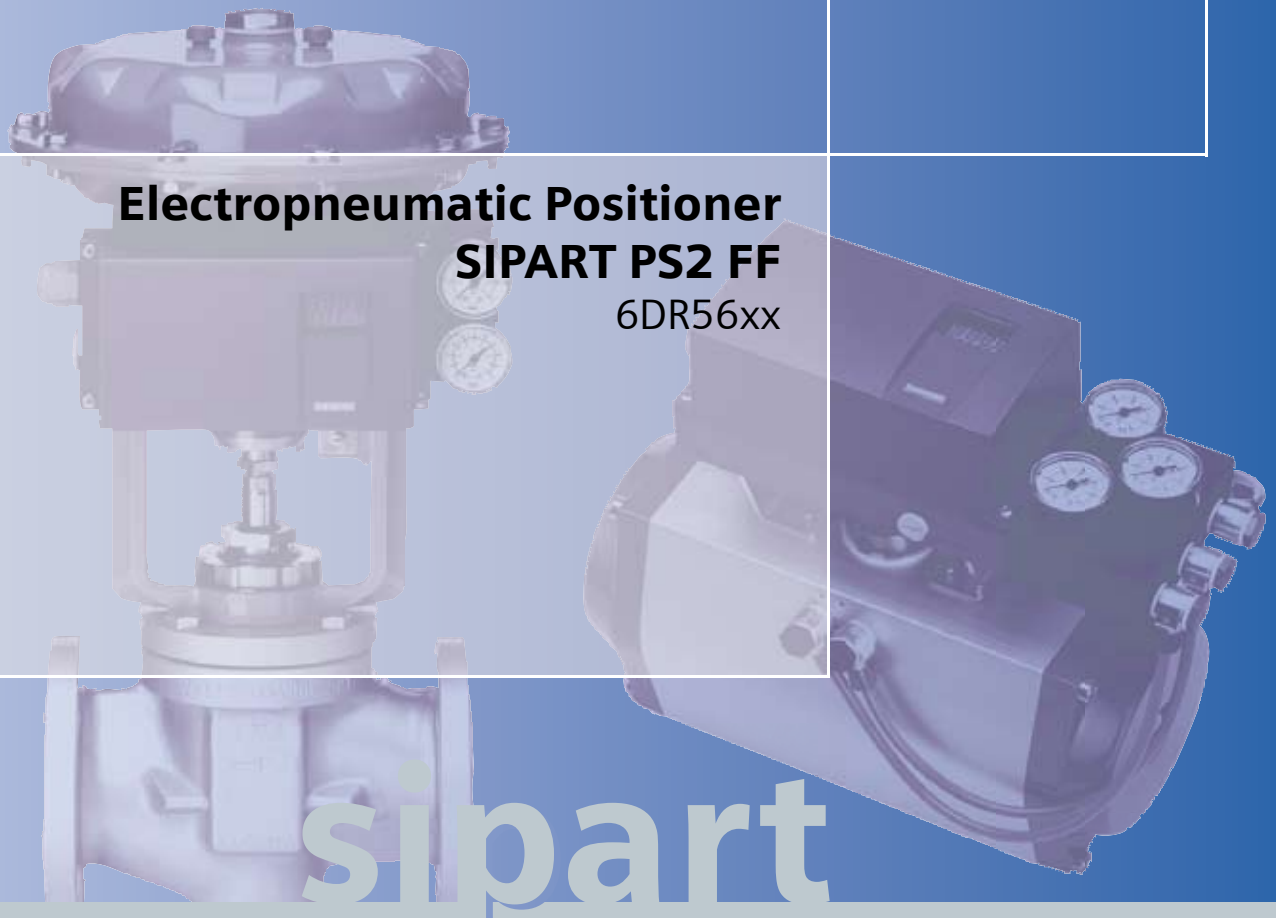
Manual Edition 02/2007

Electropneumatic Positioner
SIPART PS2 FF

6DR56xx



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6DR56xx

Edition 02/2007

Manual

Electropneumatic Positioner with FOUNDATION Fieldbus for Linear and Rotary Actuators

Siemens AG
Bereich Automation & Drives
Geschäftsgebiet Process Instrumentation and Analytics
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Disclaimer of Liability

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

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"FOUNDATION" of "FOUNDATION Fieldbus" is a registered trademark of the Fieldbus Foundation.

Patents

Manufactured under one or more of the following patents
U.S. 6,424,872 U.S. 09/598,697 PCT/US001/17022 U.S. 60/384,846 U.S. 5,909,368 U.S. 5,333,114 U.S. 5,485,400 U.S. 5,825,664 Australian Patent #638507 Canadian Patent #2,066,743 European Patent # 04905001 UK Patent # 0495001 France # 0495001 Germany # 69032954.7 Netherlands # 0495001 Japan Patent # 3137643 U.S. 6,055,633 EP1029406A2 U.S. 6,104,875 AU9680998A1

Contents

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 flameproof enclosure (EEx d)

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

Scope of delivery, see chapter 8, page 225.

0.1 General information

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

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

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

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

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

Functionality, commissioning and operation are described in this manual.

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

0.2 Classification of Safety-Related Notices

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

DANGER

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

WARNING

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

CAUTION

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

CAUTION

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

NOTICE

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

NOTE

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

0.3 Qualified Personnel

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

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

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

WARNING

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

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

The instrument is designed for connection to operate voltage or safety extra–low voltage.

Electrical safety depends only on the power supply equipment.

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

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

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

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

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

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

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

WARNING

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

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

WARNING

The device may not be operated while the leaflets are in the housing.

0.4 Use as intended

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

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

0.5 Technical Documentation

The instructions are a constituent part of the enclosed CD ”sipartp ps2 POSITIONERS” (order number A5E00214567). The manual and further documentations are available on the Internet at:

www.siemens.com/sipartps2

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

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

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

www.siemens.com/processinstrumentation

Click on ”Contact” and select your closest town.

0.6 Warranty Information

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

0.7 Delivery Notes

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

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

For the scope of delivery please see Chapter 8.

0.8 Standards and Regulations

As far as possible, the harmonized European standards were used to specify and manufacture this equipment. If harmonized European standards have not been applied, the standards and regulations of the Federal Republic of Germany apply (see also Chapter 7 “Technical Data”).

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

Introduction 1

1.1 General information about the positioner

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

The positioner together with the FOUNDATION Fieldbus communications interface are components in a digital process automation system. The field bus is used not only for communication but also to supply the positioner with electrical power.

Purpose

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

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

Different mounting types are available for linear actuators:

- NAMUR or IEC534
- integrated mounting to ARCA
- integrated mounting to SAMSON (non-explosion-proof version)

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

Versions

The positioner is available for the following actuators:

- double-acting and
- single-acting

For following applications:

- potentially explosive or
- not potentially explosive applications.

Housing

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

The housing is available in three versions:

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

Degree of protection

The device is designed with IP66/NEMA4x degree of protection.

Explosion Protection

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

SIL applications

The positioners (version 6DR561* for single acting actuators) are also suitable for positioning on fittings with pneumatic actuators, which satisfy the special requirements for safety devices up to SIL 2 to IEC 61508 part 1–7 and IEC 61511 part 1–3. For this the SIL safety instructions in the ”SIL Safety Manual (PA/FF)” order number A5E00489773 must be followed.

Options

The positioner can be expanded with various options modules (chapter 2.6, page 25). The following modules are available in:

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

Accessories

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

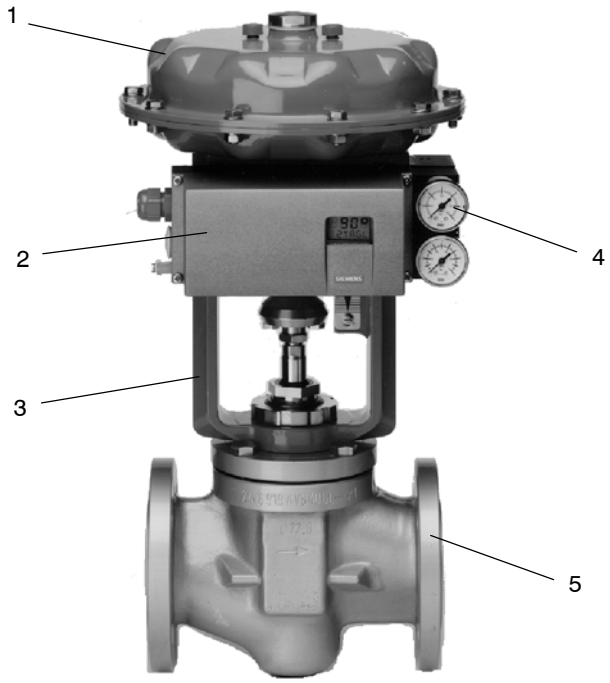
For decentralized installation of the positioner and position sensor:

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

Environmental Protection

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

The technical manual is printed on chlorine-free bleached paper.

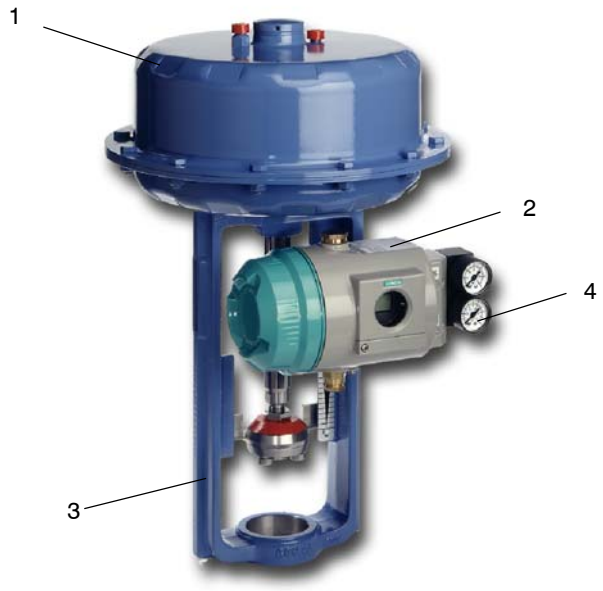


1	Actuator
2	Positioner, single-acting in metal housing
3	Lantern
4	Manometer block, single-acting
5	Valve

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

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

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



1	Actuator
2	Positioner, single-acting in explosion proof metal housing
3	Lantern
4	Manometer block, single-acting

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

1	Positioner double-acting in explosion proof metal housing
2	Rotary actuator
3	Manometer block, double-acting

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

Design and Method of Operation 2

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

2.1 Overview

Introduction

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

The setpoint is set by the control system and passed to the positioner by the FOUNDATION Fieldbus digitally.

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

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

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

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

A further input (Shut down) has the function of moving the actuator to a pre-set safety position (end stop).

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

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

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

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

The friction clutch (9, Figure 2-2, page 19) allows you to set the working range, particularly for linear actuators, after installation. You thus do not have to ensure symmetrical mounting during the installation.

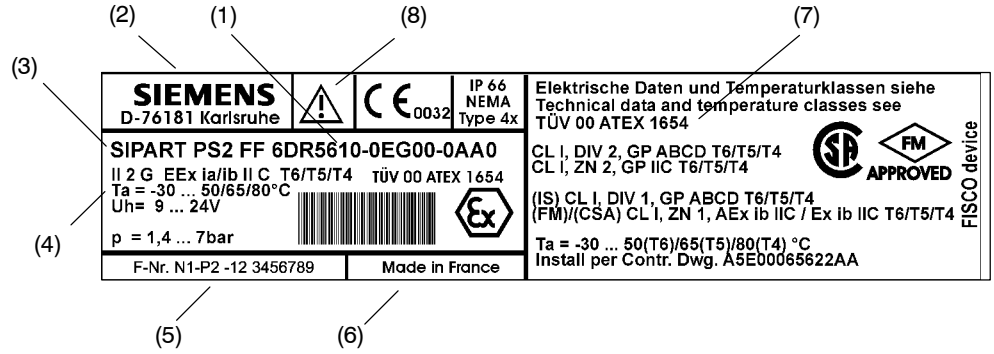
As it is not allowed to open the housing of an explosion proof version in a potentially explosive atmosphere, the shaft has an externally fitted, additional friction clutch (8, Figure 2-3, page 20).

NOTICE

for the explosion proof version:

Only adjust the outer friction clutch (8, Figure 2-3, page 20). The internal friction clutch (9, Figure 2-2, page 19) is fixed and, for the explosion proof version, must **not** be adjusted.

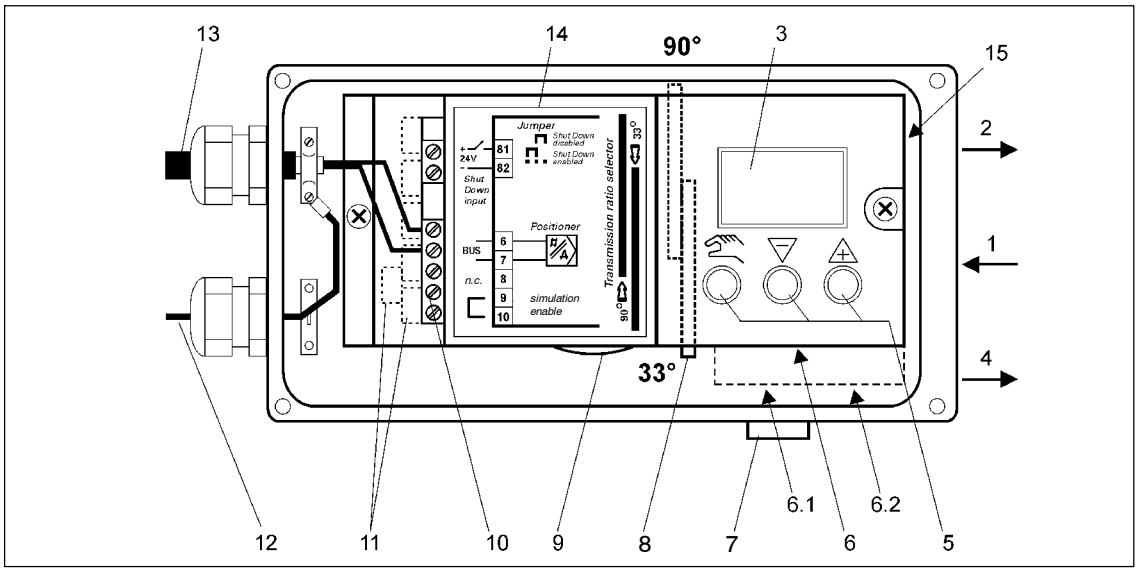
2.2 Design Rating Plate



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

Figure 2-1 Design rating plate, example with protection class EEx ia/ib

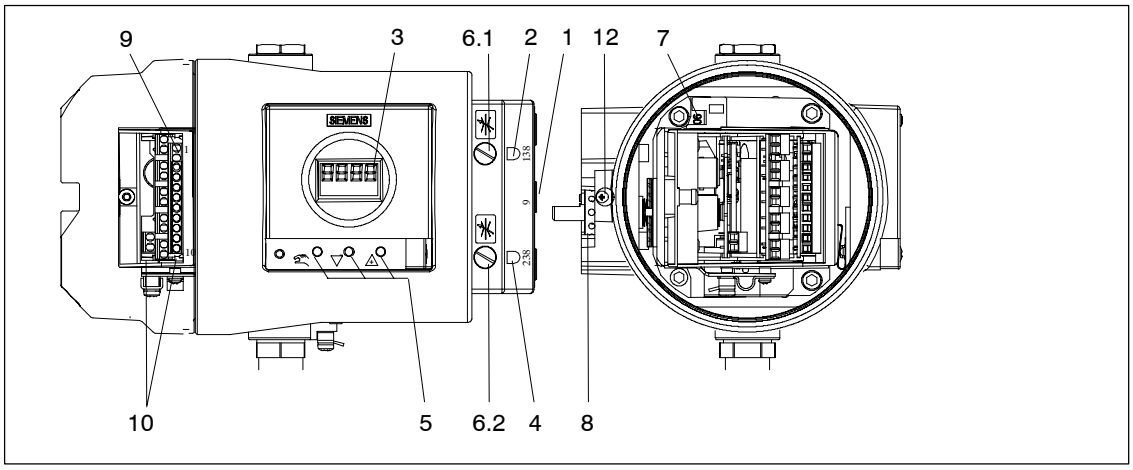
2.3 Instrument Components



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

*) in double-acting actuators

Figure 2-2 View of the positioner (cover open); plastic housing



1	Input: Supply air	7	Transmission ratio selector (only possible with positioner open)
2	Output: Actuating pressure Y1	8	Adjustment wheel for friction 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 2-3 View of the explosion-proof version of the positioner

2.3.1 Motherboard

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

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

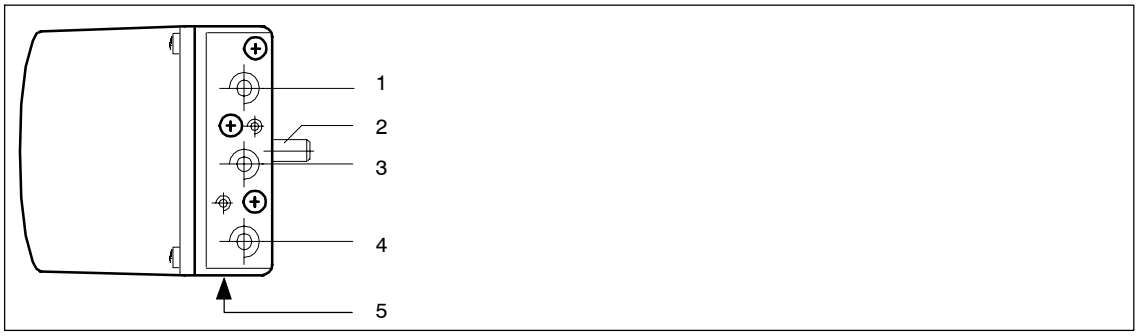
2.3.2 Electrical Connections

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

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

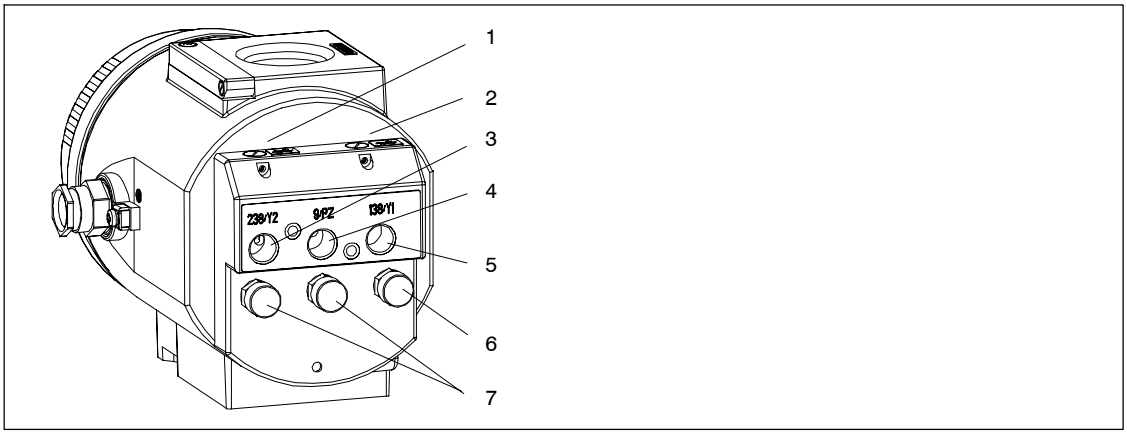
2.3.3 Pneumatic Connections

The pneumatic connections are on the right hand side of the positioner (figure 2-4 and figure 2-5).



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 2-4 Pneumatic connection in normal version



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

*) in double-acting actuators

Figure 2-5 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 37, figure 3-3, page 38 and figure 3-4, page 39).

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

Figure 2-6, page 22 shows the pneumatic connection variants for the different actuator types, the positioning acting and the safety position after power failure.

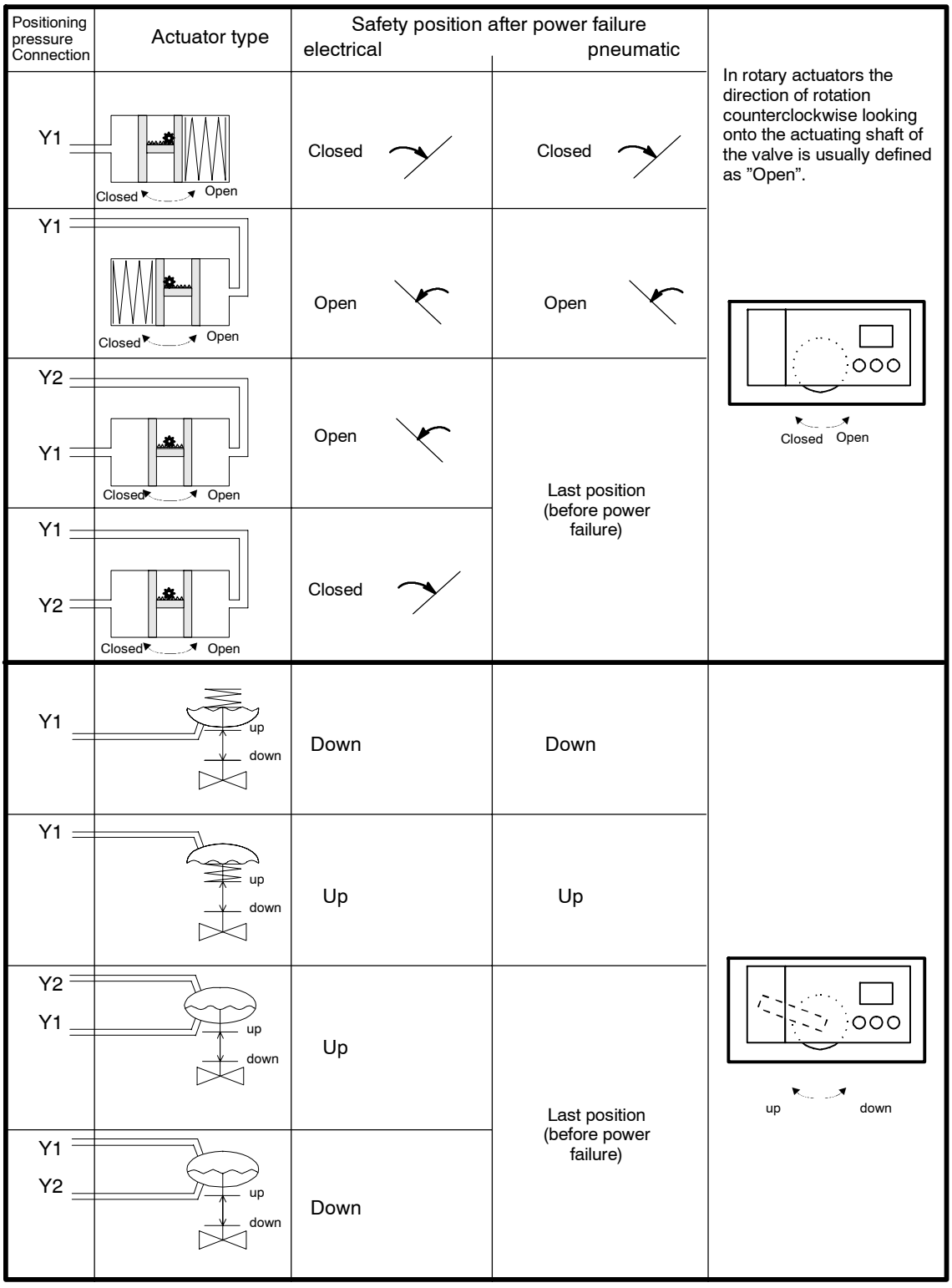


Figure 2-6 Pneumatic connection positioning

2.3.4 Mounting Kit

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

2.3.5 Purge air switching (not in the explosion-proof version)

The purge air switch is accessible above the pneumatic terminal strip with the housing open (figure 2-7). In the IN position the inside of the housing is purged with very small amounts of clean, dry instrument air. In the OUT position the purge air is fed directly to the outside air (for more information: see Chapter 3.3, page 39).

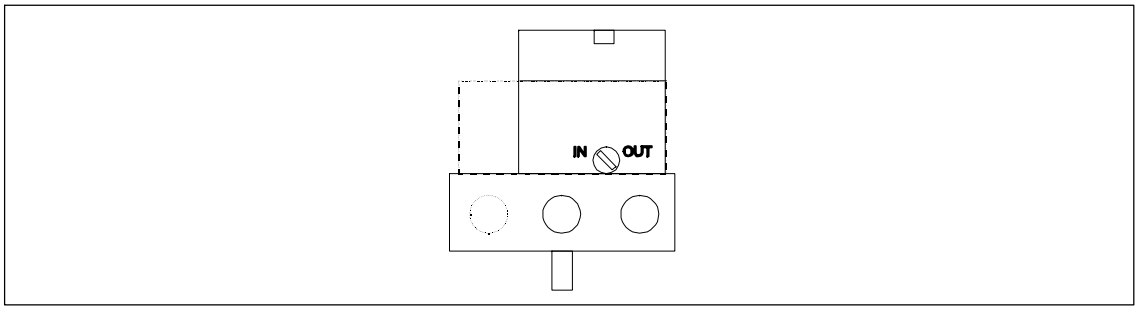


Figure 2-7 Purge air switch on the valve block, view of the positioner onto pneumatic connection side with cover open

2.3.6 Restrictors

In order to achieve travel times of > 1.5 s in small actuators, the air rate can be reduced with the restrictors Y1 and Y2 (figure 2-8, in explosion-proof version, see figure 2-5, page 21). By turning clockwise the air rate is reduced up to shutting off. To set the restrictors it is advisable to close them and then open them slowly (see initialization RUN3).

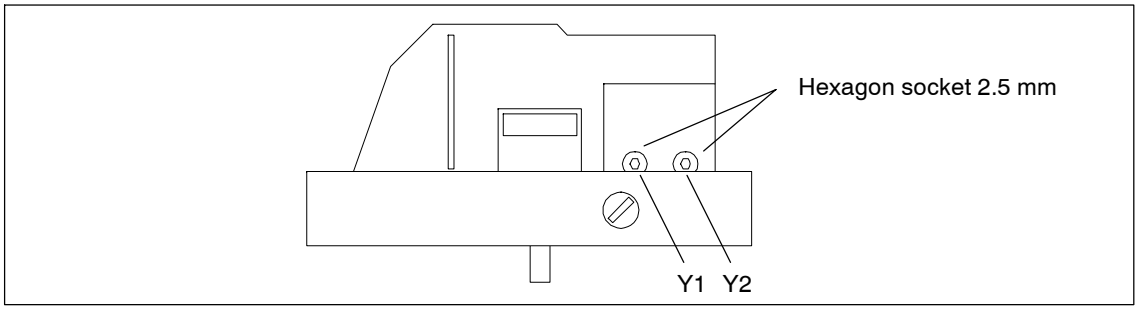


Figure 2-8 Restrictors

2.4 Method of Operation

The electropneumatic positioner forms a control circuit with the pneumatic actuator in which the actual value x is the position of the actuator bar in linear actuators or the position of the actuator shaft in rotary actuators and the command variable w is supplied digitally via the FOUNDATION Fieldbus.

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. The current position can also be measured using an external sensor. For this the stroke and the angle of rotation are sensed by a Non-Contacting Position Sensor directly on the actuator.

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

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

The control algorithm is an adaptive predictive five-point switch (see figure 2-9, page 25). The valves are controlled with continuous contact at large control errors (fast step zone). At medium control errors the valve is controlled by pulse length modulated pulses (short step zone).

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

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

NOTE

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

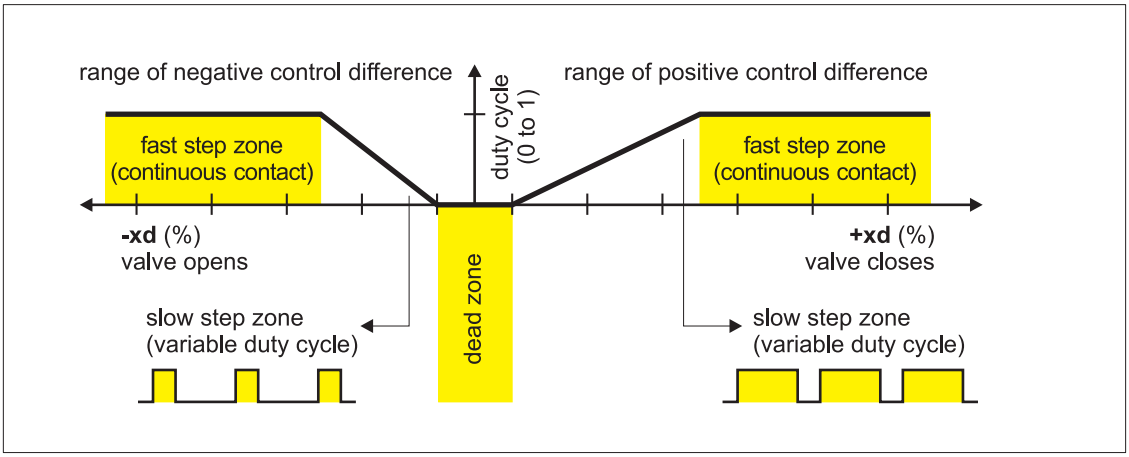


Figure 2-9 Method of operation five-point switch

2.5 State as supplied

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

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

The pneumatic connections on the rear are sealed.

The input for the safety shut down is not activated.

The simulation enable jumper is not set.

2.6 Options modules

2.6.1 Installation of options modules in normal and intrinsically safe versions

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

- I_y module
- Alarm module
- SIA module
- Mechanical limit switch module
- EMC filter module

Installation

The option modules are secured by a assembly covering ((1), see figure 2-10, page 27) and mechanically fixed.

☞ **NOTE**

The housing must be opened to install the options modules. The degree of protection IP66 is not guaranteed as long as the positioner is open.

Opening the positioner

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

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

☞ **NOTE**

The housing must be opened to install the options modules. The degree of protection IP66 is not guaranteed as long as the positioner is open.

Opening the instrument

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

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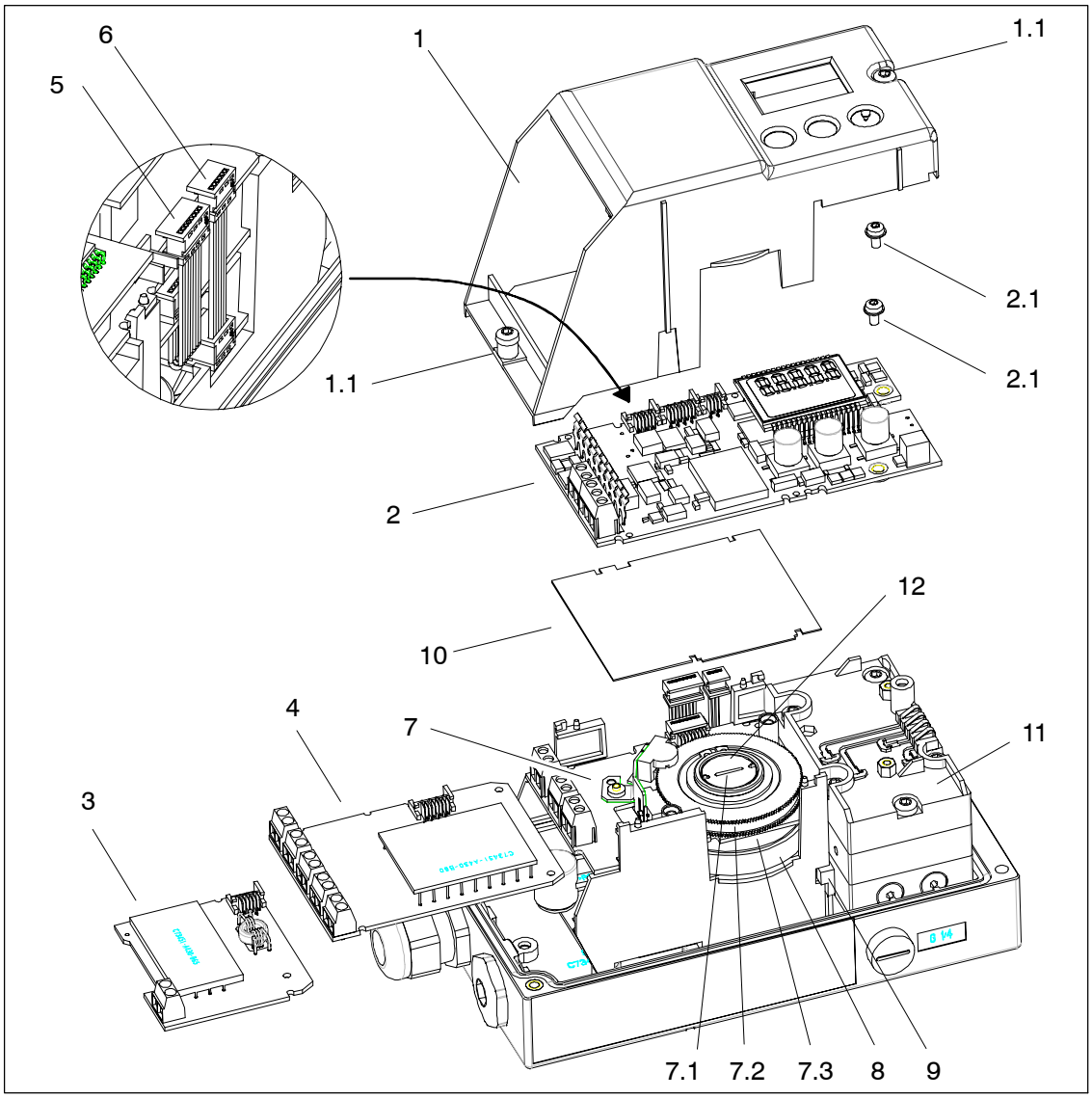


1	Module cover	7	SIA-module and mechanical limit switch module
1.1	Fixing screws	7.1	Special screw
2	Motherboard	7.2	Actuating disc for A1 (terminals 41 and 42)
2.1	Fixing screws	7.3	Actuating disc for A2 (terminals 51 and 52)
3	I_y-module with ribbon cable (6)	8	Adjusting wheel for friction clutch
4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

Figure 2-10 Installation of Options Modules

2.6.2 Installation of options modules in explosion proof version

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

- I_y module
- Alarm module

Installation

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

NOTE

The housing must be opened to install the options modules. The degree of protection IP66/NEMA4x is not guaranteed as long as the positioner is open.

WARNING

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

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

Open the positioner

See figure 2-11, page 29. Disconnect or isolate the power supply cables first.

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

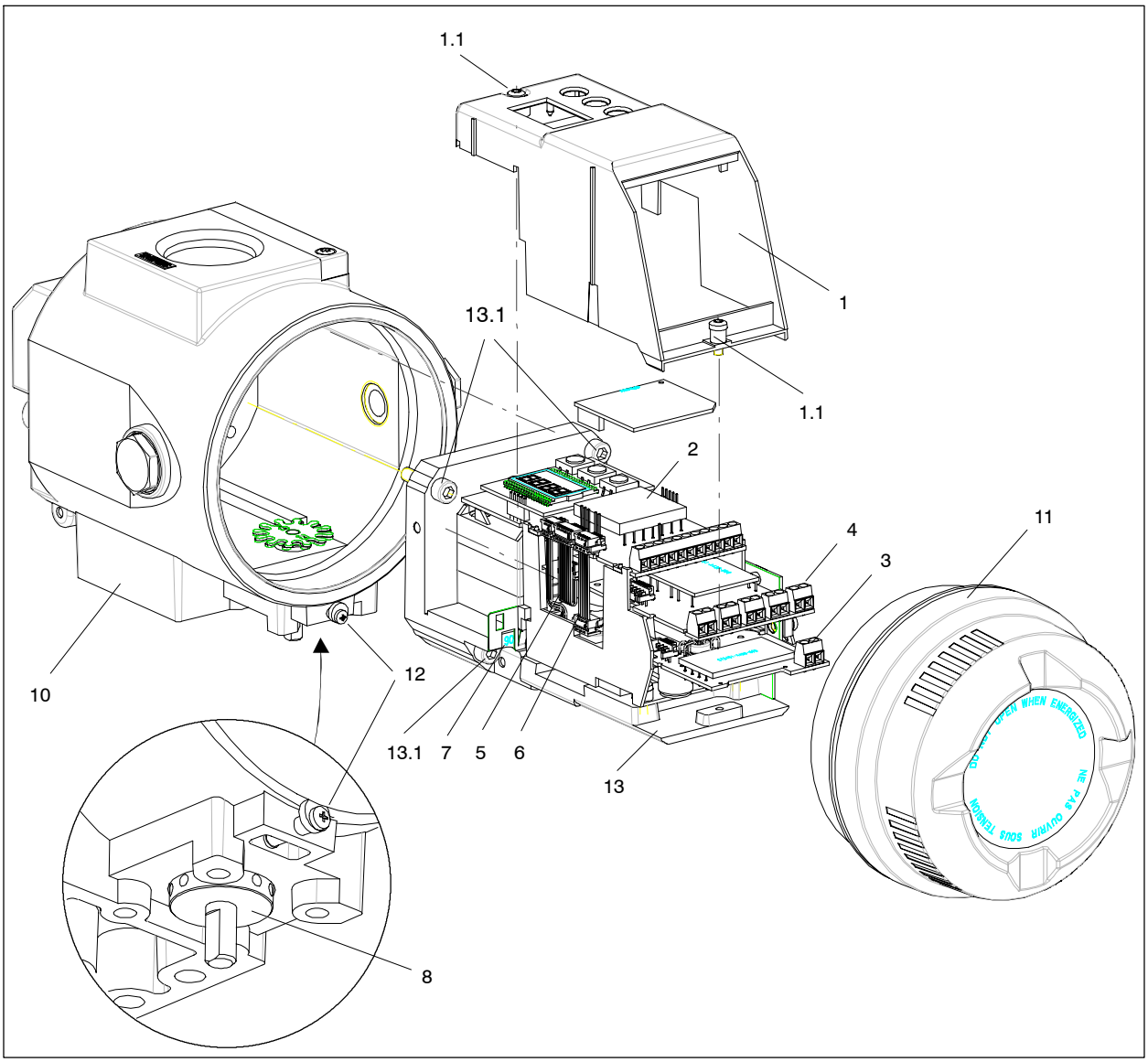
After loosening the four fixing screws (13.1) the complete rack (13) can be removed. The actuator may have to be turned so that the clutch can be easily disengaged.

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

NOTE

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

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



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

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

2.6.3 Iy module

Function

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

Installation

The I_y module (3) is pushed in to the bottom compartment of the module rack up to the stop and connected by the enclosed 6-wire ribbon cable (6) to the motherboard (see figure 2-10, page 27).

2.6.4 Alarm module

The alarm module contains

- 3 digital outputs and
- 1 digital input

Function

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

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

The alarm module is available in two versions:

- explosion protected for connecting to switching amplifier EN 60947–5–6
- non–explosion protected for connection to voltage sources with a maximum 35 V

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

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

The digital input is double.

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

These two inputs are designed as logic OR links.

Installation

Push the alarm module (4) underneath the motherboard into the module rack up to the stop and connect by the enclosed 8-wire ribbon cable (5) to the motherboard (see figure 2-10, page 27).

2.6.5 SIA module

The SIA module contains three digital outputs.

Function

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

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

Installation

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

1. Remove all the electrical connections from the motherboard (2).
2. Loosen the two fixing screws (2.1) of the motherboard.
3. Snap out the motherboard by carefully bending the four holders.
4. Insert the SIA-module (7) from above up to the top pcb rail of the rack.
5. Push the SIA module in the pcb rail of the rack about 3 mm to the right.
6. Screw the special screw (7.1) through the SIA module into the axle of the positioner **(Torque: 2 Nm)**:

CAUTION

The pin pressed into the actuating disc bearing (12) must be adjusted to just before touching with the special screw. The actuating disc bearing and the special screw must then be turned simultaneously so that the pins slot into the special screw.

---

7. Place the insulating cover (10) over the SIA module underneath the surface of the motherboard at the container wall on one side. The recesses in the insulating cover must slot into the corresponding lugs on the container wall. Place the insulating cover on the SIA module by carefully bending the container walls.
8. Snap the motherboard into the four holders and screw it tight again with the two fixing screws (2.1).
9. Make all the electrical connections between the motherboard and the options with the ribbon cables provided and between the motherboard and potentiometers with the potentiometer cable.
10. Fix the enclosed module cover instead of the standard version with the two screws (1.1).

11. Select the plates which already exist on the standard version of the module cover from the set of plates enclosed. Stick the selected plates according to the standard version to the mounted module cover. In the case of the version which doesn't feature explosion protection, stick the warning sign (figure 2) onto the side of the ground plate opposite the typeplate.
12. Make the electrical connections.

Setting the two limit values:

NOTE

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

1. Drive the actuator to the first desired mechanical position.
2. Adjust the top actuating disc (7.2) by hand until the output signal on terminals 41 and 42 changes.
3. Drive the actuator to the second desired mechanical position.
4. Adjust the bottom actuating disc (7.3) by hand until the output signal on terminals 51 and 52 changes.

NOTE

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

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

2.6.6 Mechanical limit switch module

The mechanical limit switch module contains the following:

- A binary output for the output of a group error message)
- Two switches for signaling two limit values that can be set mechanically. These two switches are electrically independent from the rest of the electronic system

Installation

CAUTION

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

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

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

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

Follow the instructions below for installation:

1. Remove all electrical connections on the motherboard (2).
2. Loosen carefully both fixing screws (2.1) for the motherboard.
3. Insert the limit switch module (7) from above until it reaches the upper printed circuit board rail of the rack.
4. Snap put the motherboard (2) by carefully bending the four holders.
5. Push the mechanical limit switch module (7) in the printed circuit board rail of the rack ca. 3 mm towards the right
6. Screw the special screw (7.1) through the mechanical limit switch module into the axle of the positioner **(torque: 2 Nm)**.

CAUTION

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

7. Place the insulating cover (10) over the mechanical limit switch module underneath the surface of the motherboard onto the container on the wall. The recesses in the insulating cover must slot into the corresponding lugs on the container wall. Place the insulating cover on the mechanical limit switch module by carefully bending the container walls.
8. Snap the motherboard board into the four holders and screw it tight again with the two fixing screws (2.1).
9. Make sure all electrical connections between the motherboard and the options using the ribbon cables provided and between the motherboard and potentiometer using the potentiometer cable.
10. Fix the enclosed module cover (1) instead of the standard version using the two screws (1.1).

☞ **NOTE**

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

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

☞ **NOTE**

Before connecting up the limit contact module, ensure that:

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

Connection

1. Loosen the screw (1) on the cover (2).
2. Push the cover (2) till it reaches the front stop.
3. Screw each cable tight in the appropriate terminal.
4. Push the cover (2) till it stops at the motherboard.
5. Tighten the screw (1) of the cover (2).
6. Fix the cables of each switch in pairs on the mounting eye using the cable binders provided (3).

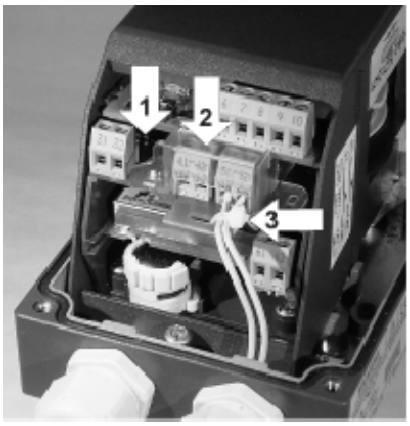


Figure 2-12 Installation of the options modules in the explosion-proof version

Setting the two limit values:

1. Drive the actuator to the first desired mechanical position.
2. Adjust the top actuating disc (7.2) by hand until the output signal on terminals 41 and 42 changes.
3. Drive the actuator to the second desired mechanical position.
4. Adjust the bottom actuating disc (7.3) by hand until the output signal on terminals 51 and 52 changes.

☞ **NOTE**

To avoid the actuating discs (7.2/7.3) being accidentally adjusted during operation, they are relatively sluggish. The following remedy might be of help if you are having trouble with the adjustment: open and close the actuator several times while holding the actuating discs. This temporarily reduces the friction. This allows an easier and finer adjustment.

2.6.7 EMC filter module

The positioner can also be driven by an external position sensor (potentiometer or NCS) (see page 42 ”3.3.2 Instructions for using positioners which are exposed to strong accelerations or vibrations”). An EMC filter module, order number C73451–A430–D23, is required for this.

2.6.8 Accessories

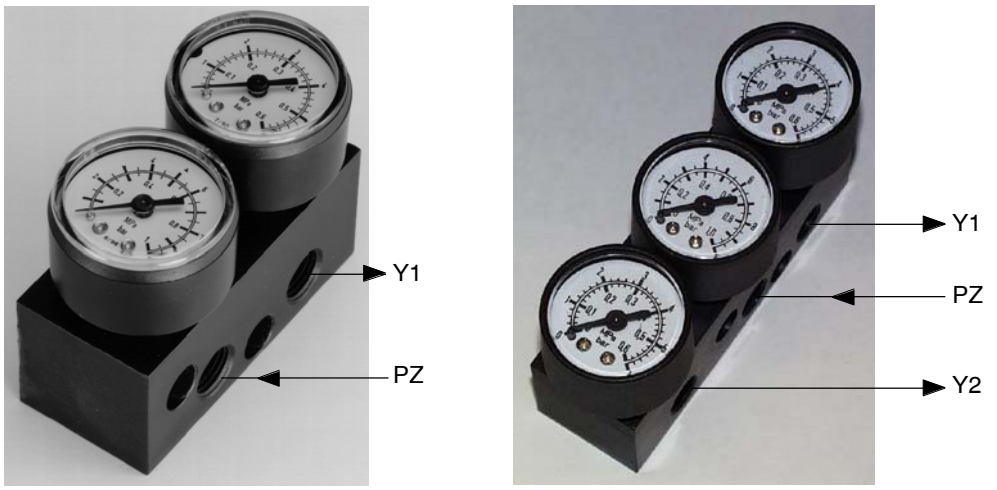


Figure 2-13 Manometer block (left for single-acting, right for double-acting actuators)

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 LEERER MERKER, page LEERER MERKER.

Installation of any modules required is described in chapter 2.6, page 25 of this technical manual.

