.29E9	Hours	x
40	WT50	Number of operating hours in distance class WT50	0 to 4.29E9	Hours	x
41	WT70	Number of operating hours in distance class WT70	0 to 4.29E9	Hours	x
42	WT90	Number of operating hours in distance class WT90	0 to 4.29E9	Hours	x
43	WT95	Number of operating hours in distance class WT95	0 to 4.29E9	Hours	x
44	mA	Current setpoint	0.0 to 20.0	mA	

Table 4-1 Overview diagnostic values

4.5.2 Meaning of the diagnostic values

1 STRKS


Number of strokes

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

2 CHDIR


Number of direction changes

Every change in direction leaving the dead zone is noted in the controller and added to the number of changes of direction.

The value is written every 15 minutes in a non-volatile memory. It can be reset to zero with the increment key .

3 CNT

Fault counter

Every fault is noted in the controller and added to the number of fault messages. The counter can be reset to zero with the increment key .

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 \triangle .
6 HOURS	Operating hours
	The operating hours counter is updated every hour as soon as the positioner has been supplied with electrical power.
7 WAY	Determined actuating way
	This value indicates the actuating way determined during initialization according to the display at the end of an initialization. Prerequisite in linear actuator: Specification of the lever arm with the parameter "3.YWAY".
8 TUP	Travel time up
	and
9 TDOWN	travel time down
	These values show the travel times which have been determined during initialization. The unit is seconds.
10 LEAK	Leakage
	If a leakage message has been output during initialization, the value of the leakage can be read here in %/min.
11 P0	Potentiometer value bottom stop
	and
12 P100	Potentiometer value top stop
	These two values indicate the measured values of displacement measurement (potentiometer) at the bottom and top hard stops as determined in automatic initialization. In manual initialization the values of the manually reached limit positions are indicated here.
13 IMPUP	Impulse length up
	and
14 IMPDN	Impulse length down
	During initialization the smallest impulse lengths are determined with which a movement of the actuator can be achieved. They are determined and displayed here for the "Up"-direction and the "Down"-direction.
	These two parameter can be used for special applications (see chapter 4.7 page 110).

15 DBUP Dead zone up
and
16 DBDN Dead zone down

Here the dead zone of the controller is displayed in "Up"-direction or in "Down"-direction. The values correspond either to the manually set value of the parameter "34.DEBA" or the value adapted automatically by the instrument when "DEBA" has been set to "Auto".

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

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

These two parameter can be tuned for special applications (see chapter 4.7 page 110).

19 TEMP Current temperature

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

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

20 TMIN Minimum temperature (drag pointer)
and

21 TMAX Maximum temperature (drag pointer)

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

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

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

The temperature ranges are divided up as follows:

	T1	T2	T3	T4	T5	T6	T7	T8	T9
Temperature range [°C]	≥ -30	≥ -30 < -15	≥ -15 < 0	≥ 0 < 15	≥ 15 < 30	≥ 30 < 45	≥ 45 < 60	≥ 60 < 75	≥ 75
[°F]	< -22	≥ -22 < 5	≥ 5 < 32	≥ 32 < 59	≥ 59 < 86	≥ 86 < 113	≥ 113 < 140	≥ 140 < 167	≥ 167

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 Δ for at least 5 seconds. Here the diagnostic data 7 to 17 are stored in a non-volatile memory as "Data of the last maintenance". These diagnostic data are selected values, the changes of which can provide information on the mechanical wear of the valve.

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

34 PRUP Prediction up
35 PRDN Prediction down
see chapter 4.7 page 110).

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

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

The setting range is divided as follows:

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

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

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

44 MA

Setpoint

You can display the current setpoint in mA here.

**NOTE**

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

4.5.3 Online-Diagnosis

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

Table 4-2, page 104 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
41	Remaining control error	always active	... the control error has disappeared again	Compressed air missing, actuator fault, valve fault (e.g. blockade).
42	Instrument not in automatic mode	47.4 FCT= 4 nA or = 4 nAB	... the instrument is brought into automatic mode	The instrument is configured or is in manual operation.
43	Digital input DI1 or DI2 active	47.4 FCT= 4 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).
44	Limit value Number of strokes exceeded	50.4 STRK≠OFF	... the stroke counter is reset or the limit value increased	The total distance traveled by the actuator exceeded the set limit value.
45	Limit value change of direction exceeded	51.4 DCHG≠OFF	... the change of direction counter is reset or the limit value increased	The number of changes of direction exceeded the set limit value.
46	Limit value bottom hard stop exceeded	52.4 ZERO≠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.
47	Limit value top hard stop exceeded	53.4 OPEN≠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.
48	Limit value dead zone adaptation exceeded	54.4 DEBA≠OFF 34.DEBA = Auto	... the limit value is dropped below again	Increased stuffing box friction, mechanical lots of the position feedback

Table 4-2 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 48.4 TIM, monitoring time for setting the fault messages and 49.4 LIM, response threshold of the fault message. As soon as the control error drops back below the response threshold, the fault message is reset.

2 Monitoring automatic operation

A fault message is generated when the instrument is not in the automatic mode at the appropriate parameter setting "47.4 FCT". In this way the control system can be warned for example when the instrument has been switched to manual operation or Configuration on site.

3 Digital input DI1 or DI2 active

A fault message is generated when the digital input is activated at the the corresponding setting of the parameter "47.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 \neq OFF. Errors of the valve seat can be detected with this function for example. Exceeding of the limit value may hint at deposits or foreign bodies in the valve seat. Exceeding the limit value may be caused by wear of the valve seat. Mechanical maladjustment of the position feedback may also trigger this error message.

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

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

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

8 Monitoring of the dead zone adaptation

If the dead zone increases unproportionally in operation in automatic adaptation of the dead zone (parameter DEBA = Auto) this points to an error in the system (e.g. a marked increase in stuffing box friction, play in the displacement detection, leakage). Therefore a limit value can be specified for this value ("54.4DEBA", limit value for dead zone monitoring) which activates the fault message output when it is exceeded.

4.6 Meanings of other display texts

Notes on the tables:

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

Reports before initializing (first commissioning):

	Upper line	Lower line	Meaning/Cause	Actions
CPU START	x	x	Report after connecting the electrical auxiliary power	• Wait
P nnn.n	x		Potentiometer voltage for non-initialized positioner (P manual mode) (Setting actual value in % of measurement range)	<ul style="list-style-type: none"> • Check using the "+" and "-" keys whether the overall travel can be traversed without ever "P----" being displayed • Perform initialization
P---	x		Measurement range exceeded, potentiometer is in the inactive zone, transmission ratio selector or effective lever arm are not matched to the travel	<ul style="list-style-type: none"> • Set transmission ratio selector to 90 degrees, in particular for rotary actuators • Match effective arm length for linear actuators to measurement range
NOINI		x	Positioner not initialized	• Start initialization

Messages during initialization:

	Upper line	Lower line	Meaning/Cause	Actions
P--	x		See above	See above
RUN 1		x	Initialization started, part 1 active (direction of control action being determined)	• Wait
RUN 2		x	Initialization part 2 active (travel check and determination of the end stops)	• Wait

	Upper line	Lower line	Meaning/Cause	Actions
RUN 3		x	Initialization part 3 active (determination and display of positioning times)	<ul style="list-style-type: none"> • Wait
RUN 4		x	Initialization part 4 active (determination the minimum positioning increment length)	<ul style="list-style-type: none"> • Wait
RUN 5		x	Initialization part 5 active (optimization of the behavior on transients)	<ul style="list-style-type: none"> • Wait until "FINSH" is displayed (initialization completed successfully) • Press "operating mode" key briefly to acknowledge or longer to quit configuration mode
YEND1		x	<u>only during manual initialization</u> first end position can be moved to	<ul style="list-style-type: none"> • Move to first end position using the "+" or "-" key • Press "operating mode" key to acknowledge
YEND2			<u>only during manual initialization</u> second end position can be moved to	<ul style="list-style-type: none"> • Move to second end position using the "+" or "-" key • Press "operating mode" key to acknowledge
RANGE		x	<u>only during manual initialization</u> End position or measurement span are outwith the permitted measurement range	<ul style="list-style-type: none"> • Using "+" and "-" keys move to the other end position and press "operating mode" key to acknowledge, <u>or</u> • Adjust slip clutch until "ok" is displayed and press "operating mode" key to acknowledge <u>or</u> • Interrupt initialization by pressing the "operating mode" key, switch to P manual mode and correct the travel and position sensing
ok			<u>only during manual initialization</u> permitted measurement range for end positions reached	<ul style="list-style-type: none"> • Press "operating mode" key to acknowledge, the remaining steps ("RUN1" to "FINSH") will run through automatically
RUN 1/ ERROR		x	Fault in RUN 1 no movement e.g. no compressed air	<ul style="list-style-type: none"> • Ensure compressed air is sufficient • Open any choke(s) • Re-start initialization
↳ d__U		x	Bar display of the zero point Zero point is outwith the tolerance range	<ul style="list-style-type: none"> • With slip clutch set to "P 4.0" to "P 9.9" (>0<) • Continue using the "+" or "-" key
SEt MIDL	x	x	Slip clutch misaligned; "P 50.0" no displayed when arm horizontal	<ul style="list-style-type: none"> • For linear actuators, use the "+" and "-" keys to bring the arm to the correct angle on the spindle • Press "operating mode" key briefly to acknowledge (initialization will resume)
↳ UP >		x	"UP" – tolerance range exceeded or inactive zone of potentiometer entered	<ul style="list-style-type: none"> • Match effective arm length for linear actuators to measurement range, or set transmission ratio selector to 90 degrees • Press "operating mode" key briefly to acknowledge • Re-start initialization
↳ 90_95		x	Only applies to rotary drives: travel is not within range 90 to 95%	<ul style="list-style-type: none"> • Use the "+" and "-" keys to move into the range of 90 to 95% • Press "operating mode" key briefly to acknowledge

	Upper line	Lower line	Meaning/Cause	Actions
↳ U-d>		x	Measurement span "Up-Down" is insufficient	<ul style="list-style-type: none"> Reduce effective arm length for linear actuators or set transmission ratio selector to 33 degrees Press "operating mode" key briefly to acknowledge Re-start initialization
U nn.n D->U	x	x	Display the positioning time "Up"	<ul style="list-style-type: none"> Wait, <u>or</u> To change the travel time interrupt initialization with the "-" key, <u>or</u> Activate the leakage test with the "+" key
d nn.n U->d	x	x	Display the positioning time "Down"	<ul style="list-style-type: none"> Wait, <u>or</u> To change the travel time interrupt initialization with the "-" key, <u>or</u> Activate the leakage test with the "+" key
NOZZL		x	Actuator stationary (initialization interrupted with the "-" key during actuation speed display)	<ul style="list-style-type: none"> Travel time can be adjusted by varying the choke(s) Use the "-" key to repeat the determination of the positioning speed Continue using the "+" key
TEST LEAKG	x	x	Leakage test active initialization interrupted with the "+" key during travel-speed display)	<ul style="list-style-type: none"> Wait 1 minute Continue with the "+" key
nn.n °oMIN	x	x	Value and units of results of the leakage test	<ul style="list-style-type: none"> Remove leakage if value is too high. Continue with the "+" key
nn.n FINSH	x	x	Initialization completed successfully, with display of the travel or positioning angle as appropriate	<ul style="list-style-type: none"> Press "operating mode" key briefly to acknowledge or longer to quit configuration mode

Reports on leaving "configuration" operating mode:

	Upper line	Lower line	Auto- matic	Manual mode	P manual mode	Meaning/Cause	Actions
Cn VER	x	x				Software version	<ul style="list-style-type: none"> Wait
Error SLnn	x	x				Monotonicity transgression of the free characteristic line at support point "n"	<ul style="list-style-type: none"> Correct value

Reports on leaving "configuration" operating mode:

	Upper line	Lower line	Auto-automatic	Manual mode	P manual mode	Meaning/Cause	Actions
CPU START	x					Message after applying auxiliary electrical power	<ul style="list-style-type: none"> • Wait
HW / ERROR		x				Fault in the hardware	<ul style="list-style-type: none"> • Exchange electronics
NOINI		x			x	Positioner not initialized	<ul style="list-style-type: none"> • Start initialization
nnn.n	x		x	x		Setting actual value [in %] for initialized positioners. Flashing decimal point indicates communication with a class 2 master	
AUTnn		x	x			Automatic mode (nn = setpoint)	
MANnn				x		Manual mode (nn = setpoint)	<ul style="list-style-type: none"> • Press operating mode key to change to automatic mode
oFL / 127.9	x		x	x		Display range exceeded. Possible causes: <ul style="list-style-type: none"> • Slip clutch <u>or</u> • Transmission ratio selector switch changed <u>or</u> • Positioner installed without reinitialization, having previously been fitted to another drive 	<ul style="list-style-type: none"> • Adjust slip clutch so that when moving the drive the actual value display remains within 0.0 to 100.0 <u>or</u> • Change transmission selector switch <u>or</u> • Carry out factory setting (preset) and initialization
EXSTP		x	x			Actuator stopped by binary input	
EX UP		x	x			Actuator moved by binary input to upper stop	
EXDWN		x	x			Actuator moved by binary input to lower stop	
HTCNF		x	x	x	x	HART configuration is running	

4.7 Optimization of the control data

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

- 13 Pulse length up** This determines for any sense of actuation the smallest drive movement pulse length. The optimum value is dependent particularly on the volume of the drive. Small values will lead to small actuation increments and frequent control drive activations. Note that if the value is too small no movement will result. If drive volumes are large, then it is better to use larger actuation increments. Note also that large actuation increments will still lead to large movements for small drives.
- 14 Pulse length down**

17 Short step zone up

18 Short step zone down

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

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

34 Prediction up

35 Prediction down

These parameters operate on the damping factor and have the effect of adjusting the control dynamics.

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

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

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

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

On leaving the diagnostic menu the activation of the parameter for adjustment will be deactivated again.

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

Positioner in metal housing and explosion proof version

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

Positioner in plastic housing

Removal

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

Installation

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

Important:

Make sure that the same thread is used. To do this turn the screws counterclockwise until they snap into the thread audibly. Only then should you tighten the screws.

8. Replace the cover and screw it tight.
9. Re-connect the pipes and supply pneumatic energy.



DANGER

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

Technical Data

6

General data for basic device 6DR5

(see following pages)

Technical data	
SIPART PS2 SIPART PS2 EEx d	
General data	
Travel range (linear actuators)	3 to 130 mm (0.12 to 5.12 inch) (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 (see Fig. 5/16)
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 (≤ 0.1%/18 °F)
Binary input BI1 (terminals 9/10; electrically connected to basic device)	Can only be used for floating contact; max. contact rating < 5 μA at 3 V
Degree of protection	IP 65 to EN 60 529/NEMA 4x
Mounting position	Any; in wet environment, pneumatic connections and exhaust opening not upwards
CE marking	Conforms to EMC guideline 89/336 EEC in compliance with the following standards
EMC requirements	EN 61 326/A1 Appendix A.1 and NAMUR NE21 August 1998

1) When commissioning at ≤ 0 °C (≤ 32 °F) make sure that the valves are purged with the dry medium for a sufficiently long time.
 2) Limited refresh rate of LCD below -10 °C (+14 °F). Only T4 permissible when using with ly module.
 3) With the EEx d version (6DR5 ■■ 5-...), the values are reduced by approx. 20%.