3.2 Dimensional drawings

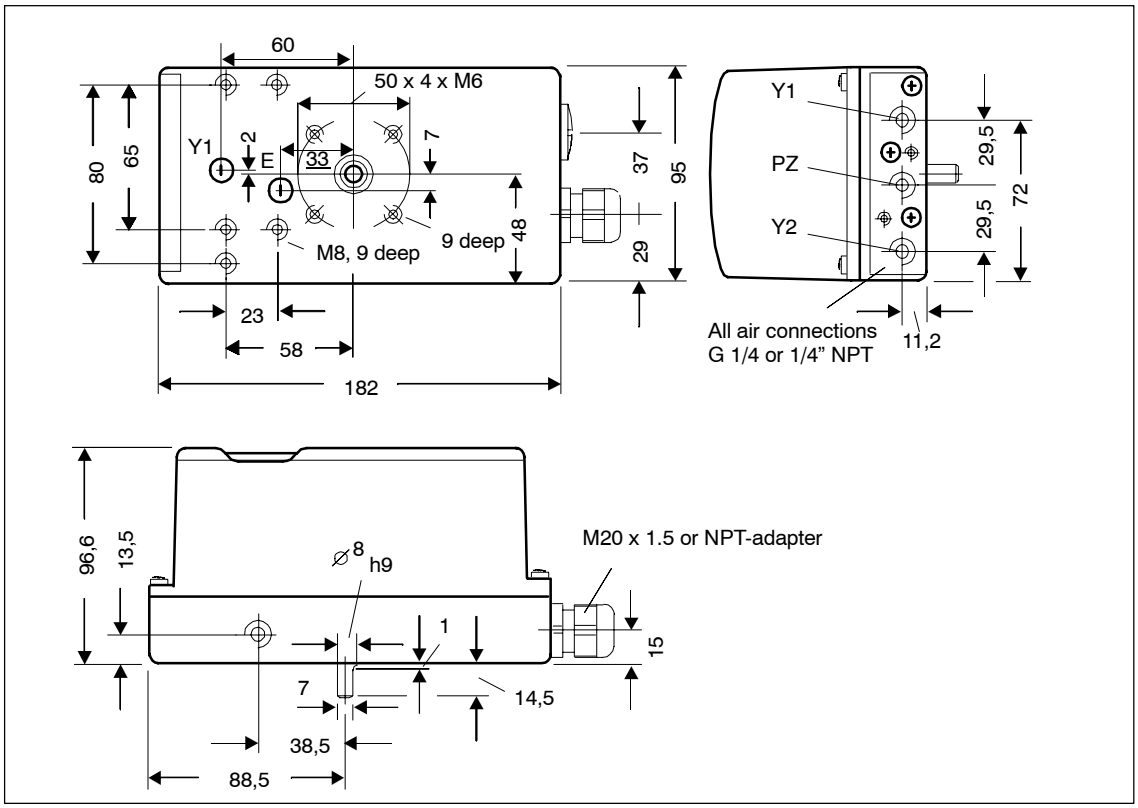


Figure 3-1 Dimensional drawing version plastic housing 6DR5xx0

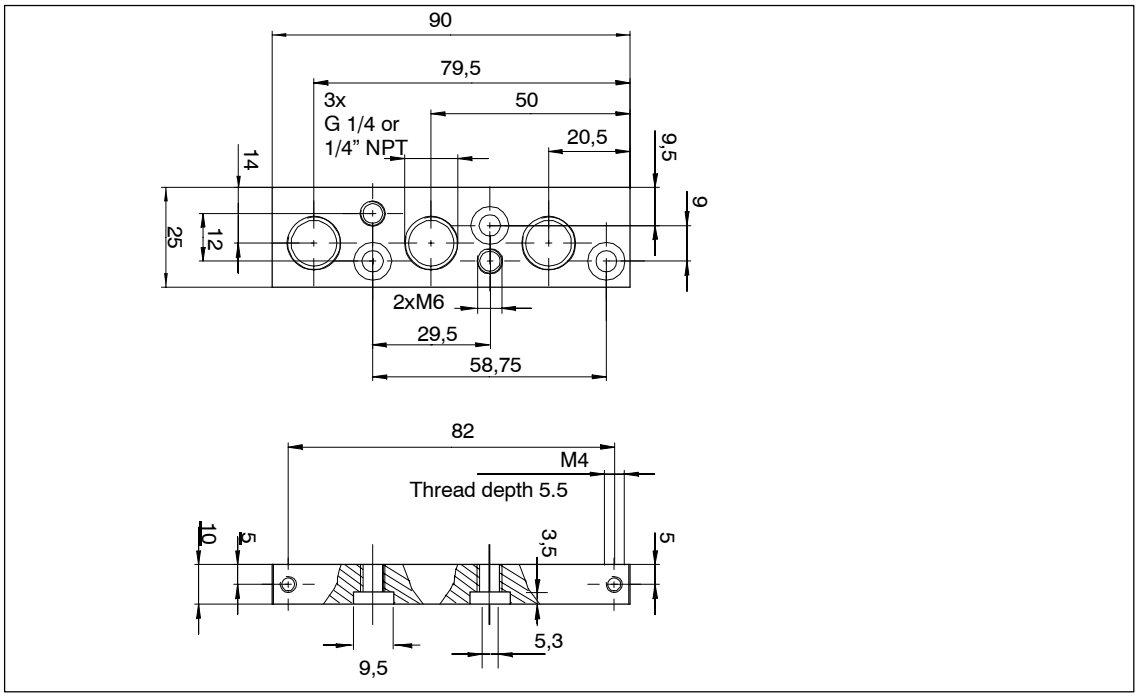


Figure 3-2 Dimensional drawing terminal strip for plastic housing

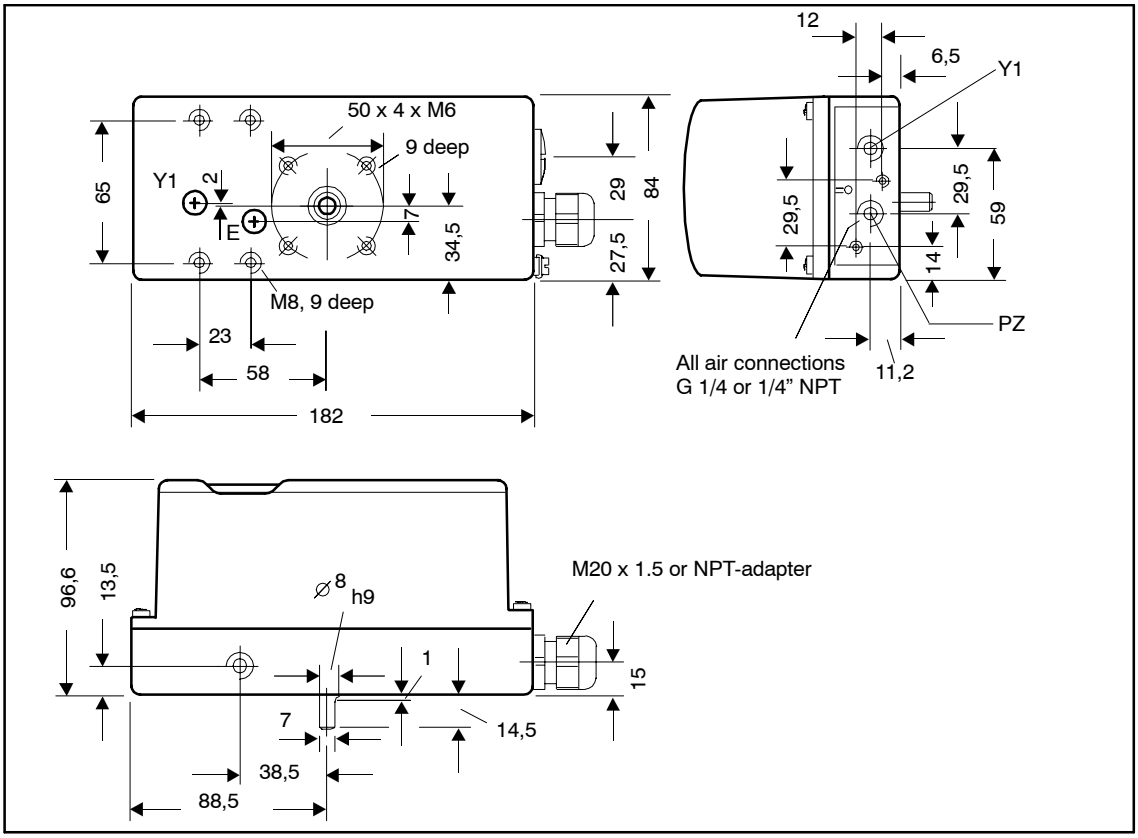


Figure 3-3 Dimensional drawing version metal housing 6DR5xx1

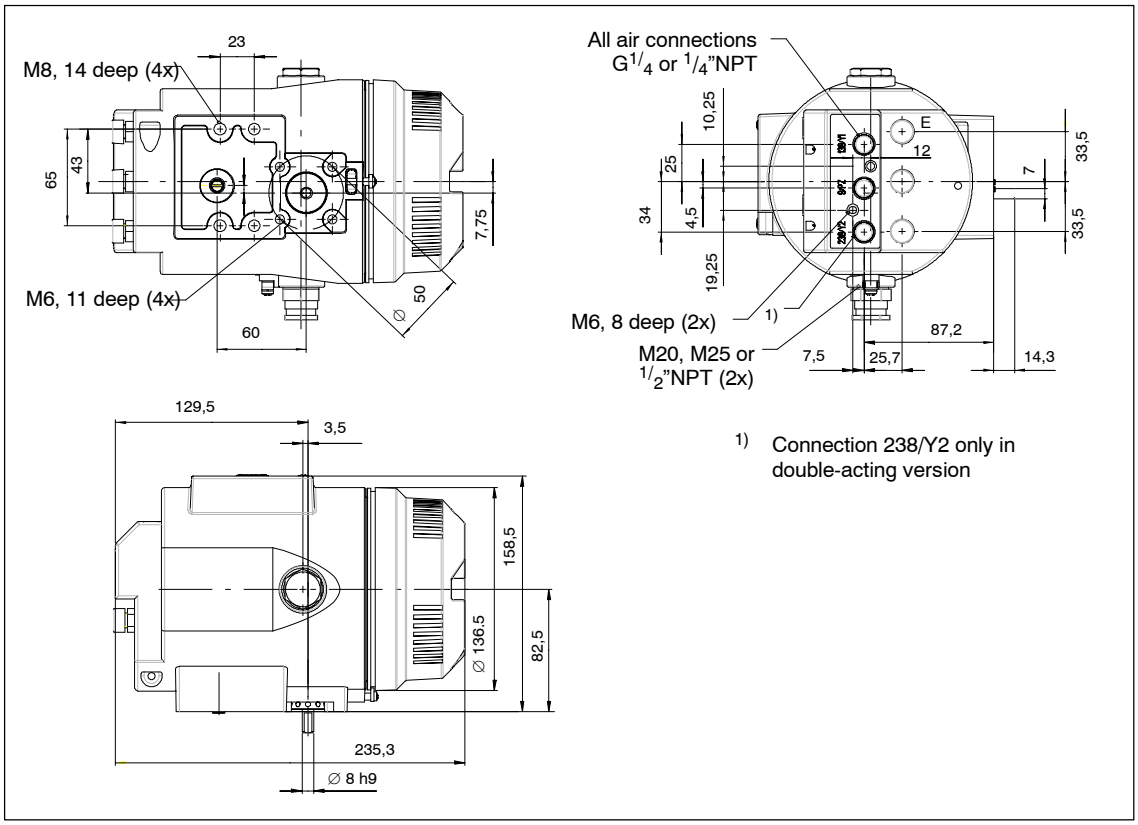


Figure 3-4 Dimensional drawing for positioner with metal housing in explosion-proof version 6DR5xx5

3.3 Assembly

General

WARNING

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

1.	Mechanical fitting of positioner	this chapter
2.	Connection of electric power supply	see chapter 3.4, p. 54
3.	Connection of pneumatic power supply	see chapter 3.5, p. 63
4.	Put into operation	see chapter 3.6, p. 64

Please also observe the warning on page 10 and 54!

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 IP66 degree of protection is no longer sufficient and especially when there is a danger that water may freeze.

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

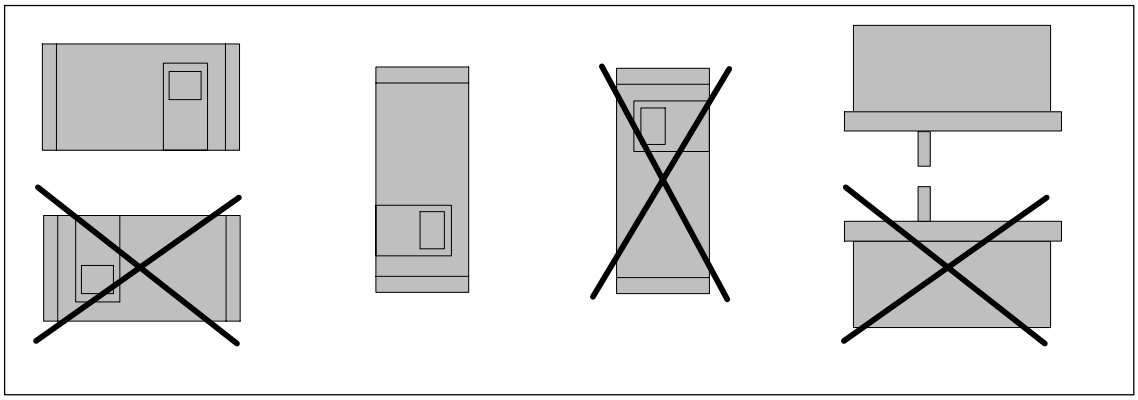


Figure 3-5 Favorable and unfavorable installation positions

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 IP66 degree of protection is inadequate protection for this.

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

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

Procedure

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

Assembly of the screw-type gland with plastic hose

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

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

NOTICE

for explosion proof versions:

Only adjust the outer friction clutch (8, Fig.2-11, page 29). The internal friction clutch (8, Fig.2-10 page 27) is fixed and, for the explosion proof version, must **not** be adjusted.

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

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

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

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

Both setting options are designated accordingly by icons on additional signs (see Fig. 3-6 page 43).

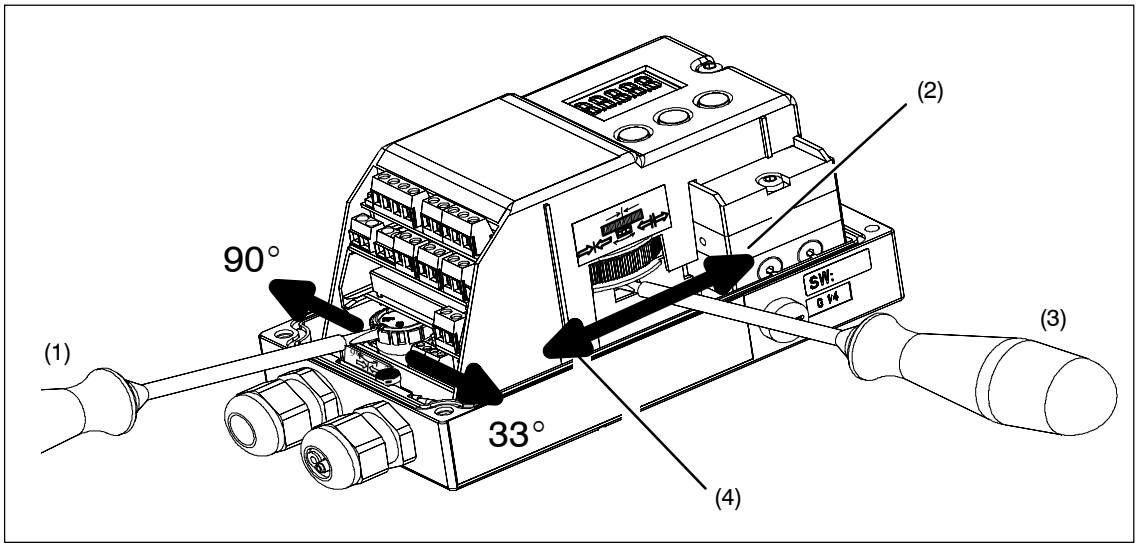
Procedure

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

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

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

- Using a conventional flat headed screwdriver (approx. 4 mm wide) turn the yellow wheel underneath the clamps to the left or right according to your chosen setting (either 33° or 90°) until it snaps in audibly.
- In order to set the transmission ratio selector any locks in place must first be released. Hence the yellow wheel must first be put into the original factory set position in order to reset the transmission ratio selector if necessary, e.g. after replacing the actuator.



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

Figure 3-6 Fixing device for the slip clutch

External position detection

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

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

You require the following:

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

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

WARNING

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

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

The *scope of delivery of the mounting kit*” linear actuator IEC 534 (3 mm to 35 mm)” are contained (ser. no. see figure 3-7, page 47):

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

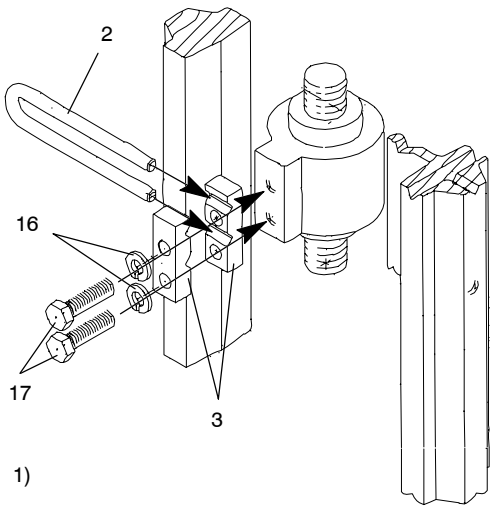
3.3.4 Assembly procedure (see figure 3-7, page 47)

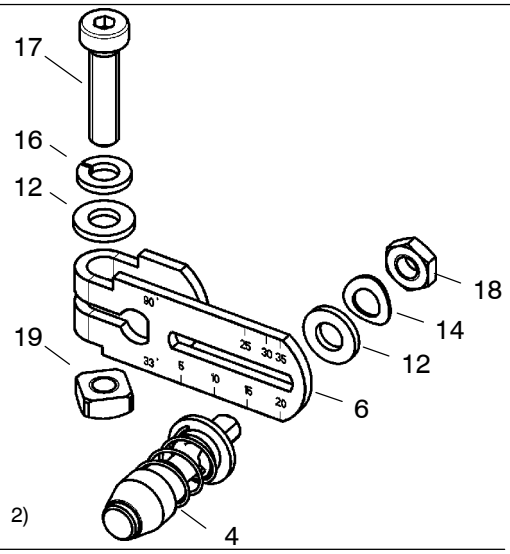
1. Mount clamping assembly (3) with hexagon socket cap screws (17) and lock washer (16) on the actuator spindle.
2. Insert the pick-up bracket (2) into the recesses of the clamping assembly. Set the necessary length and tighten the screws so that the pick-up bracket can still be shifted.
3. Insert the premounted pin in the lever (6) and assemble with nut (18), spring washer (14) and washer (12).
4. The value of the stroke range specified on the actuator or if this does not exist as a scaling value, the next greatest scaling value is set. The center of the pin must be in line with the scaling value. The same value can be set later under parameter 3.YWAY in commissioning to display the way in mm after initialization.
5. Assemble the hexagon socket cap screw (17), spring washer (16), washer (12) and square nut (19) on the lever.
6. Push the premounted lever onto the positioner axle up to the stop and fix with the hexagon socket cap screw (17).
7. Fit the mounting bracket (1) with two hexagon head screws (9), lock washer (10) and flat washer (11) on the rear of the positioner.

8. Selection of the row of holes depends on the width of the actuator yoke. The roll (5) should engage in the pick-up bracket (2) as close as possible to the spindle but may not touch the clamping assembly.
9. Hold the positioner with the mounting bracket on the actuator so that the pin (4) is guided within the pick-up bracket (2).
10. Tighten the pick-up bracket.
11. Position the mounting parts according to the type of actuator.
    - Actuator with ledge: Hexagon head screw (8), flat washer (11) and lock washer (10).
    - Actuator with plane surface: Four hexagon head screws (8), flat washer (11) and lock washer (10).
    - Actuator with columns: Two U bolts (7), four hexagon nuts (21) with flat washer (11) and lock washer (10).
12. Secure positioner onto the yoke using the previously positioned mounting parts.

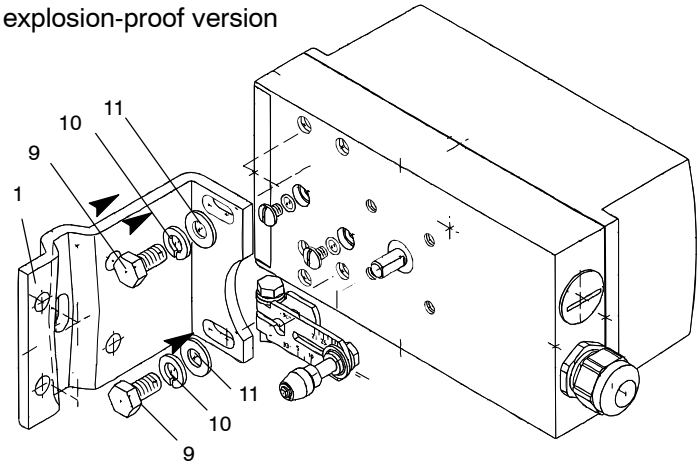
NOTE

Set the height of the positioner so that the horizontal lever position is reached as close to the stroke center as possible. You can use the lever scale as orientation. If no symmetrical mounting is possible it must be guaranteed that the horizontal lever position is passed through within the stroke range.





Without explosion-proof version



Explosion-proof version:

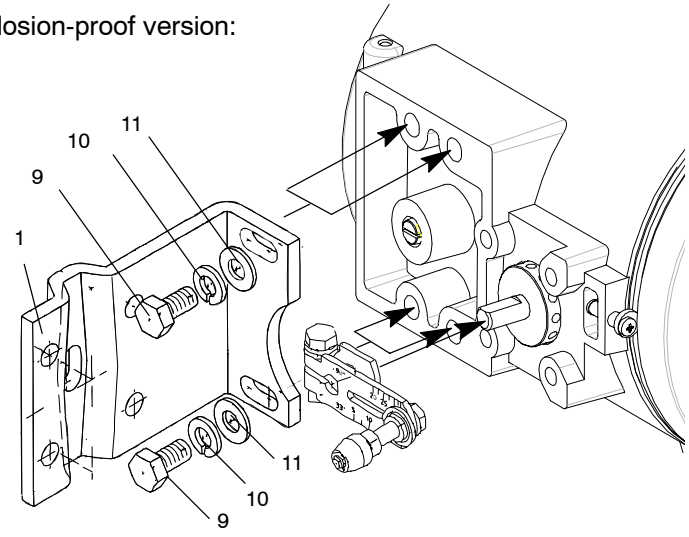


Figure 3-7 Assembly procedure (linear actuator)

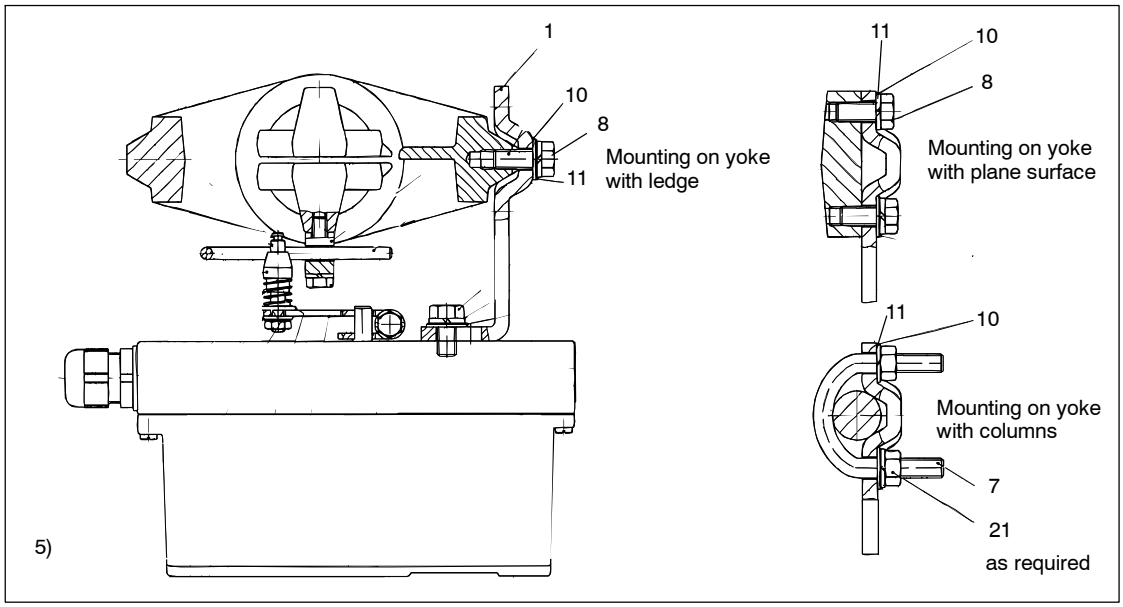


Figure 3-7 Assembly procedure (linear actuator) *continued*

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

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 axle, pull back by about 1 mm and tighten the hexagon socket head screw (18) with the Allen key provided.
4. Place the carrier (3) onto the end of the actuator and secure using Fillister head screw (16) and washer (17).
5. Carefully place positioner with mounting console onto the actuator such that the pin of the coupling wheel engages in the driver.
6. Align the positioner/mounting console assembly in the center of the actuator and screw tight.
   (Screws not included in delivery; they are part of the actuator mounting console!)
7. Following startup as described in Chapter 3.6, page 64: 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!*

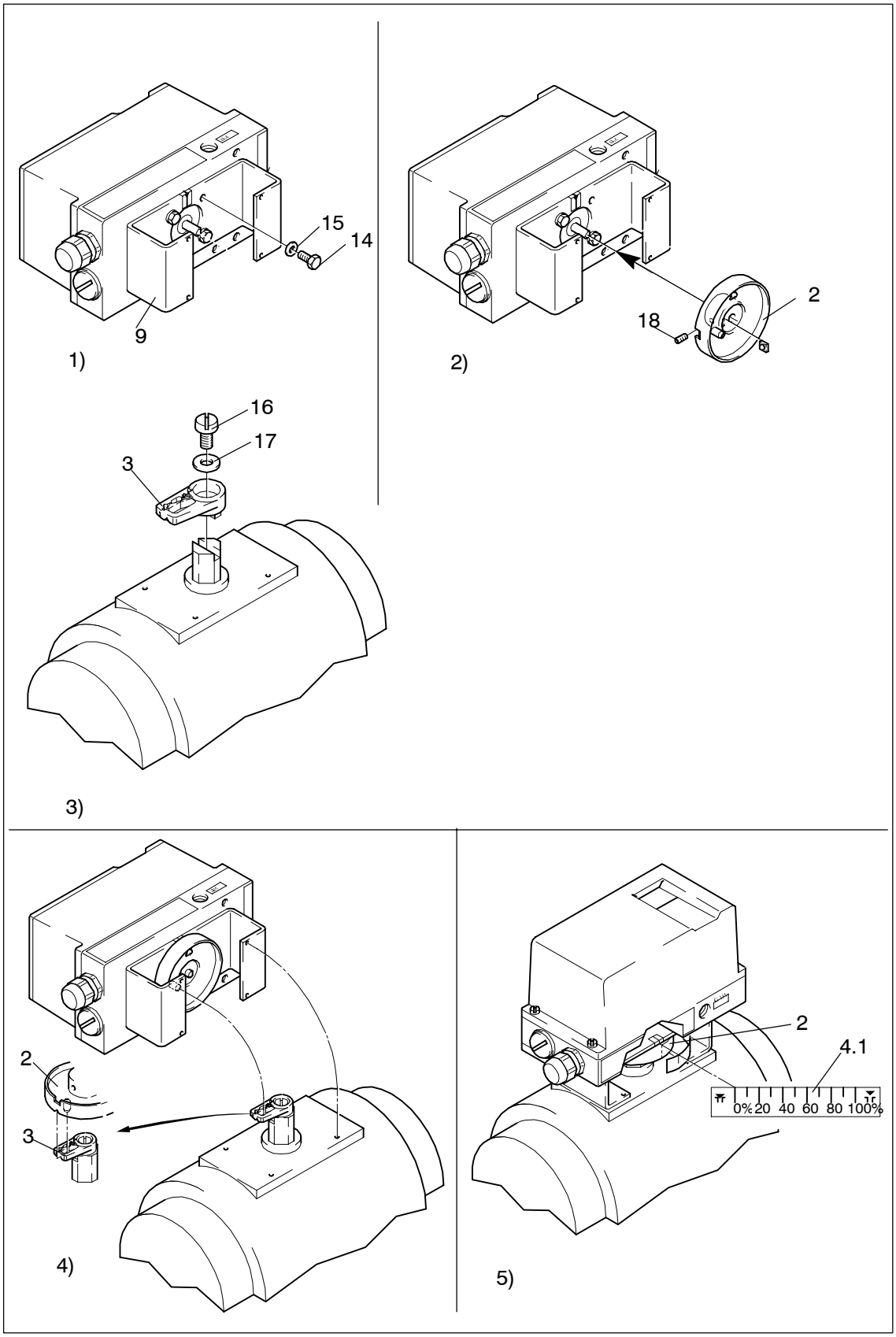


Figure 3-8 Assembly procedure (rotary actuator)

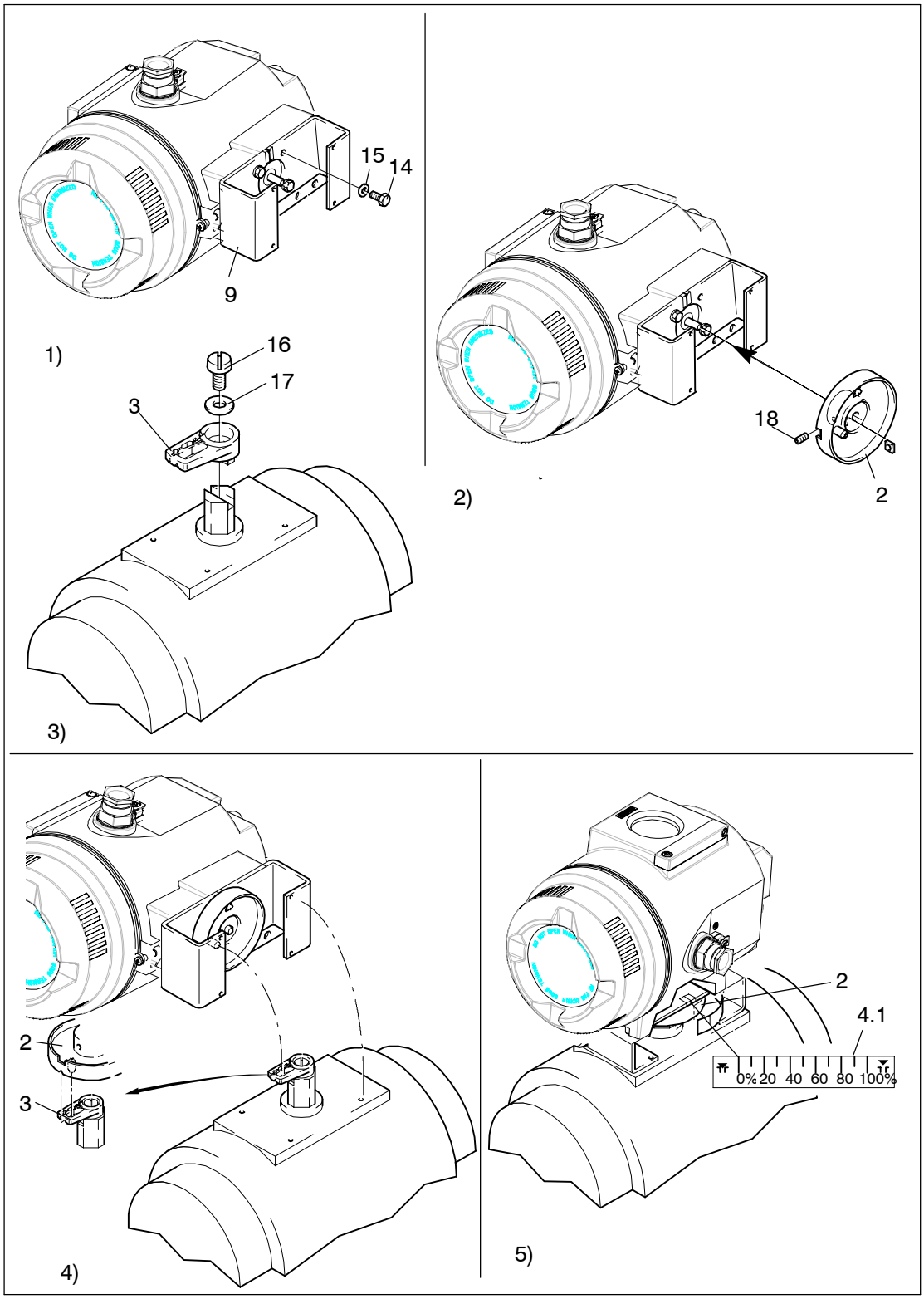
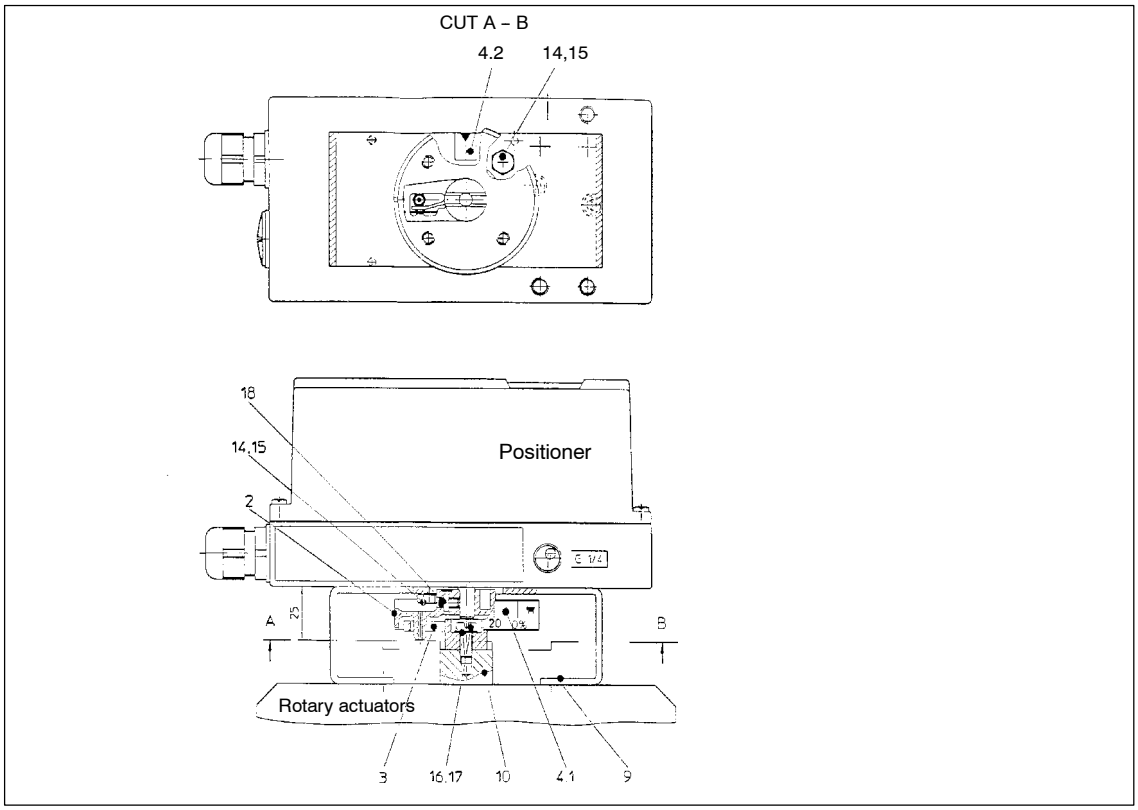


Figure 3-9 Assembly procedure for **explosion-proof version** (rotary actuator)



2	Clutch wheel	10	Feedback shaft
3	Driver	14	Hexagon-head screw M6 × 12
4	Multiple-purpose plate	15	Retaining washer S6
4.1	Scale	16	Round-head screw M6 × 12
4.2	Pointer mark	17	Washer
9	VDI/VDE 3845 mounting bracket	18	Socket-head cap screw

Figure 3-10 Mounted positioner for rotary actuators

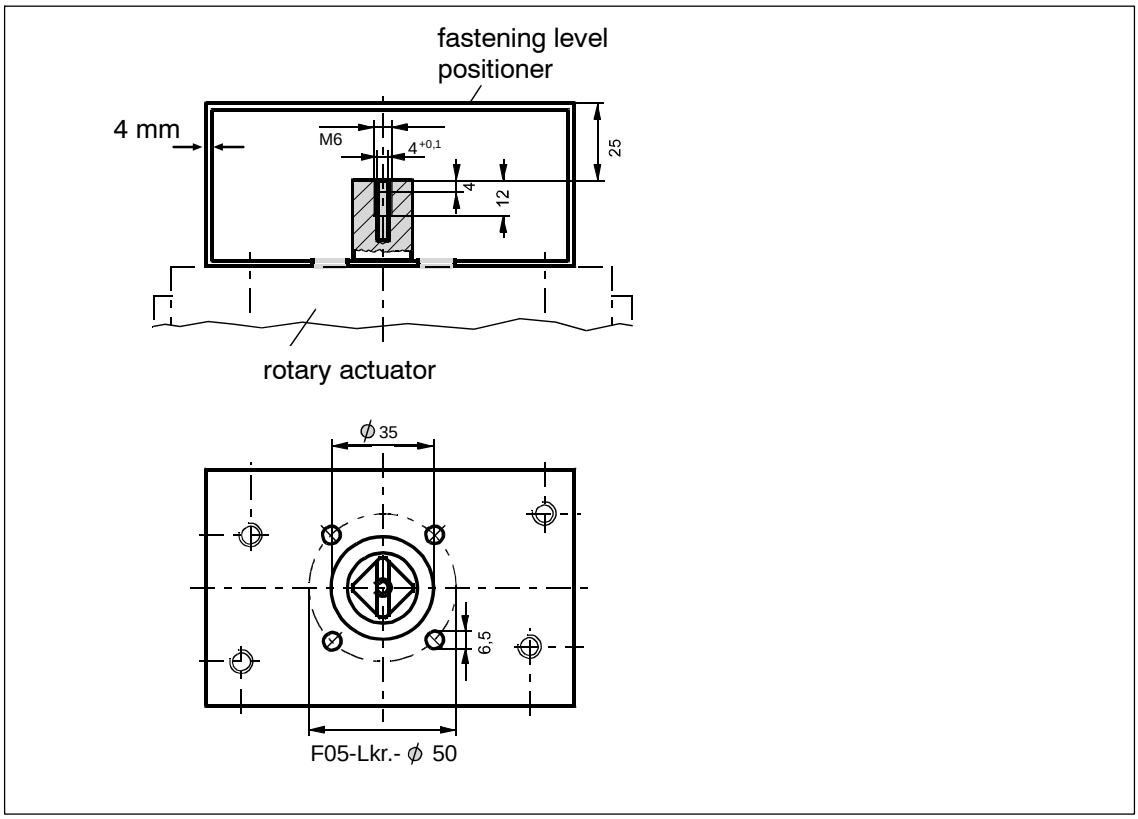


Figure 3-11 Attachment of rotary actuator, mounting console (scope of delivery actuator manufacturer), dimensions

3.4 Electrical Connection

NOTE

Any necessary options modules must be installed before electrical connection (see chapter 2.6, page 25).

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

WARNING

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

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

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

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

The plastic housing is metal lined to increase the electromagnetic compatibility (EMC) against high frequency radiation. This screen is connected electrically to the threaded bushes shown in figure 3-12, page 55.

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

CAUTION

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

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

Provide for suitable potential equibonding between the hazardous and non-hazardous areas for applications in areas where there is a risk of explosions.

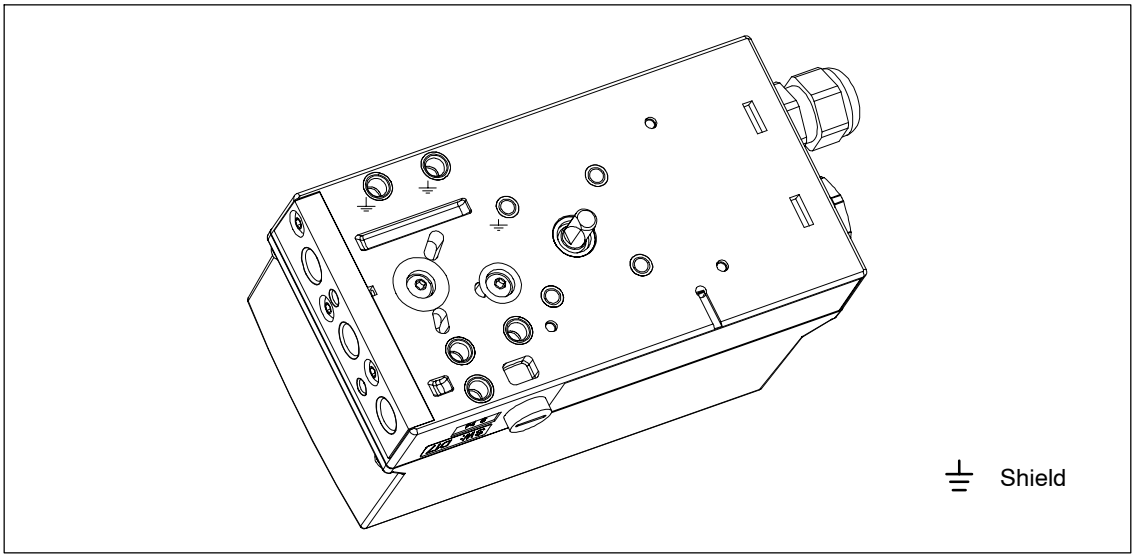


Figure 3-12 Base plate

Fitting the bus cable

Normal, intrinsically safe and zone 2 versions.	Explosion–proof version
1. Isolate the bus cable as shown in figure 3-13, page 56.	1. Isolate the bus cable as shown in figure 3-13, page 56.
2. Open the positioner housing by undoing the four cover screws.	2. To open the positioner, the cover catch (12) must be undone and the screw cover unscrewed.
3. Insert the prepared bus cable through the cable gland.	3. Insert the prepared bus cable through the Ex–d–certified cable gland *)
4. Secure the shield with the cable clip and the two screws to the housing.	4. Secure the shield with the cable clip and the two screws to the housing.

5. Tighten the cable gland.
6. Connect the red and green wires as shown in figure 3-14, page 57 to terminals 3 and 7 of the motherboard (the polarity is immaterial).

5. Tighten the Ex–d–certified cable gland. *)
6. Connect the red and green wires as shown in figure 3-16, page 58 to terminals 3 and 7 of the motherboard (the polarity is immaterial).

*) if the Conduit Tube System is being used, refer to the relevant instructions.

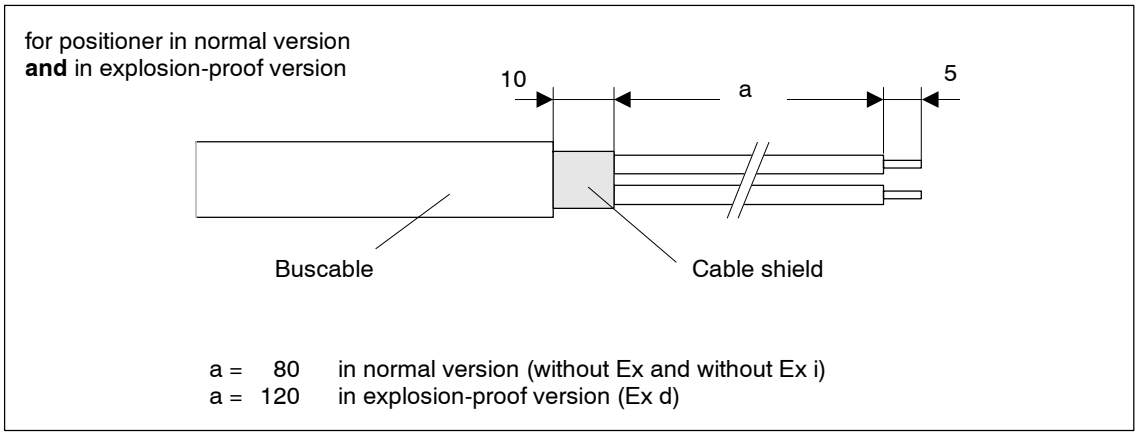


Figure 3-13 Preparation of bus cable

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

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

☞ **NOTE**

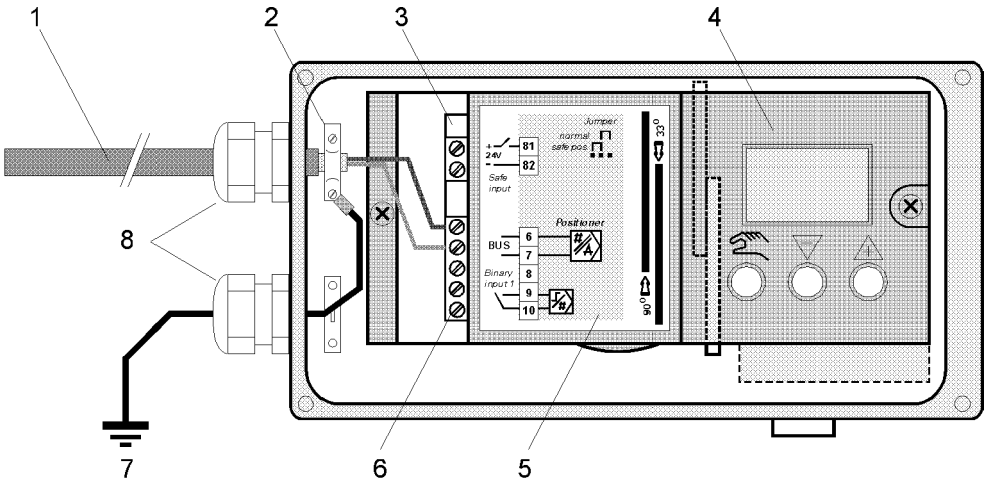
Use standard M20 x 1.5 cable gland nuts to ensure leakage (IP–protection of the housing) and for the necessary tensile strength use only cables with a cable diameter ≥ 8 mm, or for smaller diameters use a suitable sealing insert.