Technical data (continued)	
Material of:	
• Casing	Glass-fiber-reinforced Macrolon
- 6DR5 ■■ 0-... (plastic)	GK-AISi12
- 6DR5 ■■ 1-... (metal)	GK-AISi12
- 6DR5 ■■ 5-... (metal)	Aluminium AlMgSi, anodized
• Pressure gauge block	
Vibration resistance	
• Harmonic oscillations (sine-wave) according to DIN EN 60 062-2-6/05.96	3.5 mm (0.14 inch) (2 to 27 Hz) 3 cycles/axis 98.1 m/s ² (321.84 ft/s ²) (27 to 300 Hz) 3 cycles/axis
• Repetitive shocks (half sine-wave) according to DIN EN 60 068-2-29/03.95	150 m/s ² (492 ft/s ²), 6 ms 1000 shocks/axis
• Noise (digitally controlled) according to DIN EN 60 068-2-64/08.95	10 to 200 Hz 1 (m/s ²) ² /Hz (3.28 (ft/s ²) ² /Hz) 200 to 500 Hz 0.3 (m/s ²) ² /Hz (0.98 (ft/s ²) ² /Hz)
• Recommended continuous range of use for complete fitting	4 hours/axis ≤ 30 m/s ² (≤ 98.4 ft/s ²) without magnification factor
Weight, basic device	
• Plastic casing	Approx. 0.9 kg (1.98 lb)
• Metal casing	Approx. 1.3 kg (2.87 lb)
• Metal casing, EEx d version	Approx. 5.2 kg (11.46 lb)
Dimensions	See Fig. 5/14 and Fig. 5/15
Climatic class	To IEC 721
• Storage	1K5, but -40 to +80 °C ¹⁾ (1K5, but -40 to +176 °F ¹⁾)
• Transport	2K4, but -40 to +80 °C ¹⁾ (2K4, but -40 to +176 °F ¹⁾)
• Operation	
- Without purging air	3K3, but -30 to +80 °C ²⁾ (3K3, but -22 to +176 °F ²⁾)
- With purging air	3K4, but -30 to +80 °C ²⁾ (3K4, but -22 to +176 °F ²⁾)
Certificates and approvals	
Classification according to pressure equipment directive (DGRL 97/23/EC)	For gases of fluid group 1 and liquids of fluid group 1, complies with requirements of article 3, paragraph 3 (sound engineering practice SEP)
Pneumatic data	
Supply (inlet air)	
• Pressure	1.4 to 7 bar (20.3 to 101.5 psi): sufficiently larger than max. actuator pressure (positioning pressure)
Air quality according to ISO 8573-1	
• Size and density of particulates	Class 2
• Pressure dew point	Class 2 (min. 20 K (36 °F) below ambient temperature)
• Oil concentration	Class 2
Unrestricted flow of:	At
• Inlet air valve [Nm ³ /h] (USgpm) ³⁾	2 bar (29 psi) 4 bar (58 psi) 6 bar (87 psi)
• Outlet air valve [Nm ³ /h] (USgpm) ³⁾	4.1 (18.1) 7.1 (31.3) 9.8 (43.1)
	8.2 (36.1) 13.7 (60.3) 19.2 (84.5)
Valve leakage	< 6 x 10 ⁻⁴ Nm ³ /h (0.0026 USgpm)
Throttle ratio	Adjustable up to ∞ : 1
Consumption of inlet air in stable state	< 3.6 x 10 ⁻² Nm ³ /h (0.158 USgpm)
Types of actuators	
• In plastic casing	Single-action and double-action
• In metal casing	Single-action
• In flameproof casing	Single-action and double-action

Technical data

SIPART PS2	Basic device without Ex protection	Basic device with Ex protection EEx d (flameproof casing)	Basic device with Ex protection EEx ia/ib	Basic device with Ex protection EEx n
Explosion protection to EN 50 014, EN 50 020 and EN 50 021	Without	EEx d II 2 G EEx ia/ib II C T6	EEx ia/ib II 2 G EEx ia/ib II C T6	EEx n II 3 G EEx nA L [L] II C T6
Mounting location		Zone 1	Zone 1	Zone 2
Permissible ambient temperature for operation	-30 to +80 °C (-22 to +176 °F)	T4: -30 to +80 °C ¹⁾ (T4: -22 to +176 °F ¹⁾) T5: -30 to +65 °C ¹⁾ (T5: -22 to +149 °F ¹⁾) T6: -30 to +50 °C ¹⁾ (T6: -22 to +122 °F ¹⁾)	T4: -30 to +80 °C ¹⁾ (T4: -22 to +176 °F ¹⁾) T5: -30 to +65 °C ¹⁾ (T5: -22 to +149 °F ¹⁾) T6: -30 to +50 °C ¹⁾ (T6: -22 to +122 °F ¹⁾)	T4: -30 to +80 °C ¹⁾ (T4: -22 to +176 °F ¹⁾) T5: -30 to +65 °C ¹⁾ (T5: -22 to +149 °F ¹⁾) T6: -30 to +50 °C ¹⁾ (T6: -22 to +122 °F ¹⁾)
Electrical data				
Input				
<u>Two-wire system</u> (terminals 6/8)				
• Rated signal range			4 to 20 mA	
• Current to maintain power supply			≥ 3.6 mA	
• Required load voltage U_B ($\cong \Omega$ at 20 mA)				
- without HART 6DR50.. typ. max.		≤ 6.36 V ($\cong 318 \Omega$) ≤ 6.48 V ($\cong 324 \Omega$)	≤ 7.8 V ($\cong 390 \Omega$) ≤ 8.3 V ($\cong 415 \Omega$)	≤ 7.8 V ($\cong 390 \Omega$) ≤ 8.3 V ($\cong 415 \Omega$)
- without HART 6DR53.. typ. max.	≤ 7.9 V ($\cong 395 \Omega$) ≤ 8.4 V ($\cong 420 \Omega$)	–	–	–
- with HART 6DR51.. typ. max.		≤ 6.6 V ($\cong 330 \Omega$) ≤ 6.72 V ($\cong 336 \Omega$)	–	–
- with HART 6DR52.. typ. max.	–	≤ 8.4 V ($\cong 420 \Omega$) ≤ 8.8 V ($\cong 440 \Omega$)	≤ 8.4 V ($\cong 420 \Omega$) ≤ 8.8 V ($\cong 440 \Omega$)	≤ 8.4 V ($\cong 420 \Omega$) ≤ 8.8 V ($\cong 440 \Omega$)
• Static destruction limit		± 40 mA	–	–
• Internal capacitance C_i				
- without HART		–	≤ 22 nF	–
- with HART		–	≤ 7 nF	–
• Internal inductance L_i				
- without HART		–	≤ 0.12 mH	–
- with HART		–	≤ 0.24 mH	–
• For connection to circuits with		–	Intrinsically-safe $U_o \leq 30$ V DC $I_k \leq 100$ mA $P \leq 1$ W	$U_i \leq 30$ V DC $I_i \leq 100$ mA
<u>Three-wire/four-wire system</u> (terminals 2/4 and 6/8) (only 6DR52.. and 6DR53..)				
• Power supply U_H		18 to 35 V DC	18 to 30 V DC	18 to 30 V DC
• Current consumption I_H			($U_H - 7.5$ V)/2.4 k Ω [mA]	
• Internal capacitance C_i		–	≤ 22 nF	–
• Internal inductance L_i		–	≤ 0.12 mH	–
• For connection to circuits with		–	Intrinsically-safe $U_o \leq 30$ V DC $I_k \leq 100$ mA $P \leq 1$ W	$U_i \leq 30$ V DC $I_i \leq 100$ mA
Current input I_W				
• Rated signal range			4 to 20 mA	
• Load voltage at 20 mA		≤ 0.2 V ($\cong 10 \Omega$)	≤ 1 V ($\cong 50 \Omega$)	≤ 1 V ($\cong 50 \Omega$)
• Internal capacitance C_i		–	≤ 22 nF	–
• Internal inductance L_i		–	≤ 0.12 mH	–
• For connection to circuits with		–	Intrinsically-safe $U_o \leq 30$ V DC $I_k \leq 100$ mA $P \leq 1$ W	$U_i \leq 30$ V DC $I_i \leq 100$ mA

1) Limited refresh rate of LCD below -10 °C (+14 °F). Only T4 permissible when using with Iy module.

Technical data (continued)

SIPART PS2	Basic device without Ex protection	Basic device with Ex protection EEx d (flameproof casing)	Basic device with Ex protection EEx ia/ib	Basic device with Ex protection EEx n
Electrical data				
Electrical isolation	Between U_H and I_W		Between U_H and I_W (2 intrinsically-safe circuits)	Between U_H and I_W
• Test voltage	DC 840 V (1 s) or 700 V (50 Hz, 1 s)			
Connections				
• Electric	Screw terminals 2.5 AWG28-12 Cable bushing M20 or 1/2" NPT (see Ordering data)	Screw terminals 2.5 AWG28-12 EEx d-certified cable bushing M20x1.5, 1/2" NPT or M25x1.5 (see Ordering data)	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)
• Pneumatic	Female thread G1/4 DIN 45 141 or 1/4" 18 NPT (see Ordering data)			
• External position sensor (potentiometer or NSC; option)				
- U_o	-	-	-	< 5 V
- I_o	-	-	-	< 75 mA
- I_s	-	-	-	< 160 mA
- P_o	-	-	-	< 120 mW
- Max. perm. external capacitance (C_o)	-	-	-	< 1 μ F
- Max. perm. external inductance (L_o)	-	-	-	< 1 mH

Technical data

Option modules	Without Ex protection		With Ex protection	
Electrical data				
Ex protection to EN 50 014, EN 50 020 and 50 021	–		II 2G EEx ia/ib II C T4/T5/T6 ¹⁾	
Mounting location	–		Zone 1	
Permissible ambient temperature for operation	-30 to +80 °C (-22 to +176 °F)		T4: -30 to +80 °C ¹⁾ (T4: -22 to +176 °F ¹⁾) T5: -30 to +65 °C ¹⁾ (T5: -22 to +149 °F ¹⁾) T6: -30 to +50 °C ¹⁾ (T6: -22 to +122 °F ¹⁾)	
Alarm module	6DR4004-8A (without Ex protection)		6DR4004-6A (with Ex protection)	6DR4004-6A (with Ex protection)
<u>Binary alarm outputs A1, A2 and alarm output</u> (terminals 41/42, 51/52 and 31/32)				
Signal status High (not triggered)	Conductive, $R = 1 \text{ k}\Omega$, +3/-1%		$\geq 2.1 \text{ mA}^2$	$\geq 2.1 \text{ mA}^2$
Signal status Low ³⁾ (triggered)	Non-conductive, $I_R < 60 \mu\text{A}$		$\leq 1.2 \text{ mA}^2$	$\leq 1.2 \text{ mA}^2$
Internal capacitance C_i	–		$\leq 5.2 \text{ nF}$	–
Internal inductance L_i	–		Negligible	–
Power supply U_H	$\leq 35 \text{ V}$		–	–
Connection to circuits with	–		Intrinsically-safe switching amplifier DIN 19 234 $U_o \leq 15.5 \text{ V DC}$ $I_k \leq 25 \text{ mA}$, $P \leq 64 \text{ mW}$	$U_i \leq 15.5 \text{ V DC}$
<u>Binary input BI2</u>				
• Electrically connected to basic device (terminals 21/22)			Floating contact, open	
- Signal status 0			Floating contact, closed	
- Signal status 1			3 V, 5 μA	
- Contact rating				
• Electrically isolated from basic device (terminals 11/12)			$\leq 4.5 \text{ V}$ or open	
- Signal status 0			$\geq 13 \text{ V}$	
- Signal status 1			$\geq 25 \text{ k}\Omega$	
- Inherent resistance				
Static destruction limit	$\pm 35 \text{ V}$		–	–
Internal inductance and capacitance	–		Negligible	–
Connection to circuits with	–		Intrinsically-safe $U_i \leq 25.2 \text{ V}$	$U_i \leq 25.2 \text{ V DC}$
Electrical isolation	The 3 outputs, the input BI2 and the basic device are electrically isolated from each other			
Test voltage	840 V DC, 1 s			
SIA module	6DR4004-8G (without Ex protection)		6DR4004-6G (with Ex protection)	6DR4004-6G (with Ex protection)
<u>Limit monitor with slot-type initiators and alarm output</u> (terminals 41/42 and 51/52)			Two-wire connection	
Ex protection	Without		II 2 G EEx ia/ib IIC T6	II 2 G EEx nA L [L] IIC T6
Connection	Two-wire system to DIN 19 234 (NAMUR), for series-connected switching amplifiers			
2 slot-type initiators	Type SJ2-SN			
Function	Opener (NC, normally closed)			
Connection to circuits with	Rated voltage 8 V		Intrinsically-safe switching amplifier DIN 19 234	$U_i \leq 15.5 \text{ V DC}$
	Current consumption: $\geq 3 \text{ mA}$ (limit not triggered) $\leq 1 \text{ mA}$ (limit triggered)		$U_i \leq 15.5 \text{ V DC}$ $I_i \leq 25 \text{ mA}$, $P_i \leq 64 \text{ mW}$	$P_i \leq 64 \text{ mW}$
Internal capacitance	–		$\leq 41 \text{ nF}$	–
Internal inductance	–		$\leq 100 \mu\text{H}$	–
Electrical isolation	The 3 outputs are electrically isolated from the basic device			
Test voltage	840 V DC, 1 s			
Alarm output (terminals 31/32)	See alarm module			

¹⁾ Only in conjunction with the basic device 6DR5 ■■■■ - ■ E ■■■■. Only T4 permissible when using with Iy module.

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.

Technical data (continued)

Option modules	Without Ex protection		With Ex protection	
Electrical data				
Ex protection to EN 50 014, EN 50 020 and 50 021	–	II 2G EEx ia/ib II C T4/T5/T6 ¹⁾	II 3G EEx nA L [L] II C T6	
Mounting location	–	Zone 1	Zone 2	
Permissible ambient temperature for operation	-30 to +80 °C (-22 to +176 °F)	T4: -30 to +80 °C ¹⁾ (T4: -22 to +176 °F ¹⁾) T5: -30 to +65 °C ¹⁾ (T5: -22 to +149 °F ¹⁾) T6: -30 to +50 °C ¹⁾ (T6: -22 to +122 °F ¹⁾)	T4: -30 to +80 °C ¹⁾ (T4: -22 to +176 °F ¹⁾) T5: -30 to +65 °C ¹⁾ (T5: -22 to +149 °F ¹⁾) T6: -30 to +50 °C ¹⁾ (T6: -22 to +122 °F ¹⁾)	
I_y module	6DR4004-8J (without Ex prot.)	6DR4004-6J (with Ex prot.)	6DR4004-6J (with Ex prot.)	
Direct current output for position feedback (terminals 61/62)			Two-wire system	
Rated signal range <i>i</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	+ 12 to 30 V	
External load R_B [kΩ]			$\leq (U_H [V] - 12 V) / i [mA]$	
Transmission error			$\leq 0.3\%$	
Temperature influence			$\leq 0.1\%/10 K (\leq 0.1\%/18 °F)$	
Resolution			$\leq 0.1\%$	
Residual ripple			$\leq 1\%$	
Internal capacitance C_i	–	≤ 11 nF	–	
Internal inductance L_i	–	Negligible	–	
For connection to circuits with			Intrinsically-safe: $U_i \leq 30$ V DC $I_i \leq 100$ mA; $P_i \leq 1$ W (only T4)	
Electrical isolation			Electrically isolated from basic device	
Test voltage			840 V DC, 1 s	
NCS sensor				
Positioning range			max. 14 mm (max. 0.55 inch)	
• Linear actuator			max. 120°	
• Rotary actuator				
Linearity (after correction by SIPART PS2)			$\pm 1\%$	
• Linear actuator			$\pm 1\%$	
• Rotary actuator			$\pm 0.2\%$	
Hysteresis			$\pm 0.2\%$	
Continuous operating temperature			-40 °C to +90 °C (-40 °F to +194 °F)	
Degree of housing protection			Only without Ex protection: -50 °C to +120 °C (-58 °F to +248 °F) with limited service life	
Degree of housing protection			IP 68/NEMA 4x	

¹⁾ Only in conjunction with the basic device 6DR5 ■■■■ - ■ E ■■■■. Only T4 permissible when using with I_y module.

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.



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.

7.2 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

7.3 Scope of delivery of options

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

1) EC-type examination certificates

2) Approval Reports of Factory Mutual System

7.4 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
NCS-Sensor not explosion protected explosion-protected cable length 6 m for rotary actuators for linear actuators up to 14 mm	6DR4004- _ N _ 0 6DR4004-8N 6DR4004-6N 6DR4004- _ NN 6DR4004- _ N _ 10 6DR4004- _ N _ 20
EMV filter module	C73451-A430-D23
External position detection system	C73451-A430-D78
Operating software SIMATIC PDM	on request

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9.1 Literature and catalogs

Nr.	Title	Issue by	Order no.
/1/	Industrial Communication and Field Devices Catalog IK PI · 2002/2003	Siemens AG	E86060-K6710-A101-B2-7600
/2/	Field Instruments for Process Automation Catalog FI 01 · 2003	Siemens AG	E86060-K6201-A101-A3-7600
/3/	SIMATIC PCS 7 Process Control System Catalog ST PCS 7 · 2002	Siemens AG	E86060-K4678-A111-A5-7600

9.2 Certificates

9.2.1 EC Declaration of Conformity (EEx d)

SIEMENS

EG-Konformitätserklärung EC Declaration of Conformity

No.1240.030 - S01

Hersteller:
Manufacture: Siemens AG

Anschrift:
Address: Östliche Rheinbrückenstr. 50; 76187 Karlsruhe
Bundesrepublik Deutschland

Produkt-
bezeichnung:
Product description: SIPART PS 2 EEx d

6DR5ab5 - eDef - xxxx
a = 0, 1, 2, 3, 5 b = 1, 2 c = 0, 1 d = G, N, M, P, Q e = 0, 1 f = 0, 1

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 vom 3. Mai 1989 zur Angleichung der Rechtsvorschriften der Mitgliedstaaten über die elektromagnetische Verträglichkeit.
(Gesetz Nr. 924/1989, 92/1/EEG, 92/1/EEG, 92/1/EEG)
Council Directive of 3 May 1989 on the approximation of the laws of the Member States relating to electromagnetic compatibility.
(amended by 92/25/EEC, 92/31/EEC, 93/88/EEC and 93/87/EEC)

94/9/EG Richtlinie des Europäischen Parlaments und des Rates vom 23. März 1994 zur Angleichung der Rechtsvorschriften der Mitgliedstaaten für Geräte und Schutzsysteme zur bestimmungsgemässen Verwendung in explosionsgefährdeten Bereichen.
Directive of the European Parliament and the Council of 23 March 1994 on the approximation of the laws of the Member States concerning equipment and protective systems intended for use in potentially explosive atmospheres.

CE-Kennzeichnung / CE marking: 07/02

Karlsruhe, 26.07.2002

Siemens AG

Schraefl, Entwicklung
Name, Funktion
Name, function

Unterschrift
signature

Kumpfmüller, Fertigung
Name, Funktion
Name, function

Unterschrift
signature

Anhang A ist integraler Bestandteil dieser Erklärung
Annex A is integral part of the declaration
Diese Erklärung bescheinigt die Übereinstimmung mit den genannten Richtlinien, ist jedoch keine Zusage von Eigenschaften.
The safety 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.

SIEMENS

Anhang A zur EG-Konformitätserklärung Annex A to the EC Declaration of Conformity

No.1240.030 - S01

Produkt-
bezeichnung:
Product description: SIPART PS 2 EEx d

6DR5ab5 - eDef - xxxx
a = 0, 1, 2, 3, 5 b = 1, 2 c = 0, 1 d = G, N, M, P, Q e = 0, 1 f = 0, 1

Die Konformität mit den auf Blatt 1 angeführten Richtlinien wird nachgewiesen durch die Einhaltung folgender Normen:
Conformity to the Directives indicated on page 1 is assured through the application of the following standards:

Referenznummer Reference number	Ausgabedatum Edition
EN 61326/AL Anh. A.1	1998
EN 50014	1997
EN 50018	1994

Zertifikat:
Certificate:

Zertifikat Certificate	Prüfbericht Nr. Report no.
PTB 99 ATEX 1101	PTB Ex 99-19094
	PTB Ex 00-10227
	PTB Ex 02-12178

Diese Erklärung bescheinigt die Übereinstimmung mit den genannten Richtlinien, ist jedoch keine Zusage von Eigenschaften.
The safety 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.

9.2.2 EC Declaration of Conformity

SIEMENS

EG-Konformitätserklärung EC Declaration of Conformity

No. 1240.010- S01

Hersteller: Siemens AG
 Manufacturer:
 Anschrift: Östliche Rheinbrückenstr. 50; 76187 Karlsruhe
 Address: Bundesrepublik Deutschland
 Produkt- SIPART PS2
 bezeichnung: 6DR5xxb-xxxx-xxxx a = 0, 1, 2, 3, 5; b = 0, 1; c = N, E, G
 Product 6DR4004-GJ Iy - Modul SIA - Modul
 description 6DR4004-GA Alarm - Modul C73451-A430-L8 EMV - Modul

Das beschriebene Produkt stimmt in der von uns in Verkehr gebrachten Ausführung mit den Vorschriften folgender Europäischen 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 vom 3. Mai 1989 zur Angleichung der Rechtsvorschriften der Mitgliedstaaten über die elektromagnetische Verträglichkeit (geändert durch 92/31/EWG, 92/31/EWG, 93/88/EWG und 93/97/EWG).
 Council Directive of 3 May 1989 on the approximation of the laws of the Member States relating to electromagnetic compatibility (amended by 92/31/EEC, 92/31/EEC, 93/88/EEC and 93/97/EEC)

94/9/EG Richtlinie des Europäischen Parlaments und des Rates vom 23. März 1994 zur Angleichung der Rechtsvorschriften der Mitgliedstaaten für Geräte und Schutzsysteme zur bestimmungsgemäßen Verwendung in explosionsgefährdeten Bereichen.
 Directive of the European Parliament and the Council of 23 March 1994 on the approximation of the laws of the Member States concerning equipment and protective systems intended for use in potentially explosive atmospheres

CE-Kennzeichnung / CE marking : 0602

Karlsruhe, den / the 02.06.2002

Siemens AG

Erwähnung Schrödi
 Name, Funktion
 Name, function
 Unterschrift
 Signature

Fertigung von Dyckerhoff & Widmann
 Name, Funktion
 Name, function
 Unterschrift
 Signature

Anhang A ist integraler Bestandteil dieser Erklärung.
 Annex A is an integral part of this declaration.
 Diese Erklärung bescheinigt die Übereinstimmung mit den genannten Richtlinien, ist jedoch keine Zusage von Eigenschaften.
 This declaration certifies the conformity to the specified directives but contains no assurance of properties. The safety documentation accompanying the product shall be consulted in detail.

SIEMENS

Anhang A zur EG-Konformitätserklärung Annex A to the EC Declaration of Conformity

No. 1240.010- S01

Produkt- SIPART PS2
 bezeichnung: 6DR5xxb-xxxx-xxxx a = 0, 1, 2, 3, 5; b = 0, 1; c = N, E, G
 Product 6DR4004-GJ Iy - Modul 6DR4004-6G SIA - Modul
 description 6DR4004-GA Alarm - Modul C73451-A430-L8 EMV - Modul

Die Konformität mit den auf Blatt 1 angeführten Richtlinien wird nachgewiesen durch die Einhaltung folgender Normen (Variantenabhängig):
 Conformity to the Directives indicated on page 1 is assured through the application of the following standards (depending on versions):

Richtlinie directive	Norm Standard Reference number	Ausgabedatum Edition	a =	b =	c =
89/336/EWG	EN 61326/A1 Anh. A	1998	0, 1, 2, 3, 5	0, 1	N, E, G
94/9/EG	EN 50 014	1997	0, 2, 5	0, 1	E
94/9/EG	EN 50 020	1994	0, 2, 5	0, 1	E
94/9/EG	EN 50021	1999	0, 2, 5	0, 1	G

Zertifikate:
 Certificates:

Zertifikat Certificate	Prüfbericht Nr.: Report no.:	a =	b =	c =
TÜV 00 ATEX 1654	00 Px 26800 01 Px 14510	0, 2, 5	0, 1	E
TÜV 01 ATEX 1786 X	02 YEX 142409a 02 YEX 134074	0, 2, 5	0, 1	G

Die Erklärung bescheinigt die Übereinstimmung mit den genannten Richtlinien, ist jedoch keine Zusage von Eigenschaften.
 This declaration certifies the conformity to the specified directives but contains no assurance of properties. The safety documentation accompanying the product shall be consulted in detail.

9.2.3 EC Type-Examination Certificate PTB 99 ATEX 1101 (EEx d)

(type of protection "flameproof enclosure")

Physikalisch-Technische Bundesanstalt

Braunschweig und Berlin

PTB



(1) EC-TYPE-EXAMINATION CERTIFICATE (Translation)

(2) Equipment and Protective Systems Intended for Use in
Potentially Explosive Atmospheres - **Directive 94/9/EC**

(3) EC-type-examination Certificate Number:

PTB 99 ATEX 1101



(4) Equipment: Electropneumatic positioner type SIPART PS2 EEx d
type 6DR4*05-*E*

(5) Manufacturer: Siemens AG Automatisierungstechnik

(6) Address: D-76181 Karlsruhe

(7) This equipment and any acceptable variation thereto are specified in the schedule to this certificate and the documents therein referred to.

(8) The Physikalisch-Technische Bundesanstalt, notified body No. 0102 in accordance with Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres, given in Annex II to the Directive.

The examination and test results are recorded in the confidential report PTB Ex 99-19094.

(9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with:
EN 50014:1997 **EN 50018:1994**

(10) If the sign "X" is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the schedule to this certificate.

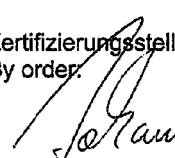
(11) This EC-type-examination Certificate relates only to the design and construction of the specified equipment in accordance with Directive 94/9/EC. Further requirements of this Directive apply to the manufacture and supply of this equipment.

(12) The marking of the equipment shall include the following:

 **II 2 G EEx d IIC T4...T6**

Zertifizierungsstelle Explosionsschutz
By order:

Braunschweig, August 17, 1999


Dr.-Ing. U. Johanns
Regierungsdirektor



sheet 1/3

EC-type-examination Certificates without signature and official stamp shall not be valid. The certificates may be circulated only without alteration. Extracts or alterations are subject to approval by the Physikalisch-Technische Bundesanstalt. In case of dispute, the German text shall prevail.

Physikalisch-Technische Bundesanstalt • Bundesallee 100 • D-38116 Braunschweig

SCHEDULE TO EC-TYPE-EXAMINATION CERTIFICATE PTB 99 ATEX 1101

(13) **SCHEDULE**

(14) **EC-TYPE-EXAMINATION CERTIFICATE PTB 99 ATEX 1101**

(15) **Description of equipment**

The explosion-protected, electro-pneumatic positioner of type SIPART PS2 EEx d type 6DR4*05-"E" serves as a coupling module between electrical controllers or control devices and pneumatic actuators. The housing of the SIPART PS2 EEx d type 6DR4*05-"E" positioner is of the type of protection "flameproof enclosure" and accommodates the electrical and pneumatic connections in its base, the screwed-in support with the electronics container and the plug-in printed circuits boards arranged in maximally three mounting racks and the pneumatic valve block as well as display and actuating elements and the drive.

Technical data

Supply voltage maximally 30 V
Power consumption maximally 1,6 W

(16) **Report PTB Ex 99-19094**

(17) **Special conditions for safe use**

Conditions for connection

1. The SIPART PS2 EEx d type 6DR4*05-"E" electro-pneumatic positioner is to be connected via cable entries or conduit entries suitable for this purpose, which meet the requirements of sections 13.1 and 13.2 of EN 50 018 and for which a separate test certificate is available.
2. Cable entries (screwed conduit entries) and plugs of simple design must not be used. When the SIPART PS2 EEx d type 6DR4*05-"E" is connected via a conduit entry approved for this purpose, the associated sealing device must be arranged directly on the housing.
3. Apertures which are not used must be closed in compliance with section 11.9 of EN 50 018.

The above notes must accompany each apparatus in suitable form.

sheet 2/3

EC-type-examination Certificates without signature and official stamp shall not be valid. The certificates may be circulated only without alteration. Extracts or alterations are subject to approval by the Physikalisch-Technische Bundesanstalt. In case of dispute, the German text shall prevail.