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).

for positioner in normal version:



1 Bus cable
2 Cable clip
3 Motherboard
4 Module cover
5 Plate
6 Terminal block
7 Ground potential
8 Cable glands

Figure 3-14 Bus cable connection

for positioner in explosion-proof version

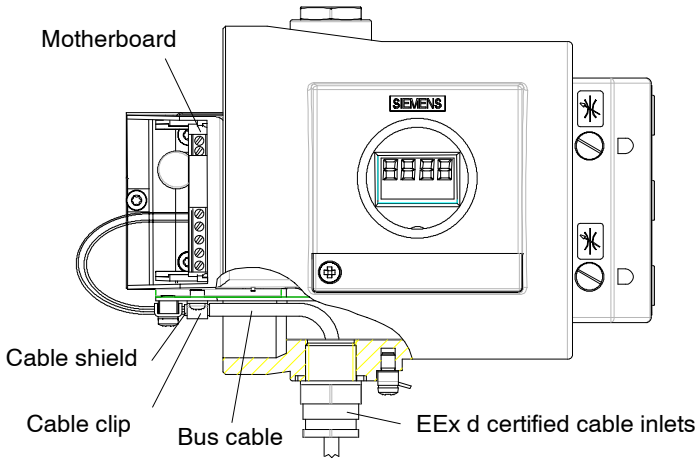


Figure 3-15 Bus cable connection for positioner in explosion-proof version

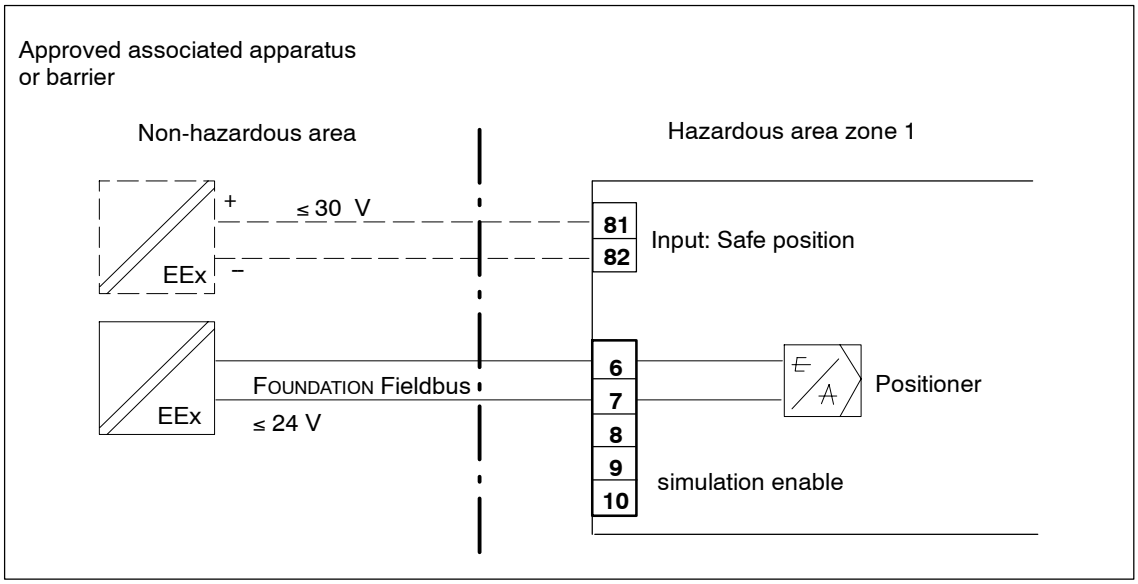


Figure 3-16 Electric connection of basic device with in intrinsically safe version

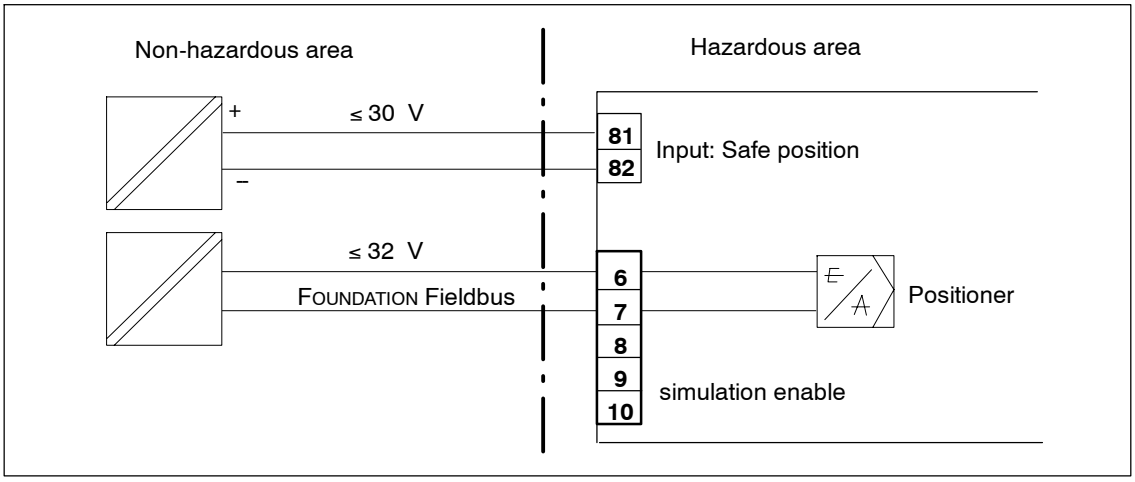


Figure 3-17 Electric connection for positioner in explosion-proof version or in type of explosion protection “n” version

Safety position

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

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

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

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

Current output

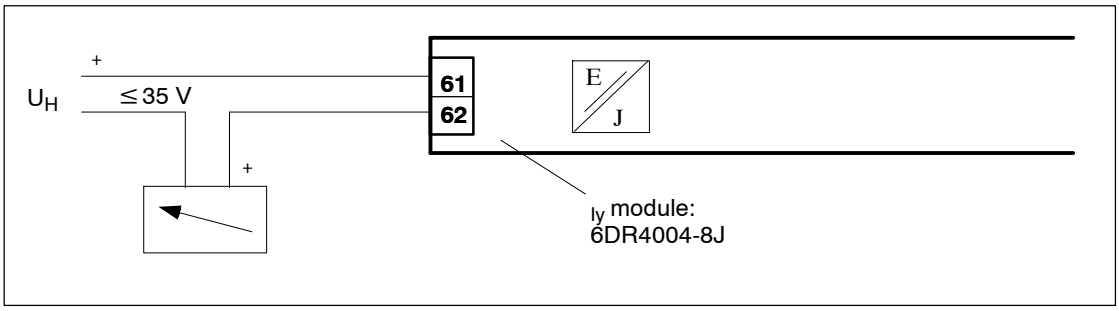


Figure 3-18 I_y module 6DR4004-8J, **non** Ex

Digital inputs and outputs

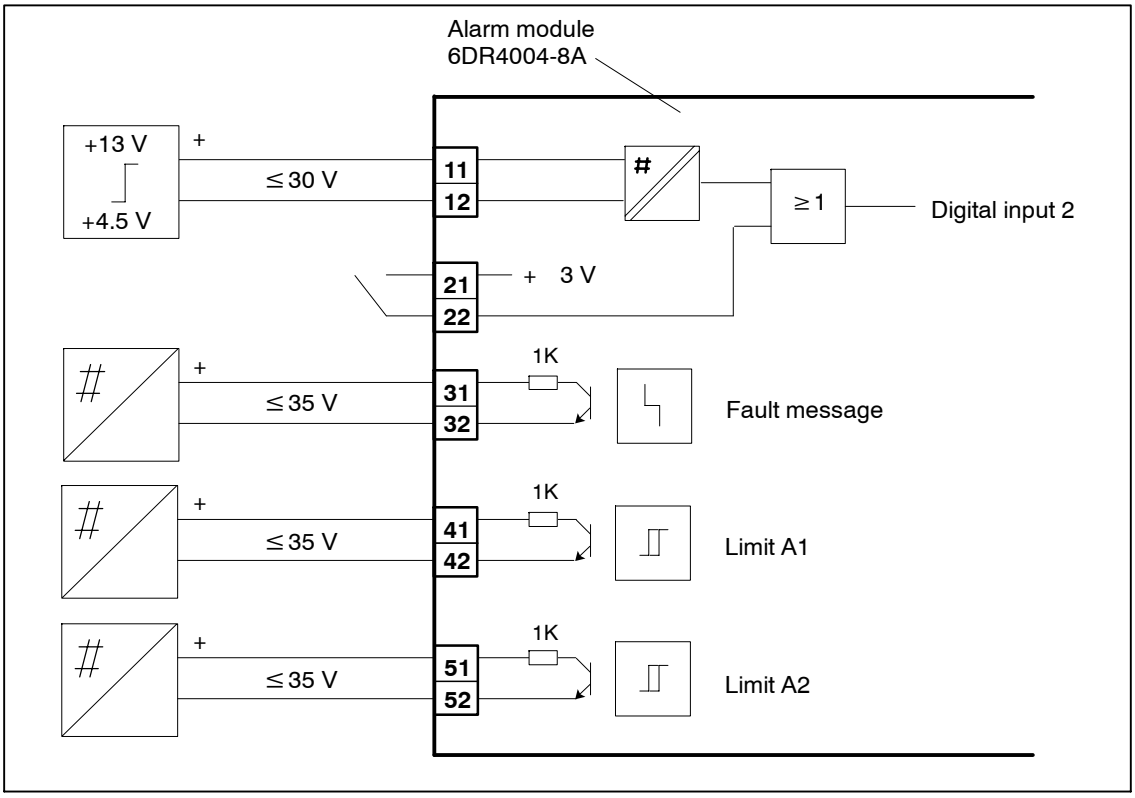


Figure 3-19 Alarm module 6DR4004-8A, **non** Ex

SIA module

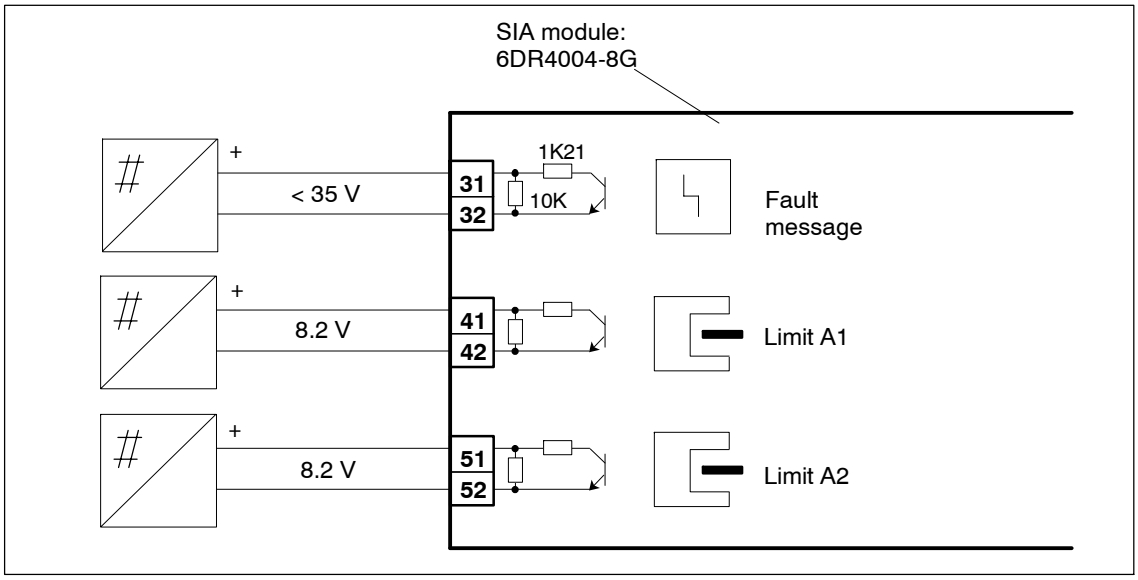


Figure 3-20 SIA module 6DR4004-8G, **non** Ex

Mechnical limit switch module

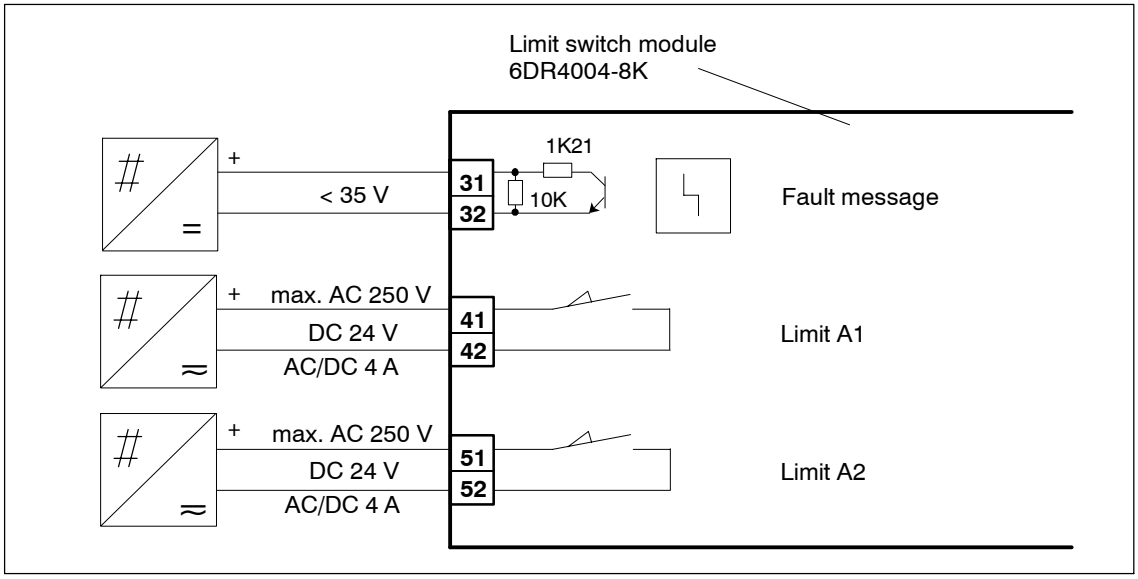


Figure 3-21 Mechanical limit switch module 6DR4004–8K, **non** Ex

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

Current output

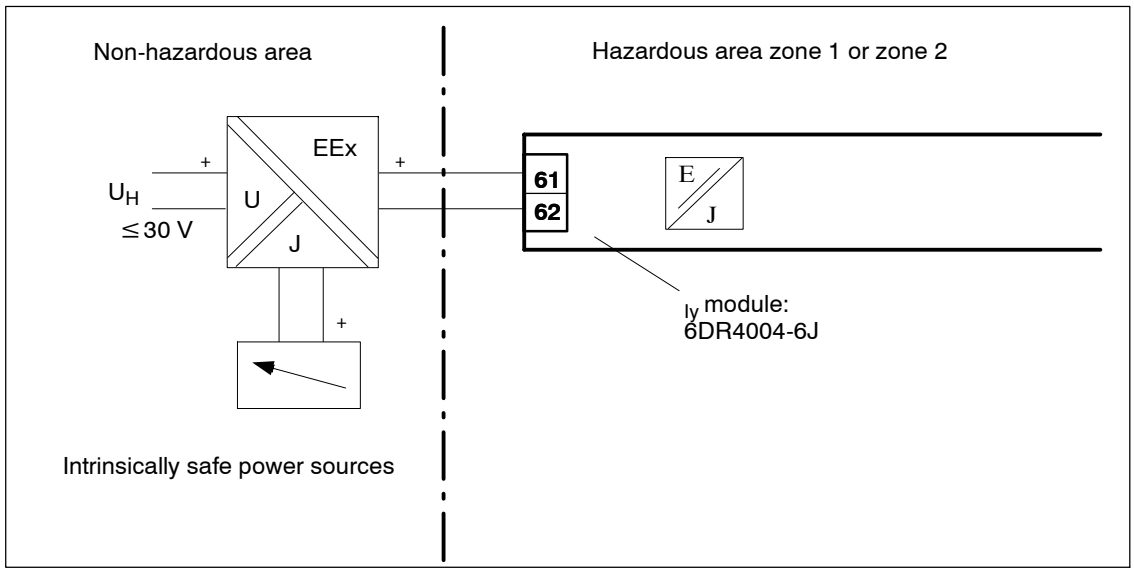


Figure 3-22 I_y module 6DR4004-6J, EEx i

Digital inputs and outputs

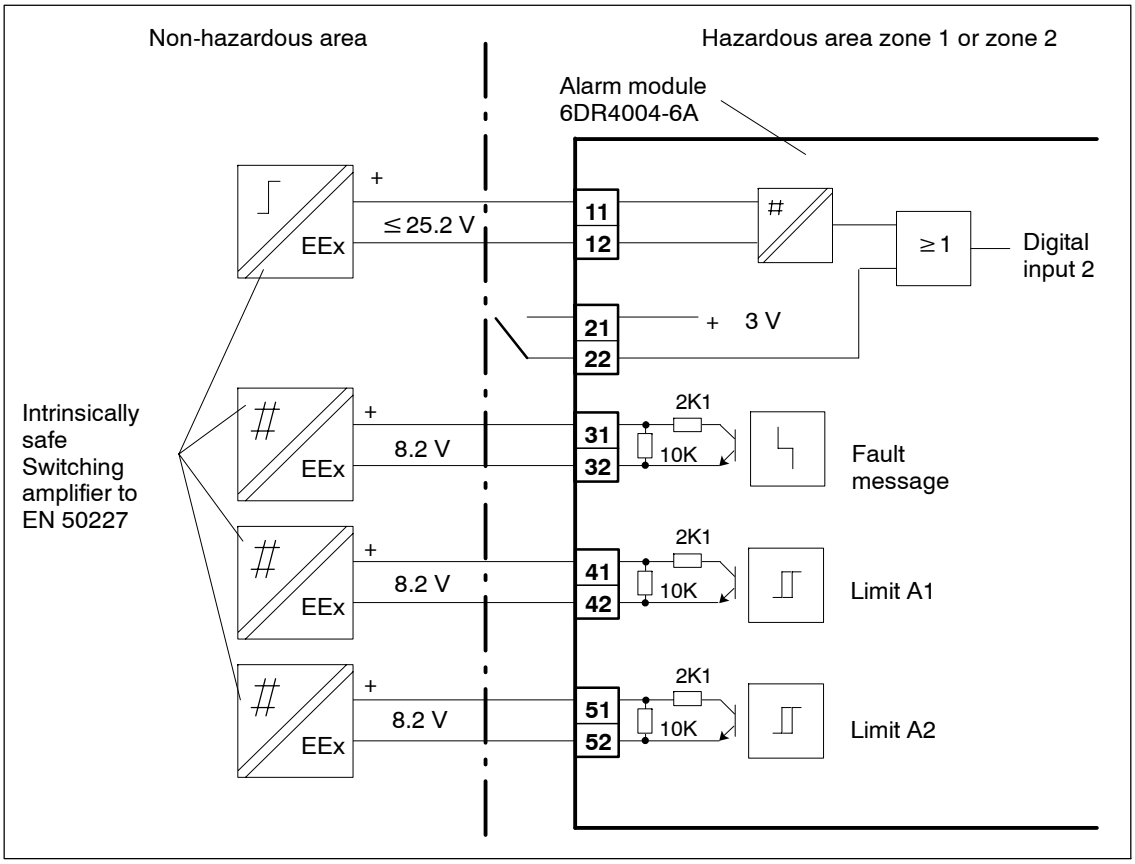


Figure 3-23 Alarm module 6DR4004-6A, EEx i

SIA module

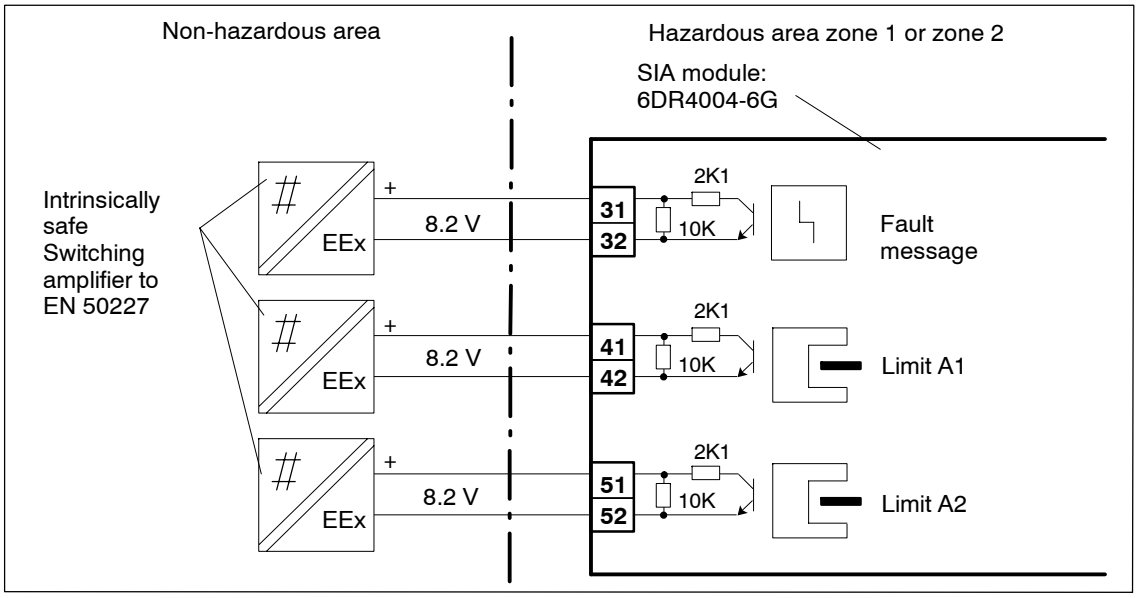


Figure 3-24 SIA module 6DR4004-8G, EEx i

Mechnical limit switch module

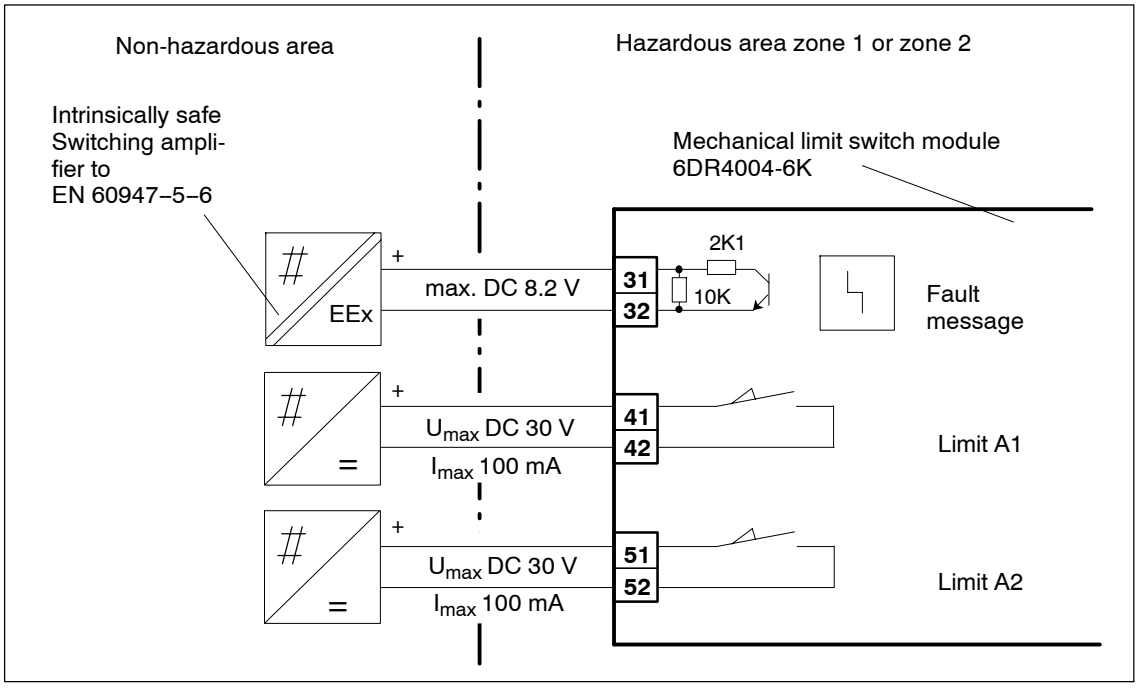


Figure 3-25 Mechnical limit switch module 6DR4004–6K, EEx i

3.5 Pneumatic Connection

WARNING

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

NOTE

Note the air quality! Oil-free industrial air, solid content < 30 µm, pressure dew point 20 K below the lowest ambient temperature (chapter 7 “Technical Data”, page 219).

- 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 2-4 and 2-5, page 21.
- 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 stroke, the supply pressure must be sufficiently greater than the maximum required final pressure of the actuator.

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

3.6 Commissioning

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

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

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

This initialization can be effected in three different ways:

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

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

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

NOTE

N.B.: The operating pressure should be at least one bar greater than is necessary for closing/opening the valve during initialization. However, the operating pressure may not be higher than the maximum permissible operating pressure of the actuator.

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

3.6.1 Preparations for linear actuators

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

☞ **NOTE**

Particularly important is the position of the transmission ratio selector (7, figure 2-2, page 19) 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 47) 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 2-4 and 2-5, page 21).
4. Connect the positioner to the fieldbus line (figure 3-16, page 58 and figure 3-17, page 58).
5. The positioner is now in the operating mode "**P-manual operation**" The current potentiometer voltage (P) is displayed in percent in the top line of the display, e.g.: "**P12.3**", and "**NOINI**" flashes in the bottom line:

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

☞ **NOTE**

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

7. Now move the actuator to the horizontal position of the lever. A value between **P48.0** and **P52.0** should be visible in the display. If this is not the case, adjust the slip clutch (8, figure 2-10, page 27) until "**P50.0**" is displayed with a horizontal lever. The more accurately you hit this value, the more exactly the positioner can determine the total stroke.

NOTICE

for the explosion proof version:

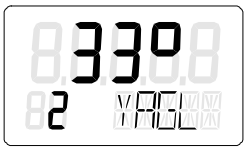
Only adjust the outer friction clutch (8, Figure 2-3, page 20). The internal friction clutch (9, Fig. 2-2 page 19) is fixed and, for the explosion proof version, must **not** be adjusted.

3.6.2 Automatic initialization of linear actuator

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

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

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



or

NOTE

It is vital that this value corresponds to the setting of the transmission ratio selector (8, figure 2-2, page 19) (33° or 90°).

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

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

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

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

During the initialization phase ”**RUN1**” to ”**RUN5**” appear one after another in the bottom display (see also structograms figures 3-27, page 76 to figure 3-30, page 79).

☞ **NOTE**

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

The initialization is complete when the following display appears:

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

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

☞ **NOTE**

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

3.6.3 Manual initialization of linear actuator

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

Manual initialization procedure in linear actuator

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

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

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

or

NOTE

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

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

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

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

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 stem path and the displacement detection according to step 1.

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

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

NOTE

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

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

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

---

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

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 2-2, page 19) to position 90° (normal angle for rotary actuator).

1. Mount the positioner with the appropriate mounting kit (see chapter 3.3.5, page 48).
2. Connect the actuator and the positioner with the pneumatic lines and supply pneumatic power to the positioner (figure 2-4 and 2-5, page 21).
3. Connect the positioner to the fieldbus line (Figure 3-16, page 58 and Figure 3-17, page 58).
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.

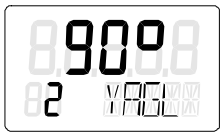
3.6.5 Automatic initialization of rotary actuator

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

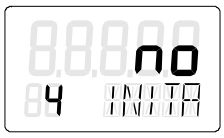
1. Press the operation mode key for longer than 5 s. This brings you to the Configuration operating mode.
   Display

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 3-27, page 76 to figure 3-30, page 79).

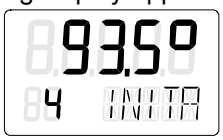
☞ **NOTE**

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

Manual initialization procedure in rotary actuators

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

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

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

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

NOTE

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

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

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

After successful initialization the determined rotary range appears in the top display.

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

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

3.6.7 Automatic initialization (structograms)

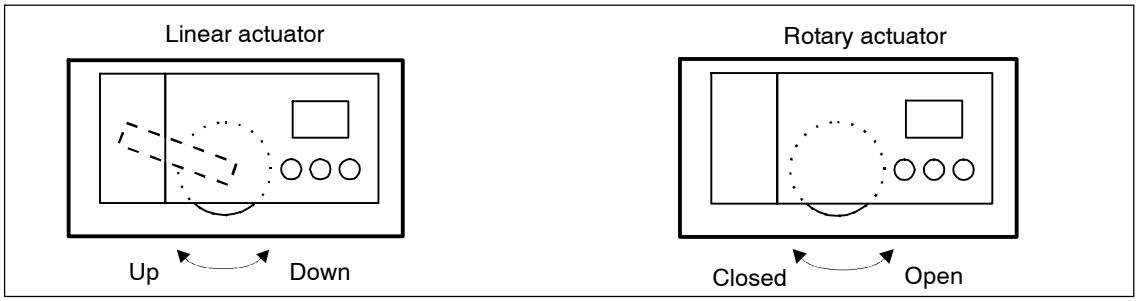


Figure 3-26 Direction of action of the actuators

The initialization procedure should be taken from the following structogram (figure 3-27 to figure 3-30). The terms Open/Closed and up/down in the structogram refer to the direction of action of the actuators as illustrated in figure 3-26.

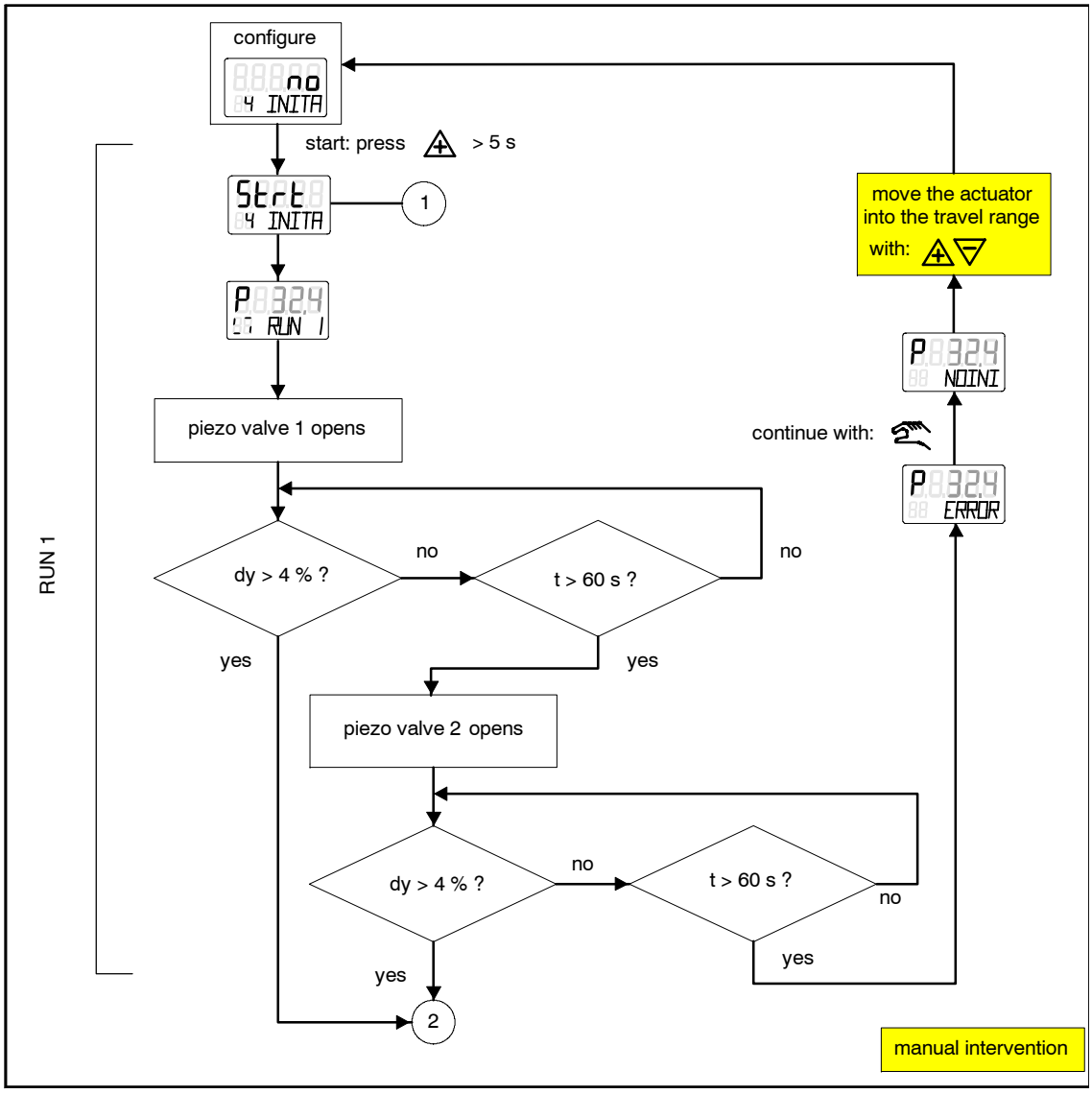


Figure 3-27 Automatic initialization, part 1

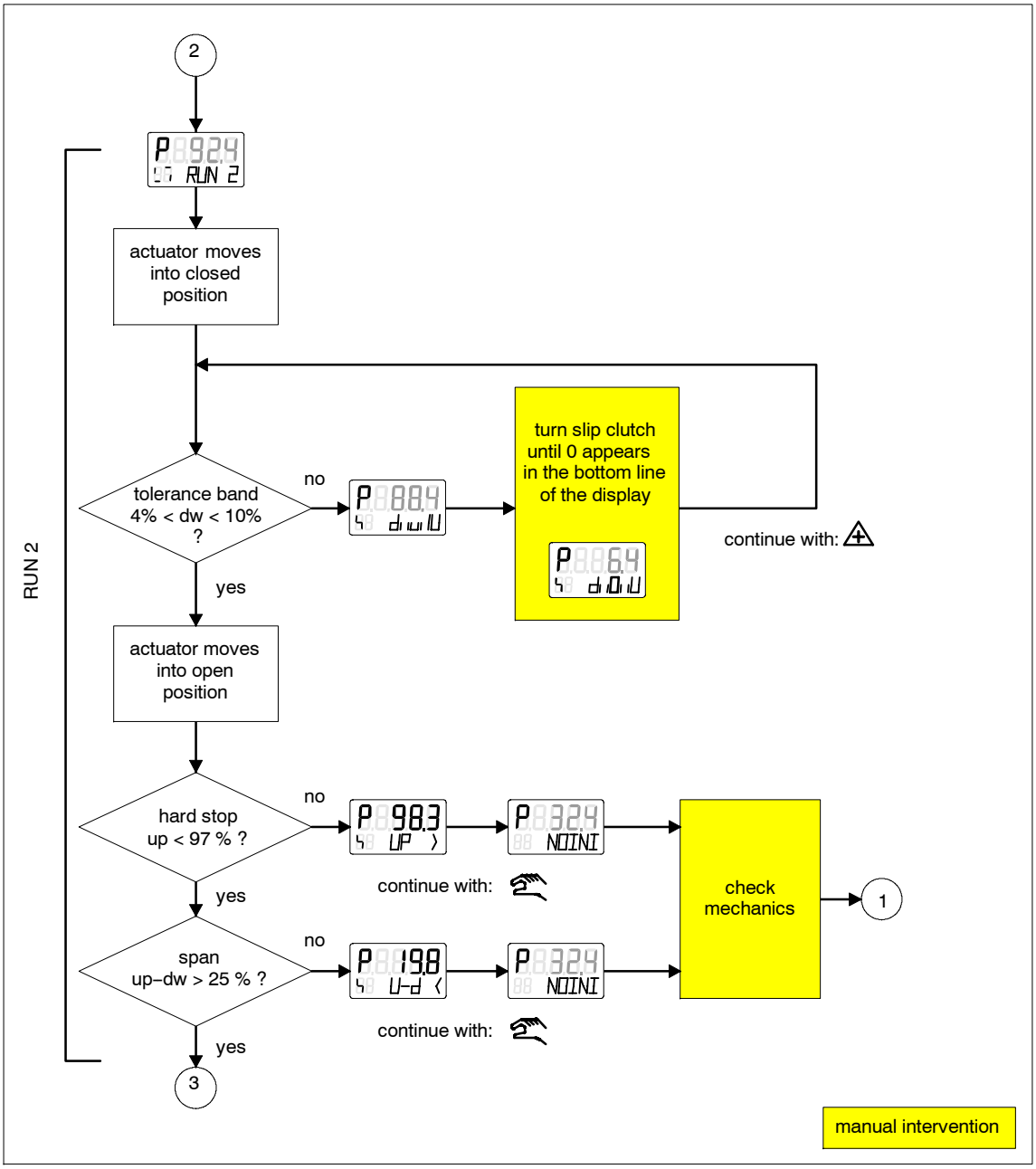


Figure 3-28 Automatic initialization, part 2 (for linear actuators)

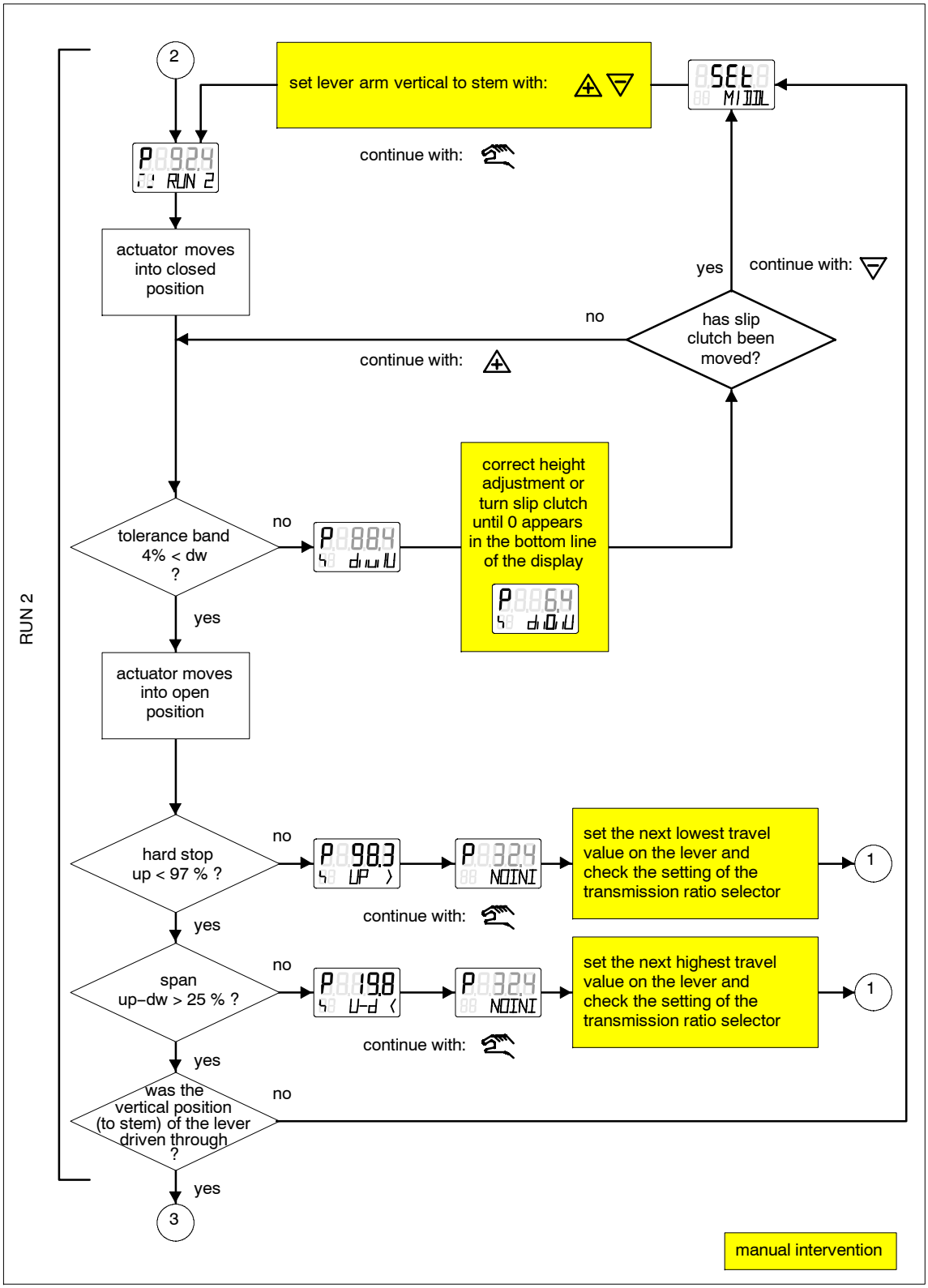


Figure 3-29 Automatic initialization part 2 (for rotary actuators)

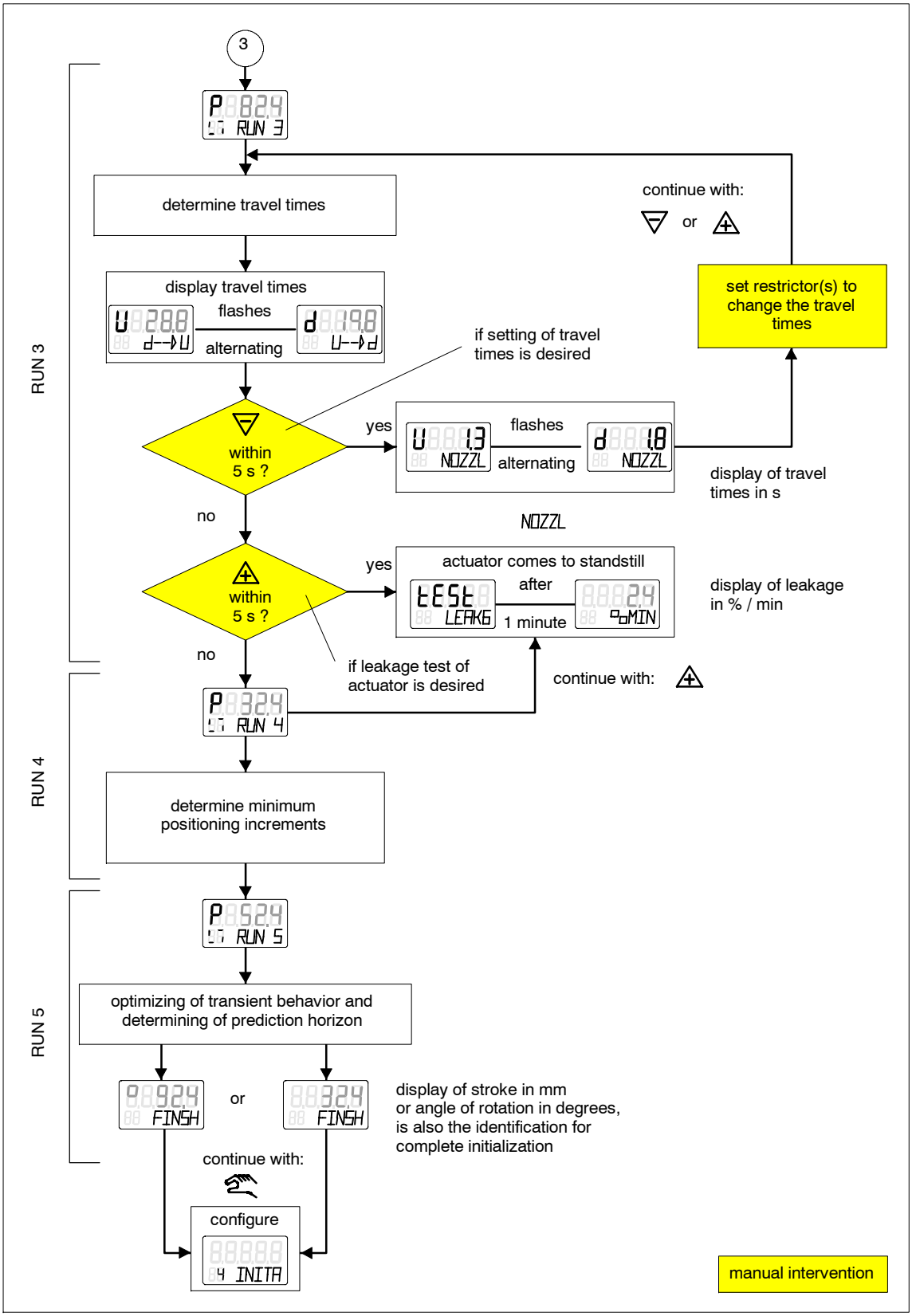


Figure 3-30 Automatic initialization, part 3

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.

The following procedure describes how to replace a positioner when using the National Configurator. If you use a different tool step 5 may vary slightly.

1. Prerequisite is that the positioner to be replaced and all ist parameters is in the project database. The replacement instrument should be online on the bus.
2. Fix the actuator in its momentary position (by mechanical or pneumatic means).
3. Read and note the current position value of the positioner to be replaced. 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 valve. Move the gear switch to the same position as the defective instrument.
5. Now transfer all parameters from the projected positioner to the new positioner. With the NI Configurator this can be done by right clicking the appropriate blocks in the function block application window, chosing ”Replace With ...” and selecting the new blocks. Do this also with the Transducer Block. In order to transfer the parameter INIT_VALUES (Initialisation parameters), you have to set SERVICE_UPDATE (Save/Reset) to 9 (Enable Write INIT–Values), then click ”Write changes” and set SERVICE_UPDATE to 3 (Set device to state INIT). Now the positioner is initilized with the same parameters as the old one.
6. If the current position value on the display does not match the noted value of the defective positioner, set the correct value with the slip clutch.
7. 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.

Local Operation 4

The following chapter describes the local operation of the positioner. The local operation allows the configuration of many parameters, the initialization of the positioner, and the manual control of the actuator and the display of many diagnostic values.

All these actions can also be performed via bus communication. But with the local operation feature you can carry out some fundamental tasks without the need of a bus interface or a configuration tool.

4.1 Display

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

☞ **NOTE**

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

Figure 4-1 shows you the various display options.

The meaning of further display capabilities is detailed in chapter 4.6 page 127.

4.2 Input keys

The positioner is operated by three keys (figure 4-2, page 83) the function of which depends on the selected operating mode. In the explosion-proof version of the positioner the input keys are underneath a key cover which can be lifted up after loosening the cover screw.

☞ **NOTE**

The input keys of the explosion-proof version must be covered to prevent liquid getting in. The IP66/NEMA4x degree of protection is not guaranteed when the housing is open or the key cover is open.