Physikalisch-Technische Bundesanstalt • Bundesallee 100 • D-38116 Braunschweig

Ambient temperature

The electro-pneumatic positioner of type SIPART PS 2 EEx d type 6DR4*05-"E" can be used in

temperature class T6 at ambient temperatures between -30 °C and +50 °C, in temperature class T5 at ambient temperatures between -30 °C and +65 °C, in temperature class T4 at ambient temperatures between -30 °C and +80 °C.

Routine test

The routine test in compliance with section 16.1 of EN 50 018 can be dispensed with, because a type test at four times the reference pressure in compliance with section 16.2 was passed.

Working medium in the pneumatic section

The user of the apparatus must ensure that the working medium cannot form an explosive atmosphere, i.e. only such gases may be used which are free from substances whose presence in the medium might lead to the formation of an explosive atmosphere.

- (18) **Essential health and safety requirements**
Fulfilled by the standards referred to above.

Zertifizierungsstelle Explosionsschutz

By order



Dr.-Ing. U. Johannes
Regierungsreferent

Braunschweig, August 17, 1999

sheet 3/3

EC-type-examination Certificates without signature and official stamp shall not be valid. The certificates may be circulated only without alteration. Extracts or alterations are subject to approval by the Physikalisch-Technische Bundesanstalt. In case of dispute, the German text shall prevail.

Physikalisch-Technische Bundesanstalt • Bundesallee 100 • D-38116 Braunschweig

1st SUPPLEMENT
in accordance with directive 94/9/EC Appendix III.6

to EC TYPE EXAMINATION CERTIFICATE PTB 99 ATEX 1101

Equipment: Electropneumatic positioner SIPART PS2 EEx d
Marking: [] II G EEx d IIC T4 ... T6
Manufacturer: Siemens AG Automatisierungstechnik
Address: Siemensallee 84, D-76187 Karlsruhe

Description of supplements and modifications

1. The material for the nameplate is to be changed to "Polyester laminate Scotchmark 7924 silver" made by 3M. The print will be supplemented by the equipment approval now granted by FM. The code for the specified testing authority is to be changed to "0032".
2. The condition of connection 2 (Section 17 of the EC Type Examination Certificate) will be revised as follows: "Cable entries (screwed conduit entries) and plugs of simple design may not be used. When the SIPART PS2 EEx d is connected via a conduit entry approved for this purpose, the associated sealing device must be arranged at a maximum distance of 18 inches from the housing."

Test report: PTB Ex 00-10227


Zertifizierungsstelle Explosionsschutz Braunschweig, 13th December 2000
By order:

Dr. Ing. U. Klausmeyer
Regierungsdirektor

2nd SUPPLEMENT
according to Directive 94/9/EC Annex III.6

to EC-TYPE-EXAMINATION CERTIFICATE PTB 99 ATEX 1101

(Translation)

Equipment: Electropneumatic positioner SIPART PS2 EEx d
Marking:  II G EEx d IIC T4 ... T6
Manufacturer: Siemens AG Automatisierungstechnik
Address: Ostliche Rheinbrückenstr. 50
76187 Karlsruhe, Germany

Description of supplements and modifications

- The certificate is extended with type Typ 6DR5ab5-cEdof.
1. A modified electronics system is used. The new electronics assemblies have the same dimensions and, with the components fitted, also a volume which compares to the previously used assemblies.
 2. The base material for the name plate is changed to material 3M7879 silver or 3M7871 white (produced by 3M), and the protection film is changed to type K8151Y or RRT thermal transfer film, transparent (produced by Astro-Med). The name plate provides additional details, so that the (F-Nr.) plate previously applied in addition can be dispensed with.
 3. The container cover, which protects the electronics assembly in the container, is no longer metal coated. The contact springs on the base plate can thus also be dispensed with. These measures have no effect on the type of protection Flameproof Enclosure.
 4. Depending on the design version, the supply voltage will in future be
 - 2/3/4 conductor unit: 18 ... 35 V DC
 - Profibus equipotential bonding conductor: 9 ... 32 V DC
 The power input does not exceed the previously certified value of 1.6 W.

Test report: PTB Ex 02-12178

Zertifizierungsstelle Explosionsschutz



Braunschweig, June 10, 2002

Sheet 1/1

EC-type examination Certificates without signature and official stamp shall not be valid. The certificates may be circulated only without alteration. Extracts or alterations are subject to approval by the Physikalisch-Technische Bundesanstalt. In case of dispute, the German text shall prevail.

Physikalisch-Technische Bundesanstalt • Bundesallee 100 • D-38116 Braunschweig

9.2.4 EC Type-Examination Certificate TÜV 00 ATEX 1654



Translation

(1) **EC TYPE-EXAMINATION CERTIFICATE**(2) Equipment or Protective System intended for use in potentially explosive atmospheres - **Directive 94/9/EC**

(3) EC-Type Examination Certificate Number

TÜV 00 ATEX 1654

(4) Equipment: Electropneumatic Positioner SIPART PS2 type 6DR5***-***** with options

(5) Manufacturer: Siemens AG, Automatisierungs- und Antriebstechnik (A&D)
Östliche Rheinbrückenstraße 50

(6) Address: D-76187 Karlsruhe

(7) This equipment or protective system and any acceptable variation thereto is specified in the schedule to this certificate and the documents therein referred to.

(8) The TÜV Hannover/Sachsen-Anhalt e.V., TÜV CERT-Certification Body, notified body number N° 0032 in accordance with Article 9 of the Council Directive of the EC of March 23, 1994 (94/9/EC), certifies that this equipment or protective system has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres given in Annex II to the Directive.

The examination and test results are recorded in the confidential report N° 00Px26800.

(9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with:

EN 50 014: 1997**EN 50 020: 1994**

(10) If the sign "X" is placed after the certificate number, it indicates that the equipment or protective system is subject to special conditions for safe use specified in the schedule to this certificate.

(11) This EC-type examination certificate relates only to the design and construction of the specified equipment or protective system according to Directive 94/9/EC. Further requirements of this Directive apply to the manufacture and placing on the market of this equipment or protective system.

(12) The marking of the equipment or protective system must include the following:

**II 2 G EEx ia IIC T6 resp. EEx ib IIC T6**TÜV Hannover/Sachsen-Anhalt e.V.
TÜV CERT-Zertifizierungsstelle
Am TÜV 1
D-30519 Hannover

Hanover, 2000-12-20

Head of the
Certification Body

AP/CERTNORD 10/98

This certificate may only be reproduced without any change, schedule included.
Excerpts or changes shall be allowed by the TÜV Hannover/Sachsen-Anhalt e.V.

page 1/6



Schedule EC-Type Examination Certificate N° TÜV 00 ATEX 1654



SCHEDULE

(13)

(14) EC-TYPE EXAMINATION CERTIFICATE N° TÜV 00 ATEX 1654

(15) Description of equipment

The Electropneumatic Positioner SIPART PS2 Typ 6DR5***_****_**** is used for the control of valve resp. of flap positions of pneumatic actuators.

The Electropneumatic Positioner SIPART PS2 is an intrinsically safe apparatus that may be operated with the options listed below and that meets the requirements of category 2.

- Options:
- Alarm module 6DR4004-6A
 - SIA module 6DR4004-6G
 - ly module 6DR4004-6J
 - Card module for an external sensor (potentiometer) C73451-A430-L8

The use of the positioner fitted with the option ly module is only permissible for the temperature classes T4 – T1.

The permissible ambient temperature range in dependence of the temperature class has to be taken from the following table:

temperature class	permissible ambient temperature range
T6	-30°C to 50°C
T5	-30°C to 65°C
T4 - T1	-30°C to 80°C

Electrical Data

Basic device:

2-wire circuit without Hart

for 6DR50**_****_****
 Motherboard –L250
 Power supply / control current 4-20 mAin type of protection "Intrinsic Safety" EEx ia IIC EEx ib IIC series connection (terminals 6+ and 7/8)
 only for the connection to certified intrinsically safe circuits

Maximum values:
 $U_i = 30$ V
 $I_i = 100$ mA
 $P_i = 1$ W

effective internal capacitance: $C_i = 15$ nF
 effective internal inductance: $L_i = 0,12$ mH

2-wire circuit with Hart

for 6DR52**_****_****
 Motherboard –L200
 Power supply / control current 4-20 mAin type of protection "Intrinsic Safety" EEx ia IIC EEx ib IIC series connection (terminals 3+ and 7/8).
 Jumper between terminals 4/5 – 6) only for the connection to certified intrinsically safe circuits

Maximum values:
 $U_i = 30$ V
 $I_i = 100$ mA
 $P_i = 1$ W

effective internal capacitance: $C_i = 30$ nF
 effective internal inductance: $L_i = 0,24$ mH

3/4-wire circuit with Hart

for 6DR52**_****_****
 Plug-in module –L200
 Power supply 18-30 Vin type of protection "Intrinsic Safety" EEx ia IIC EEx ib IIC (terminals 2+ and 4/5) and (terminals 6+ and 7/8)
 Control current 4-20 mA only for the connection to certified intrinsically safe circuits

Maximum values:
 $U_i = 30$ V
 $I_i = 100$ mA
 $P_i = 1$ W

effective internal capacitance: $C_i = 15$ nF
 effective internal inductance: $L_i = 0,12$ mH

Binary input; jumpered or connected to a switch contact
 Plug-in module –L200 and –L250 (terminal 9 and 10)

Options

Alarm module type 6DR4004-6A:

Binary outputsin type of protection "Intrinsic Safety" EEx ia IIC
EEx ib IIC
(terminals 41 and 32, terminals 41 and 42, terminals 51 and 52)
only for the connection to certified intrinsically safe circuits

Maximum values:
 $U_i = 15,5 \text{ V}$
 $I_i = 25 \text{ mA}$
 $P_i = 64 \text{ mW}$

safely galvanically separated from each other.

effective internal capacitance: $C_i = 5,2 \text{ nF}$
The effective internal inductance is negligibly small.

Binary inputin type of protection "Intrinsic Safety" EEx ia IIC
EEx ib IIC
(terminals 11 and 12, terminals 21 and 22 (lumper))
safely galvanically separated from the binary outputs and the basic device, but can also activated via a jumper (then no galvanic separation from the basic device)

Maximum value:
 $U_i = 25,2 \text{ V}$

The effective internal inductance and capacitance is negligibly small.

SIA module type 6DR4004-6G:

Binary output (fault signalling)in type of protection "Intrinsic Safety" EEx ia IIC
EEx ib IIC
(terminals 31 and 32)
only for the connection to certified intrinsically safe circuits

Maximum values:
 $U_i = 15,5 \text{ V}$
 $I_i = 25 \text{ mA}$
 $P_i = 64 \text{ mW}$

effective internal capacitance: $C_i = 5,2 \text{ nF}$
The effective internal inductance is negligibly small.

Binary output (slot initiator)in type of protection "Intrinsic Safety" EEx ia IIC
EEx ib IIC
(terminals 41 and 42, terminals 51 and 52)
only for the connection to certified intrinsically safe circuits

Maximum values per circuit:
 $U_i = 15,5 \text{ V}$
 $I_i = 25 \text{ mA}$
 $P_i = 64 \text{ mW}$

effective internal capacitance: $C_i = 30 \text{ nF}$
effective internal inductance: $L_i = 100 \text{ } \mu\text{H}$

Iy module type 6DR4004-6J:

For the use at temperature classes T4 – T1 only

Power outputin type of protection "Intrinsic Safety" EEx ia IIC
EEx ib IIC
(terminals 61 and 62)
safely galvanically separated from the alarm option and the basic device

Maximum values:
 $U_i = 30 \text{ V}$
 $I_i = 100 \text{ mA}$
 $P_i = 1 \text{ W}$

effective internal capacitance: $C_i = 11 \text{ nF}$
The effective internal inductance is negligibly small.

Card module for an external Sensor (potentiometer) type C73451-A430-L8:

External potentiometeronly for the connection to certified intrinsically safe circuits
galvanically connected to the basic device

Maximum values:
 $U_o = 5 \text{ V}$
 $I_o = 6 \text{ mA}$
 $P_o = 30 \text{ mW}$

effective outer capacitance: $C_o = 1 \text{ } \mu\text{F}$
effective outer inductance: $L_o = 1 \text{ mH}$

Note for the erection: The plastic housing of the basic device type 6DR5**0-****-**** has to be protected against the occurrence of hazardous electrostatic charging.



Translation

1. SUPPLEMENT to

EC TYPE-EXAMINATION CERTIFICATE No. TÜV 00 ATEX 1654

of the company: Siemens AG, Automatisierungs- und Antriebstechnik (A&D)
 Ostliche Rheinbrückenstraße 50
 D-76187 Karlsruhe

In the future, the Electropneumatic positioner SIPART PS2 type 6DR6***_****_***** inclusive the modules listed below may also be manufactured according to the test documents listed in the test report.

- Options:
- Alarm module 6DR4004-6A
 - SIA module 6DR4004-6G
 - ly module 6DR4004-6J
 - Card module for an external sensor (potentiometer) C73451-A430-L8

The amendments concern the internal design of several modules and of the basic device and some electrical data are changed, as well.

All other data apply unchanged for this 1. Supplement. These data are repeated in the following.

The use of the positioner fitted with the option ly module is only permissible for the temperature classes T4 – T1.

The permissible ambient temperature range in dependence of the temperature class has to be taken from the following table:

temperature class	permissible ambient temperature range
T6	-30°C to 50°C
T5	-30°C to 65°C
T4 - T1	-30°C to 80°C

Electrical Data

Basic device:

2-wire circuit without Hart

for 6DR50**_****_****
 Motherboard –L250
 Power supply / control current 4-20 mA..... in type of protection "Intrinsic Safety" EEx ia IIC EEx Ib IIC series connection (terminals 6+ and 7/8) only for the connection to certified intrinsically safe circuits

Maximum values:
 U_i = 30 V
 I_i = 100 mA
 P_i = 1 W



Schedule EC-Type Examination Certificate N° TÜV 00 ATEX 1654

(16) Test documents are listed in the test report No.: 00Px26800.

(17) Special conditions for safe use
 none

(18) Essential Health and Safety Requirements
 no additional ones

effective internal capacitance: $C_i = 22 \text{ nF}$
 effective internal inductance: $L_i = 0,12 \text{ mH}$

2-wire circuit with Hart

for 6DR52**,****,****
 Motherboard -L200
 Power supply /
 control current 4-20 mA in type of protection "Intrinsic Safety" EEx ia IIC
 series connection EEx ib IIC
 (terminals 3+ and 7/8,
 Jumper between terminals 4/5 - 6)

Maximum values:
 $U_i = 30 \text{ V}$
 $I_i = 100 \text{ mA}$
 $P_i = 1 \text{ W}$

effective internal capacitance: $C_i = 7 \text{ nF}$
 effective internal inductance: $L_i = 0,24 \text{ mH}$

3/4-wire circuit with Hart

for 6DR52**,****,****
 Plug-in module -L200
 Power supply 18-30 V in type of protection "Intrinsic Safety" EEx ia IIC
 (terminals 2+ and 4/5) and EEx ib IIC
 and
 Control current 4-20 mA
 (terminals 6+ and 7/8)

Maximum values:
 $U_i = 30 \text{ V}$
 $I_i = 100 \text{ mA}$
 $P_i = 1 \text{ W}$

effective internal capacitance: $C_i = 22 \text{ nF}$
 effective internal inductance: $L_i = 0,12 \text{ mH}$

Binary input jumpered or connected to a switch contact
 Plug-in module -L200 and -L250
 (terminal 9 and 10)

Options

Alarm module type 6DR4004-6A:

Binary outputs in type of protection "Intrinsic Safety" EEx ia IIC
 (terminals 31 and 32, EEx ib IIC
 terminals 41 and 42,
 terminals 51 and 52)
 only for the connection to certified intrinsically
 safe circuits

Maximum values:
 $U_i = 15,5 \text{ V}$
 $I_i = 25 \text{ mA}$
 $P_i = 64 \text{ mW}$

effective internal capacitance: $C_i = 5,2 \text{ nF}$
 The effective internal inductance is negligibly
 small.

Binary input in type of protection "Intrinsic Safety" EEx ia IIC
 (terminals 11 and 12, EEx ib IIC
 terminals 21 and 22 (Jumper))

Maximum value:
 $U_i = 25,2 \text{ V}$

The effective internal inductance and
 capacitance is negligibly small.

SIA module type 6DR4004-6G:

Binary output (fault signalling) in type of protection "Intrinsic Safety" EEx ia IIC
 (terminals 31 and 32) EEx ib IIC
 only for the connection to certified intrinsically
 safe circuits

Maximum values:
 $U_i = 15,5 \text{ V}$
 $I_i = 25 \text{ mA}$
 $P_i = 64 \text{ mW}$

effective internal capacitance: $C_i = 5,2 \text{ nF}$
 The effective internal inductance is negligibly
 small.



1. Supplement to EC Type-Examination Certificate No. TÜV 00 ATEX 1654

Binary output (slot initiator) in type of protection "Intrinsic Safety" EEx ia IIC
 EEx Ib IIC
 (terminals 41 and 42, terminals 51 and 52)
 only for the connection to certified intrinsically safe circuits

Maximum values per circuit:
 $U_i = 15,5$ V
 $I_i = 25$ mA
 $P_i = 64$ mW

effective internal capacitance: $C_i = 41$ nF
 effective internal inductance: $L_i = 100$ µH

ly module type 6DR4004-6J:

For the use at temperature classes T4 – T1 only

Power output in type of protection "Intrinsic Safety" EEx ia IIC
 EEx Ib IIC
 (terminals 61 and 62)
 only for the connection to certified intrinsically safe circuits

Maximum values:
 $U_i = 30$ V
 $I_i = 100$ mA
 $P_i = 1$ W

effective internal capacitance: $C_i = 11$ nF
 The effective internal inductance is negligibly small.

Card module for an external Sensor (potentiometer) type C73451-A430-L8:

External potentiometer in type of protection "Intrinsic Safety" EEx ia IIC
 EEx Ib IIC
 galvanically connected to the basic device

Maximum values:
 $U_o = 5$ V
 $I_o = 100$ mA
 $P_o = 33$ mW

effective outer capacitance: $C_o = 1$ µF
 effective outer inductance: $L_o = 1$ mH

Note for the erection: The plastic housing of the basic device type 6DR5**0-***** has to be protected against the occurrence of hazardous electrostatic charging.



1. Supplement to EC Type-Examination Certificate No. TÜV 00 ATEX 1654

(16) Test documents are listed in the test report N° 01 PX 14510.

(17) Special conditions for safe use
 none

(18) Essential Health and Safety Requirements
 no additional ones

TÜV Hannover/Sachsen-Anhalt e.V.
 TÜV CERT-Zertifizierungsstelle
 Am TÜV 1
 D-30879 Hannover

Hannover, 2001-07-27

[Signature]

Head of the
 Certification Body



2. Supplement to EC Type-Examination Certificate No. TÜV 00 ATEX 1654

Safe input (terminals 81 and 82)
 in type of protection "intrinsic Safety" resp. EEx ia IIC
 resp. EEx Ib IIC
 galvanically separated from the bus circuit and the binary input
 only for the connection to certified intrinsically safe circuits
 Maximum values:
 $U_i = 30\text{ V}$
 $I_i = 100\text{ mA}$
 $P_i = 1\text{ W}$
 The effective internal capacitance and inductance is negligibly small.

Option

Card module for an external Sensor (potentiometer) type C73451-AA30-L8:

External potentiometer..... in type of protection "intrinsic Safety" EEx ia IIC resp. EEx Ib IIC
 galvanically connected to the basic device

Maximum values when supplied by the above mentioned basic device (prof bus version):
 $U_o = 5\text{ V}$
 $I_o = 75\text{ mA}$, static
 $I_o = 160\text{ mA}$, temporary
 $P_o = 120\text{ mW}$

effective outer capacitance: $C_o = 1\text{ }\mu\text{F}$
 effective outer inductance: $L_o = 1\text{ mH}$

Test documents are listed in the test report N° 02 YEX 142409a.

TÜV Hannover/Sachverständigenamt a.V.
 TÜV CERT-Zertifizierungsstelle
 D-30519 Hannover

[Signature]

Head of the Certification Body

Hannover, 2002-04-12



Translation

2. SUPPLEMENT to

EC TYPE-EXAMINATION CERTIFICATE No. TÜV 00 ATEX 1654

of the company: Siemens AG, Automatisierungs- und Antriebstechnik (A&D)
 Östliche Rheinbrückenstraße 50
 D-76187 Karlsruhe

The electropneumatic positioners of the series SIPART PS2 have been extended by a basic device provided with profibus connection. The type designation of this basic device is 6DR55**..... and it may also operated with the options listed below.

- Options: Alarm module 6DR4004-6A
 SIA module 6DR4004-6G
 ly module 6DR4004-6J
 Card module for an external sensor (potentiometer) C73451-AA30-L8

Additional some little modifications were realised at the enclosure, the Alarm module and the ly module.

All other data apply unchanged for this 2. Supplement.

Electrical Data

Basic device:

Profibus device

for 6DR55**.....
 motherboard --A5E00095037
 Bus circuit

..... in type of protection "intrinsic Safety" EEx ia IIC resp. EEx Ib IIC
 only for the connection to certified intrinsically safe circuits

Maximum values:

	FISCO power supply	Barrier
	gas group IIC or IIB	gasgroup IIC or IIB
U_i	17,5 V	24 V
I_i	360 mA	200 mA
P_i	5,92 W	1,2 W

The effective internal capacitance is negligibly small.
 effective internal inductance $L_i = 8\text{ mH}$

Binary input..... jumpered or connected to a switch contact
 (terminal 9 and 10)

galvanically connected with the bus circuit



Translation

3. SUPPLEMENT to

EC TYPE-EXAMINATION CERTIFICATE No. TÜV 00 ATEX 1654

of the company: Siemens AG, Automatisierungs- und Antriebstechnik (A&D)
Östliche Rheinbückenstraße 50
D-76187 Karlsruhe

In the future, the electropneumatic positioners of the series SIPART PS2 may also be manufactured according to the test documents listed in the test report.

The amendments concern the internal design.

The electrical data and all other data apply unchanged for this supplement.

Test documents are listed in the test report N° 03 YEX 550376.

TÜV NORD CERT GmbH & Co. KG
TÜV CERT-Certification Body
Am TÜV 1
D-30559 Hannover
Tel. 0511 986-4470
Fax. 0511 986-2555

Hannover, 2003-02-25


Head of the
Certification Body

20 03 20 04

9.2.5 Statement of conformity TÜV 01 ATEX 1786 X



Translation

STATEMENT OF CONFORMITY

- (1)
- (2) Equipment or Protective System intended for use in potentially explosive atmospheres - **Directive 94/9/EC**
- (3) Test certificate number

**TÜV 01 ATEX 1786 X**

- (4) Equipment: Electropneumatic Positioner SIPART PS2 type 6DR5axb-xGxxx-xxxx (a= 0, 2, 5; b = 0, 1) with options
- (5) Manufacturer: Siemens AG, Automatisierungs- und Antriebstechnik (A&D)
- (6) Address: Östliche Rheinbrückenstraße 50
D-76187 Karlsruhe
- (7) This equipment or protective system and any acceptable variation thereto is specified in the schedule to this certificate and the documents therein referred to.
- (8) The TÜV NORD CERT GmbH & Co. KG, TÜV CERT Certification Body N° 0032, notified body in accordance with Article 9 of the Council Directive 94/9/EC of March 23, 1994, certifies that this equipment or protective system has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres given in Annex II to the Directive.
The examination and test results are recorded in confidential report N°02 YEX 134074.
- (9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with:
EN 50021:1999
- (10) If the sign "X" is placed after the certification number, it indicates that the equipment or protective system is subject to special conditions for safe use specified in the schedule to this certificate.
- (11) This statement of conformity certificate relates only to the design, examination and tests of the specified equipment in accordance to the Directive 94/9/EC. Further requirements of the Directive apply to the manufacturing process and supply of this equipment or protective system. These are not covered by this certificate.
- (12) The marking of the equipment or protective system shall include the following:

II 3 G EEx nA L [L] IIC T6

TÜV Hannover/Sachsen-Anhalt e.V.
TÜV CERT Certification Body
Am TÜV 1
D-30619 Hannover



Hanover, 2002-06-04

Head of the
Certification Body

TÜV NORD CERT

TÜV CERT A4 07.01 10.000 L6

This statement of conformity may only be reproduced without any change, schedule included.
Excerpts or changes shall be allowed by the TÜV NORD CERT GmbH & Co. KG

page 1/5



Schedule Statement of Conformity No. TÜV 01 ATEX 1786 X



SCHEDULE

(14) STATEMENT OF CONFORMITY N° TÜV 01 ATEX 1786 X

(15) Description of equipment

The Electropneumatic Positioner SIPART PS2 Typ 6DR5axb-xGxxx-xxx (a= 0, 2, 5; b = 0, 1) is used for the control of valve resp. of flap positions of pneumatic actuators.

The Electropneumatic Positioner SIPART PS2 is a non-sparking apparatus that internally generates its energy limited circuits. The positioner meets the requirements of category 3.

- Options:
- Alarm module 6DR4004-6A
 - SIA module 6DR4004-6G
 - Iy module 6DR4004-6J
 - Card module for an external sensor (potentiometer) C73451-A430-L8

The use of the positioner fitted with the option Iy module is only permissible for the temperature classes T4 – T1.

The permissible ambient temperature range in dependence of the temperature class has to be taken from the following table:

temperature class	permissible ambient temperature range
T6	-30°C to 50°C
T5	-30°C to 65°C
T4 - T1	-30°C to 80°C

Electrical Data

Basic device:

2-wire circuit without Hart
for 6DR50xx-xxxx-xxxx
motherboard –L250

Power supply / control current 4-20 mA for the connection to circuits with the following series connection maximum values in normal operation:

$$U_n \leq 30 \text{ V}$$

$$I_n \leq 100 \text{ mA}$$

2-wire circuit with Hart
for 6DR52xx-xxxx-xxxx
motherboard –L200

Power supply / control current 4-20 mA for the connection to circuits with the following series connection maximum values in normal operation:

$$U_n \leq 30 \text{ V}$$

$$I_n \leq 100 \text{ mA}$$

Jumper between terminals 4/5 – 6)

3/4-wire circuit with Hart
for 6DR52xx-xxxx-xxxx
motherboard –L200

Power supply 18-30 V for the connection to circuits with the following (terminals 2+ and 4/5) maximum values in normal operation:

and control current 4-20 mA (terminals 6+ and 7/8)

$$U_n \leq 30 \text{ V}$$

$$I_n \leq 100 \text{ mA}$$

Profibus device
for 6DR55xx-xxxx-xxxx
motherboard –A5E00085037

Bus circuit for the connection to circuits with the following maximum values in normal operation:

$$U_n \leq 32 \text{ V}$$

Safe input for the connection to circuits with the following (terminals 81 and 82) maximum values in normal operation:

$$U_n \leq 30 \text{ V}$$

$$I_n \leq 100 \text{ mA}$$

All Basic devices

Binary input jumpered or connected to a switch contact (terminal 9 and 10)



Schedule Statement of Conformity No. TÜV 01 ATEX 1786 X



Schedule Statement of Conformity No. TÜV 01 ATEX 1786 X

Options

Alarm module type 6DR4004-6A:

Binary outputs for the connection to circuits with the following maximum values in normal operation:
 terminals 31 and 32, $U_n \leq 15,5 \text{ V}$
 terminals 41 and 42,
 terminals 51 and 52)

Binary input for the connection to circuits with the following maximum values in normal operation:
 terminals 11 and 12, $U_n \leq 25,2 \text{ V}$
 terminals 21 and 22 (jumper)

S/A module type 6DR4004-6G:

Binary output (fault signalling) for the connection to circuits with the following maximum values in normal operation:
 (terminals 31 and 32) $U_n \leq 15,5 \text{ V}$
 $P_n \leq 64 \text{ mW}$

Binary output (slot initiator) for the connection to circuits with the following maximum values in normal operation:
 (2 outputs, terminals 41 and 42, terminals 51 and 52) $U_n \leq 15,5 \text{ V}$
 $P_n \leq 64 \text{ mW}$

ly module type 6DR4004-6J:

For the use at temperature classes T4 – T1 only
 Power output for the connection to circuits with the following maximum values in normal operation:
 (terminals 61 and 62) $U_n \leq 30 \text{ V}$
 $I_n \leq 100 \text{ mA}$
 $P_n \leq 1 \text{ W}$

Card module for an external Sensor (potentiometer) type C73451-A430-L8:

External potentiometer in protection concept "Energy Limitation" nL IIC

galvanically connected to the basic device

Maximum values:
 $U_o = 5 \text{ V}$
 $I_o = 75 \text{ mA}$
 $P_o = 120 \text{ mW}$

effective outer capacitance: $C_o = 1 \mu\text{F}$
 effective outer inductance: $L_o = 1 \text{ mH}$

(16) Test documents are listed in the test report N° 02 YEX 134074.

(17) Special conditions for safe use

The electropneumatic positioners SIPART PS2 have to be erected in such a way that the plastic window is only exposed to a low level of hazard of mechanical damage.

The connecting and disconnecting of the not energy limited circuits to the terminals and the unplugging resp. unplugging of the internal plug- and socket connectors under voltage, as well, is only permitted during installation, for maintenance or for repair purposes.

Note: The temporal coincidence of explosion hazardous atmosphere and installation, maintenance resp. repair purposes is assessed as unlikely in zone 2.