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

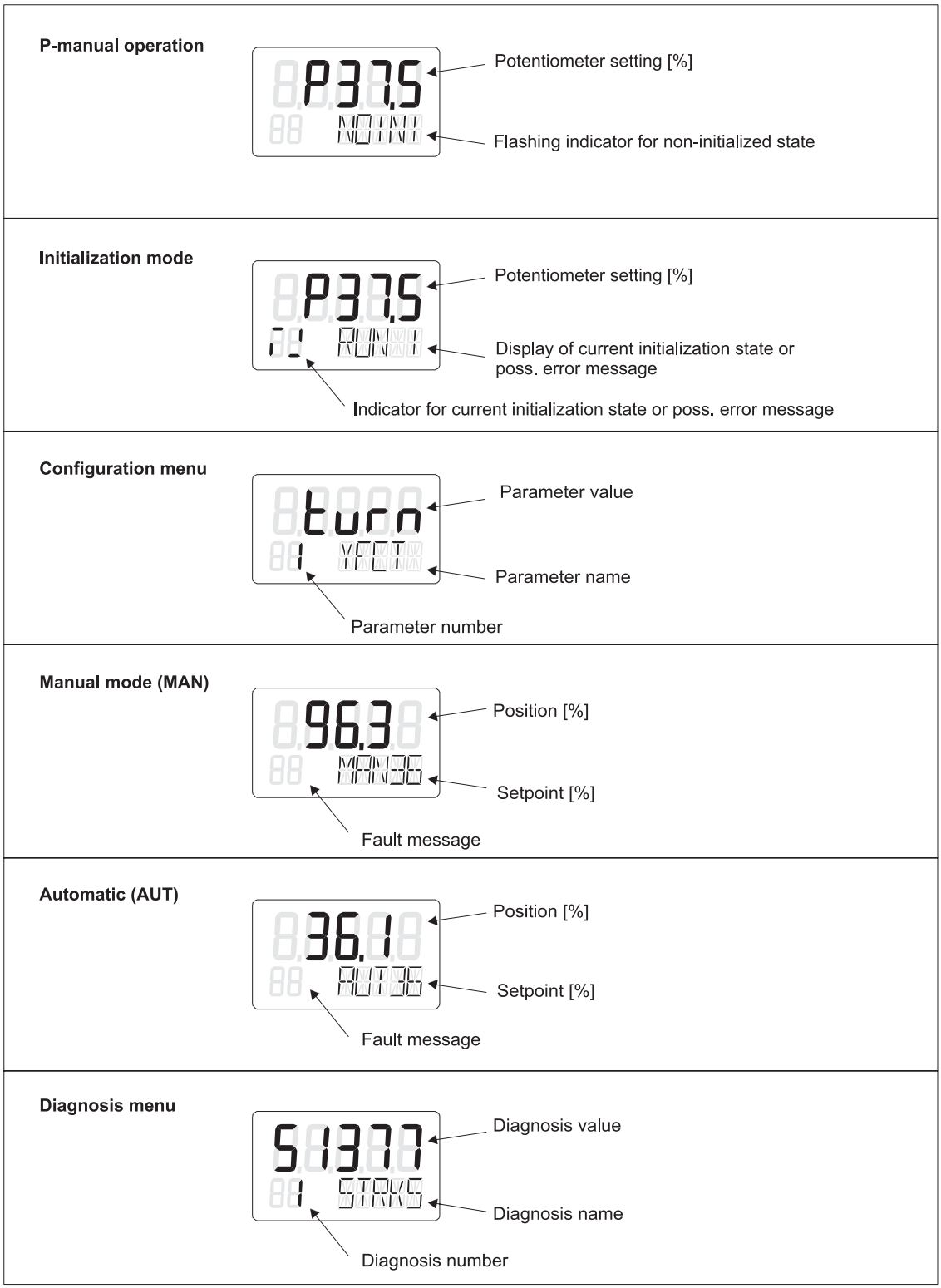
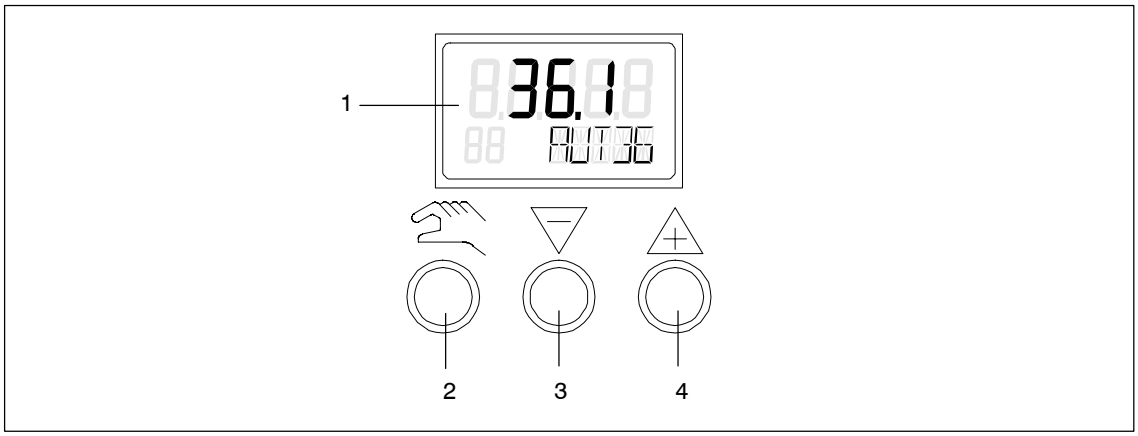


Figure 4-1 Meaning of the various display options



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.

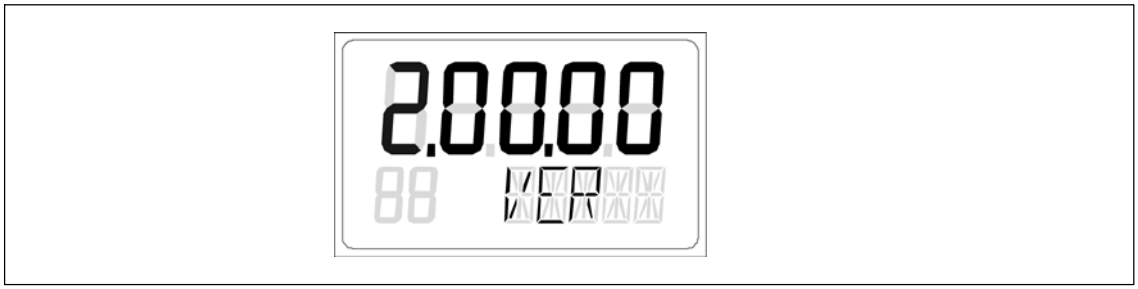


Figure 4-3 Firmware version, example: 2.00.00

4.3 Local operating modes

The positioner can be operated in five local operating modes.

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

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

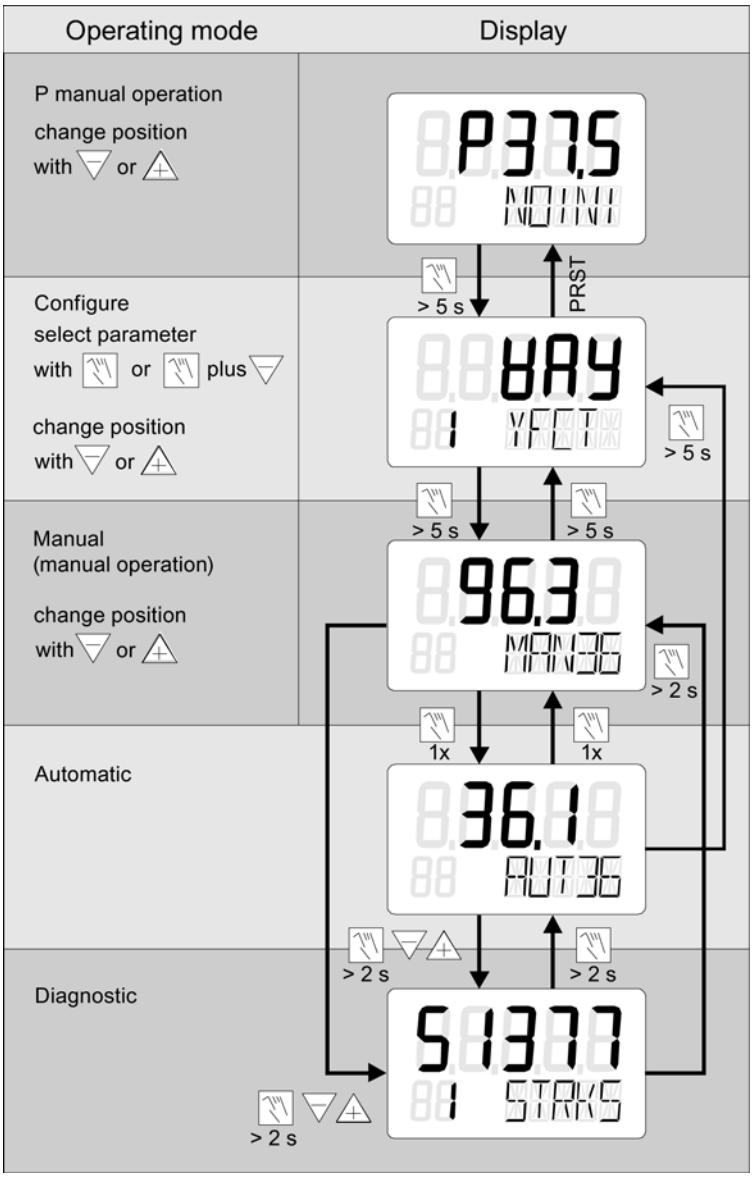


Figure 4-4 Change between the operating modes

P-manual mode (ex-factory state)

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

Manual and automatic mode or output of alarms and position feedback are possible after successful initialization.

Configuration and initialization

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

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

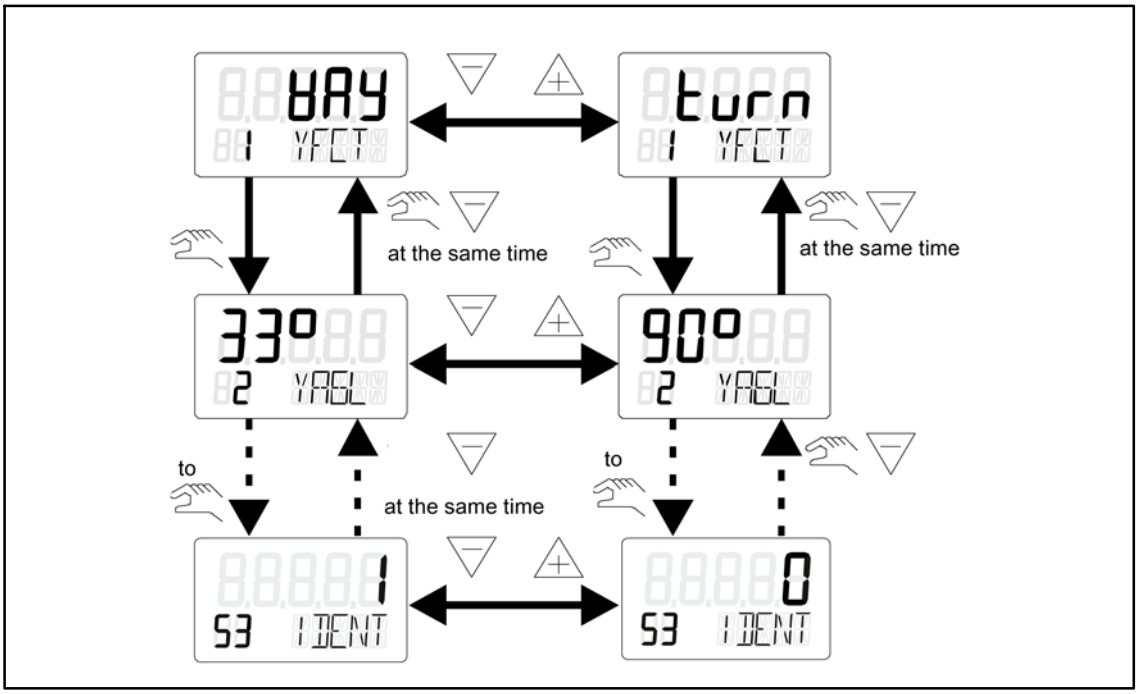


Figure 4-5 Overview: Configuration

Manual mode (MAN)

In this operating mode you can move the actuator with the decrement ( ) and increment keys ( ) 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 mode

In automatic mode the positioner behaves according to the actual modes of the transducer block and the analog output function block as described in chapter 5.

In automatic mode the bottom line of the display shows the actual mode of the analog output function block:

Display	Mode	Meaning
OS	OOS	Out Of Service
IMN	IMAN	Initialization Manual Mode
LO	LO	Local override
MM	MAN	Manual Mode
AUT	AUTO	Automatic Mode
CAS	CAS	Cascade Mode
RCS	RCAS	Remote Cascade

The right two or three digits of the bottom line show the actual setpoint of the transducer block in percent. The left two digits show if applicable error codes as described in chapter 4.5.3 Online Diagnostics.

☞ **NOTE**

Please don't mix up the local operating modes "MAN" and automatic with the function block modes MAN (display "MM") and AUTO (display "AUT").

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).

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 111 for further information.

☞ **NOTE**

The respective operating mode (manual or automatic) 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 which are locally accessible 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 and the physical unit are shown.

Each parameter described in this chapter also accessible via fieldbus communication. The respective fieldbus name of the parameter is shown in square brackets. Almost all these parameters belong to the transducer function block (few exceptions belonging to the resource block are marked RB.parametername).

Parameter name	Function	Parameter values (Bold = factory setting)	Unit
1.YFCT	Type of actuator	turn (part-turn actuator) **WAY** (linear actuator) LWAY (linear actuator without sine correction) ncSt (part-turn actuator with NCS) -ncSt (ditto, inv. direction of action) ncSL (linear actuator with NCS) ncSLL (ditto, and lever)	
2.YAGL 1)	Rated angle of rotation of feedback **Set transmission ratio selector (7) appropriately (see view of device)**	**33°** 90°	Degrees
2) 3.YWAY	Stroke range (optional setting) If used, the value must correspond with the set of the leverage ratio on the actuator Driver pin must be set to the value of the actuator travel or, if this value is not scaled, to the next larger scale value.	**OFF** 5 | 10 | 15 | 20 (short lever 33°) 25 | 30 | 35 (short lever 90°) 40 | 50 | 60 | 70 | 90 | 110 | 130 (long lever 90°)	mm
4.INITA	Initialization (automatically)	**noini** | no / ###.# | Strt	
5.INITM	Initialization (manually)	**noini** | no / ###.# | Strt	
6.TSUP	Setpoint ramp up	**Auto** / 0 ... 400	s
7.TSDO	Setpoint ramp down	0 ... 400	s
8.SFCT	Setpoint function Linear Equal-percentage 1:25, 1:33, 1:50 Inverse equal-percentage 1:25, 1:33, 1:50 Freely adjustable	**Lin** 1- 25 1 - 33 1 - 50 n1 - 25 n1 - 33 n1 - 50 FrEE	
9.SL0 3) 10.SL1 etc. up to 28.SL19 29.SL20	Setpoint turning point at 0% 5% to 95% 100%	0.0 ... 100.0	%
30.DEBA	Dead band of controller	**Auto** / 0.1 ... 10.0	%
31.YA	Start of manipulated variable limiting	**0.0** ... 100.0	%
32.YE	End of manipulated variable limiting	0.0 ... **100.0**	%
33.YNRM	Standardization of manipulated variable To mech. travel To flow	**MPOS** FLOW	
34.YCDO	Value for tight closing, bottom	**OFF** / 0 ... 100.0	%
35.YCUP	Value for tight closing, top	**OFF** / 0 ... 100.0	%
4) 36.BIN	Function of BI 1 None Only message Block configuring Block configuring and manual Drive valve to position YE Drive valve to position YA Block movement Partial-Stroke-Test	**OFF** NO contact: on / bLoc1 / bLoc2 / uP / doWn / StoP / PST NC contact: -on / -uP / -doWn / -StoP / -PST	
5) 37.AFCT	Alarm function Without A1=min. A2=max A1=min. A2=min A1=max. A2=max	**OFF** normal: ⊓ , ⊓⊓ / ⊓ , ⊓ , / ⊓⊓ ⊓⊓ inverted: ⊔ , ⊔⊔ / ⊔ , ⊔ , / ⊔⊔ ⊔⊔	
38.A1	Response threshold of alarm 1	0.0 .. **10.0** .. 100.0	%
39.A2	Response threshold of alarm 2	0.0 .. **90.0** .. 100.0	%
5) 40.ϟFCT	on fault Fault + not automatic Fault + not automatic + BI ("+" means logical OR operation)	normal: ϟ / ϟnA / ϟnAb inverted: -ϟ / -ϟnA / -ϟnAb	
41.ϟTIM	Monitoring time for fault message "control deviation"	**Auto** / 0 ... 100	s
42.ϟLIM	Response threshold for fault message "control deviation"	**Auto** / 0 ... 100	%
43.PRST	Preset (factory setting) "no" nothing activated "Strt" start of factory setting after pressing key for 5s "oCAY" display following successful factory setting CAUTION: preset results in "NO INI"	**no** Strt oCAY	
44. XDIAG	Activating for extended diagnostics off single-stage alarm two-stage alarm three-stage alarm	**OFF** On1 On2 On3	

Parameter name	Function	Parameter values (Bold = factory setting)	Unit
A.ϟ PST 6)	Partial-Stroke-Test with the following parameters:		
A1. STPOS	Start position	**0.0** ... 100.0	%
A2. STTOL	Start tolerance	0.1 .. **2.0** .. 10.0	%
A3. STEP	Step height	0.1 .. **10.0** .. 100.0	%
A4. STEPD	Step direction	**uP** / do / uP do	
A5. INTRV	Test interval	**OFF** / 1 ... 365	days
A6. PSTIN	Partial-Stroke-Test reference step time	**noini**/(C)##.#/FdInI/rEAL	s
A7. FACT1	Factor 1	0.1 .. **1.5** .. 100.0	
A8. FACT2	Factor 2	0.1 .. **3.0** .. 100.0	
A9. FACT3	Factor 3	0.1 .. **5.0** .. 100.0	
b.ϟ DEV 6)	Generally fault of valve with the following parameters:		
b1.TIM	Time constant	**Auto** / 1 ... 400	s
b2. LIMIT	Limit	0.0 .. **1.0** .. 100.0	%
b3. FACT1	Factor 1	0.1 .. **5.0** .. 100.0	
b4. FACT2	Factor 2	0.1 .. **10.0** .. 100.0	
b5. FACT3	Factor 3	0.1 .. **15.0** .. 100.0	
C.ϟ LEAK 6)	Pneumatic leakage with the following parameters:		
C1. LIMIT	Limit	0.0 .. **30.0** .. 100.0	%
C2. FACT1	Factor 1	0.1 .. **1.0** .. 100.0	
C3. FACT2	Factor 2	0.1 .. **1.5** .. 100.0	
C4. FACT3	Factor 3	0.1 .. **2.0** .. 100.0	
d.ϟ STIC 6)	Stiction (Slip stick effect) with the following parameters:		
d1. LIMIT	Limit	0.1 .. **1.0** .. 100.0	%
d2. FACT1	Factor 1	0.1 .. **2.0** .. 100.0	
d3. FACT2	Factor 2	0.1 .. **5.0** .. 100.0	
d4. FACT3	Factor 3	0.1 .. **10.0** .. 100.0	
E.ϟ DEBA 6)	Monitoring for dead band with the following parameter:		
E1. LEVEL3	Threshold	0.0 .. **2.0** .. 10.0	%
F.ϟ ZERO 6)	Zero shift with the following parameters:		
F1. LEVL1	Threshold 1	0.1 .. **1.0** .. 10.0	%
F2. LEVL2	Threshold 2	0.1 .. **2.0** .. 10.0	%
F3. LEVL3	Threshold 3	0.1 .. **4.0** .. 10.0	%
G.ϟ OPEN 6)	Shift of upper end stop with the following parameters:		
G1. LEVL1	Threshold 1	0.1 .. **1.0** .. 10.0	%
G2. LEVL2	Threshold 2	0.1 .. **2.0** .. 10.0	%
G3. LEVL3	Threshold 3	0.1 .. **4.0** .. 10.0	%
H.ϟ TMIN 6)	Monitoring for lower temperatur limit with the following parameters:		
H1. TUNIT	Temperature unit	**°C** / °F	
H2. LEVL1	Threshold 1	-40 ... 90 / -40 ... 194	
H3. LEVL2	Threshold 2	-40 ... 90 / -40 ... 194	
H4. LEVL3	Threshold 3	-40 ... 90 / -40 ... 194	
J. ϟ TMAX 6)	Monitoring for upper temperature limit with the following parameters:		
J1. TUNIT	Temperature unit	**°C** / °F	
J2. LEVL1	Threshold 1	-40 ... 90 / -40 ... 194	
J3. LEVL2	Threshold 2	-40 ... 90 / -40 ... 194	
J4. LEVL3	Threshold 3	-40 ... 90 / -40 ... 194	
L. ϟ STRK 6)	Monitoring for stroke integral with the following parameters:		
L1. LIMIT	Limit of strokes	1 ... **1 000 000**	
L2. FACT1	Factor 1	0.1 .. **1.0** .. 40.0	
L3. FACT2	Factor 2	0.1 .. **2.0** .. 40.0	
L4. FACT3	Factor 3	0.1 .. **5.0** .. 40.0	
O.ϟ DCHG 6)	Monitoring for direction change with the following parameters:		
O1. LIMIT	Limit of direction changes	1 ... **1 000 000**	
O2. FACT1	Factor 1	0.1 .. **1.0** .. 40.0	
O3. FACT2	Factor 2	0.1 .. **2.0** .. 40.0	
O4. FACT3	Factor 3	0.1 .. **5.0** .. 40.0	
P. ϟ PAVG 6)	Calculation for average value of position with the following parameters:		
P1. TBASE	Time basis for average value	**0.5h** / 8h / 5d / 60d / 2.5y	
P2. STATE	Condition of calculation	**IdLE** / rEF./###.# / Strt	
P3.LEVL1	Threshold 1	0.1 .. **2.0** .. 100.0	%
P4. LEVL2	Threshold 2	0.1 .. **5.0** .. 100.0	%
P5. LEVL3	Threshold 3	0.1 .. **10.0** .. 100.0	%

HINTS:

1) Parameter appears only if "turn" or "WAY" is selected; at "turn", you cannot select 33°

2) Parameter does not appear if "turn", "LWAY" or "ncS_" has been selected with YFCT

3) Turning points only appear with selection 8.SFCT = "FrEE"

4) NC contact means: action with opened switch or Low level
NO contact means: action with closed switch or High level

5) Normal means: High level without fault
Inverted means: Low level without fault

6) Parameters A up to P appears only if the extended diagnostics with On1, On2 or On3 is activated. The contents of the parameters A up to P appears also only if the selected pameter is activated with On.

Figure 4-6 Parameter table of the positioner

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. The parameter ”43.PRST” is provided for this purpose.

1.YFCT [VALVE_TYPE]

Type of actuator

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 adjusted if an NCS is to be connected to a linear actuator with the position measured directly (linear) from the NCS.

- YFCT = ncSLL

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

☞ **NOTE**

After ”LWAY, ncSt, –ncSt or ncSL” have been adjusted, the parameter ”3. YWAY” will not be displayed.

2.YAGL [TRANSM_ANGLE]

Rated angle of rotation of the feedback shaft

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

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

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

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

☞ **NOTE**

The setting of the transmission ratio selector on the positioner (see figure 2-2, page 19 and figure 2-3, page 20) **must** correspond to the angle value selected under “2. YAGL”.

3.YWAY [TRANSM_ LENGTH]

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 [SELF_CALIB_ COMMAND]

Automatic initialization (see chapter 3.6, page 64)

By selecting “Strt” and pressing the increment key ⧋ for at least 5 seconds, automatic initialization is started. The initialization process is displayed by “RUN 1” to “RUN 5” (see figure 3-27, page 76 to figure 3-30, page 79).

5.INITM [no correspon- dence]

Manual initialization

By selecting “Strt” and pressing the increment key ⧋ for at least 5 seconds, manual initialization is started. The manual initialization process is described in chapter 3.6.3, page 68 and chapter 3.6.6, page 74.

☞

NOTE

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

6.TSUP [TRAVEL_ RATE_UP]

Setpoint ramp UP

and

7.TSDO [TRAVEL_ RATE_DOWN]

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 set-point 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 deter-mined during initialization is used for the setpoint ramp. TSDO is then ineffective.

8.SFCT [CHARACT_TYPE]

Setpoint function (see figure 4-7, page 92)

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 (8.SFCT = Lin, factory setting)
- equal percentage 1 : 25 (8.SFCT = 1 : 25)
- equal percentage 1 : 33 (8.SFCT = 1 : 33)
- equal percentage 1 : 50 (8.SFCT = 1 : 50)
- inverse equal percentage 25 : 1 (8.SFCT = n1 : 25)
- inverse equal percentage 33 : 1 (8.SFCT = n1 : 33)
- inverse equal percentage 50 : 1 (8.SFCT = n1 –: 50)
- freely adjustable (8.SFCT = FrEE)

9.SLO to 29.SL20 [TAB_VALUES]

Setpoint turning point/characterization

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

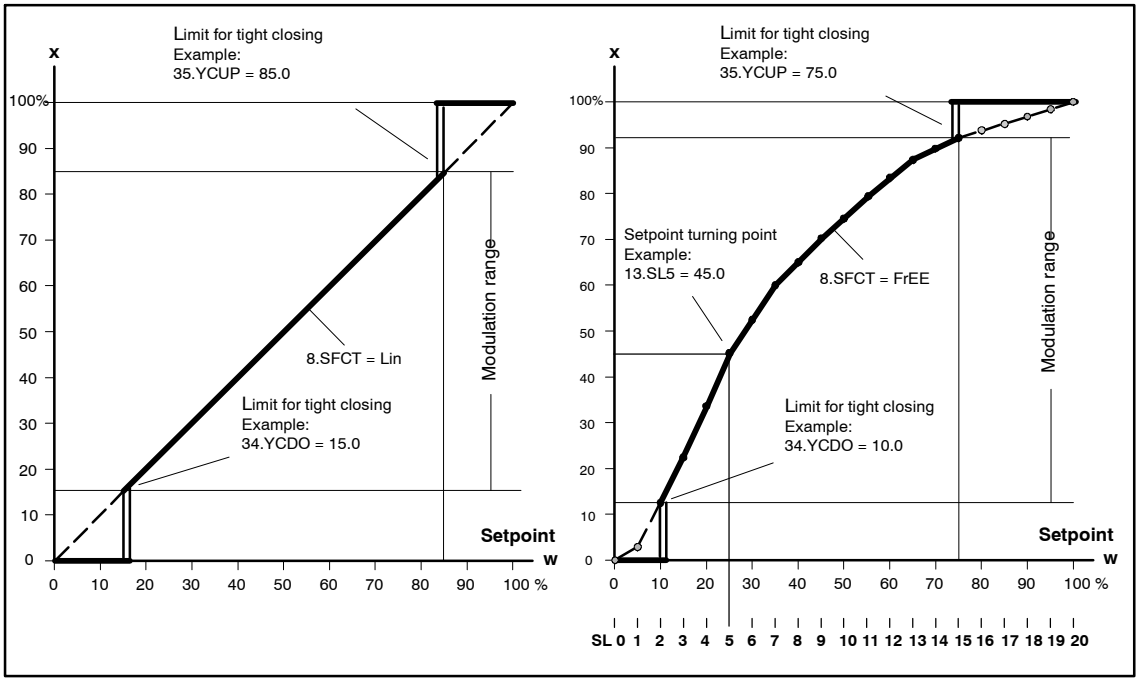


Figure 4-7 Setpoint characteristic, manipulated variable standardization and tight closing function

The setpoint turning point can only be input if 8. SFCT is set to “FREE”. You may only enter a strictly monotonous characteristic, and two consecutive vertex values must differ by at least 0.2 %.

30.DEBA [DEADBAND]

Deadband of the controller

At dEbA = AUto the deadband in automatic operation is adapted continuously to the requirements of the control circuit. The deadband 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 deadband.

31.YA [TRAVEL_ LIMIT_DOWN]

Manipulated variable limiting start (see figure 4-7, pg. 92 and 4-8, pg. 94)

and

32.YE [TRAVEL_ LIMIT_UP]

Manipulated variable limiting end (see figure 4-7, pg. 92 and 4-8, pg. 94)

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.

33.YNRM [Y_NORM]

Manipulated variable feedback standardization (see figure 4-7, pg. 92 and 4-8, pg. 94)

With limiting of the manipulated variable (by “31.YA” and “32.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 “31.YA” and “32.YE”. The parameters “31.YA” and “32.YE” are displayed in the MPOS-scale.

The FLOW-scale is the standardization (0 to 100%) to the range between “31.YA” and “32.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 I_y.

The setpoint is also shown in the appropriate scale on the display.

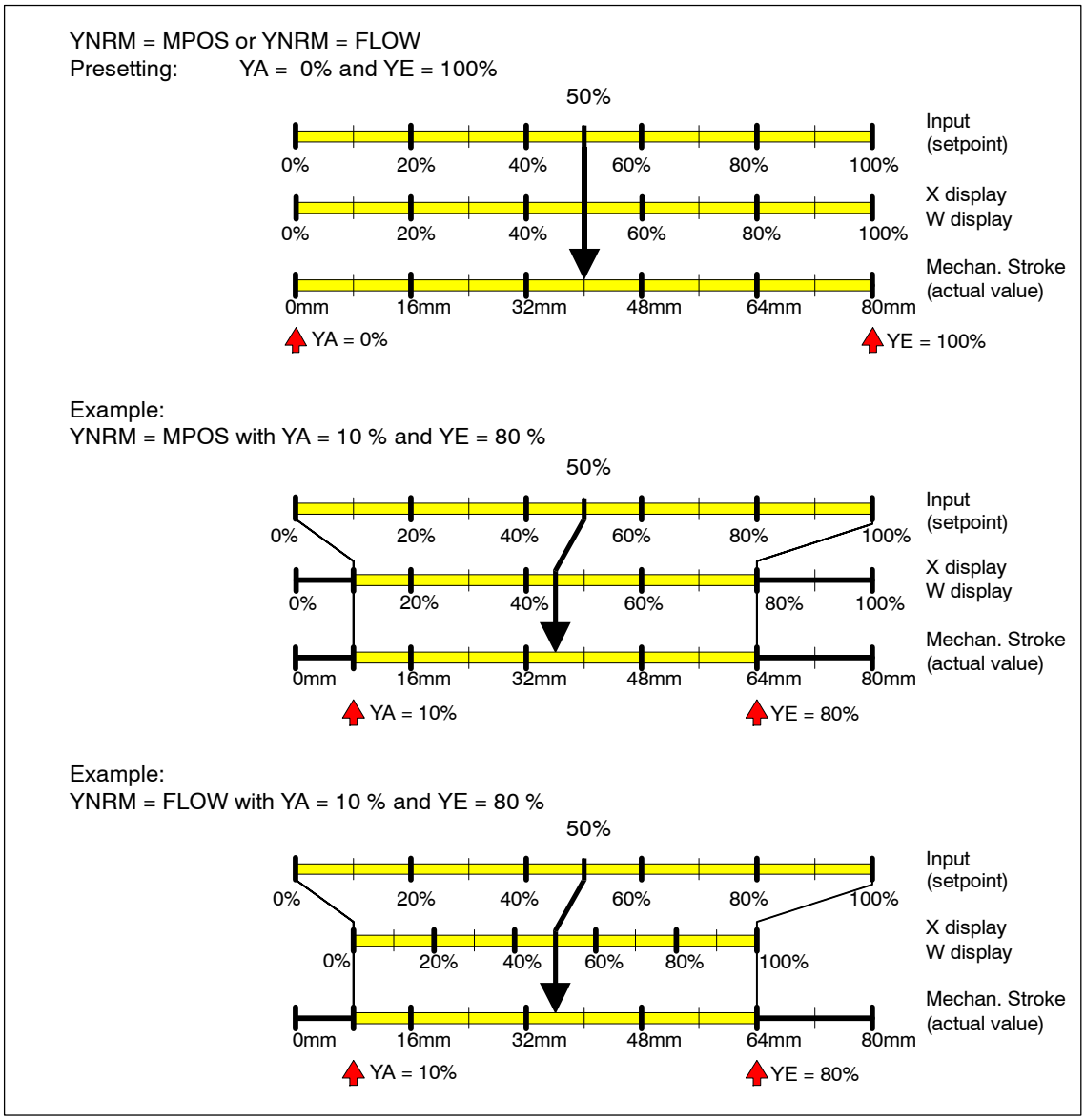


Figure 4-8 Dependence of the stroke on standardization and on YA and YE in the example of an 80 mm linear actuator

34.YCDO [FINAL_VALUE_ CUTTOFF_LO]

Value for tight closing, bottom

35.YCUP [FINAL_VALUE_ CUTTOFF_HI]

Value for tight closing, up

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. It becomes active when the setpoint is below YCDO or above YCUP (figure 4-7, page 92). “off” disables this function.

☞ **NOTE**

YCDO must always be set to less than YCUP.

The tight closing function has a fixed hysteresis of 1%.

36.BIN [BIN_IN_FUNCT]

Function of the binary input (on optional alarm module)

This parameter can be set individually depending on the purpose. The direction of action can be adapted to an NCC or an NOC.

- BIN = on or –on

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

- BIN = bLoc1

  The Configuration operating mode is locked to prevent it being adjusted (e.g. by a wire jumper between terminals 21 and 22).

- BIN = bLoc2

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

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

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

- BIN (contact closes) = StoP or –StoP (contact opens).

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

- BIN = oFF (factory setting)

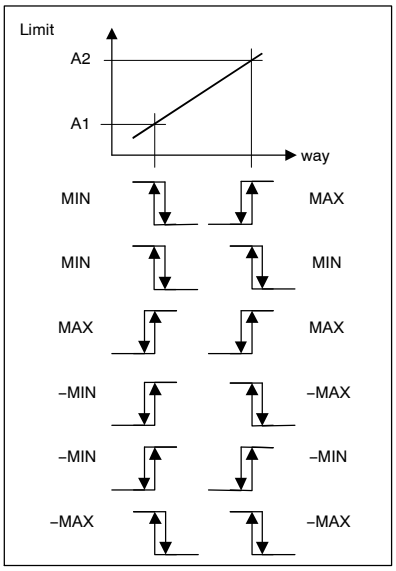
  no function

37.AFCT
[ALARM_FUNCT]

Alarm function

There are 6 setting capabilities available:

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



Please note:

- the direction of control action shown on the alarm module is reversed.
- the direction of control action is also reversed if A1 is set to greater than A2.
- the hysteresis of the limit value is 1% as standard.
- in the factory setting ”OFF” the output of both alarms A1 and A2 is deactivated.

☞ **NOTE**

If you have activated the extended diagnostics (parameter 44.XDIAG) with On2 or On3, the alarms cannot be output via the alarm unit. However, the message is possible via communication at any time.

38.A1
[ALARM1]
39.A2
[ALARM2]

Response threshold alarm 1
and
Response threshold alarm 2

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

40. ϟFCT [FAULT_FUNCT]

Function of the fault message output

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

- Power failure
- Processor fault
- Actuator fault
- Valve fault
- Compressed air failure
- Threshold 3 error message of extended diagnostics, see also description to parameter “44.XDIAG”.

Note that the fault message cannot be switched off, however it can be suppressed (factory setting), if the actuator is set to ”non–automatic mode”. If it is wished to generate fault messages here also, the parameter FCT must be set to ”ϟnA”.

In addition there is also the facility to ”alternate” the fault message using the status of the binary inputs. For this, set the parameter FCT to ””ϟnAb””.

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

41. ϟTIM [DELAY_TIME]

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 “42.ϟLIM”.

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

NOTE

If the control function to close tightly is activated, for parameter ”42.ϟ LIM” the monitoring of the control deviation in each overrun direction (YCDO: < 0 %, YCUP: > 100 %) is disabled. This function is particularly useful for valves with a soft seating. For long term monitoring of the end–stop positions, we recommend activating the parameters ”G.ϟ ZERO” and ”F. ϟOPEN”.

For more information on fault messages, see chapter 4.5.3 Online–Diagnostics, page 119.

42. ϟLIM [TOLERANCE_ BAND]

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 “41.ϟTIM” and “42.ϟLIM” are both set to ”Auto” (factory setting), the fault message is set if the slow step zone is not reached within a certain time. This time is 2 times the initialization travel time within 5 to 95% of the actuating path and 10 times this time outside 10 to 90% of the actuating path.

43.PRST [no correspondence]

Preset

By pressing the increment key for at least 5 seconds all parameters accessible by local operation are reset to their default value. The initialization is also reset so that the positioner is in P–manual mode (ex–factory state). The positioner has to be initialized again before it can resume normal operation. You should use PRST if the positioner previously has been operated at a different actuator.

☞ **NOTE**

This function is not identical with the fieldbus parameter RESTART with defaults. The latter clears all parameters of all blocks, PRST only the locally visible transducer block parameters.

44.XDIAG [EXT_DIAG]

Activation of the extended diagnostics

The extended diagnostics is deactivated at the factory, parameter 51 is therefore at “OFF”. There are three operating modes for activating the extended diagnostics:

- On1: The extended diagnostics is activated and the threshold 3 error messages are also output via the fault message output.
- On2: The extended diagnostics is activated, the threshold 2 error messages are output via alarm output 2 and the threshold 3 error messages are also output via fault message output.
- On3: The extended diagnostics is activated, the threshold 1 error messages are output via alarm output 1, the threshold 2 error messages are output via alarm output 2 and the threshold 3 error messages are also output via the fault message output.

☞ **NOTE**

Please note that the menu items of the extended diagnostics from A. ЧPST to P.ϟ PAVG are only displayed in the display after selecting one of the three On operating modes.

With the factory setting, the parameters of menu items A to P are deactivated by default (OFF). The corresponding parameters are only displayed once you have activated the relevant menu item with “On”.

A.ϟPST [PST_DIAG. PST_ENABLE]

Partial stroke test

This parameter activates the partial stroke test for the cyclic or manual partial stroke test of Up/Down and modulating valves.

The partial stroke test can be triggered via keyboard, a binary input or the communication.

A1.STPOS [PST_DIAG.PST_ START_POS]

Start position

The start position of the partial stroke test is specified here within the range of 0.0 to 100.0%.

A2.STTOL [PST_DIAG.PST_ START_TOL]

Start tolerance

The start tolerance in relation to the start position is specified here in the range of 0.1 to 10.0%. That means, with a start position of e.g. 50% and a start tolerance of 2%, a partial stroke test can only be triggered during operation if the current position is between 48 and 52%.

A3.STEP [PST_DIAG.PST_ STEP]

Step height

Input of the step height of the partial stroke test within the range of 0.1 to 100.0%. The factory setting is 10.0%.

A4.STEPD [PST_DIAG.PST_ STEP_DIR]

Step direction

Input of the step direction of the partial stroke test. The following options are available:
“up”, “do” (down), “up do” (up and down). If “up” is selected, the actuator is moved in a controlled manner from its start position to the target position (start position + step height) and then back to the original position in a controlled way once the target position has been reached. The procedure for the “do” option is the same but in the opposite direction. With “up do”, the actuator first travels in a controlled manner from its start position to the upper target position (start position + step height), then controlled from the upper to the lower target position (start position – step height). After reaching the lower target position, it returns to its original position in a controlled manner.

A5.INTRV [PST_DIAG.PST_ INTERVAL]

Test interval

Input of the interval for the cyclic partial stroke test within the range of one day to 365 days.

A6.PSTIN [PST.PST_REF_TIME]

Partial stroke test reference step time
(PSTIN = Partial Stroke Test Initialization)

Measurement of the reference step time for the partial stroke test. After the initialization of the device, the calculated (C = calculated) average actuating time of the control valve is displayed in seconds in the form: C ###.#. This time can be used as reference step time, however it is only a rough guide value.

That is why it is recommended to measure the reference step time here after the specification of the partial stroke test (parameters A1 to A5) by pressing the Greater Than button for five seconds. In doing so, “rEAL” is shown in the display. The device then automatically moves to the set start position, performs the desired step and saves the time required to do this. The time that is measured is the controlled movement from start position to target position. After the succesful measurement, this reference step time is shown in the display in the form: “###.#” seconds.

If a reference step is attempted without previous initialization of the device, “noini” appears in the display. If the start position cannot be approached or if the jump destination cannot be reached, “Fdini“ (Failed PST Initialization) is displayed.

A7.FACT1 [PST_DIAG.PST_FACT1]

Factor 1

Input of the factor for the threshold 1 error message. The factor 1 refers to the reference step time. If a specified partial stroke test results e.g. in a reference step time of 1.0 second and factor 1 is used in the factory setting of 1.5, the threshold 1 error message of the partial stroke test is performed for a measuring time of 1.5 seconds.

A8.FACT2 [PST_DIAG.PST_FACT2]

Factor 2

Input of the factor for the threshold 2 error message. The factor 2 refers to the reference step time. If a specified partial stroke test results e.g. in a reference step time of 1.0 second and factor 2 is used in the factory setting of 3.0, the threshold 2 error message of the partial stroke test is performed for a measuring time of 3.0 seconds.

A9.FACT3 [PST_DIAG.PST_FACT3]

Factor 3

Input of the factor for the threshold 3 error message. The factor 3 refers to the reference step time. If a specified partial stroke test results e.g. in a reference step time of 1.0 second and factor 3 is used in the factory setting of 5.0, the threshold 3 error message of the partial stroke test is performed for a measuring time of 5.0 seconds. At the same time, if this time threshold is exceeded, the excitation signal of the actuator is cancelled to prevent any sudden breaking free and overshooting of a valve that might be jammed or rusted in place.

The partial stroke test is thus stopped immediately, a threshold 3 error is reported and the actuator is moved back to its original position.

b.ϟDEVI [DEVIATION_ DIAG.DEVIATION_ ENABLE]

General control valve malfunction

This parameter activates the dynamic monitoring of the control valve reaction. To do this, the actual position sequence is compared to the guide value and the expected position sequence, which allows conclusions with regard to the correct operational behavior of the control valve.

When the parameter is activated, the submenu for the general control valve malfunctions from b1 to b5 opens. The function can be configured there.

b1.TIM [DEVIATION_DIAG. DEVIATION_TIME]

Time constant of the low-pass filter

The time constant of the low-pass filter is determined during the automatic initialization of the device. In the factory setting, parameter b1 therefore indicates “Auto”.

If the user is very familiar with the process sequence or desires a certain filter time constant for application-specific reasons, parameter b1 can be set from one second to 400 seconds manually. One second causes no damping, 400 seconds result in a strong damping effect.

b2.LIMIT [DEVIATION_DIAG. DEVIATION_LIMIT]

Limit for the general control valve malfunction

Sets the limit for the deviation from the model behavior. This limit is a reference value for the error message factors. Factory setting is 1.0 %.

b3.FACT1 [DEVIATION_DIAG. DEVIATION_ FACT1]

Factor 1

Input of the factor for the threshold 1 error message. This factor refers to the limit for the general control valve malfunction. Factory setting for factor 1 is 5.0. That means, for b2.LIMIT = 1.0% and factor 1 = 5.0, the first error message is triggered at a control deviation of 5.0 % from the model behavior.

b4.FACT2 [DEVIATION_DIAG. DEVIATION_ FACT2]

Factor 2

Input of the factor for the threshold 2 error message. This factor refers to the limit for the general control valve malfunction. Factory setting for factor 2 is 10.0. That means, for b2.LIMIT = 1.0% and factor 2 = 10.0, the second error message is triggered at a control deviation of 10.0 % from the model behavior.

b5.FACT3 [DEVIATION_DIAG. DEVIATION_ FACT3]

Factor 3

Input of the factor for the threshold 3 error message. This factor refers to the limit for the general control valve malfunction. Factory setting for factor 3 is 15.0. That means, for b2.LIMIT = 1.0% and factor 3 = 15.0, the third error message is triggered at a control deviation of 15 % from the model behavior.

C.ϟLEAK [LEAKAGE_DIAG. LEAKAGE_ ENABLE]

Pneumatic leakage

This parameter is used to activate the function for the detection of a pneumatic leakage. To do so, the changes of position and the internally used controller output are recorded and filtered, depending on the direction. The filter result provides a coefficient that allows the detection of any leakage.

Note that the detection of a leak can only provided clear results for spring-loaded actuators.

C1.LIMIT [LEAKAGE_DIAG. LEAKAGE_LIMIT]

Limit for the leakage indicator

Sets the limit for the leakage indicator The leakage indicator is scaled within the range of 0.0 to 100.0. Factory setting for the limit is 30.0. In other words, there is leakage below this limit. A leak can be expected if this value is exceeded.

To be able to make full use of the sensitivity of the detection process, it is recommended to perform a ramp test with a calibrator after the automatic initialization of the device. The ramp should cover the standard operating range of the valve and correspond in steepness to the approximate dynamic requirements of the application. During the ramp test, parameter 15.ONLK of the diagnosics menu provides information on the values shown by the leakage indicator. This allows the limit for the leakage coefficient to be defined above the maximum ramp test value.

C2.FACT1 [LEAKAGE_DIAG. LEAKAGE_FACT1]

Factor 1

Input of the factor for the threshold 1 error message. This factor refers to the limit for the leakage indicator. Factory setting for factor 1 is 1.0. That means, for C1.LIMIT = 30.0 and factor 1 = 1.0, the first leakage error message is triggered at a leakage indication of 30.0.

C3.FACT2 [LEAKAGE_DIAG. LEAKAGE_FACT2]

Factor 2

Input of the factor for the threshold 2 error message. This factor refers to the limit for the leakage indicator. Factory setting for factor 2 is 1.5. That means, for C1.LIMIT = 30.0 and factor 2 = 1.5, the second leakage error message is triggered at a leakage indication of 45.0.

C4.FACT3 [LEAKAGE_DIAG. LEAKAGE_FACT3]

Factor 3

Input of the factor for the threshold 3 error message. This factor refers to the limit for the leakage indicator. Factory setting for factor 3 is 2.0. That means, for C1.LIMIT = 30.0 and factor 3 = 2.0, the third leakage error message is triggered at a leakage indication of 60.0.

d.ϟSTIC [SLIP_STICK_ DIAG.SLIP_STICK_ ENABLE]

Slipstick effect

This parameter is used to activate the function for the detection of a slipstick effect. The device tries to detect sudden changes of the valve position that indicate excess slipstick. If the device detects a slipstick, the filtered step is saved as slipstick value. When the valve moves normally again (without detection of a slipstick), the slipstick value is reduced slowly.

Note that to avoid misinterpretations, for actuators with actuating times below 1 s, the positioner cannot distinguish reliably between a normal movement and a sudden change.

d1.LIMIT [SLIP_STICK_ DIAG.SLIP_STICK_ LIMIT]

Limit for the slipstick detection

Sets the limit for a step caused by a slipstick effect. The limit can be set within the range of 0.0 to 100.0%. Factory setting for the limit is 1.0.

d2.FACT1 [SLIP_STICK_ DIAG.SLIP_STICK_ FACT1]

Factor 1

Input of the factor for the threshold 1 error message. This factor refers to the limit for the slipstick detection. Factory setting for factor 1 is 2.0. That means, for d1.LIMIT = 1.0 and factor 1 = 2.0, the first slipstick error message is triggered when the current slipstick value has reached 2.0.

d3.FACT2 [SLIP_STICK_ DIAG.SLIP_STICK_ FACT2]

Factor 2

Input of the factor for the threshold 2 error message. This factor refers to the limit for the slipstick detection. Factory setting for factor 2 is 5.0. That means, for d1.LIMIT = 1.0 and factor 2 = 5.0, the second slipstick error message is triggered when the current slipstick value has reached 5.0.

d4.FACT3 [SLIP_STICK_ DIAG.SLIP_STICK_ FACT3]

Factor 3

Input of the factor for the threshold 3 error message. This factor refers to the limit for the slipstick detection. Factory setting for factor 3 is 10.0. That means, for d1.LIMIT = 1.0 and factor 3 = 10.0, the third slipstick error message is triggered when the current slipstick value has reached 10.0.

E.↾DEBA [DEBA_DIAG. DEBA_ENABLE]

Dead band monitoring

This parameter activates the monitoring of the dead band adaptation. Prerequisite for the function is the setting of parameter “34.DEBA” = Auto.