(18) Essential Health and Safety Requirements

no additional ones

9.2.6 FM Approval Report (EEx d)



FM Approvals
1151 Boston-Providence Turnpike
P.O. Box 9102 Norwood, MA 02062 USA
T: 781 762 4300 F: 781 762 9375 www.fmglobal.com

CERTIFICATE OF COMPLIANCE

HAZARDOUS (CLASSIFIED) LOCATION ELECTRICAL EQUIPMENT

This certificate is issued for the following equipment:

6DR4a05-bEc. SIPART PS2 EEx d Positioner.

(Includes electronics model 6DR4004-7x, where x = H, J or A.)

a = Electrical design 0 (without Profibus) or 1 (with Profibus).

b = Function 1 or 2.

c = Connections N or none.

6DR5ab5-cEdef. SIPART PS2 EEx d Positioner.

a = Electrical design 0, 1, 2, 3, 4 or 5.

b = Actuator 1 or 2.

c = Clutch 0 or 1.

d = Connection thread G, N, M, P or Q.

e = Limit monitor 0 or 1.

f = Option module 0 or 1.

Equipment Ratings:

Explosionproof for Class I, Division 1, Groups A, B, C and D; for Class I, Zone 1, Group IIC hazardous (classified) locations, indoors and outdoors (NEMA Type 4X/IP65)

Approved for:

Siemens AG
Oestliche Rheinbrueckenstrasse 50
D-76187 Karlsruhe
Germany

FM Approvals HLC 8/02

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Page 1 of 2





This certifies that the equipment described has been found to comply with the following FM Approval Standards and other documents:

Class 3600	1998
Class 3615	1989
Class 3810	1989
Including Supplement 1	1995
ANSI/NEMA 250	1991
IEC 60529	1989
Amendment 2	1999


Original Project ID: 3005166

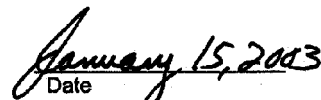
FM Approval Granted: February 9, 2000

Subsequent Revision Reports / Date FM Approval Amended

Report Number	Date	Report Number	Date
3015306	January 9, 2003		

FM Global Technologies LLC


Andrew Lozinski
Technical Team Manager


Date



FM Approvals HLC 8/02

3005166
Page 2 of 2

9.2.7 FM Approval Report



FM Approvals
 1151 Boston-Providence Turnpike
 P.O. Box 9102 Norwood, MA 02062 USA
 T: 781 762 4300 F: 781 762 9375 www.fmglobal.com

CERTIFICATE OF COMPLIANCE

HAZARDOUS (CLASSIFIED) LOCATION ELECTRICAL EQUIPMENT

This certificate is issued for the following equipment:

6DR5abc-defgh-0IAJ. Electropneumatic Positioner SIPART PS2.

IS / 1 / 1 / ABCD / T6 Ta=50°C; T5 Ta=65°C; T4 Ta=80°C - A5E00065622D; Entity; Type 4X
 I / 1 / AEx ib IIC / T6 Ta=50°C; T5 Ta=65°C; T4 Ta=80°C - A5E00065622D; Entity; Type 4X
 NI / 1 / 2 / ABCD / T6 Ta=50°C; T5 Ta=65°C; T4 Ta=80°C; Type 4X
 NI / 1 / 2 / IIC / T6 Ta=50°C; T5 Ta=65°C; T4 Ta=80°C; Type 4X

Entity/Nonincendive Field Wiring Parameters:

Assembly	Terminals	V _{max} (V)	I _{max} (mA)	P _{max} (W)	CI (nF)	LI (μH)
Basic Board	6 & 7/8	30	100	1.0	22	120
Basic Board	3 & 7/8	30	100	1.0	7	240
Basic Board	2 & 4/5; 6 & 7/8	30	100	1.0	30	120
Alarm Module	31 & 32; 41 & 42; 51 & 52	15.5	25	0.064	5.7	2.6
Alarm Module	11 & 12	25.2	155	3.9	0	0
SIA Module	31 & 32	15.5	20	0.064	5.7	2.6
SIA Module	41 & 42; 51 & 52	15.5	20	0.064	71	100
Ly Module	61 & 62	30	100	1.0	11	4.2
Assembly	Terminals	U _o (V)	I _o (mA)	P _o (mW)	C _o (μF)	L _o (mH)
Card Module	1-4	5	100	33	1.0	1.0

- a = Communications option 0 or 2.
- b = Function 1 or 2.
- c = Housing material 0 or 1.
- d = Friction clutch option 0 or 1.
- e = Explosion protection option E or G.
- f = Electric/Pneumatic thread option G, N, M or P.
- g = Limit switch option 0, 1 or 2.

FM Approvals HLC 8/02

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 Page 1 of 3

An FM Global Enterprise



This certifies that the equipment described has been found to comply with the following FM Approval Standards and other documents:

- Class 3600 1996
- Class 3810 1999
- Class 3811 1999
- Class 3810 1989
- NEMA 250 1991

Original Project ID: 3010184 FM Approval Granted: August 29, 2001

Subsequent Revision Reports / Date FM Approval Amended

Report Number	Date	Report Number	Date
3013969	October 18, 2002		
3016206	February 28, 2003		

FM Global Technologies LLC

David W. Strycula

David W. Strycula
Technical Team Manager

3/4/03
Date



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Page 3 of 3



- h = Module option 0, 1, 2 or 3.
- i = Language of documentation A or B.
- j = Mounted pressure gauge block option 0, 1, 2, 3 or 4.

6DR55ab-cd6fg-dhAl. Electropneumatic Positioner, SIPART PS2

IS 1/1/1/ABCD / T6 Ta=50°C; T5 Ta=65°C; T4 Ta=80°C - ABE00065622AA; Entity; FISCO;
 I/1/AEX-ib IIC / T6 Ta=50°C; T5 Ta=65°C; T4 Ta=80°C - ABE00065622AA; Entity; FISCO;
 NI 1/1/2/ABCD / T6 Ta=50°C; T5 Ta=65°C; T4 Ta=80°C;
 NI 1/1/2/IIC / T6 Ta=50°C; T5 Ta=65°C; T4 Ta=80°C; Type 4X

Entity/Nonincendive Field Wiring Parameters:

Assembly	Terminals	Vmax (V)	Imax (mA)	PI (W)	CI (nF)	LI (µH)
Basic Board	6 & 7	24	200	1.2	0	8.0
Basic Board	81 & 82	30	100	1.0	0	0
Alarm Module	31 & 32; 41 & 42; 51 & 52	15.5	25	0.064	5.7	2.6
Alarm Module	11 & 12	25.2	155	3.9	0	0
SIA Module	31 & 32	15.5	20	0.064	5.7	2.6
SIA Module	41 & 42; 51 & 52	15.5	20	0.064	71	100
Ly Module	81 & 82	30	100	1.0	11	4.2
Assembly	Terminals	Uo (V)	Io (mA)	Po (mW)	Co (µF)	Lo (mH)
Card Module	1-4	5	112	120	1.0	1.0

FISCO Parameters:

Assembly	Terminals	Vmax (V)	Imax (mA)	PI (W)	CI (nF)	LI (µH)
Basic Board	6 & 7	17.5	390	5.32	0	8.0

- a = Function 1 or 2.
- b = Housing material 0 or 1.
- c = Friction clutch option 0 or 1.
- d = Evulsion protection option E or G.
- e = Electrical/pneumatic thread option G, N, M or P.
- f = Limit switch option 0, 1 or 2.
- g = Module option 0, 1, 2 or 3.
- h = Language of documentation A or B.
- i = Mounted pressure gauge block option 0, 1, 2, 3 or 4.

Equipment Ratings:

Intrinsically Safe for use in Class I, Division 1, Groups A, B, C and D and Class I, Zone 1, Group IIC in accordance with Entity/FISCO requirements and the applicable Control Drawing; Nonincendive for use in Class I, Division 2, Groups A, B, C and D and Class I, Zone 2, Group IIC in accordance with Nonincendive Field Wiring Requirements and the applicable Control Drawing; Indoor and outdoor, Type 4X Hazardous (Classified) Locations


Approved for:

Siemens AG - A&D PT Q.2
 Oestliche Rheinbrueckenstr. 50
 Postfach 21 12 82
 D-76181 Karlsruhe, Germany



3010184
Page 2 of 3

FM Approvals HLC 802



CSA INTERNATIONAL

Certificate: 1233781 **Master Contract:** 185289
Project: 1233781 **Date:** December 18, 2001


APPLICABLE REQUIREMENTS

- CAN/CSA-E79-0-95 - Electrical Apparatus for Explosive Gas Atmospheres—Part 0: General Requirements
- CAN/CSA-E79-11-95 - Electrical Apparatus for Explosive Gas Atmospheres—Part 11: Intrinsic Safety "i"
- CAN/CSA-C22.2 No.157-92 - Intrinsically Safe and Non-Incendive Equipment for Use in Hazardous Locations
- CSA Std C22.2 No. 213-M1987 - Non-Incendive Electrical Equipment for Use in Class I, Division 2 Hazardous Locations
- CSA Std C22.2 No. 25-1966 - Enclosures for Use in Class II, Groups E, F and G Hazardous Locations
- CAN/CSA-C22.2 No. 94-M91 - Special Purpose Enclosures

MARKINGS

- Submitter's name, trade name and/or CSA Master Contract 185289;
- Model designations;
- CSA Monogram;
- Serial number or date code;
- Hazardous Locations designations;
- Special purpose enclosure designation, TYPE 4X;
- Caution markings, "WARNING: Handle Instrument to avoid electrostatic charge" appear in a visible manner on polymeric enclosure and "Install per Control Dwg A5E0065622D."

DDO-507WD-2001-08/07



CSA INTERNATIONAL

Supplement to Certificate of Compliance

Certificate: 1233781 **Master Contract:** 185289 (LR 104225)

The products listed, including the latest revision described below, are eligible to be marked in accordance with the referenced Certificate.

Product Certification History

Project	Date	Description
1233781	Dec. 18/2001	Original Certification.

DDO-507WD-2001-08/07

9.2.9 Control Drawing A5E00065622D

CAD	1	2	3	4	
<p style="font-size: small;">Proprietary data, company confidential. All rights reserved. Reservados todos los derechos. No se permite la explotación económica ni la transformación de esta obra. Queda permitida la impresión en su totalidad. Reservados todos los derechos. No se permite la explotación económica ni la transformación de esta obra. Queda permitida la impresión en su totalidad.</p> <p style="font-size: x-small;">Weitergabe sowie Vervielfältigung dieser Unterlage, Verwertung und Mitteilung ihres Inhalts nicht gestattet, soweit nicht ausdrücklich zugestimmt. Bewusstlosigkeiten von Dritten sind nicht ausgeschlossen. Weitergabe und Vervielfältigung dieser Unterlage, Verwertung und Mitteilung ihres Inhalts nicht gestattet, soweit nicht ausdrücklich zugestimmt. Bewusstlosigkeiten von Dritten sind nicht ausgeschlossen.</p>	<p>DESCRIPTION</p> <p>General - The electropneumatic positioner SIPART PS2 acts as a coupling module between electrical controllers or control systems and pneumatic actuators. The positioner is available for single-action or double-action actuators.</p> <p>The device type 6DR50xx-xExxx can operate in 2-wire-mode and type 6DR52xx-xExxx can operate additionally in 4-wire-mode. (The 'x' in the model key stand for sub-variants). They are powered by 4...20mA current loop or 24V supply voltage and have a power consumption of less than 160 mW.</p> <p>The base units 6DR50xx-xExxx or 6DR52xx-xExxx can be equipped with the following options:</p> <ul style="list-style-type: none"> > Iy-module 6DR4004-7J (analog position feedback) > Alarm-module type 6DR4004-7A (electronic limit monitors, fault output, binary input) > SIA-module type 6DR4004-6G (inductive limit switch and fault output) > Filter PCB type C73451-A430-L8 (for external potentiometer) <p>The positioners SIPART PS2 type 6DR50xx-xExxx and 6DR52xx-xExxx are suitable for hazardous locations:</p> <p>Intrinsically safe: Class I Div 1 Groups A, B, C, D Class I Zone 1 AEx(FM) Ex(CSA) ib IIC indoor and outdoor (NEMA 4X)</p> <p>Division 2: Class I Div 2 Groups A, B, C, D Class I Zone 2 Group IIC indoor and outdoor (NEMA 4X)</p> <p>Temperature classes: T6 @ Ta = -30°C ... +50°C T5 @ Ta = -30°C ... +65°C T4 @ Ta = -30°C ... +80°C</p> <p>Notes</p> <ol style="list-style-type: none"> 1. Approved associated apparatus or approved barrier must be installed in accordance with manufacturer instructions. 2. Approved associated apparatus or approved barrier must meet the following requirements: $U_o \leq U_i, \max$ and $I_o \leq I_i, \max$ and $P_o \leq P_i, \max$ and $C_a > C_i + C_{cable}$ and $L_a > L_i + L_{cable}$ 3. The maximum non-hazardous area voltage must not exceed 250 V. 4. The installation must be in accordance with the National Electrical Code NFPA 70, Article 504, 505, and ANSI/ISA-Rp 12.6. 5. The screen must be connected to earth potential in accordance with ANSI/ISA-Rp. 12.6. 6. Caution: Use only supply wires suitable for 5 °C above surrounding temperature. 7. Warning: Substitution of components may impair intrinsic safety. 8. For division 2 installations, without the use of conduit, Associated Nonincendive Field Wiring Apparatus is required for connection to the power supply. 9. No barrier is required for division 2 / zone 2 installation. Equipment must be wired per the NEC Division 2 / zone 2 wiring methods. 10. Diameter of cable for delivered cable gland is 6 to 12mm 				
	<p>Fab-Gr. : 4759</p>	<p>Positioner</p>	<p>SIPART PS2</p>	<p>Maßstab: Scale : Layout: (</p>	<p>ControlDrawingV0802.cdr</p>
	<p>Aend.Nr. : Modif.no.:</p>	<p>79A39567</p>	<p>Datum: Date :</p>	<p>Control Drawing</p>	
	<p>DS: Document status:</p>	<p>06</p>	<p>FK: PI:</p>	<p>Urheber: Author : Prüfer : Controller:</p>	<p>Blatt Sheet 1 von of 10</p>
	<p>Aend.Datum: Modif.date:</p>	<p>05.12.2002</p>	<p>Artikel/Item</p>	<p>Dokument/Document</p>	<p>Dok.Type Doc.type</p>
<p>Bearbeiter : Modified by:</p>	<p>Eckthaler</p>	<p>A&D PA13</p>	<p>A5E00065622D</p>	<p>A5E00065622D</p>	
<p>Unterlage fuer EX-Baugruppe Document for explosionproof-module</p>		<p>Siemens AG</p>			