E1.LEVL3 [DEBA_DIAG. DEBA_LEVEL3]

Threshold for the monitoring of the dead band adaptation.

This value (%) can be used for the automatic adaptation of the dead band. If the dead band exceeds the set value, the threshold 3 error message is triggered. The three-level error message is not implemented for dead band monitoring.

F.↾ZERO [ZERO_DIAG. ZERO_ENABLE]

Zero point offset

This function is for detecting when the lower stop has changed its value compared to the value during initialization by more than the set thresholds. Monitoring is only possible if the valve is within the tight closing function. The activation of the “bottom tight closing function” (parameter “34.YCDO”) is therefore prerequisite.

F1.LEVL1 [ZERO_DIAG. ZERO_LEVEL1]

Threshold 1

First threshold for monitoring the lower limit stop. If the set absolute value is exceeded during “bottom tight closing” (parameter “34.YCDO”), this will trigger the threshold 1 error message.

F2.LEVL2 [ZERO_DIAG. ZERO_LEVEL2]

Threshold 2

Second threshold for monitoring the lower limit stop. If the set absolute value is exceeded during “bottom tight closing” (parameter “34.YCDO”), this will trigger the threshold 2 error message.

F3.LEVL3 [ZERO_DIAG. ZERO_LEVEL3]

Threshold 3

Third threshold for monitoring the lower limit stop. If the set absolute value is exceeded during “bottom tight closing” (parameter “34.YCDO”), this will trigger the threshold 3 error message.

G.ϟ OPEN [OPEN_DIAG. OPEN_ENABLE]

Shifting the upper stop

This function is for detecting when the upper stop has changed its value compared to the value during initialization by more than the specified tolerance value. Monitoring is only possible if the valve is within the tight closing function. The activation of the “top tight closing function” (parameter “35.YCUP”) is therefore prerequisite.

G1.LEVL1 [OPEN_DIAG. OPEN_LEVEL1]

Threshold 1

First threshold for monitoring the upper limit stop. If the set absolute value is exceeded during “top tight closing”, this will trigger the threshold 1 error message.

G2.LEVL2 [OPEN_DIAG. OPEN_LEVEL2]

Threshold 2

Second threshold for monitoring the upper limit stop. If the set absolute value is exceeded during “top tight closing”, this will trigger the threshold 2 error message.

G3.LEVL3 [OPEN_DIAG. OPEN_LEVEL3]

Threshold 3

Third threshold for monitoring the upper limit stop. If the set absolute value is exceeded during “top tight closing”, this will trigger the threshold 3 error message.

NOTE

Monitoring of the lower and upper limit stops does not only react to valve faults. A misadjustment of the position feedback is also detected as a malfunction if the threshold values are exceeded.

H.ϟTMIN [TEMP_MIN_DIAG. TEMP_MIN_ ENABLE]

Monitoring of the lower temperature limit

The current temperature in the positioner housing is measured by a sensor on the electronic circuit board. This parameter is for the three-level monitoring of the lower temperature limit.

H1.TUNIT [TEMPERATURE_ UNIT]

Temperature unit

The temperature unit can be switched over by pressing the Greater Than or Smaller Than button between °C and °F. Another way of switching over is the J1.TUNIT parameter for monitoring the upper temperature limit. The selected unit applies to all temperature-related parameters.

H2.LEVL1 [TEMP_MIN_DIAG. TEMP_MIN_ LEVEL1]

Threshold 1

First threshold for monitoring the lower temperature limit. The factory setting is –25.0 °C. If the temperature falls below the set value, the threshold 1 error message is triggered.

H3.LEVL2 [TEMP_MIN_DIAG. TEMP_MIN_ LEVEL2]

Threshold 2

Second threshold for monitoring the lower temperature limit. The factory setting is –30.0°C. If the temperature falls below the set value, the threshold 2 error message is triggered.

H4.LEVL3 [TEMP_MIN_DIAG. TEMP_MIN_ LEVEL3]

Threshold 3

Third threshold for monitoring the lower temperature limit. The factory setting is –40.0°C. If the temperature falls below the set value, the threshold 3 error message is triggered.

J.ϟTMAX [TEMP_MAX_ DIAG.TEMP_MAX_ ENABLE]

Monitoring of the upper temperature limit

The current temperature in the positioner housing is measured by a sensor on the electronic circuit board. This parameter is for the three-level monitoring of the upper temperature limit.

J1.TUNIT [TEMPERATURE_ UNIT]

Temperature unit

The temperature unit can be switched over by pressing the Greater Than or Smaller Than button between °C and °F. Another way of switching over is the H1.TUNIT parameter for monitoring the lower temperature limit. The selected unit applies to all temperature-related parameters.

J2.LEVL1 [TEMP_MAX_ DIAG.TEMP_MAX_ LEVEL1]

Threshold 1

First threshold for monitoring the upper temperature limit. The factory setting is 75.0°C. If the temperature exceeds the set value, the threshold 1 error message is triggered.

J3.LEVL2 [TEMP_MAX_ DIAG.TEMP_MAX_ LEVEL2]

Threshold 2

Second threshold for monitoring the upper temperature limit. The factory setting is 80.0°C. If the temperature exceeds the set value, the threshold 2 error message is triggered.

J4.LEVL3 [TEMP_MAX_ DIAG.TEMP_MAX_ LEVEL3]

Threshold 3

Third threshold for monitoring the upper temperature limit. The factory setting is 90.0°C. If the temperature exceeds the set value, the threshold 3 error message is triggered.

L.ϟSTRK [STROKE_DIAG. STROKE_ENABLE]

Monitoring of the displacement integral

This parameter activates the monitoring of the displacement integral. This function allows the preventive maintenance of the control valve, also see chapter 4.5 “Diagnosics”, page 111.

L1.LIMIT [STROKE_DIAG. STROKE_LIMIT]

Limit for the number of strokes

Input of the limit for the number of strokes. The parameter can be used depending on the requirement profile of the user.

On the one hand, it is possible to enter a maximal number for the strokes and to use factors smaller than one to receive warning messages when a certain fraction of the maximal number is reached. On the other hand, a minimum value can be entered for the strokes. Factors greater than one are then used to receive warning messages for certain limits above the minimum value. Factory setting for the limit is 1 000 000.

L2.FACT1 [STROKE_DIAG. STROKE_FACT1]

Factor 1

Input of the factor for the threshold 1 error message. This factor refers to the limit for the number of strokes. Factory setting for factor 1 is 1.0. That means, for L1.LIMIT = 1 000 000 and factor 1 = 1.0, the first stroke counter error message is triggered after 1 000 000 strokes.

L3.FACT2 [STROKE_DIAG. STROKE_FACT2]

Factor 2

Input of the factor for the threshold 2 error message. This factor refers to the limit for the number of strokes. Factory setting for factor 2 is 2.0. That means, for L1.LIMIT = 1 000 000 and factor 2 = 2.0, the second stroke counter error message is triggered after 2 000 000 strokes.

L4.FACT3 [STROKE_DIAG. STROKE_FACT3]

Factor 3

Input of the factor for the threshold 3 error message. This factor refers to the limit for the number of strokes. Factory setting for factor 3 is 5.0. That means, for L1.LIMIT = 1 000 000 and factor 3 = 5.0, the third stroke counter error message is triggered after 5 000 000 strokes.

O.↳DCHG [DIRCHANGE_ DIAG. DIRCHANGE_ ENABLE]

Monitoring of the changes of direction

This parameter activates the monitoring of the changes of direction. This function allows the preventive maintenance of the control valve, also see chapter 4.5 “Diagnosics”, page 111.

O1.LIMIT [DIRCHANGE_ DIAG. DIRCHANGE_ LIMIT]

Limit for the changes of direction

Input of the limit for the number of changes of direction.

On the one hand, it is possible to enter a maximal number for the changes of direction and to use factors smaller than one to receive warning messages when a certain fraction of the maximal number is reached. On the other hand, a minimum value can be entered for the changes of direction. Factors greater than one are then used to receive warning messages for certain limits above the minimum value. Factory setting for the limit is 1 000 000.

O2.FACT1 [DIRCHANGE_ DIAG. DIRCHANGE_ FACT1]

Factor 1

Input of the factor for the threshold 1 error message. This factor refers to the limit for the number of changes of direction. Factory setting for factor 1 is 1.0. That means, for O1.LIMIT = 1 000 000 and factor 1 = 1.0, the first direction change error message is triggered after 1 000 000 strokes.

O3.FACT2 [DIRCHANGE_ DIAG. DIRCHANGE_ FACT2]

Factor 2

Input of the factor for the threshold 2 error message. This factor refers to the limit for the number of changes of direction. Factory setting for factor 2 is 2.0. That means, for O1.LIMIT = 1 000 000 and factor 2 = 2.0, the second direction change error message is triggered after 2 000 000 strokes.

O4.FACT3 [DIRCHANGE_ DIAG. DIRCHANGE_ FACT3]

Factor 3

Input of the factor for the threshold 3 error message. This factor refers to the limit for the number of changes of direction. Factory setting for factor 3 is 5.0. That means, for L1.LIMIT = 1 000 000 and factor 3 = 5.0, the third direction change error message is triggered after 5 000 000 strokes.

P.↳PAVG [POS_AVG_ DIAG.POS_AVG_ ENABLE]

Calculation of the position average

This parameter is used to activate the function for the calculation of the position average. The function allows the calculation of a reference average for the position sequence within preset intervals and the calculation of comparison average values for the following intervals. If the comparison average values deviate from the reference average, error messages are displayed, depending on the set thresholds.

P1.TBASE [POS_AVG_ DIAG.POS_AVG_ TIME_BASE]

Time basis for the formation of the average value

Sets the intervals for the formation of the average value. The following time intervals are available:

30 minutes
8 hours
5 days
60 days
2.5 years

P2.STATE [POS_AVG_ STATUS]

Status of the calculation of the position average

After activating the function with parameter P.↳PAVG, the initial status of the calculation of the position average is “IdLE” (inactive). To start the calculation of the position average, the Greater Than button is pressed for five seconds. The display text then switches from “IdLE” to “rEF” (reference average is calculated) and remains there until the selected time interval has passed. The reference average is then shown on the display.

NOTE

The current comparison average is displayed in the diagnostics menu under parameter 19.PAVG as soon as the first comparison interval has passed. During the first comparison interval, “COMP” (comparison interval) is displayed there.

P3.LEVL1 [POS_AVG_ DIAG.POS_AVG_ LEVEL1]

Threshold 1

First threshold for monitoring the reference average. The factory setting is 2.0%. If a comparison average deviates from the reference by more than this value, the threshold 1 error message is triggered.

P4.LEVL2 [POS_AVG_ DIAG.POS_AVG_ LEVEL2]

Threshold 2

Second threshold for monitoring the reference average. The factory setting is 5.0%. If a comparison average deviates from the reference by more than this value, the threshold 2 error message is triggered.

P5.LEVL3 [POS_AVG_ DIAG.POS_AVG_ LEVEL3]

Threshold 3

Third threshold for monitoring the reference average. The factory setting is 10.0%. If a comparison average deviates from the reference by more than this value, the threshold 3 error message is triggered.

4.5 Diagnostic

4.5.1 Diagnostics display

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

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 (**Str**o**kes**)	0 to 4.29E9	–	x
2	CHDIR	Changes of direction (**Ch**anges of **Dir**ection)	0 to 4.29E9	–	x
3	↳CNT	Number of fault messages (↳ **C**ou**nt**er)	0 to 4.29E9	–	x
4	A1CNT	Number of alarms 1 (**A**larm **1 C**ou**nt**er)	0 to 4.29E9	–	x
5	A2CNT	Number of alarms 2 (**A**larm **2 C**ou**nt**er)	0 to 4.29E9	–	x
6	HOURS	Operating hours (**Hours**)	0 to 4.29E9	hours	
7	WAY	Determined actuator travel (**Way**)	0 to 130	mm or °	
8	TUP	Actuating time up (Travel **T**ime **Up**)	0 to 1000	s	
9	TDOWN	Actuating time down (Travel **T**ime **Down**)	0 to 1000	s	
10	LEAK	Leakage (**Leak**age)	P 0.0 to 100.0	%	
11	PST	Monitoring of the **P**artial **S**troke **T**est	OFF / notol		
12	PRPST	Time since the last **P**artial **S**troke **T**est (**Pr**evious **PST**)	notSt / ###		
13	NXPST	Time until the next **P**artial **S**troke **T**est (**Nex**t **PST**)	0.0 to 100.0		
14	DEVI	General control valve malfunction (**Dev**iation)	0.0 to 100.0		
15	ONLK	Pneumatic leakage (**O**nline **L**ea**k**age)	0.0 to 100.0		
16	STIC	Slipstick effect	0.0 to 100.0		
17	ZERO	Zero point offset	0.0 to 100.0		
18	OPEN	Shifting the upper stop	0.0 to 100.0		
19	PAVG	Average position value	0.0 to 100.0		
20	P0	**P**otentiometer value lower stop (**0**%)	0.0 to 100.0		
21	P100	**P**otentiometer value upper stop (**100**%)	0.0 to 100.0		
22	IMPUP	Pulse length up (**Imp**ulse Length **Up**)	2 to 160	ms	
23	IMPDN	Pulse length down (**Imp**ulse Length **Dow**n)	2 to 160	ms	
24	DBUP	Dead band up (**D**ead **B**and **Up**)	0.1 to 10.0	%	
25	DBDN	Dead band down (**D**ead **B**and **Dow**n)	0.1 to 10.0	%	
26	SSUP	Short step zone up (**S**hort **S**tep Zone **Up**)	0.1 to 100.0	%	
27	SSDN	Short step zone down (**S**hort **S**tep Zone **Dow**n)	0.1 to 100.0	%	
28	TEMP	Current **temp**erature	–40 to 85	°C	
29	TMIN	**Min**imum**t**emperature (“min/max pointer”)	–40 to 85	°C	

No.	Abbreviation	Meaning	Displayable values	Unit	Rest poss.
30	TMAX	**Max**imum**t**emperature (“min/max pointer”)	–40 to 85	°C	
31	T1	Number of operating hours in **t**emperature range **1**	0 to 4.29E9	hours	
32	T2	Number of operating hours in **t**emperature range **2**	0 to 4.29E9	hours	
33	T3	Number of operating hours in **t**emperature range **3**	0 to 4.29E9	hours	
34	T4	Number of operating hours in **t**emperature range **4**	0 to 4.29E9	hours	
35	T5	Number of operating hours in **t**emperature range **5**	0 to 4.29E9	hours	
36	T6	Number of operating hours in **t**emperature range **6**	0 to 4.29E9	hours	
37	T7	Number of operating hours in **t**emperature range **7**	0 to 4.29E9	hours	
38	T8	Number of operating hours in **t**emperature range **8**	0 to 4.29E9	hours	
39	T9	Number of operating hours in **t**emperature range **9**	0 to 4.29E9	hours	
40	VENT1	Number of switching operations pilot**vallve 1**	0 to 4.29E9	–	
41	VENT2	Number of switching operations pilotvallve 2	0 to 4.29E9	–	
42	STORE	Save current values as “last maintenance” (press increment button for 5s) (**Store**)	–	–	
43	PRUP	**Pr**ediction **up**	1 to 40	–	
44	PRDN	**P**rediction **d**ow**n**	1 to 40	–	
45	WT00	Number of operating hours in actuating range WT00	0 to 4.29E9	hours	x
46	WT05	Number of operating hours in actuating range WT05	0 to 4.29E9	hours	x
47	WT10	Number of operating hours in actuating range WT10	0 to 4.29E9	hours	x
48	WT30	Number of operating hours in actuating range WT30	0 to 4.29E9	hours	x
49	WT50	Number of operating hours in actuating range WT50	0 to 4.29E9	hours	x
50	WT70	Number of operating hours in actuating range WT70	0 to 4.29E9	hours	x
51	WT90	Number of operating hours in actuating range WT90	0 to 4.29E9	hours	x
52	WT95	Number of operating hours in actuating range WT95	0 to 4.29E9	hours	x

Table 4-1 Overview diagnostic values

4.5.2 Meaning of the diagnostic values

The respective fieldbus names are shown in square brackets. All parameters belong to the transducer block except those starting with RB.xxx).

0 [RB.DESCRIPTOR]

Device Tag

The contents of the resource block parameter DESCRIPTOR (a 32 byte visible string) is displayed in the bottom line. You can use it e.g. for displaying the device tag.
If the string is longer than five characters, it can be scrolled with the decrement key and the increment key.

1 STRKS [TOTAL_VALVE_ TRAVEL]

Number of strokes (Total valve travel)

The actuator movements during operation are totalized and can be read here as number of strokes. Unit: 100% strokes, i.e. the distance between 0 to 100 % and backwards. The value is written every 15 minutes in a non-volatile memory. It can be reset to zero with the increment key  .

2 CHDIR [NUMBER_DIREC- TION_CHANGE]

Number of direction changes

Every change in direction is detected by the controller and added to the number of changes of direction.

The value is written every quarter of an hour in a non-volatile memory. It can be reset to zero with the increment key ⚠.

3 ↳CNT [NUMBER_ ALARMS]

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 [NUMBER_ ALARMS_1]

Alarm counter 1
and

5 A2CNT [NUMBER_ ALARMS_2]

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 “37.AFCT”. The counters can be reset to zero with the increment key ⚠.

6 HOURS [RB.HOURS]

Operating hours

The operating hours counter is incremented every hour when the positioner is supplied with electrical power.

7 WAY [RATED_TRAVEL]

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_ RATE_UP]

Travel time up
and

9 TDOWN [TRAVEL_RATE_ DOWN]

travel time down

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

10 LEAK [LEAKAGE]

Leakage

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

11 PST [PST.PST_CUR_TIME]

Monitoring of the partial stroke test

The measured step time of the last partial stroke test is displayed here. A partial stroke test can be triggered manually by pressing the Greater Than button, or a partial stroke test that is just being performed can be interrupted.

The following states are shown in the display:

- OFF
  The partial stroke test function is deactivated in the configuration menu.
- FdIni (Failed PST Initialization)
  The partial stroke test reference step time measurement failed.
- notSt (No Test)
  No partial stroke test carried out yet.
- ###.# (measured step time in seconds)
  The last partial stroke test was carried out successfully.
- SdtSt (Stopped Test)
  The last partial stroke test was interrupted.
- FdtSt (Failed Test)
  The last partial stroke test failed.

The following status messages appear on pressing the Greater Than button:

- notoL (No Tolerance)
  The control valve is outside the tolerance range for starting the partial stroke test. No manual partial stroke test has been started.
- Strt (Start)
  A manual partial stroke test was started after pressing the button for five seconds.
- StoP (Stop)
  The currently performed partial stroke test is interrupted.

12 PRPST [PST.PST_PREV_TIME]

Time since the last partial stroke test

The time that has passed since the last partial stroke test is displayed here (in days). The following status messages can also appear:

- notSt (No Test)
  No partial stroke test carried out yet.
- SdtSt (Stopped Test)
  The last partial stroke test was interrupted.
- FdtSt (Failed Test)
  The last partial stroke test failed.

13 NXPST [PST.PST_NEXT_ TIME]

Time until the next partial stroke test

The time until the next partial stroke test is displayed here (in days). Conditions are that the partial stroke test is deactivated in the configuration menu and a test interval is set. If one of these two conditions is not fulfilled “OFF” appears in the display.

14 DEVI [DEVIATION_ VALUE]

General control valve malfunction

This value provides information on the current dynamically determined deviation from the model behavior. If the basic function is deactivated in the configuration menu “OFF” is displayed.

15 ONLK [ONLINE_ LEAKAGE_VALUE]

Pneumatic leakage

The current leakage indicator is displayed here. If the leakage detection is deactivated in the configuration menu “OFF” is displayed.

16 STIC [SLIP_STICK_ VALUE]

Slipstick effect

The filtered step height value cause by slipstick is displayed here in percent. If the function is deactivated in the configuration menu, “OFF” is displayed.

17 ZERO [ZERO_VALUE]

Zero point offset

Display of the current displacement of the lower limit stop compared to its initialization value. Condition for the determination is the activation of the “bottom tight closing function” (parameter “34.YCDO” in the configuration menu). If the basic function is deactivated in the configuration menu “OFF” is displayed.

18 OPEN [OPEN_VALUE]

Shifting the upper stop

Display of the current displacement of the upper limit stop compared to its initialization value. Condition for the determination is the activation of the “top tight closing function” (parameter “35.YCUP” in the configuration menu). If the basic function is deactivated in the configuration menu “OFF” is displayed.

19 PAVG [POS_AVG_ VALUE]

Average position value

The comparison average calculated last is displayed here. There are also the following status messages:

- OFF
  The basic function is deactivated in the configuration menu.
- IdLE (inactive)
  The function has not been started yet.
- rEF (reference average is calculated)
  The function was started and the reference interval is currently active.
- COMP (comparison average is calculated)
  The function was started and the comparative interval is currently active.

20 P0 [ZERO_POINT_P0]
21 P100 [END_VALUE_ P100]

Potentiometer value bottom stop
and
Potentiometer value top stop

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

22 IMPUP [PULS_LENGTH_ UP]
23 IMPDN [PULS_LENGTH_ UP]

Impulse length up
and
Impulse length down

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

These two parameter can be tuned for special applications (see chapter 4.7 page 131).

24 DBUP
25 DBDN [DEADBAND]

Dead band up
and
Dead band down

Here the dead band of the controller is displayed in “Up”-direction or in “Down”-direction. The values correspond either to the manually set value of the parameter“30.DEBA” or the value adapted automatically by the instrument when “DEBA” has been set to ”Auto”.

26 SSUP [SERVO_GAIN_UP]
27 SSDN [SERVO_GAIN_ DOWN]

Short step zone up
and
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 131).

☞ **NOTE**

The corresponding fieldbus parameters are inverted (SSUP = 1/SERVO_GAIN_UP).

28 TEMP [TEMPERATURE]

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.

29 TMIN [MIN_TEMPERATURE]
and
30 TMAX [MAX_TEMPERATURE]

Minimum temperature (drag pointer)
and
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.

31 T1 to **39 T9 [RB_TEMPERATURE_HOURS]**

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

40 VENT1 [NUMBER_CYCLES_VALVE_1]
Number of cycles pre-control valve 1
and
41 VENT2 [NUMBER_CYCLES_VALVE_2]
Number of cycles pre-control valve 2

These two counters add up the control processes of the pre-control valves.

42 STORE [no correspondence]
Store maintenance data

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

Normally this function is operated via bus communication, transducer block method “Maintenance Info Save/Reset” → “safe maintenance info”. Data is stored in the object PREV_CALIB_VALUES.

43 PRUP
Prediction up
44 PRDN
Prediction down
[INIT_VALUES_INIT_PREDICTION_UP and INIT_PREDICTION_DOWN]
see chapter 4.7 page 131.

45 WT00 to **52 WT95**
Number of operating hours in actuating range WT00 to WT95

If the positioner is in automatic mode, statistical information is generated as to how long a valve or a flap was operated in which section of the actuating range. For this purpose, the entire actuating range (0 to 100 %) is divided into 8 sections (actuating ranges). The positioner registers the current position continuously and increments the operating hours counter that is assigned to the relevant section (actuating range) every hour. This allows conclusions to be made about past operating conditions and is in particular for the assessment of the control characteristics of the control loop or of the entire control valve.

The actuating range is divided as follows:

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

The 8 operating hours counters can be set to zero together by pressing the increment button (for at least 5 seconds).

TIP: Since the actuating ranges are arranged at the end of the diagnosis menu with numbers 45 to 52, press the decrement button several times in addition to the operating mode button. That is how you access diagnosis numbers 45 to 52 quickly.

☞ **NOTE**

All diagnostics values are updated every 15 minutes in the non-volatile memory so that only the values of the past quarter of an hour are lost if there is a power failure.

4.5.3 Online-Diagnostic

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

The following table shows which events can activate the fault message output, how the parameters must be set for this event to be monitored, when the fault message disappears again and where the possible causes of the fault lie.

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

The parameters of the extended diagnostics allow error messages to be displayed in one, two or three levels. In addition to the fault message output, alarm outputs 1 and 2 are then used. For this purpose, parameter 44.XDIAG needs to be set according to the following table:

Settings of 44.XDIAG	**Message by**
Off	Extended diagnostics not activated
On1	Fault message output for threshold 3 error messages (one-level)
On2	Fault message output for threshold 3 error messages and alarm output 2 for threshold 2 error messages (two-level)
On3	Fault message output for threshold 3 error messages and alarm output 2 for threshold 2 error messages and alarm output 1 for threshold 1 error messages (three-level)

Error code	three-level	Event	Parameter-setting	Error message disappears if...	Possible causes
ϟ1	no	Remaining control deviation	always active	... the control deviation has disappeared again.	Compressed air missing, actuator fault, valve fault (e.g. blockage).
ϟ2	no	Device not in automatic mode	40.ϟFCT= ϟnA or = ϟnAB	... the device is switched to automatic mode.	The device is configured or is in manual mode.
ϟ3	no	Binary input BE1 or BE2 active	40.ϟFCT= ϟnAB and binary function BIN1 or BIN2 at “on”	... the binary input is no longer activated.	The contact connected to the binary input became active (e.g. stuffing box monitoring, overpressure, temperature switch).
ϟ4	yes	Limit Stroke number exceeded	L.ϟSTRK≠OFF	... the stroke counter is reset or the thresholds are increased	The sum of the distance covered by the actuator exceeds one of the set thresholds.
ϟ5	yes	Direction change limit exceeded	O.ϟDCHG≠OFF	... the direction change counter is reset or the thresholds are increased	The number of changes of direction exceeds one of the set thresholds.
ϟ6	yes	Lower limit stop limit exceeded	F.ϟZERO≠OFF 34.YCDO or 35.YCUP≠oFF	... the deviation of the stop disappears or the device was re-initialized.	Wear of the valve seat, deposit or foreign matter in the valve seat, mechanical misadjustment, friction clutch misadjusted.
ϟ7	yes	Limit of upper limit stop exceeded	G.ϟOPEN≠OFF 34.YCDO or 35.YCUP≠oFF	... the deviation of the stop disappears or the device was re-initialized.	Wear of the valve seat, deposit or foreign matter in the valve seat, mechanical misadjustment, friction clutch misadjusted.
ϟ8	no	Limit Dead zone adaptation exceeded	E.ϟDEBA≠OFF 34.DEBA = Auto	... the value has fallen below the limit again.	Increased stuffing box friction, mechanical batches of the position feedback.
ϟ9	yes	Partial stroke test exceeds reference step time	A.ϟPST≠OFF	... a partial stroke test is performed successfully within the reference step time or the function is deactivated.	Valve jams or is rusted in place, increased friction
10	yes	General control valve malfunction	b.ϟDEVI≠OFF	... the position is back within a narrow corridor between guide value and model, or the function is deactivated.	actuator fault, valve fault, valve jams, increased friction, compressed air drop
11	yes	Pneumatic leakage	C.ϟLEAK≠OFF	... the leakage falls below the set thresholds, or the function is deactivated.	Pneumatic leakage

Error code	three-level	Event	Parameter-setting	Error message disappears if...	Possible causes
12	yes	Slipstick effect occurs	d.ϟSTIC≠OFF	... no more slipstick can be detected, or the function is deactivated.	Increased slipstick, valve no longer moves constantly but judders instead
13	yes	Temperature short of	H.ϟTMIN≠OFF	... the lower temperature threshold values are no longer fallen short of.	Ambient temperature too low
14	yes	Temperature exceeded	J.ϟTMAX≠OFF	... the upper temperature thresholds are no longer exceeded.	Ambient temperature too high
15	yes	Position average deviates from the reference value	P.ϟPAVG≠OFF	... after a comparison interval, a position average is calculated that is within the reference value thresholds or the function is deactivated.	In the last comparison interval, the valve trajectory changed so much that a deviating position average was calculated.

Table 4-2 Events which can activate the fault message output

See also parameter FAULT_MESSAGE of the transducer block. There each error is bit coded.

Explanations of column “Error codes”:

1 Monitoring of control error

In automatic mode 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 41.ϟ TIM, monitoring time for setting the fault messages and 42.ϟLIM, 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 “40.ϟFCT”. In this way the control system can be warned for example when the instrument has been switched to manual operation or Configuration on site.

3 Binary input active

A fault message is generated when the digital input is activated at the the corresponding setting of the parameter “40.ϟFCT”, function of the fault message output and the parameter “36.BIN”, function digital input. This may be a switch for stuffing box monitoring, a temperature switch or a limit value switch for example.

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 to the threshold values on a continuous basis. These values result from the parameters “L1.LIMIT” to “L4.FACT3” and “O1.LIMIT” to “O4.FACT3”. If they are exceeded, depending on the operating mode of the extended diagnostics, the fault message output reacts, and possibly also the alarm outputs. The two functions can be deactivated by the parameter setting “OFF” for “L.┗STRK” or “O.┗DCHG”.

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 “F.┗ZERO” has a value≠OFF. Errors of the valve seat can be detected with this function for example. Exceeding of the limit value may hint at deposits or foreign bodies in the valve seat. Exceeding the limit value may be caused by wear of the valve seat. Mechanical maladjustment of the position feedback may also trigger this error message.

Monitoring takes place every time the valve is in tight closing bottom 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 “34.YCDO”) 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 (“F.┗ZERO”=OFF) also clears any existing fault message.

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

An appropriate diagnostic is made for the top hard stop. The limit value for this is set with the parameter G.┗OPEN. Activation of the tight closing top function (parameter “35.YCUP”) is therefore a prerequisite.

8 Monitoring of the dead band adaptation

If, during the automatic adaptation of the dead zone (parameter 30.DEBA=Auto) the dead zone increases disproportionately during operation, this is an indication of a fault in the system (e.g. significantly increased stuffing box friction, play in the position displacement sensor, leakage). Therefore a limit can be specified for this value (“E1.LEVL3”, threshold for dead band monitoring) that activates the fault message output if it is exceeded.

9 **Partial stroke test exceeds reference step time**

This error message appears on the one hand if a manual or cyclic partial stroke test is triggered and the test cannot be started because the valve is not within the start tolerance range. The error message also appears if one of the three thresholds of the partial stroke test that are a result of the reference step time (A6.PSTIN) times factors (A7.FACT1 to A9.FACT3) is violated. How serious the error message is, can be seen at the bar graph on the right side of the display. At the same time, the severity of the error message is output via the fault message output or the alarm outputs, according to the operating mode of the extended diagnostics.

10 **General control valve malfunction**

The monitoring of the operational behavior triggers if the actual valve position leaves a narrow corridor between guide value and expected position sequence. In this case, the deviation between expected and actual position sequence is filtered and output and compared to the set thresholds that are the result of the limit (b2.LIMIT) times the factors (b3.FACT1 to b5.FACT3).

11 **Pneumatic leakage**

This error message appears if the leakage indicator exceeds the set thresholds. Note that the function can only take effect with its entire sensitivity if a ramp test is performed to set the leakage indicator after initialization (see Explanations on C1.LIMIT).

12 **Slipstick effect too high**

If the slipstick of the control valve is increased during operation of if an increasing number of slip jumps are detected, the relevant limits can be exceeded, resulting in an error message.

13 **Temperature fallen short of**

This error message appears if the lower temperature limit thresholds are fallen short of.

14 **Temperature exceeded**

This error message appears if the upper temperature limit thresholds are exceeded.

15 **Monitoring of the position average**

If a position average is calculated when a comparison interval passes that deviates from the reference value by more than the set thresholds, this error message triggers.

4.5.4 Troubleshooting

Diagnostics indicator

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

Fault description (symptoms)	Possible cause(s)	Corrective actions
• Positioner comes to a halt in RUN 1	• Initialization started from the final stop **and** • Reaction time of max. 1 min. not waited • Network pressure not connected or too low	• Up to 1 min. waiting time required • Do not start initialization from an end stop • Confirm network pressure
• Positioner comes to a halt in RUN 2	• Transmission ratio selector and parameter 2 (YAGL) and true stroke did not correlate • Stroke on the lever incorrectly set • Piezo valve(s) do not switch (see Table 4-4)	• Check settings: • See leaflet: Figure Device view (7) and parameters 2 and 3 • Check stroke setting on the lever • see Table 4-4
• Positioner comes to a halt in RUN 3	• Actuator positioning time too long	• Open restrictor fully and/or set pressure PZ(1) to the highest permissible value • Use booster if necessary
• Positioner comes to a halt in RUN 5, does not reach FINISH (waiting time > 5 min)	• Play in the positioner, actuator, fittings system	• Linear actuator: Check seating of the stud screw of the coupling wheel • Rotary actuator: Check seating of the lever on the positioner shaft • Correct any other play between the actuator and the fittings

Table 4-3

Fault description (symptoms)	Possible cause(s)	Corrective actions
• CPU test blinks in the display of the SIPART PS2 (ca. every 2 secs) • Piezo valve(s) do not switch	• Water in the valve manifold (from wet compressed air)	• At the early stages the fault can be corrected by subsequent operation with dry air (when necessary, in a temperature cupboard at 50 to 70 °C) • Otherwise: send back to repair center (see page 217)
• Actuator cannot be moved in manual or automatic mode, or only in one direction	• Dampness in the valve manifold	
• Piezo valve(s) do not switch (no soft clicking can be heard when the + or – keys are pressed in manual mode)	• Screw between cover hood and the valve manifold is not tight or the hood is jammed	• Tighten screw, or release cause of jamming when necessary
	• Dirt (swarf, particles) in the valve manifold	• Send back to repair center (see page 217)
	• Deposits on the contact(s) between the electronics board and the valve manifold can occur from abrasion through continuous stresses from strong vibrations	• Clean all contact surfaces with alcohol: when necessary bend the valve manifold contact springs back into place

Table 4-4

Fault description (symptoms)	Possible cause(s)	Corrective actions
• Actuator does not move	• Compressed air < 1.4 bar	• Set inlet air pressure to > 1.4 bar
• Piezo valve(s) do not switch (although a soft clicking can be heard when the + or – keys are pressed in manual mode)	• Restrictor(s) closed down (screw(s) at the right end stop)	• Open restrictor screw(s) (see leaflet, Figure “View of device (6)”) by turning to the left
	• Dirt in the valve manifold	• Send back to repair center (see page 217) or new device with integrated fine filter which can be replaced and cleaned
• One piezo valve constantly switches in stationary automatic mode (constant setpoint) and in manual mode	• Pneumatic leak in the positioner, actuator system, start leak test in RUN 3 (Initialization) !!!	• Fix leak in the actuator and/or supply line • If the actuator and supply line are intact: Send back to repair center (see page 217)
	• Dirt in the valve manifold (see above)	• See above

Table 4-5

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

Table 4-6

Fault description (symptoms)	Possible cause(s)	Corrective actions
• Zero point shifts sporadically (> 3 %)	• Such high accelerations have occurred through impact or shock that the friction clutch has shifted (e.g. through steam jets in the steam pipelines)	• Shut off the cause of the shocks • Reinitialize the positioner • Upgrade at the repair center (see below): mount reinforced friction clutch (order number C73451-A430-D14)
• Device function breaks down totally: no display	• Insufficient electrical supply	• Check electrical supply
	With very high continuous stresses by vibrations, the following can occur:	
	• Screws of the electrical terminals can loosen • The electrical terminals and/or electronic modules can be shaken loose	• Tighten screws and secure with sealing varnish • Send back to repair center (see below) • Prevention: Mount the positioner on rubber metal

Table 4-7

4.6 Meanings of the display texts

Notes on the tables:

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

Reports before initializing (first commissioning):

	Upper line	Lower line	Meaning/Cause	Actions
CPU START	x	x	Report after connecting the electrical auxiliary power	• Wait
P *nnn.n*	x		Potentiometer voltage for non-initialized positioner (P manual mode) (Setting actual value in % of measurement range)	• Check using the ”+” and ”–” keys whether the overall actuator travel can be traversed without ever ”**P–––**” being displayed • Perform initialization
P–––	x		Measurement range exceeded, potentiometer is in the inactive zone, transmission ratio selector or effective lever arm are not matched to the actuator travel	• Set leverage ratio switch to 90 degrees, in particular for rotary actuators • Match effective arm length for thrust drives to measurement range
NOINI		x	Positioner not initialized	• Start initialization

Messages during initialization:

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

	Upper line	Lower line	Meaning/Cause	Actions
YEND2			only during manual initialization second end position can be moved to	• Move to second end position using the ”+” or ”–” key • Press ”operating mode” key to acknowledge
RANGE		x	only during manual initialization End position or measurement span are outwith the permitted measurement range	• Using ”+” and ”–” keys move to the other end position and press ”operating mode” key to acknowledge, **or** • Adjust slip clutch until ”**ok**” is displayed and press ”operating mode” key to acknowledge**__or** • Interrupt initialization by pressing the ”operating mode” key, switch to P manual mode and correct the actuator travel and position sensing
ok			only during manual initialization permitted measurement range for end positions reached	• Press ”operating mode” key to acknowledge, the remaining steps (”**RUN1**” to ”**FINSH**”) will run through automatically
RUN 1/ ERROR		x	Fault in RUN 1 no movement e.g. no compressed air	• Ensure compressed air is sufficient • Open any choke(s) • Re-start initialization
ϟ d___U		x	Bar display of the zero point Zero point is outwith the tolerance range	• With slip clutch set to ”**P 4.0**” to ”**P 9.9**” (>0<) • Continue using the ”+” or ”–” key
SEt MIDDL	x	x	Slip clutch misaligned; ”P 50.0” no displayed when arm horizontal	• For thrust drives, use the ”+” and ”–” keys to bring the arm to the correct angle on the spindle • Press ”operating mode” key briefly to acknowledge (initialization will resume)
ϟ UP >		x	”UP” – tolerance range exceeded or inactive zone of potentiometer entered	• Increase effective arm length with linear actuators or set leverage ratio switch to 90 degrees • Press ”operating mode” key briefly to acknowledge • Re-start initialization
ϟ90_95		x	Only applies to rotary drives: Actuator travel is not within range 90 to 95%	• Use the ”+” and ”–” keys to move into the range of 90 to 95% • Press ”operating mode” key briefly to acknowledge
ϟ U–d>		x	Measurement span ”Up–Down” is insufficient	• Reduce effective arm length for thrust drives or set leverage ratio switch to 33 degrees • Press ”operating mode” key briefly to acknowledge • Re-start initialization
U nn.n D–>U	x	x	Display the positioning time ”Up”	• Wait, **or** • To change the positioning time interrupt initialization with the ”–” key, **_or** • Activate the leakage test with the ”+” key
d nn.n U–>d	x	x	Display the positioning time ”Down”	• Wait, **or** • To change the positioning time interrupt initialization with the ”–” key, **_or** • Activate the leakage test with the ”+” key
NOZZL		x	Actuator stationary (initialization interrupted with the ”–” key during actuation speed display)	• Positioning time can be adjusted by varying the choke(s) • Use the ”–” key to repeat the determination of the positioning speed • Continue using the ”+” key
TESt LEAKG	x	x	Leakage test active initialization interrupted with the ”+” key during actuation speed display)	• Wait 1 minute • Continue with the ”+” key

	Upper line	Lower line	Meaning/Cause	Actions
nn.n **°oMIN**	x	x	Value and units of results of the leakage test	• Remove leakage if value is too high. • Continue with the "+" key
nn.n **FINSH**	x	x	Initialization completed successfully, with display of the actuator travel or positioning angle as appropriate	• Press "operating mode" key briefly to acknowledge or longer to quit configuration mode

Reports on leaving "configuration" operating mode:

	Upper line	Lower line	Local operating mode			Meaning/Cause	Actions
			Automatic	Manual mode	P manual mode		
2.nn.nn **VER**	x	x				Software version	• Wait
Error **SL*nn***	x	x				Monoticity transgression of the free characteristic line at support point "n"	• Correct value

Reports during operation:

	Upper line	Lower line	Local operating mode			Meaning/Cause	Actions
			Automatic	Manual mode	P manual mode		
CPU **START**	x	x				Message after applying auxiliary electrical power	• Wait
NOINI		x			x	Positioner not initialized	• Start initialization
nnn.n	x		x	x		Setting actual value [in %] for initialized positioners. Flashing decimal point indicates communication with a class 2 master	
MAN nn		x		x		Positioner is in local operation mode "Manual"	• In this mode you can move the actuator with the decrement and increment keys • Press operation mode key to enter automatic mode
OS nn		x	x			Actual mode of AO function block is Out of Service (O/S)	• Set target mode of AO function block to the desired mode • If AO remains in O/S, check if resource block is in actual mode AUTO
IMN nn		x	x			Actual mode of AO function block is Initialization Manual (IMan). AO has no access to transducer block	• Set the transducer block to target mode AUTO

	Upper line	Lower line	Auto-matic	Manual mode	P manual mode	Meaning/Cause	Actions
MM nn		x	x			Actual mode of AO function block is Manual	• The setpoint for the transducer block is given by writing a value to AO parameter OUT
LO nn		x	x			Actual mode of AO function block is Local Override (LO). Device might be in Fault State	• Check if communication from the upstream block is established • Check if resource block is in Faultstate
AUT nn		x	x			Actual mode of AO function block is Automatic (Auto)	• If you expected CADS, check if CAS_IN is linked to an upstream block and has a good status
CASnn		x	x			Actual mode of AO function block is Cascade (Cas)	
RCS nn		x	x			Actual mode of AO function block is Remote Cascade (RCas)	
oFL / **127.9**	x		x	x		Display range exceeded. Possible causes: • Slip clutch **or** • Transmission ratio selector switch changed **or** • Positioner installed without reinitialization, having previously been fitted to another drive	• Adjust slip clutch so that when moving the drive the actual value display remains within 0.0 to 100.0 **or** • Change transmission selector switch **or** • 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	
EXTPSt						Partial stroke test was activated e.g. via binary input	
InPSt						cyclic partial stroke test	

4.7 Optimization of the control data

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

13 Pulse length up
14 Pulse length down

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

17 Short step zone up
18 Short step zone down

The short step zone is the range in which the control deviation is between the fast step zone and the deadband. 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 possibly with overshoots. If the value is large, response will be slow but without overshoots.

It is recommended that first 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 band (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.

5 Fieldbus Communication

5.1 Overview

5.1.1 Block Structure

The positioner is implemented as a Basic Field Device according to FOUNDATION fieldbus specifications. It comprises four blocks

- Resource Block
- Analog output function block
- Analog output transducer block
- PID function block

Figure 5-1 shows an overview over the two function blocks and the transducer block with their in– and outputs. The resource block is not shown, as it has neither inputs nor outputs.

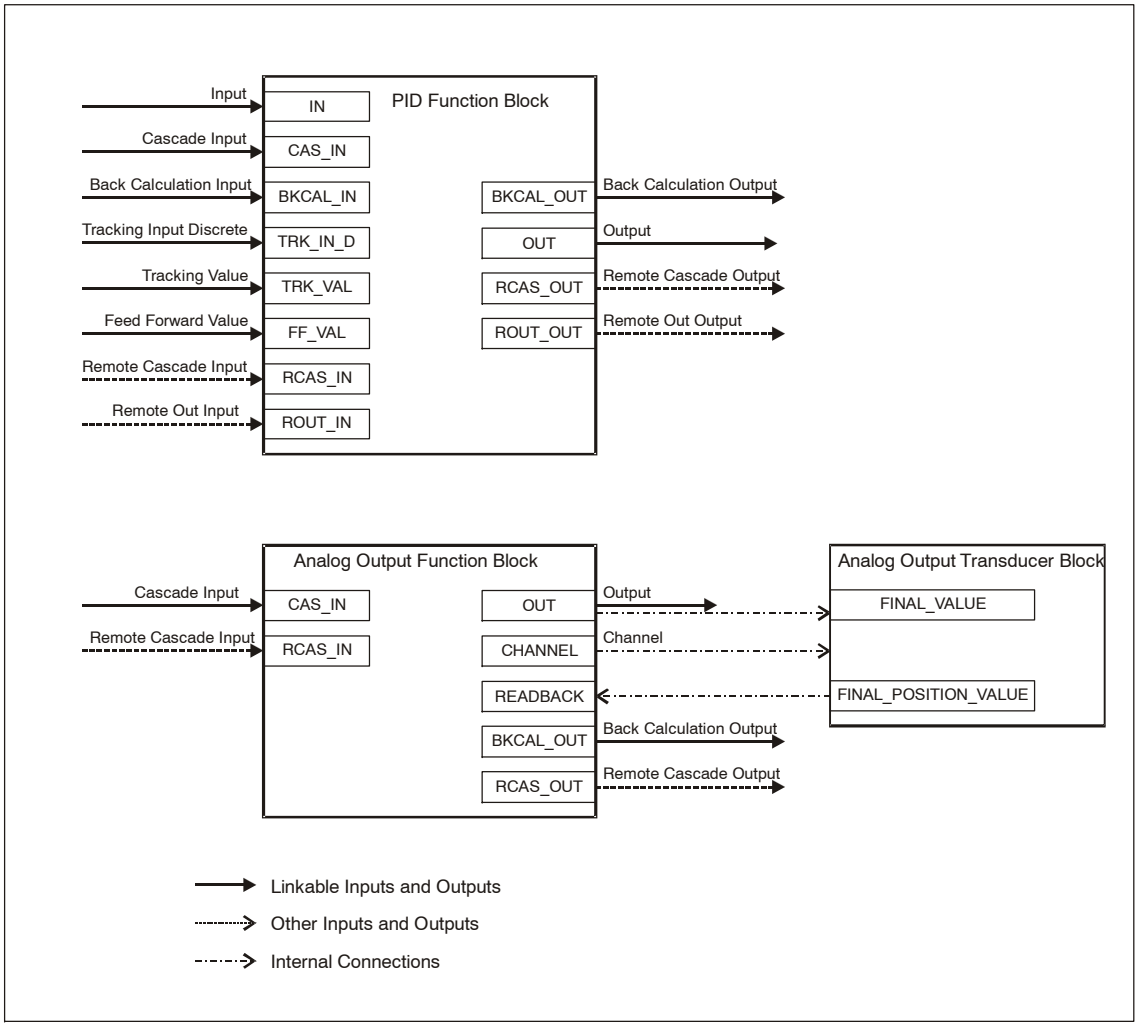


Figure 5-1 Overview Function Blocks

5.1.2 Addressing

Every fieldbus device must have a unique node address and physical device tag for the fieldbus to operate properly. The node address must be unique within the link (segment), the physical device tag must be unique within the whole network.

When a SIPART PS2 FF leaves the factory, it has a unique physical device tag, which is a concatenation of the string “SIPART PS2 FF” and part of the serial number. The node address is set to the value 22.

When configuring the device, the node address must be set to a value which is unique within the link. To avoid address conflicts, the SIPART PS2 FF sets its address automatically to one of the temporary default addresses of 248 to 251, if it detects another device with the same node address.