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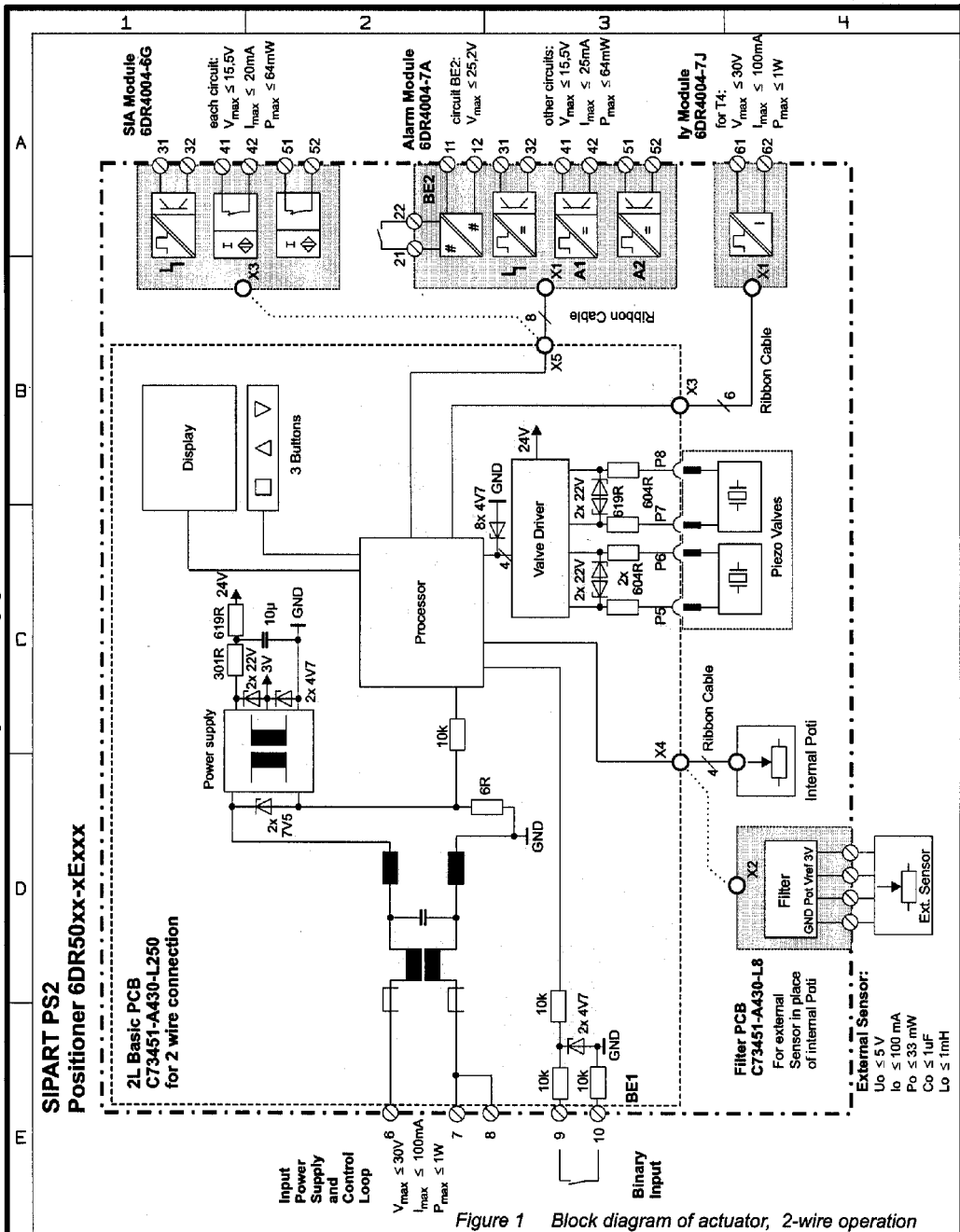


Figure 1 Block diagram of actuator, 2-wire operation

Fab-Gr. : 4759		Positioner	SIPART PS2	Maasstab: Scale : Layout : (ControlDrawingV0602.cdr
Aend.Nr. : Modif.no. : DS: Document status: 06		79A39567	FK: PT:	Control Drawing	
Aend.Datum: Modif.date:		05.12.2002	Urheber: Author : Schmädicke		
Bearbeiter : Modified by:		Eckthaler	Pruefer : Controller:	Artikel/Item	Blatt Sheet 2 von of 10
Unterlage fuer EX-Baugruppe Document for explosionproof-module		A&D PA13	Siemens AG	Dokument/Document	A5E00065622D
					Dok.Type Doc.type

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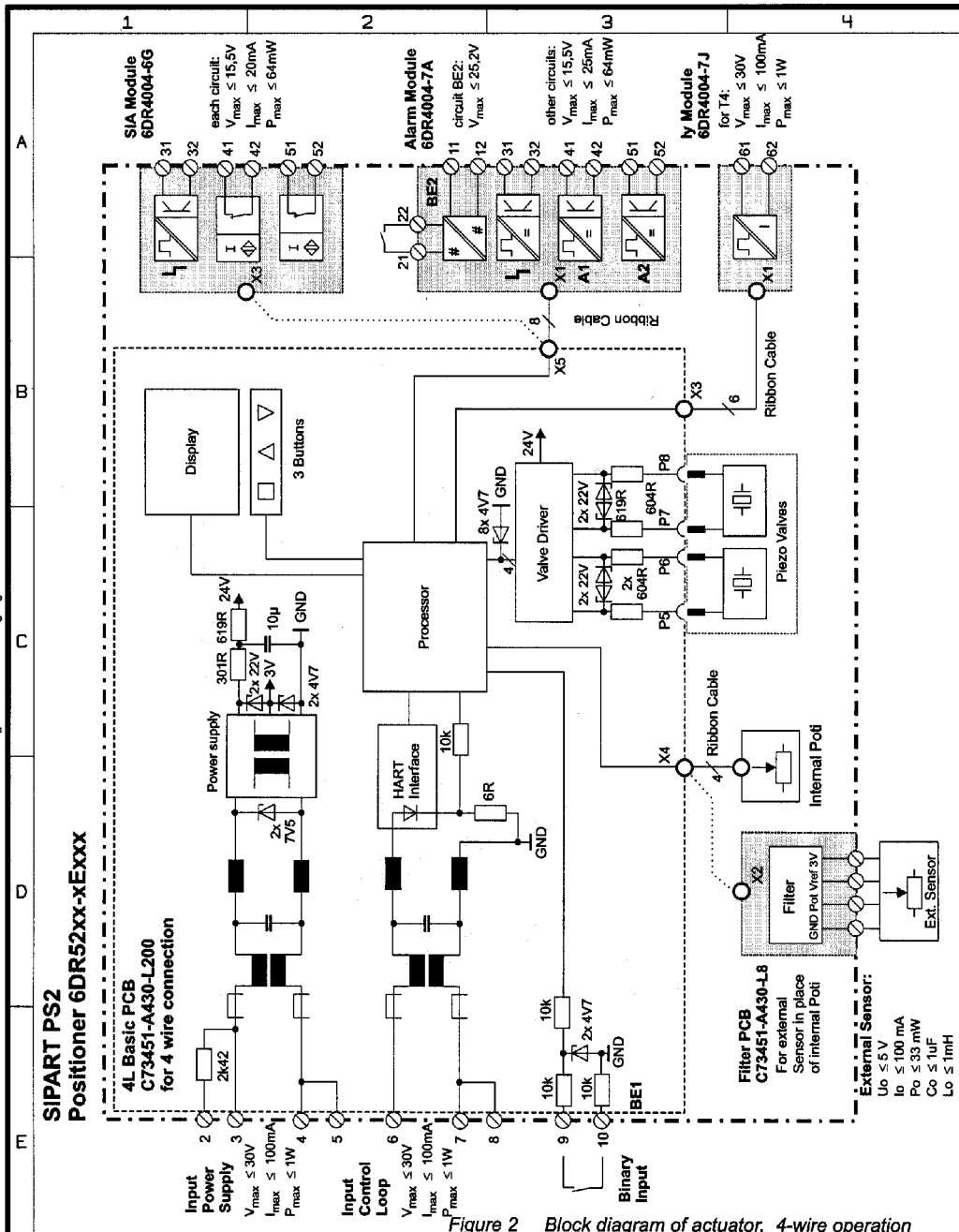


Figure 2 Block diagram of actuator, 4-wire operation

Fab-Gr.: 4759		Positioner	SIPART PS2	Massstab: Scale: 1	ControlDrawingV0602.cdr
Aend.Nr.: Modif.no.: 79A39567		DS: Document status: 06	FK: PT: Urheber: Schmädicke	Layout: (
Aend.Datum: Modif.date: 05.12.2002		Pruefer: Controller:		<p style="text-align: center;">Control Drawing</p>	
Bearbeiter: Modified by: Eckthaler		A&D PA13			
Unterlage fuer EX-Baugruppe Document for explosionproof-module		Siemens AG		Artikel/Item	Blatt Sheet 3 von of 10
				Dokument/Document A5E00065622D	Dok.Type Doc.type

CAD

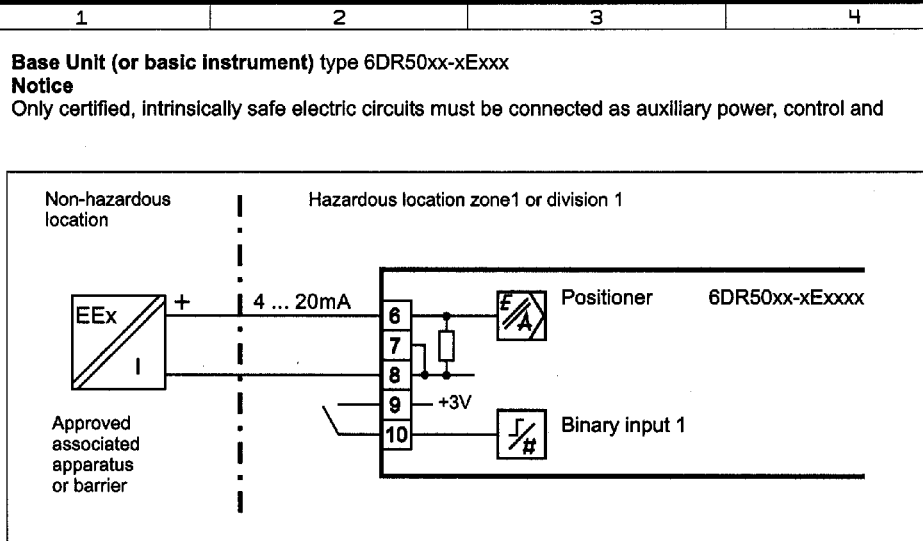


Figure 3 2-wire connection basic instrument 6DR50xx-xExxx (auxiliary power from the signal current)

(2-wire system)

With type of protection "Intrinsically-safe", only for connection to certified intrinsically-safe circuits with the following maximum values:

$U_i = 30\text{ V}$
 $I_i = 100\text{ mA}$

$P_i = 1\text{ W}$
 $C_i = 22\text{ nF}$
 $L_i = 0.12\text{ mH}$

Effective internal capacitance:
 Effective internal inductance:

Binary input circuit (terminals 9 and 10) connected by jumper, or connection to switching contact.

For Division 2 application: $V_{max} = 30\text{ V}$
 $I_{max} = 100\text{ mA}$

Binary input circuit: Maximum output: $V_i = 5\text{ V}$, $I_i = 0,25\text{ mA}$
 (terminals 9 and 10)

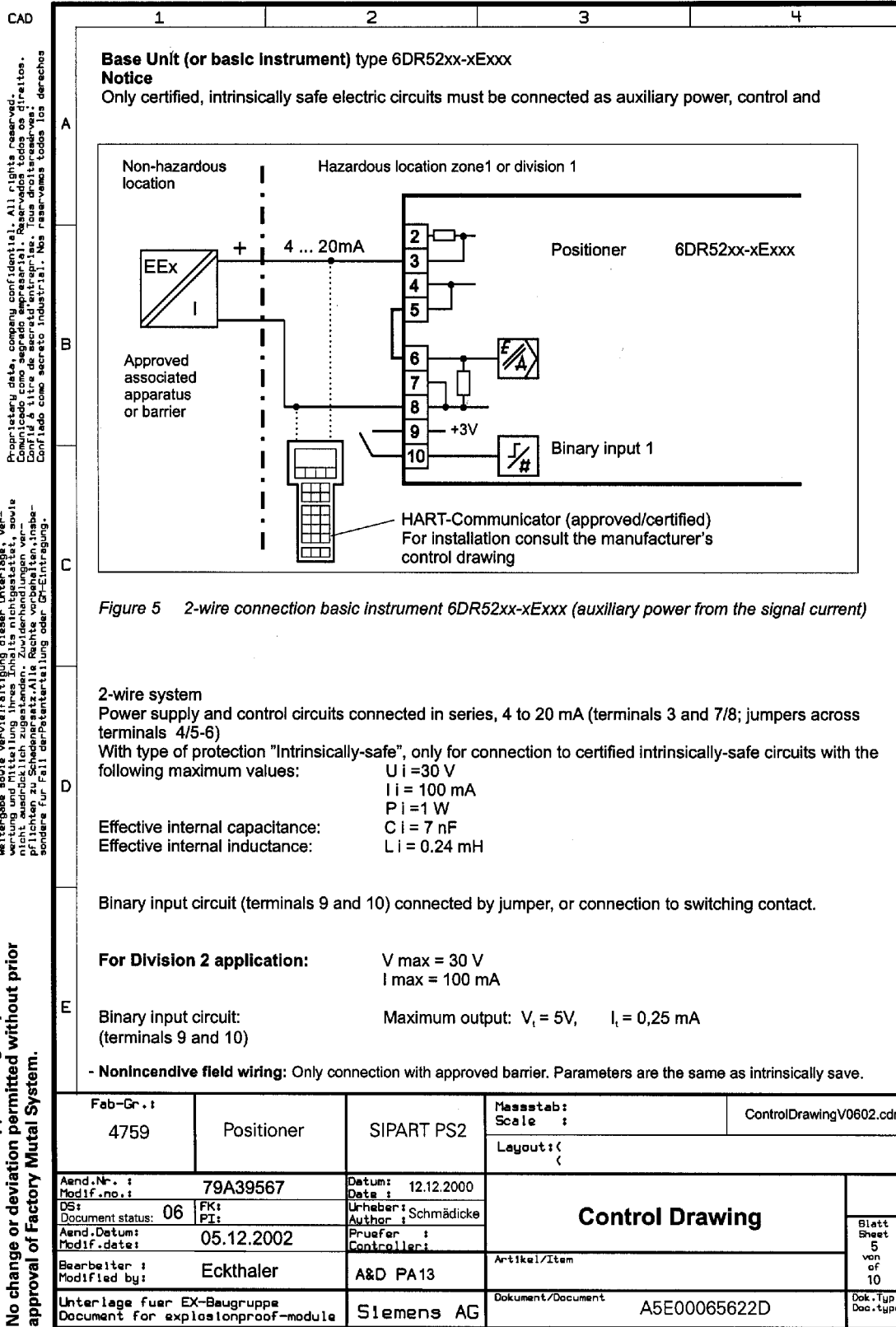
- **Nonincendive field wiring:** Only connection with approved barrier. Parameters are the same as intrinsically save.