5.1.3 Configuration

For the configuration of the SIPART PS2 FF you need

- the Device Description
- the capability file (for offline configuration)
- a configuration tool such as National Instruments NIFBUS–Configurator or the tool integrated in your control system

The Device Description (DD) describes in machine–readable format all the information available at the fieldbus interface. It also contains information how to display information to the user and how to arrange the parameters in hierarchical menus. Another element of the DD is a number of so–called methods, which carry out sequences of actions to make some configuration steps easier. Extensive help texts are also included in the DD to describe the meaning and handling of the various parameters.

Hosts and configuration tools can use the information contained in the DD to generate a user friendly configuration surface.

The DD consists of two files:

- 0201.ffo (DD binary)
- 0201.sym (Symbol information)

The capability file (020101.cff) contains all information necessary for offline configuration.

Please refer to the manual of your configuration tool or control system how to install the files.

NOTE

Many of the parameters can be set directly via the three keys and the local display. This way you can perform certain tasks such as the initialization without the need of a fieldbus interface and configuration tool. You only need to supply the device with electrical and pneumatic power. See also chapter 4, page 81 Local Operation.

5.2 Resource Block (RB2)

5.2.1 Overview

The Resource block contains data that is specific to the hardware that is associated with the resource. This includes the device type and revision, manufacturer ID, serial number, and resource state. All data is modeled as Contained, so there are no links to this block. The data is not processed in the way that a function block processes data, so there is no function schematic.

☞ **NOTE**

The resource block must be in automatic mode for any function blocks in the device to execute.

5.2.2 Parameter description

The Resource Block contains all standard parameters as specified in [FF−891−1.5] and some manufacturer specific parameters. These include additional static information about the device and several counters for operating time. For detailed information see the following table.

Resource Block

Label/Name/Handling	Index (rel.)	Description/Format
ACK_OPTION Acknowledge Option Read & Write	38	Selection of whether alarms associated with the block will be automatically acknowledged. Bit Clear: Auto acknowledge disabled Bit Set: Auto acknowledge enabled (Operator must Acknowledge Alarm Condition) Bit 0: Write has been disabled Bit 7: Block Alarm Data format: Bit−String with 16 Bits (2 Byte) Default value: 0
ALARM_SUM (Record) Alarm Summary	37	The current alert status, unacknowledged states, unreported states, and disabled states of the alarms associated with the block. Data format: Record with 4 Parameters (8 Byte)
1. CURRENT Current Read only	37.1	The active status of each alarm. Meaning of the bits see ACK_OPTION Data format: Bit−String with 16 Bits (2 Byte)
2. UNACKNOWLEDGED Unacknowledged Read only	37.2	The unacknowledged state of each alarm. Meaning of the bits see ACK_OPTION Data format: Bit−String with 16 Bits (2 Byte)
3. UNREPORTED Unreported Read only	37.3	The unreported status of each alarm. Meaning of the bits see ACK_OPTION Data format: Bit−String with 16 Bits (2 Byte)

Resource Block		
Label/Name/Handling	**Index (rel.)**	**Description/Format**
4. DISABLED Disabled Read & Write	37.4	The disabled state of each alarm. Meaning of the bits see ACK_OPTION Data format: Bit–String with 16 Bits (2 Byte)
ALERT_KEY Alert Key Read & Write	4	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc. Data format: Unsigned8 (1 Byte) Value range: 1 …. 255 Default value: 0
BLOCK_ALM (Record) Block Alarm	36	The block alarm is used for all configuration, hardware, connection failure or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the Active status in the Status attribute. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Activestatus, if the subcode has changed. Data format: Record with 5 Parameters (13 Byte)
1. UNACKNOWLEDGED Unacknowledged Read & Write	36.1	A discrete enumeration which is set to Unacknowledged when an alarm occurs, and set to Acknowledged by a write from a human interface device or other entity which can acknowledge that the alarm/event has been noticed. 0: Uninitialized 1: Acknowledged 2: Unacknowledged Data format: Unsigned8 (1 Byte) Default value: 0
2. ALARM_STATE Aarm State Read only	36.2	A discrete enumeration which gives an indication of whether the alert is active and whether it has been reported. 0: Uninitialized 1: Alarm not active and reported 2: Alarm not active and not reported 3: Alarm active and reported 4: Alarm active and not reported Data format: Unsigned8
3. TIME_STAMP Time Stamp Read only	36.3	The time when evaluation of the block was started and a change in alarm/event state was detected that is unreported. The time stamp value will be maintained constant until alert confirmation has been received – even if another change of state occurs. Data format: Time–Value (8 Byte)

Resource Block		
Label/Name/Handling	**Index (rel.)**	**Description/Format**
4. SUB_CODE Subcode Read only	36.4	An enumeration specifying the cause of the alert to be reported. 0: Other (Non–specific error active) 1: BlockConfiguration (Error detected in block configuration) 2: LinkConfiguration (Error detected in link configuration) 3: SimulationActive (Simulation enabled in this block) 4: LocalOverride (Output tracking or faultstate active) 5: DeviceFaultState (Device faultstate set) 6: DeviceMaintenance (Device needs maintenance soon) 7: InputFailure (Process variable has bad status) 8: OutputFailure (Failure detected in output hardware) 9: MemoryFailure (Memory error detected) 10: LostStaticData (Static parameters cannot be recovered) 11: LostNVData (Non–Volatile param. cannot be recovered) 12: ReadbackCheck (Failure detected in READBACK) 13: MaintenanceNeeded (Device NEEDS maintenanance NOW) 14: PowerUp (Recovery from power failure) 15: OutOfService (Block actual mode is Out of Service) Data format: Unsigned16 (2 Byte)
5. VALUE Value Read only	36.5	The value of the associated parameter at the time the alert was detected. Data format: Unsigned8 (1 Byte)
BLOCK_ERR Block Error Read only	6	This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string, so that multiple errors may be shown. The following bits are supported: Bit 3: Simulation Active. The simulation jumper is set, simulation can be activated. Bit 9: Memory Failure. A ROM checksum error has been detected. Bit 10: Lost Static Data. A checksum error within the FF static data has been detected. Bit 11: Lost NV Data. A checksum error within application data has been detected. Bit 15: Out Of Service. Actual mode is out–of–service. Data format: Bit–String with 16 Bits (2 Byte)
CALIBRATION_DATE (Record) Calibration	52	Date of Calibration in factory. Data format: Record with 2 Parameters (32 Byte)
1. CAL_DATE Calibration Date Read only	52.1	Date of last device calibration, stored in the field device. Data format: Visible String (10 Byte)
2. CAL_WHO Calibration Executor Read only	52.2	Name of the person who did the calibration. Data format: Visible String (22 Byte)

Resource Block		
Label/Name/Handling	**Index (rel.)**	**Description/Format**
CLR_FSTATE Clear Fault State Read & Write	30	Writing a Clear to this parameter will clear the device fault state. 0: Uninitialized 1: Off (Normal operating position) 2: Clear (Block faultstate conditions will be cleared) Data format: Unsigned8 (1 Byte) Default value: 1 = Off (Normal operating position)
CONFIRM_TIME Confirm Time Read & Write	33	The minimum time (1/32 ms) between retries of alert reports. Data format: Unsigned32 (4 Byte) Default value: 640000 (20000 ms)
CYCLE_SEL Cycle Selection Read & Write	20	Used to select the block execution method for this resource. Bit 0: Scheduled (Block execution is scheduled through system management) Bit 1: Block Execution (Block execution is scheduled the completion of another block) Bit 2: Manuf Specific (Block execution is determined by the manufacturer) Data format: Bit–String with 16 Bits (2 Byte) Default value: 0x0003 (Scheduled | Block Execution)
CYCLE_TYPE Cycle Type Read only	19	Identifies the block execution methods available for this resource. Bit 0: Scheduled (Block execution is scheduled through system management) Bit 1: Block Execution (Block execution is scheduled the completion of another block) Bit 2: Manuf Specific (Block execution is determined by the manufacturer) Data format: Bit–String with 16 Bits (2 Byte) Default value: 0x0003 (Scheduled | Block Execution)
DD_RESOURCE DD Resource Read only	9	String identifying the tag of the resource which contains the Device Description for this resource. Data format: Visible String (32 Byte)
DD_REV DD Revision Read only	13	Revision of the DD associated with the resource – used by an interface device to locate the DD file for the resource. Data format: Unsigned8 (1 Byte)
DESCRIPTOR Descriptor Read & Write	44	The descriptive text can be used freely and is saved in the field device. It is displayed in the bottom line of the LC display in the diagnostic menu, number 0. You can use it e.g. for displaying the device tag to unambiguously identify the device in the field. Data format: Visble String (32 Byte)
DEV_REV Device Revision Read only	12	Revision number associated with the resource – used by an interface device to locate the DD file for the resource. Data format: Unsigned8 (1 Byte)
DEV_TYPE Device Type Read only	11	Model number associated with the resource – used by interface devices to locate the DD file for the resource. Data format: Enumerated16 (2 Byte) Default value: 0x0015 (SIPART PS2 FF)

Resource Block		
Label/Name/Handling	**Index (rel.)**	**Description/Format**
DEVICE_CERTIFICATION Device Certification Read only	47	Certifications of the device. Data format: Visible String (32 Byte)
DEVICE_ID Device ID Read only	46	String that identifies the Device Type Data format: Visible String (16 Byte) Default value: SIPART PS2 FF
DEVICE_INSTAL_DATE Device Installation Date Read & Write	48	The date (ASCII coded) on which the device was installed in the system can be entered in this parameter (e.g. 12.01.2001) Data format: Visible String (32 Byte)
DEVICE_MESSAGE Device Message Read & Write	45	The message text can be used freely and is saved in the field device. The use is free there is no recommended application. Data format: Visible String (32 Byte)
DEVICE_SER_NUM Serial Number Read only	49	The serial number of the device. Data format: Visible String (22 Byte)
FAULT_STATE Fault State Read only	28	Condition set by loss of communcation to an output block, failure promoted to an output block or a physical contact. When faultstate condition is set, then output function blocks will perform their FSTATE actions. 0: Uninitialized 1: Clear (Normal operating position) 2: Active (Faultstate is active) Data format: Unsigned8 (1 Byte)
FEATURES Features Read only	17	Used to show supported resource block options. Bit 0: Unicode (User defined octet strings to be stored as Unicode strings) Bit 1: Reports (Device can produce alert and trend Reports) Bit 2: Faultstate (Faultstate action is possible) Bit 3: Soft W Lock (Soft Write Lock Supported) Bit 4: Hard W Lock (Hard Write Lock Supported) Bit 5: Out Readback (Output Readback Supported) Bit 6: Direct Write (Direct Write To Output Hardware) Data format: Bit–String with 16 Bits (2 Byte) Default value: 0x0036 (Reports | Faultstate | Soft Write Lock | Out Readback)
FEATURE_SEL Feature Selection Read & Write	18	Used to select resource block options (see FEATURES) Data format: Bit–String with 16 Bits (2 Byte) Default value: 0x0036 (Reports | Faultstate | Soft Write Lock | Out Readback)
FREE_SPACE Free Space Read only	24	Percent of memory available for further configuration. Zero in a preconfigured device. Data format: Float–Value (4 Byte) Value range: 0.0 % … 100.0 % Not supported, set to 0%

Resource Block		
Label/Name/Handling	**Index (rel.)**	**Description/Format**
FREE_TIME Free Time Read only	25	Percent of the block processing time that is free to process additional blocks. Data format: Float–Value (4 Byte) Value range: 0.0 % … 100.0 % Not supported, set to 0%
GRANT_DENY (Record) Grant Deny	14	Options for controlling access of host computers and local control panels to operating, tuning, and alarm parameters of the block. Data format: Record with 2 Parameters (2 Byte)
1. GRANT Grant Read & Write	14.1	Depending on the philosophy of the plant, the operator or a higher level device (HLD), or a local operator's panel (LOP) in the case of Local, may turn on an item of the Grant attribute – Program, Tuning, Alarm, or Local. Bit 0: Program (Host may change mode, setpoint, or output of block) Bit 1: Tune (Host may change tuning parameters) Bit 2: Alarm (Host may change alarm parameters) Bit 3: Local (A local panel or handheld device may change the target mode, setpoint or output) Data format: Bit–String with 8 Bits (1 Byte) Default value: 0x00
2. DENY Deny Read & Write	14.2	The Denied attribute is provided for use by a monitoring application in an interface device and may not be changed by an operator. Bit 0: Program Denied (Granting of program permission has been reset) Bit 1: Tune Denied (Granting of tune permission has been reset) Bit 2: Alarm Denied (Granting of alarm permission has been reset) Bit 3: Local (Granting of local permission has been reset) Data format: Bit–String with 8 Bits (1 Byte) Default value: 0x00
HARD_TYPES Hard Types Read only	15	The types of hardware available as channel numbers. Bit 0: Scalar Input (Device hardware supports scalar Input) Bit 1: Scalar Output (Device hardware supports scalar Output) Bit 2: Discrete Input (Device hardware supports discrete input) Bit 3: Discrete Output (Device hardware supports discrete output) Data format: Bit–String with 16 Bits (2 Byte) Default value: 0x0001 (Scalar Output)

Resource Block		
Label/Name/Handling	**Index (rel.)**	**Description/Format**
HARDWARE_REVISION Hardware Revision Read only	42	The revision state of the hardware (electronics) of the field device. Data format: Visible String (16 Byte)
HOURS Number of Operating Hours (HOURS) Read only	51	The operating hours counter is incremented hourly as soon as the positioner is supplied with auxiliary power. The value is written to non–volatile memory every 15 minutes. Data format: Unsigned32 (4 Byte)
ITK_VER ITK Version Read only	41	Major revision number of the interoperability test case used to register this device. Data format: Unsigned16 (2 Byte) Default value: 5
LIM_NOTIFY Limit Notify Read & Write	32	Maximum number of unconfirmed alert notify messages allowed. Data format: Unsigned8 (1 Byte) Value range: 0 … MAX_NOTIFY Default value: 8
MANUFAC_ID Manufacturer Id Read only	10	Manufacturer identification number – used by an interface device to locate the DD file for the resource. Data format: Enumerated32 (4 Byte) Default value: 0x00534147 (Siemens)
MAX_NOTIFY Max Notify Read only	31	Maximum number of unconfirmed alert notify messages possible. Data format: Unsigned8 (1 Byte) Default value: 8
MEMORY_SIZE Memory Size Read only	22	Available configuration memory in the empty resource. Not supported by SIPART PS2 FF. Data format: Unsigned16 (2 Byte) Default value: 0 KBytes
MIN_CYCLE_T Minumum Cycle Time Read only	21	Time duration (1/32 ms) of the shortest cycle interval of which the resource is capable. Data format: Unsigned32 (4 Byte) Default value: 1920 (60 ms)
MODE_BLK (Record) Block Mode	5	The actual, target, permitted, and normal modes of the block. Data format: Record with 4 Parameters (4 Byte)
1. TARGET Target Read & Write	5.1	This is the mode requested by the operator. Target Mode is limited to the values allowed by the permitted mode parameter. Bit 3: Auto (Automatic Mode) Bit 7: O/S (Out Of Service) Data format: Bit–String with 8 Bits (1 Byte)
2. ACTUAL Actual Read only	5.2	This is the current mode of the block, which may differ from the target based on operating conditions. Its value is calculated as part of block execution. Bit 3: Auto (Automatic Mode) Bit 7: O/S (Out Of Service) Data format: Bit–String with 8 Bits (1 Byte)

Resource Block		
Label/Name/Handling	**Index (rel.)**	**Description/Format**
3. PERMITTED Permitted Read & Write	5.3	Defines the modes which are allowed for an instance of the block. The permitted mode is configured based on application requirement. Bit 3: Auto (Automatic Mode) Bit 7: O/S (Out Of Service) Data format: Bit–String with 8 Bits (1 Byte) Default value: 0x11 (Auto | O/S)
4. NORMAL Normal Read & Write	5.4	This is the mode which the block should be set to during normal operating conditions. Bit 3: Auto (Automatic Mode) Data format: Bit–String with 8 Bits (1 Byte) Default value: 0x10 (Auto)
NV_CYCLE_T Nonvolatile Cycle Time Read only	23	Interval between writing copies of NV parameters to non–volatile memory (1/32 ms). Zero means never. Data format: Unsigned32 (4 Byte)
PRODUCT_CODE Product Type (Order Number) Read only	50	The product type (order number) of the field device corresponds to the as–delivered state of the device and was stored by manufacturer of this field device. Data format: Visible String (32 Byte)
RESTART Restart Read & Write	16	Allows a manual restart to be initiated. Several degrees of restart are possible. 0: Uninitialzed 1: Run (Setting for normal operation) 2: Resource (Restart resource as though power fail had occurred using NVM values) 3: Defaults (Restart resource as through power fail had occurred using default values) 4: Processor (Reset processor and initiate execution as though power fail had occurred) Data format: Unsigned8 (1 Byte) Default value: 1 (Run)
RS_STATE Resource State Read only	7	State of the function block application state machine. 0: Uninitialized 1: StartRestart (State entered after detection of restored power) 2: Initialization (State entered from restart or failure Condition) 3: Online Linking (State entered to evaluate status of defined links) 4: Online (Normal operation, all links established) 5: Standby (Resource block mode is Out of Service) 6: Failure (Memory or hardware failure detected) Data format: Unsigned8 (1 Byte)

Resource Block		
Label/Name/Handling	**Index (rel.)**	**Description/Format**
SET_FSTATE Set Fault State Read & Write	29	Allows the faultstate condition to be manually initiated by selecting Set. 0: Uninitialized 1: OFF (Normal operating condition) 2: SET (Activate Faultstate) Data format: Unsigned8 (1 Byte) Default value: 1 = OFF (Normal operating condition)
SHED_RCAS Shed Remote Cascade Read & Write	26	Time duration at which to give up on computer writes to function block RCas locations (1/32 ms). Data format: Unsigned32 (4 Byte) Default value: 640000 (20 sec)
SHED_ROUT Shed Remote Out Read & Write	27	Time duration at which to give up on computer writes to function block ROut location (1/32 ms)s. Data format: Unsigned32 (4 Byte) Default value: 640000 (20 sec)
SOFTWARE_REVISION Software Revision Read only	43	The revision state of the software or firmware of the field device. Data format: Visible String (16 Byte)
ST_REV Static Revision Read only	1	The revision level of the static data associated with the function block. The revision value will be incremented each time a static parameter value in the block is changed. Data format: Unsigned16 (2 Byte) Default value: 0
STRATEGY Strategy Read & Write	3	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block. Data format: Unsigned16 (2 Byte) Default value: 0
TAG_DESC Tag Description Read & Write	2	The user description of the intended application of the block Data format: Octet–String (32 Byte)
TEST_RW (Record) Test Read Write Read & Write	8	Read/write test parameter – used only for conformance testing. Data format: Record with 15 Parameters (112 Byte)

Resource Block		
Label/Name/Handling	**Index (rel.)**	**Description/Format**
UPDATE_EVT (Record) Update Event	35	This alert is generated by any change to the static data. Data format: Record with 5 Parameters (14 Byte)
1. UNACKNOWLEDGED Unacknowledged Read only	35.1	A discrete enumeration which is set to Unacknowledged when an update occurs, and set to Acknowledged by a write from a human interface device or other entity which can acknowledge that the alarm has been noticed. 0: Uninitialized 1: Acknowledged 2: Unacknowledged Data format: Unsigned8
2. UPDATE_STATE Update State Read only	35.2	A discrete enumeration which gives an indication of whether the alert has been reported. 0: Uninitialized 1: Reported 2: Not Reported Data format: Unsigned8
3. TIME_STAMP Time Stamp Read only	35.3	The time when evaluation of the block was started and a change in alarm/event state was detected that is unreported. The time stamp value will be maintained constant until alert confirmation has been received – even if another change of state occurs. Data format: Time–Value (8 Byte)
4. STATIC_REVISION Static Rev Read only	35.4	The static revision of the block whose static parameter was changed and is being reported. It is possible for the present value of static revision to be greater than this because static can be changed at any time. Data format: Unsigned16
5. RELATIVE_INDEX Relative Index Read only	35.5	The OD index of the static parameter whose change caused this alert, minus the FB starting index. If the update event was caused by a write to multiple parameters at the same time, then this attribute will be zero. Data format: Unsigned16
WRITE_ALM (Record) Write Alarm	40	This alert is generated if the write lock parameter is cleared. Data format: Record with 5 Parameters (13 Byte)
1. UNACKNOWLEDGED	40.1	See BLOCK_ALM
2. ALARM_STATE	40.2	
3. TIME_STAMP	40.3	
4. SUB_CODE	40.4	
5. VALUE Discrete Value Read only	40.5	The value of the associated parameter at the time the alert was detected. 0: Discrete state 0 (Uninitialized) 1: Discrete state 1 (Not Locked) 2: Discrete state 2 (Locked) Data format: Unsigned8

Resource Block		
Label/Name/Handling	**Index (rel.)**	**Description/Format**
WRITE_LOCK Write Lock Read & Write	34	If set, no writes from anywhere are allowed, except to clear WRITE_LOCK. Block inputs will continue to be updated. 0: Uninitialized 1: Not Locked (Writes to Parameters are allowed) 2: Locked (Writes to Parameters are not allowed) Data format: Unsigned8 Default value: 1 (Not Locked)
WRITE_PRI Write Priority Read & Write	39	Priority of the alarm generated by clearing the write lock. Data format: Unsigned8 Value range: 0 …. 15 Default value: 0

5.2.3 Device Description

The Device Description is based on the standard device description for resource block 2. Manufacturer specific parameters, hierarchical parameter menus and two method have been added. The methods allows to restart the processor or to reset all configuration data to default.

5.3 Analog Output Function Block (AO)

5.3.1 Overview

The AO block processes the setpoint SP and sends it to the analog output channel of the transducer block. The source of SP depends on the actual block mode and can be the parameter SP itself (in mode AUTO), the input CAS_IN (in mode CAS) or the value of RCAS_IN (in mode RCAS). In mode MAN the output OUT can be set directly to the desired value.

The actual position of the valve (parameter FINAL_POSITION_VALUE) is received from the transducer block and scaled to get the actual process value PV. Either PV or SP can be used to feed the back calculation output BKCAL_OUT and RCAS_OUT.

The block supports cascade initialization to allow upstream control blocks to switch bumplessly from manual to automatic mode.

The AO has a faultstate behavior to react if the communication with the upstream block fails. See parameters FSTATE_TIME, FSTATE_VAL and IO_OPTS.

Simulation is possible with the parameter SIMULATE. The simulation enable jumper has to be set for this function. When simulation is active, the transducer block is ignored and the READBACK value and status are taken from SIMULATE_VALUE and SIMULATE_STATUS.

The execution time of the AO is 60 ms with a minimum period time of 60 ms.

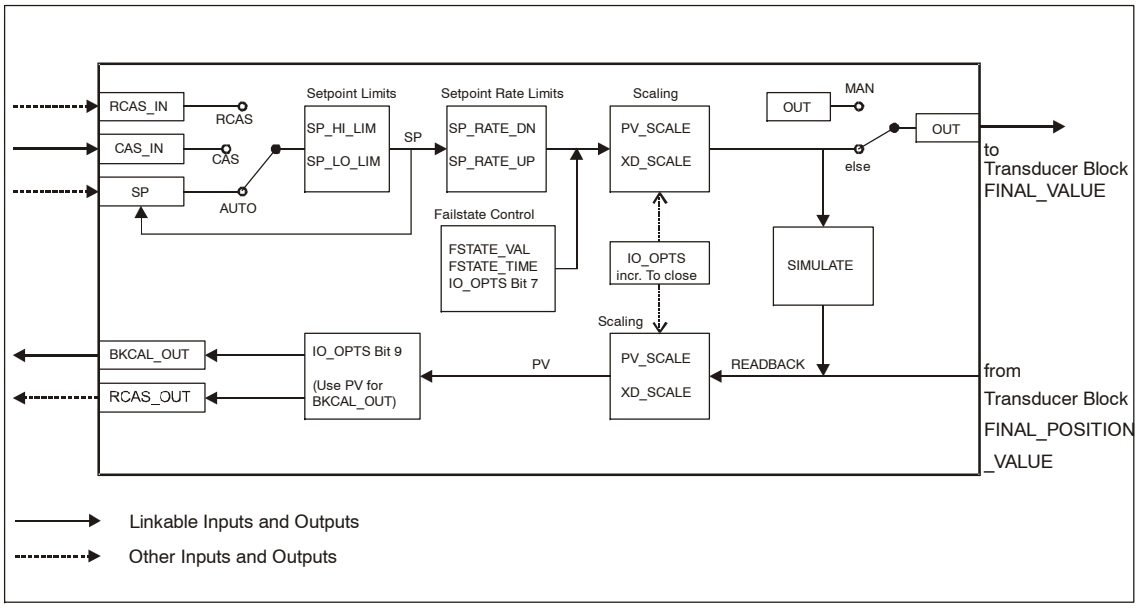


Figure 5-2 Function schematic of AO function block

5.3.2 Parameter description

The AO block contains all standard parameters as specified in [FF−891−1.5]. There are no additional manufacturer specific parameters.

Analog Output (AO) Block		
Label/Name/Handling	**Index (rel.)**	**Description/Format**
ALERT_KEY Alert Key Read & Write	4	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc. Data format: Unsigned8 Value range: 1 …. 255 Default value: 0x00
BKCAL_OU (Record) Back Calculation Output **1. STATUS** **2. VALUE**	25 25.1 25.2	The output value and status provided to an upstream block for output tracking when the loop is broken or limited, as determined by the status bits. This information is used to provide bumpless transfer to closed loop control and to prevent windup under limited conditions when that becomes possible. See PID−Block → BKCAL_IN
BLOCK_ALM (Record) Block Alarm **1. UNACKKNOWLEDGED** **2. ALARM_STATE** **3. TIME_STAMP** **4. SUB_CODE** **5. VALUE**	30 30.1 30.2 30.3 30.4 30.5	See Resource Block
BLOCK_ERR Block Error Read only	6	This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string, so that multiple errors may be shown. Bit 1: Block Configuration Bit 4: Local Override Bit 7: Input Failure Bit 8: Output Failure Bit 5: Out Of Service Data format: Bit−String with 16 Bits (2 Byte)
CAS_IN (Record) Cascade Input 1. STATUS 2. VALUE	17 17.1 17.2	This parameter is the remote setpoint value, which must come from another Fieldbus block, or a DCS block through a defined link. See PID−Block → BKCAL_IN

Analog Output (AO) Block		
Label/Name/Handling	**Index (rel.)**	**Description/Format**
CHANNEL Channel Read & Write	22	The number of the logical hardware channel that is connected to this I/O block. This information defines the transducer to be used going to or from the physical world. Must be set to 1 for SIPART PS2 FF. Data format: Unsigned16 Value range: 0x0001 ….. 0x7FFF Default value: 0x0001
FSTATE_TIME Fault State Time Read & Write	23	The time in seconds from detection of failure of the output block remote setpoint to the output action of the block output if the condition still exists. Data format: Float–Value (4 Byte) Value range: 0.0 Sec … 100.0 Sec Default value: 0.0 Sec
FSTATE_VAL Fault State Value Read & Write	24	The preset analog SP value to use when failure occurs. This value will be used if the I/O option Faultstate to value is selected. Data format: Float–Value (4 Byte) Default value: 0.0
GRANT_DENY (Record) Grant Deny **1. GRANT** **2. DENY**	13 13.1 13.2	Options for controlling access of host computers and local control panels to operating, tuning, and alarm parameters of the block. See Resource Block
IO_OPTS I/O Options Read & Write	14	Option which the user may select to alter input and output block processing. Bit 1: SP tracks PV if Man Bit 3: SP tracks PV if LO Bit 4: SP tracks RCas or Cas if LO or Man Bit 5: Increase to close Bit 6: Faultstate Type Bit 7: Faultstate restart Bit 8: Target to Man Bit 9: PV for BKCal_Out see chapter 5.3.3, page 153 for details Data format: Bit–String with 16 Bits (2 Byte) Default value: 0x0000
MODE_BLK (Record) Block Mode	5	The actual, target, permitted, and normal modes of the block. Data format: Record with 4 Parameters (4 Byte)
1. TARGET Target Read & Write	5.1	This is the mode requested by the operator. Only one mode from those allowed by the permitted mode parameter may be requested. Bit 1: RCas (Remote Cascade) Bit 2: Cas (Cascade Mode) Bit 3: Auto (Automatic Mode) Bit 4: Man (Manual Mode) Bit 7: O/S (Out Of Service) Data format: Bit–String with 8 Bits (1 Byte)

Analog Output (AO) Block		
Label/Name/Handling	**Index (rel.)**	**Description/Format**
2. ACTUAL Actual Read only	5.2	This is the current mode of the block, which may differ from the target based on operating conditions. Its value is calculated as part of block execution. Bit 1: RCas (Remote Cascade) Bit 2: Cas (Cascade Mode) Bit 3: Auto (Automatic Mode) Bit 4: Man (Manual Mode) Bit 5: LO (Local Override) Bit 6: IMan (Initializ. Man.) Bit 7: O/S (Out Of Service) Data format: Bit–String with 8 Bits (1 Byte)
3. PERMITTED Permitted Read & Write	5.3	Defines the modes which are allowed for an instance of the block. The permitted mode is configured based on application requirement. Bit 1: RCas (Remote Cascade) Bit 2: Cas (Cascade Mode) Bit 3: Auto (Automatic Mode) Bit 4: Man (Manual Mode) Bit 7: O/S (Out Of Service) Data format: Bit–String with 8 Bits (1 Byte). Default value: 0x79 (Rcas | Cas | Auto | Man | O/S)
4. NORMAL Normal Read & Write	5.4	This is the mode which the block should be set to during normal operating conditions. Bit 1: RCas (Remote Cascade) Bit 2: Cas (Cascade Mode) Bit 3: Auto (Automatic Mode) Bit 4: Man (Manual Mode) Bit 7: O/S (Out Of Service) Data format: Bit–String with 8 Bits (1 Byte) Default value: 0x30 (Cas | Auto)
OUT (Record) Output **1. STATUS** Read only **2. VALUE** Read & Write	9 9.1 9.2	The primary analog value calculated as a result of executing the function block. This parameter is linked to FINAL_VALUE in the transducer block. See PID–Block → BKCAL_IN
PV (Record) Process Value Read only **1. STATUS** **2. VALUE**	7 7.1 7.2	Either the primary analog value for use in executing the function, or a process value associated with it. May also be calculated from the READBACK value of an AO block. The PV_SCALE is used for this value. See PID–Block → BKCAL_IN

Analog Output (AO) Block

Label/Name/Handling	Index (rel.)	Description/Format
PV_SCALE (Record) Process Value Scale **1. EU_100** **2. EU_0** **3. UNITS_INDEX** **4. DECIMAL**	11 11.1 11.2 11.3 11.4	The high and low scale values, engineering units code, and number of digits to the right of the decimal point to be used in displaying the PV parameter and parameters which have the same scaling as PV. See PID–Block → FF_SCALE
RCAS_IN (Record) Remote Cascade Input **1. STATUS** **2. VALUE**	26 26.1 26.2	Target setpoint and status provided by a supervisory Host to a analog control or output block. See PID–Block → BKCAL_IN
RCAS_OUT (Record) Remote Cascade Output Read only **1. STATUS** **2. VALUE**	28 28.1 28.2	Block setpoint and status after ramping – provided to a supervisory Host for back calculation and to allow action to be taken under limiting conditions or mode change. See PID–Block → BKCAL_IN
READBACK (Record) Readback **1. VALUE** Value Read only **2. STATUS** QUALITY Status SUBSTATUS Read only LIMITS	16 16.1 16.2	This indicates the readback of the actual continuous valve or other actuator position, in transducer units. The READBACK is linked to the FINAL_POSITION_VALUE of the transducer block. Data format: Record with 2 Parameters (5 Byte) A numerical quantity received by the block parameter from another block parameter to which this block is linked. Or a default or user entered value if the parameter has not been linked. The XD_SCALE is used for this value. Data format: Float–Value (4 Byte) See PID–Block → BKCAL_IN
SHED_OPT Shed Options Read & Write	27	Defines action to be taken on remote control device timeout. 0: Uninitialized 1: Normal Shed_Normal Return 2: Normal Shed_No Return 3: Shed To Auto_Normal Return 4: Shed To Auto_No Return 5: Shed To Manual_Normal Return 6: Shed To Manual_No Return 7: Shed To Retained Target_Normal Return 8: Shed To Retained Target_No Return Data format: Unsigned8 Default value: 0 (Uninitialized)

Analog Output (AO) Block

Label/Name/Handling	Index (rel.)	Description/Format
SIMULATE (Record) Simulate	10	Allows the transducer analog input or output to the block to be manually supplied when simulate is enabled. When simulate is disabled, the simulate value and status track the actual value and status. Data format: Record with 5 Parameters (11 Byte)
1. SIMULATE_STATUS Simulate Status Read & Write	10.1	Used for the transducer status when simulation is enabled. **QUALITY:** **SUBSTATUS:** **LIMITS:** Status–Structure see: **PID–Block → BKCAL_IN** Data format: Unsigned8 Default value: 0 (Bad: Non Specific: Not Limited)
2. SIMULATE_VALUE Simulate Value Read & Write	10.2	Used for the transducer value when simulation is enabled. Data format: Float–Value (4 Byte) Default value: 0.0
3. TRANSDUCER_STATUS Transducer Status Read only	10.3	Status of value supplied by the transducer. **QUALITY:** **SUBSTATUS:** **LIMITS:** Status–Structure see: **PID–Block → BKCAL_IN** Data format: Unsigned8 Default value: 0 (Bad: Non Specific: Not Limited)
4. TRANSDUCER_VALUE Transducer Value Read only	10.4	Current value supplied by the transducer. Data format: Float–Value (4 Byte) Default value: 0.0
5. ENABLE_DISABLE Simulate En/Disable Read & Write	10.5	Enable/disable simulation. 0: Uninitialized 1: Disabled 2: Active Data format: Unsigned8 Default value: 1 (Disabled)
SP (Record) Setpoint	8	The analog setpoint of this block. Data format: Record with 2 Parameters (5 Byte)
1. STATUS QUALITY Status SUBSTATUS Read & Write LIMITS	8.1	See PID–Block → BKCAL_IN
2. VALUE Value Read only	8.2	A numerical quantity received by the block parameter from another block parameter to which this block is linked. Or a default or user entered value if the parameter has not been linked. The PV_SCALE is used for this value. Data format: Float–Value (4 Byte)

Analog Output (AO) Block		
Label/Name/Handling	**Index (rel.)**	**Description/Format**
SP_HI_LIM Setpoint High Limit Read & Write	20	The setpoint high limit is the highest setpoint operator entry that can be used for the block. Data format: Float–Value (4 Byte) Default value: 100.0
SP_LO_LIM Setpoint Low Limit Read & Write	21	The setpoint low limit is the lowest setpoint operator entry that can be used for the block. Data format: Float–Value (4 Byte) Default value: 0.0
SP_RATE_DN Setpoint Rate Down Read & Write	18	Ramp rate at which downward setpoint changes are acted on in Auto mode, in PV units per second. If the ramp rate is set to zero or the block is in a mode other than Auto, then the setpoint will be used immediately. If the setpoint changes are to be independent from loop time use TRAVEL_RATE_DOWN in the transducer block. Data format: Float–Value (4 Byte) Value range: ≥ 0.0 [PV/Sec] Default value: 1.#INF (Not active)
SP_RATE_UP Setpoint Rate Up Read & Write	19	Ramp rate at which upward setpoint changes are acted on in Auto mode, in PV units per second. If the ramp rate is set to zero or the block is in a mode other than Auto, then the setpoint will be used immediately. If the setpoint changes are to be independent from loop time use TRAVEL_RATE_UP in the transducer block. Data format: Float–Value (4 Byte) Value range: ≥ 0.0 [PV/Sec] Default value: 1.#INF (Not active)
ST_REV Static Revision Read only	1	The revision level of the static data associated with the function block. The revision value will be incremented each time a static parameter value in the block is changed. Data format: Unsigned16
STATUS_OPTS Status Options Read & Write	15	Options which the user may select in the block processing of status. Bit 4: Propagate Fault Backward Data format: Bit–String with 16 Bits (2 Byte) Default value: 0x0000
STRATEGY Strategy Read & Write	3	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block. Data format: Unsigned16 Default value: 0x0000
TAG_DESC Tag Description Read & Write	2	The user description of the intended application of the block. Data format: Octet–String (32 Byte)

Analog Output (AO) Block		
Label/Name/Handling	**Index (rel.)**	**Description/Format**
UPDATE_EVT (Record) Update Event	29	This alert is generated by any change to the static data.
1. UNACKNOWLEDGED	29.1	See Resource Block
2. UPDATE_STATE	29.2	
3. TIME_STAMP	29.3	
4. STATIC_REVISION	29.4	
5. RELATIVE_INDEX	29.5	
XD_SCALE (Record) Transducer Scale	12	The high and low scale values, engineering units code, and number of digits to the right of the decimal point used with the value obtained from the transducer for a specified channel.
1. EU_100	12.1	Because FINAL_VALUE_RANGE in the transducer block is fixed to 0.0 and 100.0 use these values for XD_SCALE for proper operation.
2. EU_0	12.2	
3. UNITS_INDEX	12.3	
4. DECIMAL	12.4	See PID–Block → FF_SCALE

5.3.3 Options

The effect of the option bits of the parameters IO_OPTS, STATUS_OPTS and SHED_OPT are described in the following sections.

IO_OPTS

Options which the user may select to alter output block processing.

SP–PV Track in Man

Permits the setpoint to track the process variable when the target mode of the block is Man.

SP–PV Track in LO

Permits the setpoint to track the process variable when the actual mode of the block is LO or IMAN.

SP Track retained target

Permits the setpoint to track the RCas or Cas parameter based on the retained target mode when the actual mode of the block is LO or Man. When SP–PV track options are enabled, then SP Track retained target will have precedence in the selection of the value to track when the actual mode is Man and LO.

Increase to close

Indicates whether the output value should be inverted before it is communicated to the I/O channel.

Fault State to value

The output action to take when fault occurs. (0: freeze, 1: go to preset value)

Use Fault State value on restart

Use the value of FSTATE_VAL(_D) if the device is restarted, otherwise use the non–volatile value. This does not act like Fault State, just uses the value.

Target to Man if Fault State activated

Set the target mode to Man, thus losing the original target, if Fault State is activated. This latches an output block into the manual mode.

Use PV for BKCAL_OUT

The BKCAL_OUT value is normally the working SP. This option changes it to the PV.

STATUS_OPTS

Options which the user may select in the block processing of status.

Propagate Fault Backward

If the status from the actuator is Bad, Device failure or Fault State Active or Local Override is active, propagate this as Bad, Device Failure or Good Cascade, Fault State Active or Local Override to BKCAL_OUT respectively without generating an alarm. The use of these sub–status in BKCAL_OUT is determined by this option. Through this option, the user may detemine whether alarming(sending of an alert) will be done by the block or propagated upstream for alarming.

SHED_OPT

Defines action to be taken on remote control device timeout.

0 = Undefined – Invalid

1 = Normal shed, normal return – Actual mode changes to the next lowest priority non–remote mode permitted but returns to the target remote mode when the remote computer completes the initialization handshake.

2 = Normal shed, no return – Target mode changes to the next lowest priority non–remote mode permitted. The target remote mode is lost, so there is no return to it.

3 = Shed to Auto, normal return

4 = Shed to Auto, no return – Target mode changes to Auto on detection of a shed condition.

5 = Shed to Manual, normal return

6 = Shed to Manual, no return – Target mode changes to Man on detection of a shed condition. When the target mode is set to Manual, the Retained bits will be set to zero (0).

7 = Shed to Retained target, normal return

8 = Shed to Retained target, no return (change target to retained target)

5.3.4 Device Description

The device description is based on the standard device description for analog output function blocks. An additional hierarchical parameter menu has been added.

5.4 Analog Output Transducer Block (AOTB)

5.4.1 Overview

The transducer block is the interface to the physical hardware. It decouples the AO function block from the hardware details of the positioner.

The FINAL_VALUE of the AOTB is feed by the output OUT of the AO (note that AO parameter CHANNEL must be set to 1). The FINAL_VALUE can be converted by standard or user defined characteristics and can be rate limited. The result is used as setpoint to the servo controller, which compares it with the actual position and generates the appropriate control signals for the piezo valve unit. The actual position value is derived from the signal of a position sensor, processed by a scaling and correction block. The value is then back−calculated by the inverted characteristic to serve as position readback to the AO (FINAL_POSITION_VALUE).

Several parameters serve to configure the diagnosis and monitoring features of the SIPART PS2 FF.

The transducer block supports modes Automatic and Out of Service. It can only be switches to Automatic after the positioner has been initialized (see chapter 3.6, page 64 Comissioning).

In Automatic mode the setpoint FINAL_VALUE can be directly written for test purpose, if the AO function block is set to Out of Service.

Local operation modes can have priority over the block actual mode, see chapter 4.3, page 84 for details.

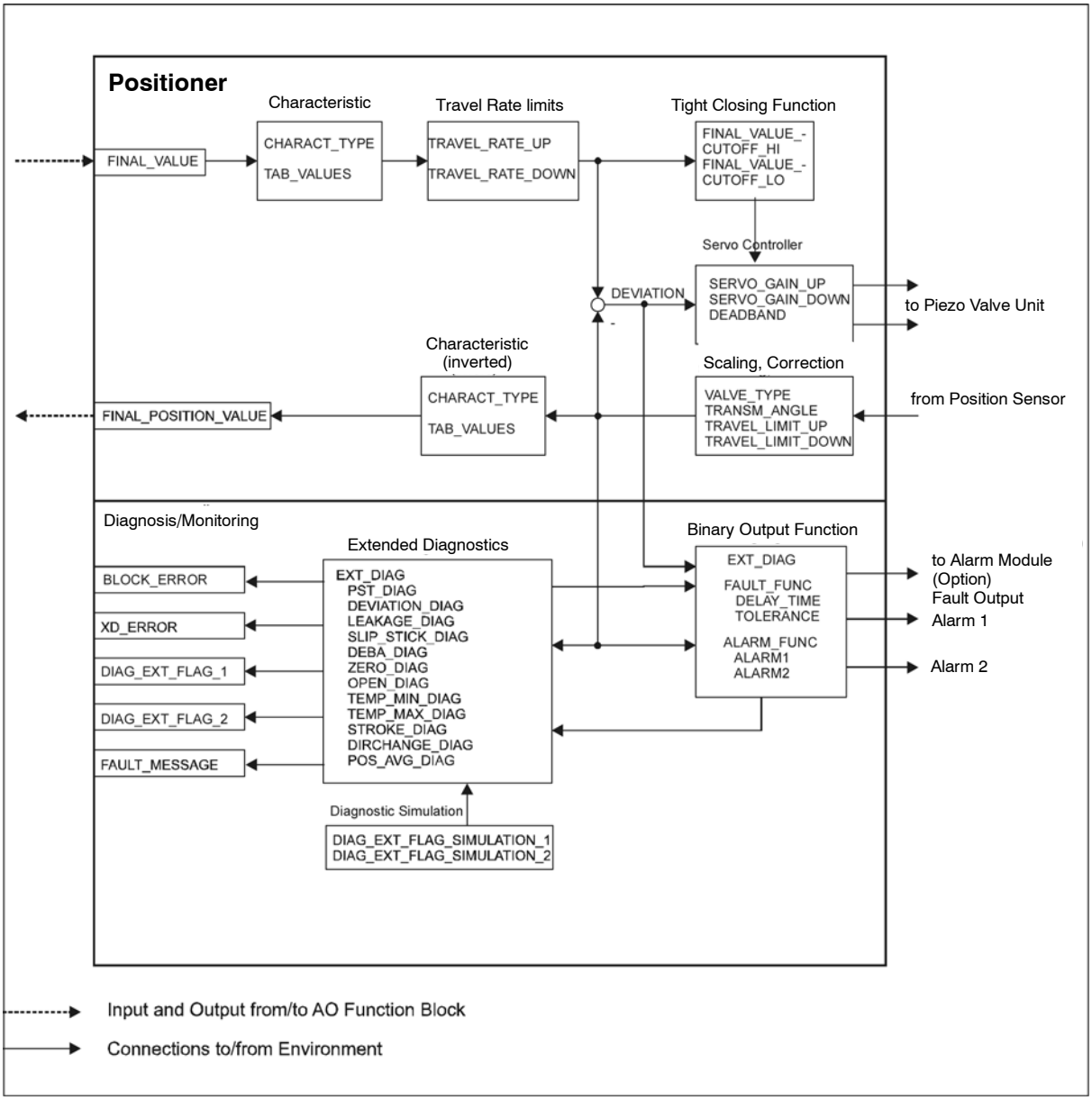


Figure 5-3 Function schematic of Analog Output transducer block

5.4.2 Parameter description

The transducer block contains all parameters as defined in the preliminary specification [FF–903 PS 3.0] for a standard advanced positioner valve. There are many additional manufacturer specific parameters to allow a perfect adaptation to all kind of actuators and valves and provide many useful information about the armature and the process.

Transducer Block

Label/Name/Handling	Index (rel.)	Description/Format
ACT_FAIL_ACTION Actuator Fail Action Read & Write	21	Specifies the action the actuator takes in case of failure. The value is only informative and has no influence on the behaviour of the positioner. Possible values: 0: Undefined 1: Self–Closing 2: Self–Opening 3: Hold last value 4: Maximum value 5: Minimum value 255: Indeterminate Data format: Unsigned8 Default value: 255 (Indeterminate)
ACT_MAN_ID Actuator Manufacturer Id Read & Write	22	The actuator manufacturer's identification number as defined by the Fieldbus Foundation. Data format: Unsigned32
ACT_MODEL_NUM Actuator Model Number Read & Write	23	The actuator model number. Data format: Visible String (32 Byte)
ACT_SN Actuator Serial Number Read & Write	24	The actuator serial number. Data format: Visible String (32 Byte)
ACT_STROKE_TIME_DOWN Min. travel time from 'OPEN' to 'CLOSE' Read only	55	This time, measured during initialization, is the minimum time, which the actuator needs to run through the rated stroke/rated angle from 'OPEN' to 'CLOSE' direction. Data format: Float–Value (4 Byte)
ACT_STROKE_TIME_UP Min. travel time from 'CLOSE' to 'OPEN' Read only	56	This time, measured during initialization, is the minimum travel time, which the actuator needs to run through the rated stroke/ rated angle from 'CLOSE' to 'OPEN' direction. Data format: Float–Value (4 Byte)

Transducer Block		
Label/Name/Handling	**Index (rel.)**	**Description/Format**
ALARM_FUNCT Alarm function (AFCT) Read & Write	47	The positioner can report the exceeding (Max.) or dropping below (Min) of a specified stroke or angle of rotation. The response of the alarms is related to the mechanical position (see TRAVEL_LIMIT_DOWN, TRAVEL_LIMIT_UP and Y_NORM). The alarms are reported by the alarm module (option) and by BINARY_STATUS. The direction of action of the alarm can be set to High active (e.g. 'Alarm 1: Min, Alarm 2: Max') or Low active (e.g. 'Alarm 1: /Min, Alarm 2: /Max'). 0: Off, Without function. 1: MI: MA (Alarm 1: Min, Alarm 2: Max) 2: MI: MI (Alarm 1: Min, Alarm 2: Min) 3: MA: MA (Alarm 1: Max, Alarm 2: Max) 4: /MI:/MA (Alarm 1: /Min, Alarm 2: /Max) inverted 5: /MI:/MI (Alarm 1: /Min, Alarm 2: /Min) inverted 6: /MA:/MA (Alarm 1: /Max, Alarm 2: /Max) inverted Data format: Unsigned8 Default value: 0 (Off, Without function)
ALARM1 Response threshold of alarm 1 (A1) Read & Write	48	The response threshold (0 to 100%) for Alarm 1 is related to the mechanical way (see TRAVEL_LIMIT_DOWN, TRAVEL_LIMIT_UP and Y_NORM). Note, if the alarm is outsite TRAVEL_LIMIT_DOWN / UP, the alarm can only occure, when FINAL_VALUE_CUTTOFF_HI / LO is activated. Depending on the parameterization of the alarm function (ALARM_FUNC), the Alarm is activated on exceeding (Max) or dropping below (Min) this response threshold. Data format: Float–Value (4 Byte) Value range: 0.0 % …. 100.0 % Default value: 10.0 %
ALARM2 Response threshold of alarm 2 (A2) Read & Write	49	See ALARM1. Data format: Float–Value (4 Byte) Value range: 0.0 % …. 100.0 % Default value: 90.0 %
ALERT_KEY Alert Key Read & Write	4	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc. Data format: Unsigned8 Value range: 1 …. 255 Default value: 0
BETR_STUNDEN_INIT Time since last initialization Read only	107	The time (in hours) since the last initialization of the device is entered in this parameter. Data format: Unsigned32 (4 Byte) Default value: 0

Transducer Block

Label/Name/Handling	Index (rel.)	Description/Format
BIN_IN_FUNCT Function of binary input (BIN) Read & Write	46	The function of the binary input (BIN) can be set individually according to the purpose. These functions can only be used with the option Alarm Module. The direction of action can be adapted to an NCC or an NOC. * + or High means: Action at high level at binary input (switch contact is closed). * – or Low means: Action at low level at the binary input (switch contact is opened). 0: OFF 1: –ON / only message (Low) 2: +ON / only message (High) 3: BLOC1 / block configuration mode 4: BLOC2 / block configuration and manual mode 5: +UP / drive valve to 'UP' position (High) 6: +DOWN / drive valve to 'DOWN' position (High) 7: +STOP / Block movement (High) 8: –UP / drive valve to 'UP' position (Low) 9: –DOWN / drive valve to 'DOWN' position (Low) 10: –STOP / Block movement (Low) 11: +PST / Start PST (High) 12: –PST / Start PST (Low) Data format: Unsigned8 Default value: 0 (OFF)
BINARY_STATUS State of the binary signals Read only	51	Status information of the binary signals. Bit 0: Simulate input Bit 3: Alarm output 2 Bit 1: Binary input Bit 4: Fault output Bit 2: Alarm output 1 Data format: Bit–String with 8 Bits (1 Byte)
BLOCK_ALM (Record)	8	See Resource Block
1. UNACKKNOWLEDGED	8.1	
2. ALARM_STATE	8.2	
3. TIME_STAMP	8.3	
4. SUB_CODE	8.4	
5. VALUE	8.5	

Transducer Block		
Label/Name/Handling	**Index (rel.)**	**Description/Format**
BLOCK_ERR Block Error Read only	6	This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string, so that multiple errors may be shown. The following bits are supported: Bit 0: Other. This bit is set, if either a bit in XD_ERROR is set or if a threshold 1 error of the extended diagnostics is present. Bit 1: Block Configuration. The user defined characteristic has violated the monotonic condition (See TAB_VALUES). Bit 6: Device Needs Maintenance Soon. This bit is set, if a threshold 2 error of the extended diagnostics is present. Bit 8: Output Failure. The deviation of the positioner has exceeded the limit. Bit 13: Device Needs Maintenance Now. This bit is set, if a threshold 3 error of the extended diagnostics is present. Bit 15: Out Of Service. Actual mode is out–of–service Data format: Bit–String with 16 Bits (2 Byte)
CHARACT_TYPE Setpoint function (SFCT) Read & Write	36	Non–linear valve characteristics can be linearized with this function and any flow characteristics simulated in linear valve characteristics. The 'LINEAR' setting means that the linearization is switched off. The entry of individual setpoint vertex points (Free) can be changed by TAB_VALUES. 0: Linear 1: Equal percentage 1:25 2: Equal percentage 1:33 3: Equal percentage 1:50 4: Equal percentage inverse 25:1 (n1:25) 5: Equal percentage inverse 33:1 (n1:33) 6: Equal percentage inverse 50:1 (n1:50) 7: Free (user defined) Data format: Unsigned8 Default value: 0 (Linear)
COLLECTION_DIRECTORY Collection Directory / Characteristics Read only	12	A directory that specifies the number, starting indicies, and DD Item IDs of the data collections in each transducer within a transducer block. Data format: Unsigned32
DEADBAND Dead zone of controller (DEBA) Read & Write	38	The dead zone can be entered as a percentage of the way in this parameter. The way corresponds to the output signal range (start value and end value). The dead zone is constantly adapted to the requirements of the control circuit in the 'AUTO' mode (value = –120.0). The initial value is used. Data format: Float–Value (4 Byte) Value range: –120.0 %, 0.1 % …. 10.0 % Default value: –120.0 % (Auto)

Transducer Block		
Label/Name/Handling	**Index (rel.)**	**Description/Format**
DEBA_DIAG (Record) Dead zone monitoring	87	This test (dead zone monitoring) can be used for continuous checking of dead zone adjustment. Condition: Parameter 'Controller dead zone (30 – DEBA)' = 'AUTO' (–120). If the parameterizable threshold exceeds the current dead zone during testing, the device outputs the diagnostic message 'Maintenance alarm'. Data format: Record with 2 Parameters (5 Byte)
1. DEBA_ENABLE Test activation (E – \DEBA) Read & Write	87.1	This parameter can be used to activate the dead zone monitoring test. 0: Off – The test is deactivated and the associated test parameters have been removed from the menu. 1: On – The test is active and the test parameters can be set. Data format: Enumerated8 (1 Byte) Default value: 0 = Off
2. DEBA_LEVEL3 Threshold (E1 – LEVL3) Read & Write	87.2	The threshold for monitoring dead zone matching must be entered in this parameter. If, during testing, the current dead zone exceeds this threshold, the device outputs the diagnostic message 'Maintenance alarm'. Data format: Float–Value (4 Byte) Value range: 0.1 …. 10.0 Default value: 2.0
DELAY_TIME Delay time for fault message (\TIM) Read & Write	41	The monitoring time for setting the fault messages (in seconds) can be set in this parameter. The initial value is valid in the 'AUTO' mode (value = –120.0). The position controller must have reached the controlled state within the set time. The corresponding response threshold can be entered by TOLERANCE_BAND. The fault message output is activated on exceeding the set time. Data format: Float–Value (4 Byte) Value range: –120.0, 0.0 sec …. 100.0 sec Default value: –120.0 (Auto)
DEVIATION Setpoint deviation Read only	53	Deviation between 'setpoint' and 'readback' in % of the travel span (span between OPEN and CLOSED). See also Fig 5-3. Data format: Float–Value (4 Byte)
DEVIATION_DIAG (Record) General control valve fault	81	The 'general control valve fault test' activates dynamic monitoring of control valve behavior. Condition: The 'Test activation (b – \DEVI)' parameter must be set to 'ON'. During this test, the actual position progress is compared with the guide value and the expected progress. This makes it possible to return to the correct operation of the control valve. If the value recorded during the test for the 'General Control Valve Fault (14 – DEVI)' exceeds one of the three parameterizable thresholds, the unit outputs a diagnostic message. Data format: Record with 6 Parameters (19 Byte)

Transducer Block

Label/Name/Handling	Index (rel.)	Description/Format
1. DEVIATION_ENABLE Test activation (b – \DEVI) Read & Write	81.1	This parameter can be used to activate the 'General control valve fault test' for the dynamic monitoring of control valve behavior. 0: Off – The test is deactivated and the associated test parameters have been removed from the menu. 1: On – The test is active and the test parameters can be set. Data format: Enumerated8 (1 Byte) Default value: 0 = Off
2. DEVIATION_TIME Time constant (b1 – TIM) Read & Write	81.2	This time constant specifies the maximum permissible travel time for the drive. If, during testing, the value for the 'General control valve fault (14 – DEVI)' exceeds the permissible travel time by the value of the parameterizable thresholds, the device outputs a diagnostic message. During automatic initialization of the device, this parameter is set to AUTO, and the time constant (b1 – TIM) derived from the initialization parameters 'Travel time UP' and 'Travel time DOWN'. If this time constant is not sufficient in exceptional cases, the range can be set manually from 1 to 400 seconds. Data format: Integer16 (2 Byte) Value range: 1 …. 400 sec / –120 (Auto) Default value: 120 = Auto
3. DEVIATION_LIMIT Basic limit value (b2 – LIMIT) Read & Write	81.3	A basic limit value can be set in this parameter to indicate how great the variation from model behavior can be. If, during testing, the value for the 'General control valve fault (14 – DEVI)' exceeds one of the three thresholds obtained by multiplying the basic limit value (b2 – LIMIT) by individual step time functions (b3 – FACT1 to b5 – FACT3), the device outputs a diagnostic message. Data format: Float–Value (4 Byte) Value range: 0.1 …. 100.0 Default value: 1.0
4. DEVIATION_FACT1 Limit factor 1 (b3 – FACT1) Read & Write	81.4	Limit factor 1 must be entered in this parameter to obtain threshold 1. (Threshold 1 = Base limit value * Limit factor 1) If the value for the 'General control valve fault (14 – DEVI) exceeds threshold 1 during testing, the device outputs the diagnostic message 'Maintenance required'. This message is only output if threshold 2 or 3 is not exceeded. Data format: Float–Value (4 Byte) Value range: 0.1 …. 100.0 Default value: 5.0

Transducer Block		
Label/Name/Handling	**Index (rel.)**	**Description/Format**
5. DEVIATION_FACT2 Limit factor 2 (b4 – FACT2) Read & Write	81.5	Limit factor 2 must be entered in this parameter to obtain threshold 2. (Threshold 2 = Base limit value * Limit factor 2) If the value for the 'General control valve fault (14 – DEVI) exceeds threshold 1 during testing, the device outputs the diagnostic message 'Maintenance demand'. This message is only output if threshold 3 is not exceeded as well. Data format: Float–Value (4 Byte) Value range: 0.1 …. 100.0 Default value: 10.0
6. DEVIATION_FACT3 Limit factor 3 (b5 – FACT3) Read & Write	81.6	Limit factor 3 must be entered in this parameter to obtain threshold 3. (Threshold 3 = Base limit value * Limit factor 3) If the value for the 'General control valve fault (14 – DEVI) exceeds threshold 1 during testing, the device outputs the diagnostic message 'Maintenance alarm'. Data format: Float–Value (4 Byte) Value range: 0.1 …. 100.0 Default value: 15.0
DEVIATION_VALUE General control valve fault (14 – DEVI) Read only	82	This value for the 'General control valve fault test' provides details of the current dynamically determined deviation from model behavior. If this value exceeds one of the three parameterizable thresholds, the device outputs a diagnostic message. Data format: Float–Value (4 Byte) Default value: 0.0
DEVICE_CONFIG_DATE Configuration date Read & Write	69	The date of the last configuration can be entered in ASCII code in this parameter (e.g. 12.01.2001) Data format: Visible String (16 Byte)
DIAG_EXEC_COMMAND Control PST and average value recording Read only	108	This function can be used to start the Partial Stroke Test, stop it during execution, or to reinitialize after resetting the position controller or start average value recording. 0: No action 1: Initialize PST 2: Execute PST 3: Stop PST 4: Start PosAVG Data format: Enumerated8 (1 Byte) Default value: 0

Transducer Block		
Label/Name/Handling	**Index (rel.)**	**Description/Format**
DIAG_EXT_FLAG_1 Device Diagnosis 1 Read only	99	In this problem description, the field device records information on the partial stroke test and the status monitoring test. Bit 0: Generally fitting disturbance (Limit 1) Bit 1: Generally fitting disturbance (Limit 2) Bit 2: Generally fitting disturbance (Limit 3) Bit 3: Pneumatic leakage (Limit 1) Bit 4: Pneumatic leakage (Limit 2) Bit 5: Pneumatic leakage (Limit 3) Bit 6: Stickiness and friction increased (Limit 1) Bit 7: Stickiness and friction increased (Limit 2) Bit 8: Stickiness and friction increased (Limit 3) Bit 9: End stop monit. bottom exceeded (Limit 1) Bit 10: End stop monit. bottom exceeded (Limit 2) Bit 11: End stop monit. bottom exceeded (Limit 3) Bit 12: End stop monitoring top exceeded (Limit 1) Bit 13: End stop monitoring top exceeded (Limit 2) Bit 14: End stop monitoring top exceeded (Limit 3) Bit 15: Stroke integral (full strokes) exceed. (Limit 1) Bit 16: Stroke integral (full strokes) exceed. (Limit 2) Bit 17: Stroke integral (full strokes) exceed. (Limit 3) Bit 18: Direction changes exceeded (Limit 1) Bit 19: Direction changes exceeded (Limit 2) Bit 20: Direction changes exceeded (Limit 3) Bit 21: Average valve position exceeded (Limit 1) Bit 22: Average valve position exceeded (Limit 2) Bit 23: Average valve position exceeded (Limit 3) Bit 24: PST Reference Time exceeded (Limit 1) Bit 25: PST Reference Time exceeded (Limit 2) Bit 26: PST Reference Time exceeded (Limit 3) Data format: Bit Enumerated32 (4 Byte)
DIAG_EXT_FLAG_2 Device Diagnosis 2 Read only	100	In this problem description, the field device records information on the upper and lower temperatures in the field device. Bit 0: Electronics temperature exceeds limit (Limit 1) Bit 1: Electronics temperature exceeds limit (Limit 2) Bit 2: Electronics temperature exceeds limit (Limit 3) Bit 3: Electronics temp. falls below limit (Limit 1) Bit 4: Electronics temp. falls below limit (Limit 2) Bit 5: Electronics temp. falls below limit (Limit 3) Bit 6: Deadband out of tolerance (Limit 3) Data format: Bit Enumerated8 (1 Byte)
DIAG_EXT_FLAG_ SIMULATION_1 Simulation Device Diagnosis 1 Read & Write	101	The simulation of the diagnostic messages of the device. Meaning of the bits see **DIAG_EXT_FLAG_1** Data format: Bit Enumerated32 (4 Byte)

Transducer Block		
Label/Name/Handling	**Index (rel.)**	**Description/Format**
DIAG_EXT_FLAG_ SIMULATION_2 Simulation Device Diagnosis 2 Read & Write	102	The simulation of the diagnostic messages of the upper and lower temperatures in the field device. Meaning of the bits see **DIAG_EXT_FLAG_2** Data format: Bit Enumerated8 (1 Byte)
DIAG_RESET_FLAG Resetting counter and trend values Read & Write	98	Different counters and trend values can be reset with this job. Bit 0: Reset counter 'Direction change' Bit 1: Reset counter 'Total valve travel' Bit 2: Reset alarm counter Bit 3: Reset alarm 1 counter Bit 4: Reset alarm 2 counter Bit 5: Reset history position Bit 6: Reset history deviation Bit 7: Reset trend position Bit 8: Reset trend deviation Bit 9: Reset trend leakage Bit 10: Reset trend slip–stick Bit 11: Reset trend bottom stop Bit 12: Reset trend top stop Bit 13: Reset trend temperature Bit 14: Reset trend deadband Bit 15: Reset slip-stick value Data format: Bit Enumerated32 (4 Byte)
DIAG_TRACE_DATA (Record) Current trace information	112	Current trace information Data format: Record with 29 Parameters (113 Byte)
1. TRACE_DATA_KENN TRACE-Data block number Read only	112.1	Data block number from the read-in 'trace data block' (see parameter **DIAG_TRACE_ENTRY**) Data format: Unsigned8 (1 Byte) Default value: 0 (No trace data)
2. TRACE_DATA_0 TRACE date 1 Read only	112.2	TRACE date 1 Data format: Float (4 Byte) Default value: 0.0 %
3. TRACE_DATA_1 TRACE date 2 Read only	112.3	TRACE date 2 Data format: Float (4 Byte) Default value: 0.0 %
4. TRACE_DATA_2 to 27. TRACE_DATA_25 TRACE date 3 to TRACE date 26 Read only	112.4 to 112.27	TRACE date 3 to TRACE date 26 Data format: Float (4 Byte) Default value: 0.0 %
28. TRACE_DATA_26 TRACE date 27 Read only	112.28	TRACE date 27 Data format: Float (4 Byte) Default value: 0.0 %

Transducer Block

Label/Name/Handling	Index (rel.)	Description/Format
29. TRACE_DATA_27 TRACE date 28 Read only	112.29	TRACE date 28 Data format: Float (4 Byte) Default value: 0.0 %
DIAG_TRACE_ENTRY Select TRACE–Data block Read & Write	111	Select TRACE–Data: 0: No trace data. TRACE_STEUER_STEUER2 = Only 'actual value'. 1: Trace data 'actual value' 1 to 28 2: Trace data 'actual value' 29 to 56 3: Trace data 'actual value ' 57 to 84 :::::: 34: Trace data 'actual value' 925 to 952 35: Trace data 'actual value' 953 to 980 36: Trace data 'actual value' 981 to 1001 TRACE_STEUER_STEUER2 = 'Actual value' and 'setpoint'. 1: Trace data 'actual value' 1 to 14 Trace data 'setpoint value' 1 to 14 2: Trace data 'actual value' 15 to 28 Trace data 'setpoint value' 15 to 28 3: Trace data 'actual value' 29 to 42 Trace data 'setpoint value' 29 to 42 :::::: 34: Trace data 'actual value' 967 to 980 Trace data 'setpoint value' 967 to 980 71: Trace data 'actual value' 981 to 994 Trace data 'setpoint value' 981 to 994 72: Trace data 'actual value' 995 to 1001 Trace data 'setpoint value' 995 to 1001 Data format: Unsigned8 (1 Byte) Default value: 0
DIAG_TRACE_MELD (Record) Current trace information	110	Current trace information Data format: Record with 5 Parameters (13 Byte)
1. TRACE_MELD_KENN Trace status Read only	110.1	Filed in this status is in which of the 'trace states' the device is in at any given time. 0: Trace mode disabled: The 'trace mode' must be Enabled. 1: Trace mode enabled: The 'trace mode' can be started. 2: Trace mode started: The 'trace mode' has been started in the device. 4: Trace mode stopped: The 'trace mode' has been stopped in the device. Data format: Enumerated8 (1 Byte) Default value: 0 (Trace mode disabled)
2. TRACE_MELD_INDEX Sample period Read only	110.2	This parameter can be used to determine the time interval (in milliseconds) for the current 'device trace data' between two measurement points. Data format: Unsigned32 (4 Byte) Default value: 0

Transducer Block		
Label/Name/Handling	**Index (rel.)**	**Description/Format**
3. TRACE_MELD_ANZ_ WERTE Number of current measured points Read only	110.3	This parameter can be used to determine the number of 'current device trace data' stored in the device. Data format: Unsigned16 (2 Byte) Default value: 0
4. TRACE_MELD_TIME Current trace time Read only	110.4	This parameter can be used to set the device's current recording time (trace time in milliseconds). After starting the 'trace mode' the devices elapsed 'trace time' can be read out. Data format: Unsigned32 (4 Byte) Default value: 0
5. TRACE_STEUER_MODUS Control trace mode Read only	110.5	Control trace mode: 0: Online trace mode 1: Active trace mode Data format: Enumerated16 (2 Byte) Default value: 0
DIAG_TRACE_MESSW (Record) Trace data	113	Current trace information Data format: Record with 2 Parameters (8 Byte)
1. TRACE_MESSW_DATUM1 Trace data 1 Read only	113.1	Entered in this parameter is the current trace reading of channel 1 – trace data 'actual value' (in %) – as at the time of the read out from the device. Data format: Float (4 Byte) Default value: 0.0 %
2. TRACE_MESSW_DATUM2 Trace data 2 Read only	113.2	Entered in this parameter is the current trace reading of channel 1 – trace data 'setpoint value' (in %) – as at the time of the read out from the device. Data format: Float (4 Byte) Default value: 0.0 %
DIAG_TRACE_STEUER (Record) Control DIAG–TRACE	109	The 'trace function' should be used to monitor the behavior of the drive and the instrument and not the process. The device's 'trace mode' refers to a special mode for test purposes, in which all other control and set value specifications are ineffective for the device. If communication is canceled the device automatically exits this 'trace mode'. In the 'trace mode' various test signals can be selected via the 'Signal type' parameter. The 'start trace mode' command initiates generation of this signal as well as its recording. The recording is terminated either automatically (by the device), after expiry of the recording time or by pressing the 'stop trace mode' button. Data format: Record with 7 Parameters (21 Byte)

Transducer Block		
Label/Name/Handling	**Index (rel.)**	**Description/Format**
1. TRACE_STEUER_ STEUER1 Control trace Read & Write	109.1	Before the start the trace mode however, must be enabled using the trace mode. Control trace: 0x00: Select 0x02: Enable trace mode 0x04: Start trace mode 0x10: Stop trace mode 0x01: Disable trace mode Data format: Enumerated8 (1 Byte) Default value: 0 (Select)
2. TRACE_STEUER_ STEUER2 Trace data output mode Read & Write	109.2	The reading to be taken has to be set over the Trace data output mode ' parameter. (siehe Record DIAG_TRACE_DATA). 0: Only 'actual value': Reading only readback 1: 'Actual value' and 'setpoint': Reading readback and setpoint Data format: Enumerated16 (2 Byte) Default value: 0 (Only 'actual value')
3. TRACE_STEUER_TIME Trace recording Time Read & Write	109.3	This parameter can be used to set the recording time (trace time in sec.) for the device. Once this recording time has expired the 'Trace mode' in the device is automatically terminated and the trace data can be read out of the device. Data format: Unsigned32 (4 Byte) Default value: 0
4. TRACE_STEUER_ANREG Trace stimulation Read & Write	109.4	This parameter can be used to set the device's 'trace mode'. The following operating modes are available: 0: Online mode. [No active trace mode. Only recording trace parameters.] 1: Go to Target value [A set value jump to the parameterizable end value is generated.] 2: Single step [A set value jump with a parameterizable 'step size' is generated.] 3: Multiple steps (Target value) [The set value stimulation consists of a stepped ramp with a parameterizable end value, (individual) step level and (ramp) steepness.] 4: Multiple steps (Total step size) [The set value stimulation consists of a stepped ramp (step) with a parameterizable (total) step level, (individual) step level and (ramp) steepness.] 5: Multiple steps (up/down) [This stimulation acts similar to the 'Multiple steps (rel.)' stimulation, but after reaching the step level it returns to the starting value (triangular shape). Data format: Enumerated16 (2 Byte) Default value: 0 (Online mode)

Transducer Block		
Label/Name/Handling	**Index (rel.)**	**Description/Format**
5. TRACE_STEUER_PAR1 Trace stimulations parameter 1 Read & Write	109.5	In this parameter must be entered. Trace stimulation: • Online mode: None. • Go to Target value: Target value. • Single step: Step size. • Multiple steps (Target value): Ramp end value. • Multiple steps (Total step size): Total step size. • Multiple steps (up/down): Total step size. Data format: Float–Value (4 Byte) Default value: 0.0
6. TRACE_STEUER_PAR2 Trace stimulations parameter 2 Read & Write	109.6	In this parameter must be entered. Trace stimulation: • Online mode: None. • Go to Target value: None. • Single step: None. • Multiple steps (Target value): Single step size. • Multiple steps (Total step size): Single step size. • Multiple steps (up/down): Single step size. Data format: Float–Value (4 Byte) Default value: 0.0
7. TRACE_STEUER_PAR3 Trace stimulations parameter 3 Read & Write	109.7	In this parameter must be entered. Trace stimulation: • Online mode: None. • Go to Target value: None. • Single step: None. • Multiple steps (Target value): Rate of change. • Multiple steps (Total step size): Rate of change. • Multiple steps (up/down): Rate of change. Data format: Float–Value (4 Byte) Default value: 0.0
DIRCHANGE_DIAG (Record) Directional change	95	This test, which facilitates preventive maintenance of the control valve, continuously monitors the number of directional changes of the final controlling element (all directional changes from the dead zone). Condition: The 'Test activation (O – \DCHG)' parameter must be set to 'ON'. If, during testing, the 'Number of directional changes (2 – CHDIR)' counter exceeds one of the three parameterizable thresholds, the device outputs a diagnostic message. Data format: Record with 5 Parameters (17 Byte)

Transducer Block

Label/Name/Handling	Index (rel.)	Description/Format
1. DIRCHANGE_ENABLE Test activation (O – \DCHG) Read & Write	95.1	This parameter can be used to activate the test for monitoring excess directional change. 0: Off – The test is deactivated and the associated test parameters have been removed from the menu. 1: On – The test is active and the test parameters can be set. Data format: Enumerated8 (1 Byte) Default value: 0 = Off
2. DIRCHANGE_LIMIT Basic limit value (O1 – LIMIT) Read & Write	95.2	A base limit value for the number of directional changes of the drive (all changes originating from the dead zone). The three thresholds are derived from the base value by multiplying it by the limit value factors. If the Number of directional changes counter (2 – CHDIR) exceeds one of the three thresholds, the device outputs a diagnostic message. Data format: Unsigned32 (4 Byte) Value range: 0 …. 100000000 Default value: 1000000
3. DIRCHANGE_FACT1 Limit factor 1 (O2 – FACT1) Read & Write	95.3	Limit factor 1 must be entered in this parameter to obtain threshold 1. (Threshold 1 = Basic limit value * Limit factor 1.) If, during testing, the Number of directional changes counter (2 – CHDIR) exceeds threshold 1, the device outputs the diagnostic message 'Maintenance required'. This message is only output if threshold 2 or 3 is not exceeded. Data format: Float–Value (4 Byte) Value range: 0.1 …. 40.0 Default value: 1.0
4. DIRCHANGE_FACT2 Limit factor 2 (O3 – FACT2) Read & Write	95.4	Limit factor 2 must be entered in this parameter to obtain threshold 2. (Threshold 2 = Basic limit value * Limit factor 2.) If, during testing, the Number of directional changes counter (2 – CHDIR) exceeds threshold 2, the device outputs the diagnostic message 'Maintenance required'. This message is only output if threshold 3 is not exceeded as well. Data format: Float–Value (4 Byte) Value range: 0.1 …. 40.0 Default value: 2.0
5. DIRCHANGE_FACT3 Limit factor 3 (O4 – FACT3) Read & Write	95.5	Limit factor 3 must be entered in this parameter to obtain threshold 3. (Threshold 3 = Basic limit value * Limit factor 1.) If, during testing, the Number of directional changes counter (2 – CHDIR) exceeds threshold 3, the device outputs the diagnostic message 'Maintenance alarm'. Data format: Float–Value (4 Byte) Value range: 0.1 …. 40.0 Default value: 5.0

Transducer Block		
Label/Name/Handling	**Index (rel.)**	**Description/Format**
END_VALUE_P100 End value P100(current) Read only	72	This value indicates the way measured value (value of the potentiometer voltage in %) at the top hard stop as it was determined in automatic initialization. In manual initialization the value of the manually reached upper limit position is indicated here. Data format: Float–Value (4 Byte)
EXT_DIAG Activating advanced diagnosis (44 – XDIAG) Read & Write	72	If parameter '44 – XDIAG' is 'Off', extended diagnostics is deactivated. There are three operating modes for activating extended diagnostics: 0: Off. (Diagnostics is deactivated.) 1: On1 (Threshold limit 3 messages are sent via the fault message output.) 2: On2: (Threshold limit 2 messages are sent via alarm output 2 and threshold limit 3 messages, as well as via the fault message output.) 3: On3: (Threshold limit 1 messages are sent via alarm output 1, threshold limit 2 messages via alarm output 2 and threshold limit 3 messages, as well as via the fault message output. Selecting either of these 'On' operating modes switches on extended diagnostics and activates the extended diagnostics menu items. Data format: Enumerated8 (1 Byte) Default value: 0 = Off
FAULT_FUNCT Function fault output (\FCT) Read & Write	43	The fault message output on the optional alarm module serves as a group message for different controller faults. This fault message output can also signal when the position controller is not in automatic mode or the binary input (BIN_IN_FUNCT) is activated. The fault message is also reported by BIN_STATUS. • Normal means: High level without fault. • Inverted means: Low level without fault. • The character '+' means a logic OR operation. 0: \ Fault 1: \nA (Fault + not automatic) 2: \nAb (Fault + not automatic + binary input) 3: –\ (Fault / inverted) 4: –\nA (Fault + not automatic / inverted) 5: –\nAb (Fault + not automatic + BI / inverted) Data format: Unsigned8 Default value: 0 (\ Fault)

Transducer Block		
Label/Name/Handling	**Index (rel.)**	**Description/Format**
FAULT_MESSAGE State of fault messages Read only	52	The FAULT_MESSAGE shows different controller faults: Bit 0: System deviation Bit 1: No automatic Bit 2: Binary input Bit 3: \STRK exceeded Bit 4: \DCHG exceeded Bit 5: \ZERO exceeded Bit 6: \OPEN exceeded Bit 7: \DEBA exceeded Bit 8: \PST exceeded Bit 9: \DEVI exceeded Bit 10: \LEAK exceeded Bit 11: \STIC exceeded Bit 12: \TMIN exceeded Bit 13: \TMAX exceeded Bit 14: \PAVG exceeded Data format: Bit–String with 16 Bits (2 Byte)
FINAL_POSITION_VALUE (Record) Final Position Value	17	The actual valve position and status, linked to the READBACK in the AO block. Data format: Record with 2 Parameters (5 Byte)
1. STATUS QUALITY Status SUBSTA-TUS Read & Write LIMITS	17.1	The status of the value. This additional, valuable information will be passed along with each transmission of a data value in the form of a status attribute. Status can be: Bad / Out of Service / Not limited, when the block is in mode O/S. Good (Cascade) / Local Override / Not limited, when local key switches are used to move the valve. Good (Cascade) / Non–specific / Not limited, in normal operation. See PID–Block → BKCAL_IN Data format: Unsigned8
2. VALUE Value Read & Write	17.2	The actual valve position, calculated backward from the position sensor. A programed linearization characteristics (CHARACT_TYPE) and travel limits (TRAVEL_LIMIT_DOWN / UP) are taken into account. Normaly, the range is from 0 to 100%. If FINAL_VALUE_CUTTOFF_HI /LO are used, the range can exceed. Data format: Float–Value (4 Byte)
FINAL_VALUE (Record) Final Value	13	The proposed valve position and status, linked to the OUT of the AO block. If the AO is in mode O/S this value can be written directly. Data format: Record with 2 Parameters (5 Byte)

Transducer Block			
Label/Name/Handling		**Index (rel.)**	**Description/Format**
1. STATUS	QUALITY	13.1	The status has to be Good (Cascade) / Non–specific, that the transducer block will accept the value.
Status	SUBSTA-TUS		See PID–Block → BKCAL_IN
Read & Write	LIMITS		
2. VALUE Value Read & Write		13.2	The proposed valve position. A programed linearization characteristics (CHARACT_TYPE) and travel limits (TRAVEL_LIMIT_DOWN / UP) are taken into account. The range is from 0 to 100%. Data format: Float–Value (4 Byte)
FINAL_VALUE_ CUTTOFF_HI Final Value Hi Cutoff Read & Write		15	If the FINAL_VALUE is more positive than this value, the valve is forced to full opened. Data format: Float–Value (4 Byte) Value range: 0.0 …. 100.0 Default value: 1.#INF (Not active)
FINAL_VALUE_ CUTTOFF_LO Final Value Lo Cutoff Read & Write		16	If the FINAL_VALUE is more negative than this value, the valve is forced to full closed. Data format: Float–Value (4 Byte) Value range: 0.0 …. 100.0 Default value: –1.#INF (Not active)
FINAL_VALUE_RANGE (Record) Final Value Range		14	The High and Low range limit values, the engineering units code and the number of digits to the right of the decimal point to be used to display the Final Value. Data format: Record with 4 Parameters (11 Byte)
1. EU_100 EU at 100% Read & Write		14.1	The engineering unit value which represents the upper end of range of the associated block parameter. Data format: Float–Value (4 Byte) Value range: Only 100.0 % possible Default value: 100.0
2. EU_0 EU at 0% Read & Write		14.2	The engineering unit value which represents the lower end of range of the associated block parameter. Data format: Float– Value (4 Byte) Value range: Only 0.0 % possible Default value: 0.0
3. UNITS_INDEX Units Index Read & Write		14.3	Device Description units code index for the engineering unit descriptor for the associated block value. Data format: Unsigned16 Value range: Only % possible Default value: % (1342)
4. DECIMAL Decimal Read & Write		14.4	The number of digits to the right of the decimal point which should be used by an interface device in displaying the specified parameter. Data format: Unsigned8 Default value: 1

Transducer Block

Label/Name/Handling	Index (rel.)	Description/Format
HISTORY_ALL (Record) Histograms	104	Histograms Data format: Record with 23 Parameters (86 Byte)
1. HISTORY_KENN Current Histogram Read only	104.1	Current Histogram: 0: No valid Histogram 1: Histogram: Position 2: Histogram: Deviation 3: Histogram: Temperature Data format: Enumerated16 (2 Byte) Default value: 0 (No valid Histogram)
2. HISTORY_DIM Dimension Read only	104.2	Histogram Dimension 0000: blank 1342: % 1001: °C 1002: °F 1054: sec 1058: min 1059: h 1060: Day 1061: Months Data format: Enumerated16 (2 Byte) Default value: 0 (blank)
3. HISTORY_ANZ Number of valid values for 'Actual Histogram' Read only	104.3	Number of valid values for 'Actual Histogram' Data format: Unsigned16 (2 Byte) Value range: 0 …. 20 Default value: 0
4. HISTORY_VALUE_1 Histogram value 1 Read only	104.4	Histogram value 1 Data format: Unsigned32 (4 Byte) Default value: 0
5. HISTORY_VALUE_2 Histogram value 2 Read only	104.5	Histogram value 2 Data format: Unsigned32 (4 Byte) Default value: 0
6. HISTORY_VALUE_3 **to** **21. HISTORY_VALUE_18** Histogram value 3 to Histogram value 18 Read only	104.6 to 104.21	Histogram value 3 to Histogram value 18 Data format: Unsigned32 (4 Byte) Default value: 1 (Ready)
22. HISTORY_VALUE_19 Histogram value 19 Read only	104.22	Histogram value 19 Data format: Unsigned32 (4 Byte) Default value: 0
23. HISTORY_VALUE_20 Histogram value 20 Read only	104.23	Histogram value 20 Data format: Unsigned32 (4 Byte) Default value: 0

Transducer Block		
Label/Name/Handling	**Index (rel.)**	**Description/Format**
HISTORY_INDEX Select Histogram Write only	103	After the history is selected, values are read out of the device automatically. 0: No valid Histogram 1: Histogram: Position 2: Histogram: Deviation 3: Histogram: Temperature Data format: Enumerated16 (2 Byte)
INIT_VALUES (Record) Initialization parameters	77	The initialization data of a positioner can be read out and transmitted to another positioner. Therefore it is possible to exchange a defective device without interrupting the running process by an initialization. After downloading the INIT_VALUES to a not–initialization device, the initialization state must be set to INIT by SERVICE_UPDATE. For correct operation of the positioner execute SELF_CALIB_COMMAND as soon as possible. Data format: Record with 17 Parameters (28 Byte)
1. INIT_SLIP_CLUTCH_ ADJ_FLAG Slip clutch adjustment flag Read & Write	77.1	This flag indicates whether the slip clutch has been adjusted. Data format: Unsigned8
2. INIT_SAFTY_ POSITION_FLAG Safety position flag Read & Write	77.2	This flag indicates the direction of the safety position. Data format: Unsigned8
3. INIT_PULS_LENGTH_UP Pulse length 'UP' Read & Write	77.3	This value indicates the current pulse length for the up direction (in ms). This is the smallest pulse length with which movement of the actuator in the up direction can be achieved. Data format: Unsigned8
4. INIT_PULS_LENGTH_ DOWN Pulse length 'DOWN' Read & Write	77.4	This value indicates the current pulse length for the down direction (in ms). This is the smallest pulse length with which movement of the actuator in the down direction can be achieved. Data format: Unsigned8
5. INIT_ACT_TIME_UP Actuating time 'UP' Read & Write	77.5	This value indicates the current upward actuating time (in seconds). Data format: Unsigned16
6. INIT_ACT_TIME_ DOWN Actuating time 'DOWN' Read & Write	77.6	This value indicates the current downward actuating time (in seconds). Data format: Unsigned16
7. INIT_SERVO_GAIN_ DOWN Short step zone 'DOWN' Read & Write	77.7	This value indicates the current short step zone of the positioner for the down direction. The short step zone is the range of the positioner in which pulse–type control signals are output. The pulse length is proportional to the system deviation. If the system deviation is outside the short step zone, the valves are controlled with maintained contact. Data format: Signed16

Transducer Block		
Label/Name/Handling	**Index (rel.)**	**Description/Format**
8. INIT_SERVO_GAIN_UP Short step zone 'UP' Read & Write	77.8	This value indicates the current short step zone of the positioner for the up direction. The short step zone is the range of the positioner in which pulse–type control signals are output. The pulse length is proportional to the system deviation. If the system deviation is outside the short step zone, the valves are controlled with maintained contact. Data format: Signed16
9. INIT_REF_VALUE_ HORIZ_LEVER Reference value for horizontal lever Read & Write	77.9	This is the reference value for correction in the case of linear actuators. Data format: Signed16
10. INIT_ZERO_POINT_P0 Zero point P0 Read & Write	77.10	This is the current position detection value (potentiometer voltage in %) at the lower stop. Data format: Unsigned16
11. INIT_END_VALUE_P100 End stop P100 Read & Write	77.11	This is the current position detection value (potentiometer voltage in %) at the upper stop. Data format: Signed16
12. INIT_PREDICTION_UP Prediction 'UP' Read & Write	77.12	This value specifies the prediction horizon of the positioner for the updward movement. Data format: Signed16
13. INIT_PREDICTION_ DOWN Prediction 'DOWN' Read & Write	77.13	This value specifies the prediction horizon of the positioner for the downward movement. Data format: Signed16
14. INIT_DEAD_ZONE_ ADAPT_TIME Dead zone adaptation time Read & Write	77.14	This value indicates the adaptation time for the dead zone. Data format: Unsigned16
15. INIT_RATED_TRAVEL Real travel Read & Write	77.15	This value indicates the current real travel (in mm or °). It corresponds to the display at the end of initialization. Prerequisite in the case of linear actuators: The lever is specified with the TRANSM_LENGTH parameter. Data format: Unsigned16
16. INIT_ROTARY_ACT_ END_FLAG Rotary actuator end stop flag Read & Write	77.16	This flag indicates whether the end stop of the rotary actuator has been reached. Data format: Unsigned8
17. INIT_INTERPULSE_ PERIODE_LEN Interpulse period length Read & Write	77.17	This value indicates the min. interpulse period length. Data format: Unsigned8

Transducer Block

Label/Name/Handling	Index (rel.)	Description/Format
LEAKAGE Leakage(current) Read only	75	This value indicates the current leakage (in %/min) if leakage measurement was specified during initialization. Data format: Float–Value (4 Byte)
LEAKAGE_DIAG (Record) Leakage pneumatic	83	Any leakage present can be detected with the 'Pneumatic Leakage Test'. Condition: The 'Test activation (C – \LEAK)' parameter must be set to 'ON'. During this test and dependent on direction, the position change and the internal manipulated variable are recorded. This provides a coefficient which allows the detection of any leakage present. Caution: This test can only be used with simple drives. If the 'Current leakage value (15 – ONLK)' exceeds one of the three parameterizable thresholds during testing, the device outputs a diagnostic message. Data format: Record with 5 Parameters (17 Byte)
1. LEAKAGE_ENABLE Test activation (C – \LEAK) Read & Write	83.1	This parameter is used to activate the leakage test for the detection of pneumatic leaks. 0: Off – The test is deactivated and the associated test parameters have been removed from the menu. 1: On – The test is active and the test parameters can be set. Data format: Enumerated8 (1 Byte) Default value: 0 = Off
2. LEAKAGE_LIMIT Limit value for leakage coefficient (C1 – LIMIT) Read & Write	83.2	The limit value of the leakage coefficient can be set in this parameter. Care should however be taken to insure that there is no leakage below a coefficient of 30.0. You are advised to carry out a ramp test after automatic initialization of the device. The ramp should cover the standard operating range of the valve and correspond in steepness to the approximate dynamic criteria of the application. During the test, the parameter 'Current leakage coefficient (15 – ONLK)' gives details of the current values. This allows the limit value for the leakage coefficient to be determined. Data format: Float–Value (4 Byte) Value range: 0.1 …. 100.0 Default value: 30.0
3. LEAKAGE_FACT1 Limit factor 1 (C2 – FACT1) Read & Write	83.3	Limit factor 1 must be entered in this parameter to obtain threshold 1. (Threshold 1 = Leakage coefficient limit value * limit value factor 1.) If, during testing, the current leakage coefficient (15 – ONLK) exceeds threshold 1, the device outputs the diagnostics message 'Maintenance required'. This message is only output if threshold 2 or 3 is not exceeded. Data format: Float–Value (4 Byte) Value range: 0.1 …. 100.0 Default value: 1.0

Transducer Block		
Label/Name/Handling	**Index (rel.)**	**Description/Format**
4. LEAKAGE_FACT2 Limit factor 2 (C3 – FACT2) Read & Write	83.4	Limit factor 2 must be entered in this parameter to obtain threshold 2. (Threshold 2 = Leakage coefficient limit value * limit value factor 2.) If, during testing, the current leakage coefficient (15 – ONLK) exceeds threshold 2, the device outputs the diagnostics message 'Maintenance demand'. This message is only output if threshold 3 is not exceeded as well. Data format: Float–Value (4 Byte) Value range: 0.1 …. 100.0 Default value: 1.5
5. LEAKAGE_FACT3 Limit factor 3 (C4 – FACT3) Read & Write	83.5	Limit factor 3 must be entered in this parameter to obtain threshold 3. (Threshold 3 = Leakage coefficient limit value * limit value factor 3.) If, during testing, the current leakage coefficient (15 – ONLK) exceeds threshold 3, the device outputs the diagnostics message 'Maintenance alarm'. Data format: Float–Value (4 Byte) Value range: 0.1 …. 100.0 Default value: 2.0
MAINTENANCE_DATE Maintenance date Read & Write	70	The date on which the valve was last serviced can be entered in ASCII code in this parameter (e.g. 12.01.2001) Data format: Visible String (16 Byte)
MAX_TEMPERATURE Maximum temperature / TMAX Read only	59	This value indicates the maximum temperature inside the housing. The value is written to non–volatile memory every 15 minutes in the form of a drag pointer. The maximum temperature can be displayed in °C or °F depending on the TEMPERATURE_UNIT setting. Data format: Float–Value (4 Byte)
MIN_TEMPERATURE Minimum temperature / TMIN Read only	60	This value indicates the minimum temperature inside the housing. The value is written to non–volatile memory every 15 minutes in the form of a drag pointer. The minimum temperature can be displayed in °C or °F depending on the TEMPERATURE setting. Data format: Float–Value (4 Byte)
MODE_BLK (Record) Block Mode	5	The actual, target, permitted, and normal modes of the block. Data format: Record with 4 Parameters (4 Byte)
1. TARGET Target Read & Write	5.1	This is the mode requested by the operator. Target Mode is limited to the values allowed by the permitted mode parameter. Bit 3: Auto (Automatic Mode) Bit 7: O/S (Out Of Service) Data format: Bit–String with 8 Bits (1 Byte)
2. ACTUAL Actual Read only	5.2	This is the current mode of the block, which may differ from the target based on operating conditions. Its value is calculated as part of block execution. Bit 3: Auto (Automatic Mode) Bit 7: O/S (Out Of Service) Data format: Bit–String with 8 Bits (1 Byte)

Transducer Block		
Label/Name/Handling	**Index (rel.)**	**Description/Format**
3. PERMITTED Permitted Read & Write	5.3	Defines the modes which are allowed for an instance of the block. The permitted mode is configured based on application requirement. Bit 3: Auto (Automatic Mode) Bit 7: O/S (Out Of Service) Data format: Bit–String with 8 Bits (1 Byte) Default value: 0x11 (Auto | O/S)
4. NORMAL Normal Read & Write	5.4	This is the mode which the block should be set to during normal operating conditions. Bit 3: Auto (Automatic Mode) Data format: Bit–String with 8 Bits (1 Byte) Default value: 0x10 (Auto)
NUMBER_ALARMS Number of alarms (\CNT} Read only	62	All faults during operation are totalized and can be read here as 'Number of fault messages'. The value is written to non–volatile memory every 15 minutes and can be reset to zero with the parameter SERVICE_UPDATE. Data format: Unsigned32 Value range: 0 …. 1,000,000,000
NUMBER_ALARMS_1 Number of alarm 1 (A1CNT) Read only	63	Every response of Alarm 1 is totalized in operation and can be read here as 'Number of Alarm 1'. The prerequisite for this is that this alarm is activated with the parameter ALARM_FUNCT. The value is written to non–volatile memory every 15 minutes and can be reset to zero with the parameter SERVICE_UP-DATE. Data format: Unsigned32 Value range: 0 …. 1,000,000,000
NUMBER_ALARMS_2 Number of alarm 2 (A2CNT) Read only	64	Every response of Alarm 2 is totalized in operation and can be read here as 'Number of Alarm 2'. The prerequisite for this is that this alarm is activated with the parameter ALARM_FUNCT. The value is written to non–volatile memory every 15 minutes and can be reset to zero with the parameter SERVICE_UP-DATE. Data format: Unsigned32 Value range: 0 …. 1,000,000,000
NUMBER_CYCLES_ VALVE_1 Number of cycles valve 1 (VENT 1) Read only	65	This counter counts the control cycles of pilot valve 1. The value is written to non–volatile memory every 15 minutes. Data format: Unsigned32 Value range: 0 …. 1,000,000,000
NUMBER_CYCLES_ VALVE_2 Number of cycles valve 2 (VENT 2) Read only	66	This counter counts the control cycles of pilot valve 2. The value is written to non–volatile memory every 15 minutes. Data format: Unsigned32 Value range: 0 …. 1,000,000,000