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Base Unit (or basic instrument) type 6DR52xx-xExxx

Notice

Only certified, intrinsically safe electric circuits must be connected as auxiliary power, control and

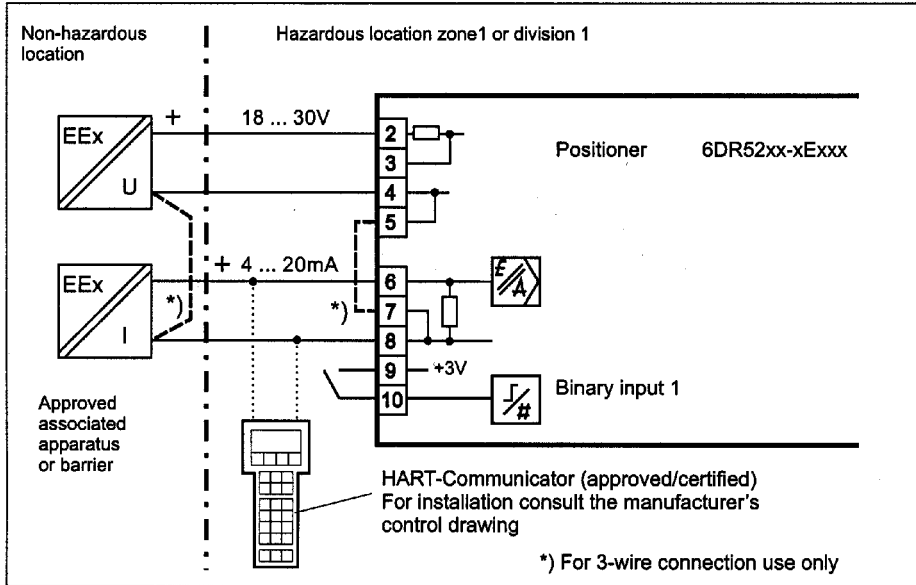


Figure 6 3/4-wire connection basic instrument 6DR52xx-xExxx

3/4-wire system

Power supply and control circuits electrically isolated or with common root (terminals 4/5 - 7/8).

Power supply 18 to 30 V (terminals 2 and 4/5).

Control current 4 to 20 mA (terminals 6 and 7/8).

With type of protection "intrinsically-safe", only for connection to certified intrinsically-safe circuits with the following maximum values:

- U_i = 30 V
- I_i = 100 mA
- P_i = 1 W

Effective internal capacitance:

C_i = 30 nF

Effective internal inductance:

L_i = 0.12 mH

(per circuit).

Binary input circuit (terminals 9 and 10) connected by jumper, or connection to switching contact.

For Division 2 application:

V_{max} = 30 V
 I_{max} = 100 mA

Binary input circuit:
 (terminals 9 and 10)

Maximum output: V_i = 5V, I_i = 0,25 mA

- **Nonincendive field wiring:** Only connection with approved barrier. Parameters are the same as intrinsically safe.

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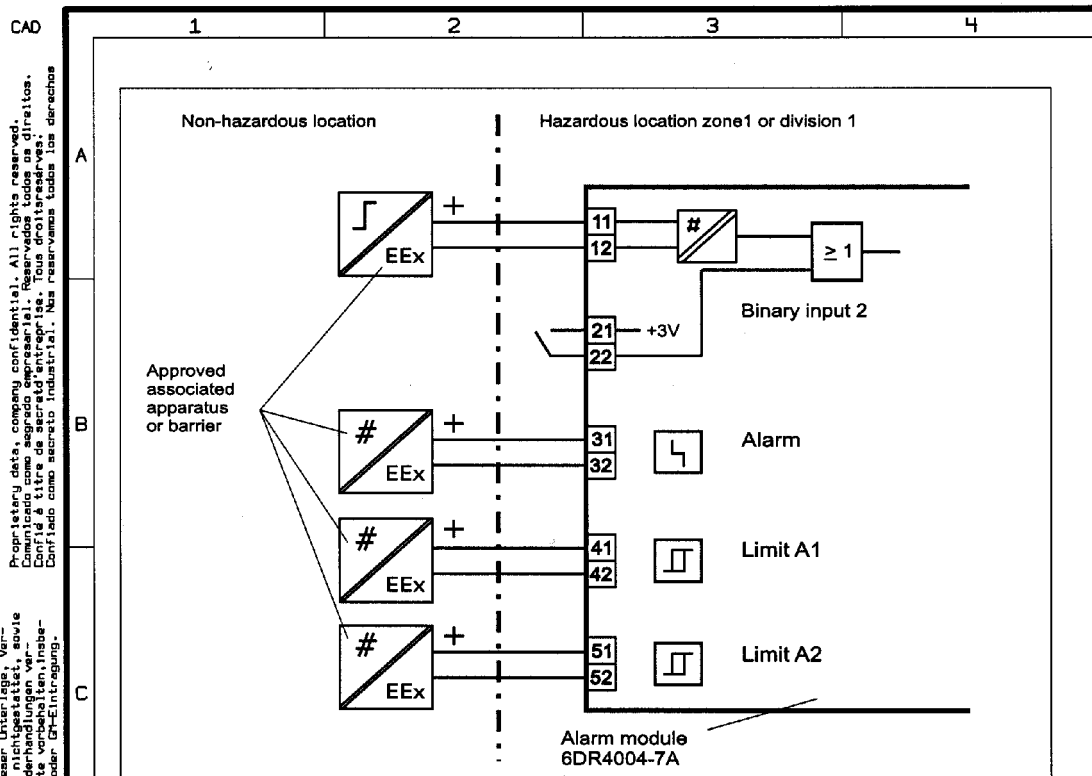


Figure 7 Alarm module 6DR4004-7A

Binary output circuits: (terminals 31/32, 41/42, 51/52) With type of protection "Intrinsically-safe", only for connection to certified intrinsically-safe circuits with the following maximum values:
 $U_i = 15,5V$, $I_i = 25mA$, $P_i = 64mW$
 Effective internal capacitance: $C_i = 5,7 nF$
 Effective internal inductance: $L_i = 2,6\mu H$

Binary input circuit With type of protection "Intrinsically-safe", only for connection to certified intrinsically-safe circuits with the following maximum values:
 $U_i = 25,2V$, $I_i = 155mA$, $P_i = 3,9W$
 Effective internal capacitance: $C_i = 0$
 Effective internal inductance: $L_i = 0$

for Division 2 application:

$V_{max} = 15,5 V$

Binary output circuits:

$V_{max} = 25,2 V$

Binary input circuit

connected by jumper, or connection to switching contact.
 Maximum output: $V_i = 5V$, $I_i = 0,01 mA$

- Nonincendive field wiring: Only connection with approved barrier. Parameters are the same as intrinsically save.

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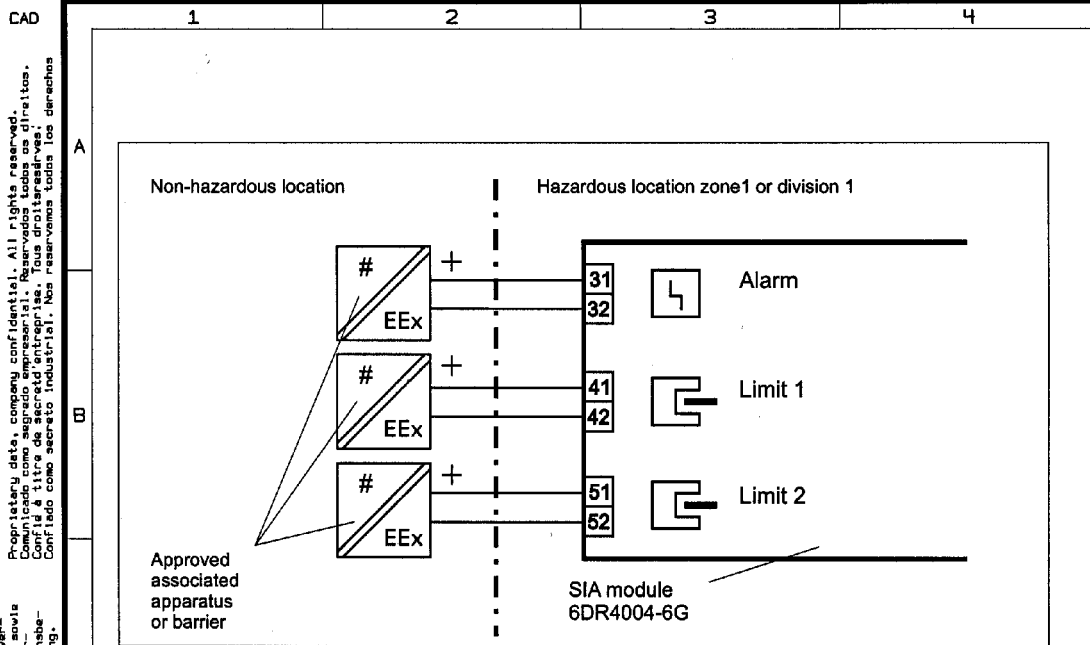


Figure 8 SIA module 6DR4004-6G

Binary output circuit

With type of protection "Intrinsically-safe", only for connection to certified intrinsically-safe circuits with the following maximum values:
 $U_i = 15,5V$ $I_i = 20mA$, $P_i = 64mW$

Effective internal capacitance: $C_i = 5.7 nF$
 Effective internal inductance: $L_i = 2,6\mu H$

Binary output circuits (terminals 41 and 42)

With type of protection "Intrinsically-safe", only for connection to certified intrinsically-safe circuits with the following maximum values:
 $U_i = 15,5V$ $I_i = 20mA$, $P_i = 64mW$

Effective internal capacitance: $C_i = 71 nF$
 Effective internal inductance: $L_i = 100\mu H$

for Division 2 application:

Binary output circuit $V_{max} = 15,5V$
 $P_i = 64mW$

Binary output circuits (terminals 41 and 42) $V_{max} = 15,5V$
 $P_i = 64mW$

- Nonincendive field wiring: Only connection with approved barrier. Parameters are the same as intrinsically safe.

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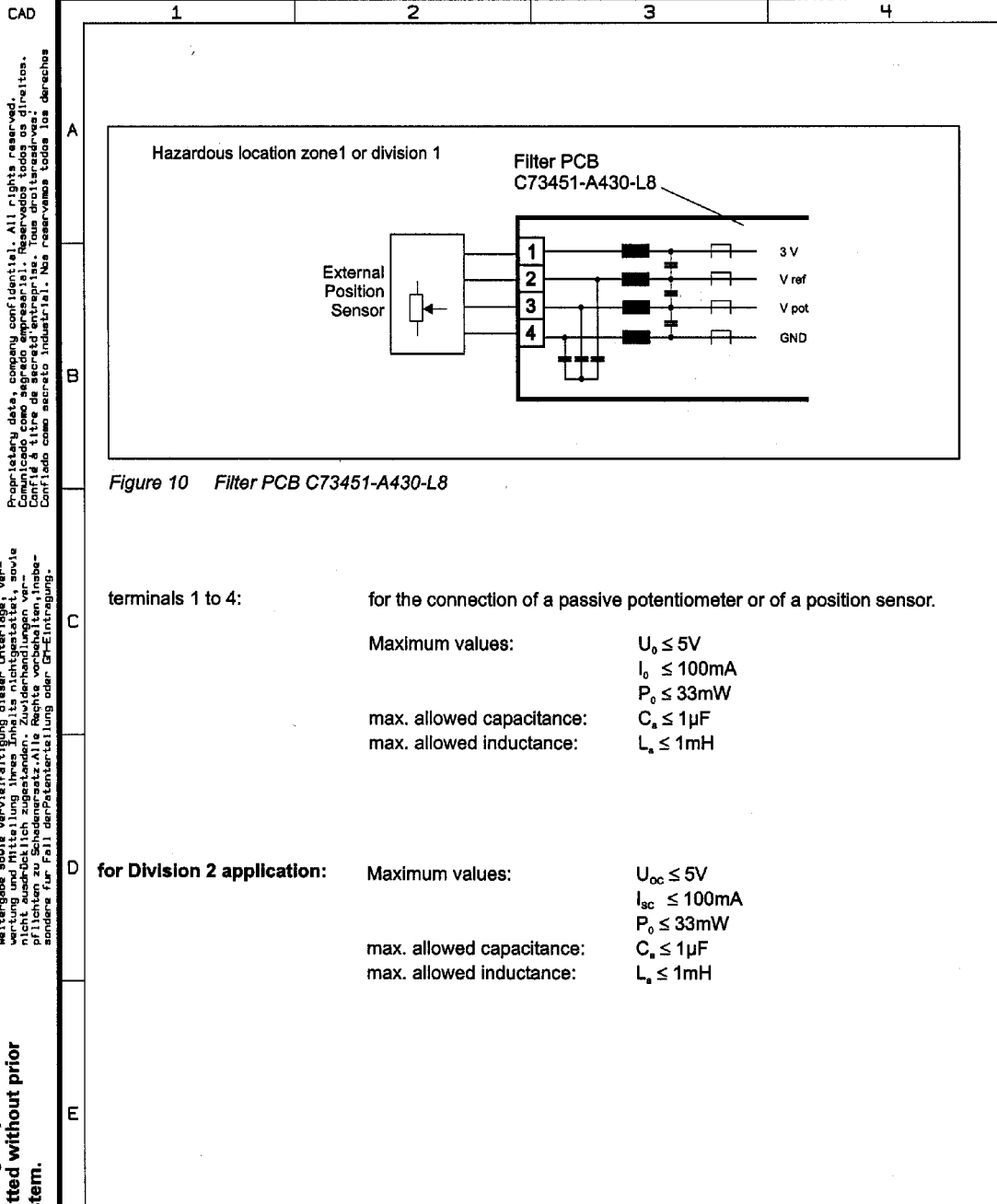


Figure 10 Filter PCB C73451-A430-L8

terminals 1 to 4: for the connection of a passive potentiometer or of a position sensor.

Maximum values: $U_0 \leq 5V$
 $I_0 \leq 100mA$
 $P_0 \leq 33mW$
 max. allowed capacitance: $C_a \leq 1\mu F$
 max. allowed inductance: $L_a \leq 1mH$

for Division 2 application: Maximum values: $U_{oc} \leq 5V$
 $I_{sc} \leq 100mA$
 $P_0 \leq 33mW$
 max. allowed capacitance: $C_a \leq 1\mu F$
 max. allowed inductance: $L_a \leq 1mH$

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