Transducer Block		
Label/Name/Handling	**Index (rel.)**	**Description/Format**
NUMBER_DIRECTION_ CHANGE Number of direction changes (CHDIR) Read only	67	During operation, all changes in direction are totaled and can be read here as 'Number of changes in direction' The value is written to non–volatile memory every 15 minutes and can be reset to zero with the parameter SERVICE_ UPDATE. Data format: Unsigned32 Value range: 0 …. 1,000,000,000
ONLINE_LEAKAGE_VALUE Current leakage coefficient (15 – ONLK) Read only	84	The current leakage coefficient is shown in this parameter. Care should be taken to insure that there is no leakage below a coefficient of 30.0. Leakage can be expected above this limit. Data format: Float–Value (4 Byte) Default value: 0.0
OPEN_DIAG (Record) Top stop	90	This test continuously monitors the shift of the top stop. Condition: The 'Test activation (G – \OPEN)' parameter must be set to 'ON'. The test always takes place when the valve is in the 'Sealing top' position. A check is made as to whether the top stop has changed from its value on initialization (end stop P100). If 'Top stop shift (18 – OPEN)' exceeds one of the three parameterizable thresholds during testing, the device outputs a diagnostic message. Data format: Record with 4 Parameters (13 Byte)
1. OPEN_ENABLE Test activation (G – \OPEN) Read & Write	90.1	This parameter can be used to activate the test for monitoring the top stop. 0: Off – The test is deactivated and the associated test parameters have been removed from the menu. 1: On – The test is active and the test parameters can be set. Data format: Enumerated8 (1 Byte) Default value: 0 = Off
2. OPEN_LEVEL1 Threshold 1 (G1 – LEVL1) Read & Write	90.2	Threshold 1 for monitoring the top hard stop must be entered in this parameter. If the valve is in the 'Sealing top' position, there is a check as to whether the top stop has changed from its value on initialization (end stop P100). If 'Shift of top stop (18 – OPEN)' exceeds threshold 1, the device outputs the diagnostic message 'Maintenance required'. This message is only output if threshold 2 or 3 is not exceeded. Data format: Float–Value (4 Byte) Value range: 0.1 …. 10.0 Default value: 1.0

Transducer Block		
Label/Name/Handling	**Index (rel.)**	**Description/Format**
3. OPEN_LEVEL2 Threshold 2 (G2 – LEVL2) Read & Write	90.3	Threshold 2 for monitoring the top hard stop must be entered in this parameter. If the valve is in the 'Sealing top' position, there is a check as to whether the top stop has changed from its value on initialization (end stop P100). If 'Shift of top stop (18 – OPEN)' exceeds threshold 2, the device outputs the diagnostic message 'Maintenance demand'. This message is only output if threshold 3 is not exceeded as well. Data format: Float–Value (4 Byte) Value range: 0.1 …. 10.0 Default value: 2.0
4. OPEN_LEVEL3 Threshold 3 (G3 – LEVL3) Read & Write	90.4	Threshold 3 for monitoring the top hard stop must be entered in this parameter. If the valve is in the 'Sealing top' position, there is a check as to whether the top stop has changed from its value on initialization (end stop P100). If 'Shift of top stop (18 – OPEN)' exceeds threshold 3, the device outputs the diagnostic message 'Maintenance alarm'. Data format: Float–Value (4 Byte) Value range: 0.1 …. 10.0 Default value: 4.0
OPEN_VALUE Current top stop shift (18 – OPEN) Read only	91	This parameter indicates the current shift of the top hard shop from its value on initialization (end stop P100). Data format: Float–Value (4 Byte) Default value: 0.0
POS_AVG (Record) Average position value	97	This test continuously monitors the device drive. This test facilitates the calculation within a predetermined time interval (P1 – TBASE) of an average reference value (P2 – STATE) for progressive position changes, and individual average position values (19 – PAVG) in subsequent intervals. Data format: Record with 3 Parameters (9 Byte)
1. POS_AVG_STATUS Average value compilation status Read only	97.1	This description indicates the status of the average value compilation. 1: Ready 2: Determining the reference value 3: Determining the position average value 4: Value is valid Data format: Enumerated8 (1 Byte) Default value: 1 (Ready)
2. POS_AVG_REF Reference average value (P2 – STATE) Read only	97.2	Once the 'Position average value over time' test has started, average value compilation should be started so the reference value (P2 – STATE) can be established. A set time (P1 – TBASE) is then used to calculate a position average value (19 – PAVG) which is compared with the reference value. Data format: Float–Value (4 Byte) Default value: 0.0

Transducer Block		
Label/Name/Handling	**Index (rel.)**	**Description/Format**
3. POS_AVG_VALUE Position average value (19 – PAVG) Read only	97.3	This parameter shows the last calculated position average value. This value (19 – PAVG) is calculated over a set time (P1 – TBASE) and compared with the reference value (P2 – STATE) at the end of the time." Data format: Float–Value (4 Byte) Default value: 0.0
POS_AVG_DIAG (Record) Average position value over time	96	This test continuously monitors the device drive. It is a condition that the 'Test activation (P – \PAVG)' parameter is set to 'ON'. Average value recording can then be started. This test facilitates the calculation within a predetermined time interval (P1 – TBASE) of an average reference value (P2 – STATE) for progressive position changes, and individual average position values (19 – PAVG) in subsequent intervals. If the average position value deviates from the reference value and exceeds the difference with one of the three parameterizable thresholds, the device outputs a diagnostic message. Data format: Record with 5 Parameters (14 Byte)
1. POS_AVG_ENABLE Test activation (P– \PAVG) Read & Write	96.1	This parameter can be used to activate the 'Position average value over time' test. 0: Off – The test is deactivated and the associated test parameters have been removed from the menu. 1: On – The test is active and the test parameters can be set. Data format: Enumerated8 (1 Byte) Default value: 0 = Off
2. POS_AVG_TIME_BASE Time basis for av. Value calculation (P1 – TBASE) Read & Write	96.2	This parameter can be used to set an interval between 0.5 seconds and 2.5 years for the calculation of the position average value. After the estimation has been started and the time interval (e.g. 0.5 hours) has expired, a position average value (19 – PAVG) is compiled over the interval and compared with a reference value (P2 – STATE). The test is then restarted. 0: Time basis = 0.5 hours 1: Time basis = 8 hours 2: Time basis = 5 days 3: Time basis = 60 days 4: Time basis = 2.5 years Data format: Enumerated8 (1 Byte) Default value: 0 (0.5 hours)

Transducer Block		
Label/Name/Handling	**Index (rel.)**	**Description/Format**
3. POS_AVG_LEVEL1 Threshold 1 (P3 – LEVL1) Read & Write	96.3	Threshold 1 for monitoring the current position average value must be entered in this parameter. If, during testing, the current value (19 – PAVG) deviates from the reference value (P2 – STATE) by more than the amount of threshold 1, the device outputs the diagnostic message 'Maintenance required'. This message is only output if threshold 2 or 3 is not exceeded. Data format: Float–Value (4 Byte) Value range: 0.1 …. 100.0 Default value: 2.0
4. POS_AVG_LEVEL2 Threshold 2 (P4 – LEVL2) Read & Write	96.4	Threshold 2 for monitoring the current position average value must be entered in this parameter. If, during testing, the current value (19 – PAVG) deviates from the reference value (P2 – STATE) by more than the amount of threshold 2, the device outputs the diagnostic message 'Maintenance demand'. This message is only output if threshold 3 is not exceeded as well. Data format: Float–Value (4 Byte) Value range: 0.1 …. 100.0 Default value: 5.0
5. POS_AVG_LEVEL3 Threshold 3 (P5 – LEVL3) Read & Write	96.5	Threshold 3 for monitoring the current position average value must be entered in this parameter. If, during testing, the current value (19 – PAVG) deviates from the reference value (P2 – STATE) by more than the amount of threshold 3, the device outputs the diagnostic message 'Maintenance alarm'. Data format: Float–Value (4 Byte) Value range: 0.1 …. 100.0 Default value: 10.0
PREV_CALIB_VALUES (Record) Calibration information	76	Information of the last calibration can be stored in this parameter by SERVICE_UPDATE. Data format: Record with 11 Parameters (44 Byte)
1. PREV_ZERO_POINT_P0 Zero point P0(old) Read only	76.1	This is the position detection value (potentiometer voltage in %) measured at the lower limit, as determined at the last service. Data format: Float–Value (4 Byte)
2. PREV_END_VALUE_P100 End value P100(old) Read only	76.2	This is the position detection value (potentiometer voltage in %) measured at the upper limit, as determined at the last service. Data format: Float–Value (4 Byte)
3. PREV_ACT_TIME_UP Actuating time 'UP'(old) Read only	76.3	This value indicates the upward actuating time (in seconds) determined during the last service. Data format: Float–Value (4 Byte)
4. PREV_ACT_TIME_DOWN Actuating time 'DOWN'(old) Read only	76.4	This value indicates the downward actuating time (in seconds) determined during the last service. Data format: Float–Value (4 Byte)

Transducer Block		
Label/Name/Handling	**Index (rel.)**	**Description/Format**
5. PREV_PULSE_ LENGTH_UP Pulse length 'UP'(old) Read only	76.5	This value indicates the current pulse length for the up direction (in ms) determined during the last service. This is the shortest pulse length with which movement of the actuator in the up direction can be achieved. Data format: Float–Value (4 Byte)
6. PREV_PULSE_ LENGTH_DOWN Pulse length 'DOWN'(old) Read only	76.6	This value indicates the current pulse length for the down direction (in ms) determined during the last service. This is the shortest pulse length with which movement of the actuator in the down direction can be achieved. Data format: Float–Value (4 Byte)
7. PREV_DEADBAND Dead zone(old) Read only	76.7	This value indicates the dead zone of the positioner in % determined during the last service. Data format: Float–Value (4 Byte)
8. PREV_SERVO_GAIN_ DOWN Servo gain 'DOWN'(old) Read only	76.8	Gain value of the servo controller 'DOWN'. Data format: Float–Value (4 Byte)
9. PREV_SERVO_GAIN_UP Servo gain 'UP'(old) Read only	76.9	Gain value of the servo controller 'UP'. Data format: Float–Value (4 Byte)
10. PREV_RATED_TRAVEL Real positioning travel(old) Read only	76.10	This value indicates the real positioning travel (in mm or °) determined during the last service. Data format: Float–Value (4 Byte)
11. PREV_LEAKAGE Leakage(old) Read only	76.11	This value indicates the leakage (in %/min) determined during the last maintenance. Data format: Float–Value (4 Byte)
PST (Record) Partial-Stroke-Test parameters	80	A cyclic or manual partial stroke test of open, closed and modulating valves can be carried out using the Partial Stroke Test. Condition: The 'Test Activation (A – \PST)' parameter must be set to 'ON'. During this test, the drive is taken from its start position to a target position and simultaneously analyzed. If, during the test, the measured step time (11 – PST) exceeds one of the three parameterizable thresholds, the device outputs a diagnostic message. Data format: Record with 7 Parameters (19 Byte)

Transducer Block

Label/Name/Handling	Index (rel.)	Description/Format
1. PST_REF_TIME Reference step time (A6 – PSTIN) Read only	80.1	The step reference time for the partial stroke test is shown here, and must always be referenced to the associated 'Step reference time status' display. The estimated average travel time of the control valve is displayed after the device is initialized. This time can be used as a step reference time, but only represents a rough value. It is therefore recommended to measure the step reference time (time taken to move from the starting position to the target position) after specifying the partial stroke test. If the starting position cannot be determined or the jump destination reached, the 'Step reference time status' display reads 'Reference time measurement failed'. Data format: Float–Value (4 Byte) Value range: 0.0 …. 100.0 sec Default value: 0.0 sec
2. PST_REF_STATE Step reference time status Read only	80.2	This parameter represents the step reference time status (A6 – PSTIN). The following status descriptions are possible: 0: Reference time estimated: After device initialization, the calculated (estimated) average travel time of he control valve is shown in the 'Step reference time' parameter (A6 – PSTIN). 1: Reference time measurement failed: The 'Step reference time' (A6 – PSTIN' could not be determined. 2: Reference time measured: The measured step reference time (movement from starting position to target position) is shown in the 'Step reference time' parameter (A6 – PSTIN). Data format: Enumerated8 (1 Byte) Default value: 0 (Reference time estimated)
3. PST_CUR_TIME Measured step time (11 – PST) Read only	80.3	This parameter shows the measured step time of the previous partial stroke test.A measurement is taken here of the controlled movement from the starting to the target position. If, during testing, the measured step time exceeds one of the three thresholds derived by multiplying the step reference time (A6 – PSTIN) by individual step time factors (A7 – FACT1 to A9 – FACT3), the device outputs a diagnostic message. The 'Status for measured step time' display indicates whether the partial stroke test could be carried out without error and whether the measured step time (11 – PST) is valid. Data format: Float–Value (4 Byte) Value range: 0.0 …. 1000.0 sec Default value: 0.0 sec
4. PST_CUR_STATE Status for measured step time Read only	80.4	This status display contains details of the previous partial stroke test carried out. The following details are possible: 0: No PST carried out yet. 1: PST interrupted. 2: PST failed. 3: PST ok. Data format: Enumerated8 (1 Byte) Default value: 0 (No PST carried out yet)

Transducer Block		
Label/Name/Handling	**Index (rel.)**	**Description/Format**
5. PST_PREV_TIME Time since previous PST (12 – PRPST) Read only	80.5	This parameter contains the time (in days) since the previous partial stroke test. The 'Status for time since previous PST' display indicates whether this time is valid or whether the function was deactivated. Data format: Float–Value (4 Byte) Default value: 0.0 Day
6. PST_NEXT_TIME Time to next PST (13 – NXPST) Read only	80.6	This parameter shows (in days) the time to the next partial stroke test. Data format: Float–Value (4 Byte) Value range: 0 …. 365 Day Default value: 0 Day
7. PST_NEXT_STATE Status for 'Time to next PST' Read only	80.7	This display indicates whether the time to next PST (13 – NXPST) is valid or whether this function has been deactivated. The following details are possible: 0: The function is deactivated. 1: Time to next PST (13 – NXPST) is valid. Data format: Enumerated8 (1 Byte) Default value: 0 (The function is deactivated)
PST_DIAG (Record) Partial Stroke Test	79	A cyclic or manual partial stroke test of open, closed and modulating valves can be carried out using the Partial Stroke Test. Condition: The 'Test Activation (A – \PST)' parameter must be set to 'ON'. During this test, the drive is taken from its start position to a target position and simultaneously analyzed. If, during the test, the measured step time (11 – PST) exceeds one of the three parameterizable thresholds, the device outputs a diagnostic message. Data format: Record with 9 Parameters (28 Byte)
1. PST_ENABLE Test activation (A – \PST) Read & Write	79.1	This parameter can be used to activate the Partial Stroke Test for cyclic or manual partial stroke testing of the valves. 0: Off – The Partial Stroke Test is deactivated and the associated test parameters have been removed from the menu. 1: On – The Partial Stroke Test can be specified and started. Data format: Enumerated8 (1 Byte) Default value: 0 = Off
2. PST_START_POS Starting position (A1 – STPOS) Read & Write	79.2	The starting position of the partial stroke test must be entered in this parameter in the range 0.0% to 100.0%. During the test, the drive travels from this starting position to the target position (starting position + step height. Data format: Float–Value (4 Byte) Value range: 0.0 …. 100.0 % Default value: 100.0 %

Transducer Block		
Label/Name/Handling	**Index (rel.)**	**Description/Format**
3. PST_START_TOL Starting tolerance (A2 – STTOL) Read & Write	79.3	The starting tolerance relative to the starting position (A1 – STPOS) must be entered in this parameter in the range 0.1% to 10.0%. At a starting position (A1 – STPOS) of, e.g., 50% and a starting tolerance (A2 – STTOL) of 2%, the partial stroke test can only be started if the current position of the drive is between 48% and 52%. Data format: Float–Value (4 Byte) Value range: 0.1 …. 10.0 % Default value: 2.0 %
4. PST_STEP Step height (A3 – STEP) Read & Write	79.4	The step height of the partial stroke test must be entered in this parameter in the range 0.1% to 100.0%. During the test, the drive travels from the starting position to the target position (starting position + step height). Data format: Float–Value (4 Byte) Value range: 0.1 …. 100.0 % Default value: 10.0 %
5. PST_STEP_DIR Step direction (A4 – STEPD) Read & Write	79.5	The step direction of the partial stroke test should be entered in this parameter. The following options are available: 0: UP (up only): The drive travels from its starting position to the target position (starting position + step height), then back to the starting position in control mode. 1: DO (down only): The procedure for option 'DO' is the same as for option 'UP' but in the opposite direction. 2: UP:DO (up and down): The drive travels from its starting position to the top target position (starting position + step height), then from the top to the bottom target position (starting position – step height). After reaching the bottom target position, it returns to its original starting position. Data format: Enumerated8 (1 Byte) Default value: 1 = DO (down only)
6. PST_INTERVAL Test interval (A5 – INTRV) Read & Write	79.6	The interval time for the cyclic Partial Stroke Test can be entered here over a range of one day to 365 days. The partial stroke test restarts automatically at the end of the test interval time. A cyclic partial stroke test is not possible if the system is OFF. Data format: Integer16 (2 Byte) Value range: 1 …. 365 Day / -120 (Off) Default value: -120 (Off)
7. PST_FACT1 Limit value 1 (A7 – FACT1) Read & Write	79.7	Limit factor 1 must be entered in this parameter to derive threshold 1. (Threshold 1 = Step reference time * Limit value 1.) If the measured step time (11 – PST) exceeds threshold 1 during testing, the device outputs the diagnostic message 'Maintenance required'. This message is only output if threshold 2 or 3 is not exceeded. Data format: Float–Value (4 Byte) Value range: 0.1 …. 100.0 Default value: 1.5

Transducer Block		
Label/Name/Handling	**Index (rel.)**	**Description/Format**
8. PST_FACT2 Limit value 2 (A8 – FACT2) Read & Write	79.8	Limit factor 2 must be entered in this parameter to derive threshold 2. (Threshold 2 = Step reference time * Limit value 2.) If the measured step time (11 – PST) exceeds threshold 2 during testing, the device outputs the diagnostic message 'Maintenance demand'. This message is only output if threshold 3 is not exceeded as well. Data format: Float–Value (4 Byte) Value range: 0.1 …. 100.0 Default value: 3.0
9. PST_FACT3 Limit value 3 (A9 – FACT3) Read & Write	79.9	Limit factor 3 must be entered in this parameter to derive threshold 3. (Threshold 3 = Step reference time * Limit value 3.) If the measured step time (11 – PST) exceeds threshold 3 during testing, the device outputs the diagnostic message 'Maintenance alarm'. Data format: Float–Value (4 Byte) Value range: 0.1 …. 100.0 Default value: 5.0
PULS_LENGTH_DOWN Pulse length 'DOWN'(current) Read only	74	This value indicates the current pulse length for the down direction (in ms) determined during initialization. This is the shortest pulse length with which movement of the actuator in the down direction can be achieved. Data format: Float–Value (4 Byte)
PULS_LENGTH_UP Pulse length 'UP'(current) Read only	73	This value indicates the current pulse length for the up direction (in ms) determined during initialization. This is the shortest pulse length with which movement of the actuator in the up direction can be achieved. Data format: Float–Value (4 Byte)
RATED_TRAVEL Real positioning travel / WAY(current) Read only	54	This value indicates the current real positioning travel (in mm or °) determined during initialization. This value corresponds to the display at the end of initialization. Prerequisite for stroke actuators: The lever must be specified with the TRANSM_LENGTH parameter. Data format: Float–Value (4 Byte) Value range: 0.0 …. 999.9
SELF_CALIB_COMMAND Initialization command Read & Write	44	Initiation of the device–specific (manufacturer specific) initialization–procedure. 0x00: No function 0x02: Start initialization 0xF0: Stop initialization Data format: Unsigned8 Default value: 0 (No function)

Transducer Block		
Label/Name/Handling	**Index (rel.)**	**Description/Format**
SELF_CALIB_STATUS Initialization status Read only	45	Status of the device–specific (manufacturer specific) initialization. 0x00: Device not initialized 0x01: Initialization: RUN 1 0x02: Initialization: RUN 2 0x03: Initialization: RUN 3 0x04: Initialization: RUN 4 0x05: Initialization: RUN 5 0xF1: Error in RUN 1 0xF2: Error in RUN 2 0xFE: Initialization OK Data format: Unsigned8
SERVICE_UPDATE Save/Reset Write only	68	Allows you to save the current values as last service or to reset the values of the last service to zero. Also, some read only counter can be reset. For 'Set device to state INIT' see INIT_VALUES. 0: No function 1: Save (last service) 2: Reset (last service) 3: Set device to state INIT 4: Reset counter: Number of 100% strokes (STRKS) 5: Reset counter: Number of dir. changes (CHDIR) 6: Reset counter: Number of alarms (\CNT) 7: Reset counter: Number of alarm 1 (A1CNT) 8: Reset counter: Number of alarm 2 (A2CNT) 9: Enable Write Init–Values Data format: Unsigned16 Default value: 0 (No function)
SERVO_GAIN_DOWN Servo gain 'DOWN' Read & Write	18	Gain value of the servo controller 'DOWN'. Data format: Float–Value (4 Byte) Value range: 1.0 …. 1000.0 Default value: 1.0
SERVO_GAIN_UP Servo gain 'UP' Read & Write	19	Gain value of the servo controller 'UP'. Data format: Float–Value (4 Byte) Value range: 1.0 …. 1000.0
SERVO_RATE Servo Rate Read & Write	20	The servo PID rate value (Not used) Data format: Float–Value (4 Byte) Not supported, set to 1.0
SLIP_STICK_DIAG (Record) Slipstick	85	This test continuously monitors the current slipstick of the final controlling element. Condition: The 'Test activation (d – \STIC)' parameter must be set to 'ON'. If the 'Slipstick (16 – STIC)' exceeds one of the three parameterizable thresholds during testing, the device outputs a diagnostic message. Data format: Record with 5 Parameters (17 Byte)

Transducer Block		
Label/Name/Handling	**Index (rel.)**	**Description/Format**
1. SLIP_STICK_ENABLE Test activation (d – \STIC) Read & Write	85.1	This parameter can be used to activate the slipstick test. 0: Off – The test is deactivated and the associated test parameters have been removed from the menu. 1: On – The test is active and the test parameters can be set. Data format: Enumerated8 (1 Byte) Default value: 0 = Off
2. SLIP_STICK_LIMIT Basic limit value (d1 – LIMIT) Read & Write	85.2	A basic limit value for the current slipstick value (16 – STIC) can be set in this parameter. The three thresholds are derived from the base value by multiplying it by the limit value factors. If the current slipstick value (16 – STIC) exceeds one of the three thresholds, the device outputs a diagnostic message. Data format: Float–Value (4 Byte) Value range: 0.1 …. 100.0 Default value: 1.0
3. SLIP_STICK_FACT1 Limit factor 1 (d2 – FACT1) Read & Write	85.3	Limit factor 1 must be entered in this parameter to obtain threshold 1. (Threshold 1 = Base limit value * Limit factor 1.) If, during testing, the current slipstick value (16 – STIC) exceeds threshold 1, the device outputs the diagnostic message 'Maintenance required'. This message is only output if threshold 2 or 3 is not exceeded. Data format: Float–Value (4 Byte) Value range: 0.1 …. 100.0 Default value: 2.0
4. SLIP_STICK_FACT2 Limit factor 2 (d3 – FACT2) Read & Write	85.4	Limit factor 2 must be entered in this parameter to obtain threshold 2. (Threshold 2 = Base limit value * Limit factor 2.) If, during testing, the current slipstick value (16 – STIC) exceeds threshold 2, the device outputs the diagnostic message 'Maintenance demand'. This message is only output if threshold 3 is not exceeded as well. Data format: Float–Value (4 Byte) Value range: 0.1 …. 100.0 Default value: 5.0
5. SLIP_STICK_FACT3 Limit factor 3 (d4 – FACT3) Read & Write	85.5	Limit factor 3 must be entered in this parameter to obtain threshold 3. (Threshold 3 = Base limit value * Limit factor 3.) If, during testing, the current slipstick value (16 – STIC) exceeds threshold 3, the device outputs the diagnostic message 'Maintenance alarm'. Data format: Float–Value (4 Byte) Value range: 0.1 …. 100.0 Default value: 10.0

Transducer Block		
Label/Name/Handling	**Index (rel.)**	**Description/Format**
SLIP_STICK_VALUE Slipstick value (16 – STIC) Read only	86	Slipstick can cause a jerky movement rest-jump-rest. The device detects a rapid change in the actual value, which is above the expected drive speed. This slipstick value indicates the detected jumps, routed via a deep-pass filter. If, during testing, the current slipstick value exceeds one of the three parameterizable thresholds, the device outputs a diagnostic message. Data format: Float–Value (4 Byte) Default value: 0.0
ST_REV Static Revision Read only	1	The revision level of the static data associated with the function block. The revision value will be incremented each time a static parameter value in the block is changed. Data format: Unsigned16
STRATEGY Strategy Read & Write	3	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block. Data format: Unsigned16 Default value: 0x0000
STROKE_DIAG (Record) Displacement integral (number of strokes)	94	This test, which facilitates preventive maintenance of the control valve, continuously monitors the total travel of the final controlling element. Condition: The 'Test activation (L – \STRK)' parameter must be set to 'ON'. During this test, the movement of the drive (unit: 100% strokes) is measured. A 100% stroke means complete bidirectional displacement (e.g. from OPEN to CLOSE and CLOSE to OPEN). Data format: Record with 5 Parameters (17 Byte)
1. STROKE_ENABLE Test activation (L – \STRK) Read & Write	94.1	This parameter can be used to activate the test for monitoring excess stroke movement. 0: Off – The test is deactivated and the associated test parameters have been removed from the menu. 1: On – The test is active and the test parameters can be set. Data format: Enumerated8 (1 Byte) Default value: 0 = Off
2. STROKE_LIMIT Basic limit value (L1 – LIMIT) Read & Write	94.2	This parameter can be used to set a base limit for drive movement (unit: 100% stroke). A 100% stroke corresponds to full bidirectional travel (e.g. from OPEN to CLOSED and CLOSED to OPEN. The three thresholds are derived from the base value by multiplying it by the limit factors." If the 'Number of 100% strokes (1 – STRKS)' counter exceeds one of the three thresholds, the device outputs a diagnostic message. Data format: Unsigned32 (4 Byte) Value range: 0 …. 100000000 Default value: 1000000

Transducer Block		
Label/Name/Handling	**Index (rel.)**	**Description/Format**
3. STROKE_FACT1 Limit factor 1 (L2 – FACT1) Read & Write	94.3	Limit factor 1 must be entered in this parameter to obtain threshold 1. (Threshold 1 = Basic limit value * Limit factor 1.) If, during testing, the Number of 100% strokes counter (1 – STRKS) exceeds threshold 1, the device outputs the diagnostic message 'Maintenance required'. This message is only output if threshold 2 or 3 is not exceeded. Data format: Float–Value (4 Byte) Value range: 0.1 …. 40.0 Default value: 1.0
4. STROKE_FACT2 Limit factor 2 (L3 – FACT2) Read & Write	94.4	Limit factor 2 must be entered in this parameter to obtain threshold 2. (Threshold 2 = Basic limit value * Limit factor 2.) If, during testing, the Number of 100% strokes counter (1 – STRKS) exceeds threshold 2, the device outputs the diagnostic message 'Maintenance demand'. This message is only output if threshold 3 is not exceeded as well. Data format: Float–Value (4 Byte) Value range: 0.1 …. 40.0 Default value: 2.0
5. STROKE_FACT3 Limit factor 3 (L4 – FACT3) Read & Write	94.5	Limit factor 3 must be entered in this parameter to obtain threshold 3. (Threshold 3 = Basic limit value * Limit factor 3.) If, during testing, the Number of 100% strokes counter (1 – STRKS) exceeds threshold 3, the device outputs the diagnostic message 'Maintenance alarm'. Data format: Float–Value (4 Byte) Value range: 0.1 …. 40.0 Default value: 5.0
TAB_VALUES (Record) Characterization	37	At a distance of 5% a flow parameter can be assigned to the respective setpoint coordinate whereby two consecutive coordinates must differ by at least 0.2%. These points lead to a polygon train with 20 straight line sections for projecting the valve characteristic. Attention: The characteristic must be monotonously rising. Data format: Record with 21 Parameters (84 Byte)
1. TAB_VALUE0 Setpoint turning point at 0% (SL0) Read & Write	37.1	The characteristic value at 0% setpoint. Data format: Float–Value (4 Byte) Value range: 0.0 % …. 100.0 % Default value: 0.0 %
2. TAB_VALUE1 Setpoint turning point at 5% (SL1) Read & Write	37.2	The characteristic value at 5% setpoint. Data format: Float–Value (4 Byte) Value range: 0.0 % …. 100.0 % Default value: 5.0 %
3. TAB_VALUE3 **to** **19. TAB_VALUE18**	37.4 to 37.19	The characteristic value at 10% to 90% setpoint. Data format: Float–Value (4 Byte) Value range: 0.0 % …. 100.0 % Default value: 10.0 % to 90.0 %

Transducer Block		
Label/Name/Handling	**Index (rel.)**	**Description/Format**
20. TAB_VALUE19 Setpoint turning point at 95% (SL19) Read & Write	37.20	The characteristic value at 95% setpoint. Data format: Float–Value (4 Byte) Value range: 0.0 % …. 100.0 % Default value: 95.0 %
21. TAB_VALUE20 Setpoint turning point at 100% (SL20) Read & Write	37.21	The characteristic value at 100% setpoint. Data format: Float–Value (4 Byte) Value range: 0.0 % …. 100.0 % Default value: 100.0 %
TAG_DESC Tag Description Read & Write	2	The user description of the intended application of the block. Data format: Octet–String (32 Byte)
TEMPERATURE Current temperature / TEMP Read only	57	This value indicates the current temperature inside the housing. This temperature can be measured and displayed in °C or °F depending on the TEMPERATURE_UNIT. Data format: Float–Value (4 Byte)
TEMPERATURE_UNIT Dimension temperature Read & Write	58	The temperature can be measured and displayed in °C or °F. 1001: °C 1002: °F Data format: Unsigned16 Default value: °C (1001)
TEMP_MAX_DIAG (Record) Top temperature limit	93	The current temperature inside the field device is checked continuously. This test monitors the top temperature limit inside the field device. Condition: The 'Test activation (J – \TMAX)' parameter must be set to 'ON'. If the top device temperature exceeds one of the three parameterizable thresholds during testing, the device outputs a diagnostic message." Data format: Record with 4 Parameters (13 Byte)
1. TEMP_MAX_ENABLE Test activation (J – \TMAX) Read & Write	93.1	This parameter can be used to activate the test for monitoring of the upper temperature limit. 0: Off – The test is deactivated and the associated test parameters have been removed from the menu. 1: On – The test is active and the test parameters can be set. Data format: Enumerated8 (1 Byte) Default value: 0 = Off

Transducer Block		
Label/Name/Handling	**Index (rel.)**	**Description/Format**
2. TEMP_MAX_LEVEL1 Threshold 1 (J2 – LEVL1) Read & Write	93.2	Threshold 1 for monitoring the upper temperature limit of the field device must be entered in this parameter. The current temperature inside the field device is checked continuously. If the current temperature inside the field device is above threshold 1, the device outputs the diagnostic message 'Process value tolerance', provided the reading is not above threshold 2 or 3. Data format: Float–Value (4 Byte) Value range: -40.0 …. 90.0° Default value: 75.0
3. TEMP_MAX_LEVEL2 Threshold 2 (J3 – LEVL2) Read & Write	93.3	Threshold 2 for monitoring the upper temperature limit of the field device must be entered in this parameter. The current temperature inside the field device is checked continuously. If the current temperature inside the field device is above threshold 2, the device outputs the diagnostic message 'Process value warning', provided the reading is not above threshold 3. Data format: Float–Value (4 Byte) Value range: -40.0 …. 90.0° Default value: 80.0
4. TEMP_MAX_LEVEL3 Threshold 3 (J4 – LEVL3) Read & Write	93.4	Threshold 3 for monitoring the upper temperature limit of the field device must be entered in this parameter. The current temperature inside the field device is checked continuously. If the current temperature inside the field device is above threshold 3, the device outputs the diagnostic message 'Process value alarm'. Data format: Float–Value (4 Byte) Value range: -40.0 …. 90.0° Default value: 90.0
TEMP_MIN_DIAG (Record) Lower temperature limit	92	The current temperature inside the field device is checked continuously. This test monitors the lower temperature limit inside the field device. Condition: The 'Test activation (H – \TMIN)' parameter must be set to 'ON'. If the lower temperature in the device is below one of the three parameterizable thresholds during testing, the device outputs a diagnostic message. Data format: Record with 4 Parameters (13 Byte)
1. TEMP_MIN_ENABLE Test activation (H – \TMIN) Read & Write	92.1	This parameter can be used to activate the test for monitoring of the lower temperature limit. 0: Off – The test is deactivated and the associated test parameters have been removed from the menu. 1: On – The test is active and the test parameters can be set. Data format: Enumerated8 (1 Byte) Default value: 0 = Off

Transducer Block		
Label/Name/Handling	**Index (rel.)**	**Description/Format**
2. TEMP_MIN_LEVEL1 Threshold 1 (H2 – LEVL1) Read & Write	92.2	Threshold 1 for monitoring the lower temperature limit of the field device must be entered in this parameter. The current temperature inside the field device is checked continuously. If the current temperature inside the field device is below threshold 1, the device outputs the diagnostics message 'Process value tolerance', provided the reading is not below threshold 2 or 3. Data format: Float–Value (4 Byte) Value range: -40.0 …. 90.0° Default value: -25.0
3. TEMP_MIN_LEVEL2 Threshold 2 (H3 – LEVL2) Read & Write	92.3	Threshold 2 for monitoring the lower temperature limit of the field device must be entered in this parameter. The current temperature inside the field device is checked continuously. If the current temperature inside the field device is below threshold 2, the device outputs the diagnostic message 'Process value warning', provided the reading is not below threshold 3. Data format: Float–Value (4 Byte) Value range: -40.0 …. 90.0° Default value: -30.0
4. TEMP_MIN_LEVEL3 Threshold 3 (H4 – LEVL3) Read & Write	92.4	Threshold 3 for monitoring the lower temperature limit of the field device must be entered in this parameter. The current temperature inside the field device is checked continuously. If the current temperature inside the field device is below threshold 3, the device outputs the diagnostic message 'Process value alarm'. Data format: Float–Value (4 Byte) Value range: -40.0 …. 90.0° Default value: -40.0
TEST_ACTIVATE Activate test function Write only	114	Used by manufacterer, do not change. Data format: Unsigned8
TEST_FUNCTION (Record) Select test function	115	Used by manufacterer, do not change. Data format: Record with 3 Parameters (32 Byte)
TEST_READ Read test result Read only	116	Used by manufacterer. Data format: Octet–String (32 Byte)

Transducer Block		
Label/Name/Handling	**Index (rel.)**	**Description/Format**
TOLERANCE_BAND Response threshold for fault message (\LIM) Read & Write	42	In this parametet a value (%) can be set for the permissible variable of control error for releasing the fault message. The initial value is valid in the 'AUTO' mode. After parameterization 'TOLERANCE_BAND = AUTO' (value = –120.0) and 'DELAY_TIME = AUTO' (value = –120.0) the fault message is set when the slow step zone has not been reached within the valid time (within 5 to 95% of the way 2 times and outside 10 to 90% 10 times the initialization time). Data format: Float–Value (4 Byte) Value range: 0.0 % …. 100.0 % Default value: –120.0 (Auto)
TOTAL_VALVE_TRAVEL Number of 100% strokes (STRKS) Read only	61	The movements of the actuator are totalized during operation (unit: 100% strokes) and can be read here as number of strokes. The value is written to non–volatile memory every 15 minutes and can be reset to zero with the parameter SERVICE_UPDATE. Data format: Unsigned32 Value range: 0 …. 1,000,000,000
TRANSDUCER_ DIRECTORY Transducer Directory Entry/ Characteristics Read only	9	A directory that specifies the number and starting indices of the data collections in the transducer block. Data format: Unsigned16 Default value: 0x0000
TRANSDUCER_TYPE Transducer Type Read only	10	Identifes the transducer that follows. 100: Standard Pressure with Calibration 101: Standard Temperature with Calibration 102: Standard Dual Temperature with Calibration 103: Standard Radar Level with Calibration 104: Standard Flow with Calibration 105: Standard Basic Positioner Valve 106: Standard Advanced Positioner Valve 107: Standard Discrete Valve 65535: Other Data format: Unsigned16 Default value: 106 (Standard Advanced Positioner Valve)
TRANSM_ANGLE Rated angle of rotation of feedback (YAGL) Read & Write	32	Rated angle of rotation of feedback. In linear actuator (VALVE_TYPE = WAY) a value of 33° or 90° can be selected depending on the stroke range: * 33° for strokes <= 20mm. * 90° for strokes >= 25mm. Important: The setting of the gear transmission switch on the control regulator must match the selected angle value. 0: 90° 1: 33° Data format: Unsigned8 Default value: 1 (33°)

Transducer Block		
Label/Name/Handling	**Index (rel.)**	**Description/Format**
TRANSM_LENGTH Lever arm transmission/stroke range (YWAY) Read & Write	33	Lever arm transmission. This parameter serves to display the real stroke after initialization. The parameter need only be set when a determined way (VALVE_TYPE = WAY) is to be displayed in mm at the end of initialization of a linear actuator. If this parameter has been set to 'Off', the real stroke is not displayed after initialization. 0: Off 1: 5mm / short lever 33° 8: 40mm / long lever 90° 2: 10mm / short lever 33° 9: 50mm / long lever 90° 3: 15mm / short lever 33° 10: 60mm / long lever 90° 4: 20mm / short lever 33° 11: 70mm / long lever 90° 5: 25mm / short lever 90° 12: 90mm / long lever 90° 6: 30mm / short lever 90° 13: 110mm / long lever 90° 7: 35mm / short lever 90° 14: 130mm / long lever 90° Data format: Unsigned8 Default value: 0 (OFF)
TRAVEL_LIMIT_DOWN Start of manipulated variable limiting (YA) Read & Write	39	With the parameters TRAVEL_LIMIT_DOWN and TRAVEL_LIMIT_UP the mechanical travel (from stop to stop) is limited to the set values. In this way the mechanical travel range of the actuator can be limited to the active flow and the integral saturation of the commanding controller avoided. Data format: Float–Value (4 Byte) Value range: 0.0 % …. 100.0 % Default value: 0.0 %
TRAVEL_LIMIT_UP End of manipulated variable limiting (YE) Read & Write	40	See TRAVEL_LIMIT_DOWN. Data format: Float–Value (4 Byte) Value range: 0.0 % …. 100.0 % Default value: 100.0 %
TRAVEL_RATE_DOWN Setpoint ramp 'DOWN' (TSDO) Read & Write	34	See TRAVEL_RATE_UP. Data format: Float–Value (4 Byte) Value range: 0 sec …. 400 sec Default value: 0 (max. speed down)
TRAVEL_RATE_UP Setpoint ramp 'UP' (TSUP) Read & Write	35	The setpoint ramp is effective in automatic operation and limits the speed of alteration of the active setpoint. When switching over from automatic operation to manual operation , the time can be specified with TRAVEL_RATE_UP / TRAVEL_RATE_DOWN in which the active setpoint is to be adapted to the setpoint applied to the device in the upward / downward movement.But movement cannot be faster than shown in ACT_STROKE_TIME_UP / ACT_STROKE_TIME_DOWN. In the position 'TSUP = AUTO' (value = –120) the slower of the two travel times determined during initialization is used for the setpoint ramp. The parameter 'TSDO' is then ineffective. Data format: Float–Value (4 Byte) Value range: 0 sec …. 400 sec. / –120 = Auto Default value: 0 (max. speed up)

Transducer Block

Label/Name/Handling	Index (rel.)	Description/Format
TREND_ALL (Record) Trends	106	Trends Data format: Record with 29 Parameters (110 Byte)
1. TREND_KENN Current Trend Read only	106.1	Current Trend: 1: … 5: Actual value trend (1: 30 minutes 2: 8 hours 3: 5 days 4: 2 months 5: 30 months) 6: … 10: Deviation trend 11: … 15: Leakage trend 16: … 20: Slipstick trend 21: … 25: Stop monitoring (bottom) trend 26: … 30: Stop monitoring (top) trend 21: … 35: Temperature trend trend 36: … 40: Dead zone trend Data format: Enumerated16 (2 Byte) Default value: 0 (No valid Histogram)
2. TREND_DIM Dimension Read only	106.2	Trend Dimension 0000: blank 1342: % 1001: °C 1002: °F 1054: sec 1058: min 1059: h 1060: Day 1061: Months Data format: Enumerated16 (2 Byte) Default value: 0 (blank)
3. TREND_ANZ Number of valid values for 'Actual Trend' Read only	106.3	Number of valid values for 'Actual Trend' Data format: Unsigned16 (2 Byte) Value range: 0 …. 20 Default value: 0
4. TREND_VALUE_1 Trend value 1 Read only	106.4	Trend value 1 Data format: Float (4 Byte) Default value: 0.0
5. TREND_VALUE_2 Trend value 2 Read only	106.5	Trend value 2 Data format: Float (4 Byte) Default value: 0.0
6. TREND_VALUE_3 **to** **21. TREND_VALUE_18** Trend value 3 to Trend value18 Read only	106.6 to 106.21	Trend value 3 to Trend value 18 Data format: Float (4 Byte) Default value: 0.0

Transducer Block		
Label/Name/Handling	**Index (rel.)**	**Description/Format**
22. TREND_VALUE_19 Trend value 19 Read only	106.22	Trend value 19 Data format: Float (4 Byte) Default value: 0.0
23. TREND_VALUE_20 Trend value 20 Read only	106.23	Trend value 20 Data format: Float (4 Byte) Default value: 0.0
24. TREND_LIMIT_1_LOW Trend limit 1 Low Read only	106.24	Trend limit 1 Low Data format: Float (4 Byte) Default value: 0.0
25. TREND_LIMIT_1_MED Trend limit 1 Medium Read only	106.25	Trend limit 1 Medium Data format: Float (4 Byte) Default value: 0.0
26. TREND_LIMIT_1_HIG Trend limit 1 High Read only	106.26	Trend limit 1 High Data format: Float (4 Byte) Default value: 0.0
27. TREND_LIMIT_2_LOW Trend limit 2 Low Read only	106.27	Trend limit 2 Low Data format: Float (4 Byte) Default value: 0.0
28. TREND_LIMIT_2_MED Trend limit 2 Medium Read only	106.28	Trend limit 2 Medium Data format: Float (4 Byte) Default value: 0.0
29. TREND_LIMIT_2_HIG Trend limit 2 High Read only	106.29	Trend limit 2 High Data format: Float (4 Byte) Default value: 0.0
TREND_INDEX Select Trend Write only	105	After the trend is selected, values are read out of the device automatically. 0: No valid trend 1: … 5: Actual value trend (1: 30 minutes 2: 8 hours 3: 5 days 4: 2 months 5: 30 months) 6: … 10: Deviation trend 11: … 15: Leakage trend 16: … 20: Slipstick trend 21: … 25: Stop monitoring (bottom) trend 26: … 30: Stop monitoring (top) trend 21: … 35: Temperature trend 36: … 40: Dead zone trend Data format: Enumerated16 (2 Byte)

Transducer Block		
Label/Name/Handling	**Index (rel.)**	**Description/Format**
UPDATE_EVT (Record) **1. UNACKNOWLEDGED** **2. UPDATE_STATE** **3. TIME_STAMP** **4. STATIC_REVISION** **5. RELATIVE_INDEX**	7 7.1 7.2 7.3 7.4 7.5	See Resource Block
VALVE_MAN_ID Valve Manufacturer Id Read & Write	25	The valve manufacturer's identification number as defined by the Fieldbus Foundation. Data format: Unsigned32
VALVE_MODEL_NUM Valve Model Number Read & Write	26	The valve model number. Data format: Visible String (32 Byte)
VALVE_SN Valve Serial Number Read & Write	27	The valve serial number. Data format: Visible String (32 Byte).
VALVE_TYPE Type of actuator (YFCT) Read & Write	28	You can choose between a linear or rotary actuator with different position sensors. 1: WAY (linear actuator with rotary potentiometer) 2: TURN (rotary actuator with rotary potentiometer) 240: LWAY (linear actuator with thrust potentiometer) 241: NCST (rotary actuator with NC–sensor) 242: –NCST (rotary actuator with NC–sensor 'inverse') 243: NCSL (linear actuator with NC–sensor) 244: NCSLL (linear actuator with NC–sensor/lever) Data format: Unsigned8 Default value: 1 { WAY (linear actuator) }
XD_CAL_DATE Transducer Calibration Date Read & Write	30	The date of the last positioner calibration. Data format: Time of Day (7 Byte)
XD_CAL_LOC Transducer Calibration Location Read & Write	29	The physical location at which the last positioner calibration was performed. Data format: Visible String (32 Byte)
XD_CAL_WHO Transducer Calibration Who Read & Write	31	The name of the person responsible for the last positioner calibration. Data format: Visible String (32 Byte)
XD_ERROR Transducer Error Read only	11	One of the transducer error codes defined in the FF Transducer Specifications in section 4.8 Block Alarm Subcodes. 17: General error 18: Calibration error 19: Configuration error Data format: Unsigned8

Transducer Block		
Label/Name/Handling	**Index (rel.)**	**Description/Format**
Y_NORM Feedback normalization (YNRM) Read & Write	50	Two different scalings are produced for the display and the position feedback with the limiting of the manipulated variable by YA and YE. * The 'MPOS scaling' shows the mechanical position (from 0 to 100%) between the hard stops of the initialization. This is not influenced by the parameters YA and YE. * The 'FLOW scaling is in the range from 0 to 100%. The FINAL_POSITION_VALUE is displayed. 0: MPOS (to mech. travel) 1: FLOW (to flow) Data format: Unsigned8 Default value: 0 { MPOS (to mech. travel) }
ZERO_DIAG (Record) Bottom stop	88	This test continuously monitors the zero shift of the final controlling element. Condition: The 'Test activation (F – \ZERO)' parameter must be set to 'ON'. The test always takes place when the valve is in the 'Sealing bottom' position. A check is made as to whether the lower stop has changed from its value on initialization (zero point P0). If the 'Current zero shift (17 – ZERO)' exceeds one of the three parameterizable thresholds during testing, the device outputs a diagnostic message." Data format: Record with 4 Parameters (13 Byte)
1. ZERO_ENABLE Test activation (F – \ZERO) Read & Write	88.1	This parameter can be used to activate the test for monitoring the bottom stop. 0: Off – The test is deactivated and the associated test parameters have been removed from the menu. 1: On – The test is active and the test parameters can be set. Data format: Enumerated8 (1 Byte) Default value: 0 = Off
2. ZERO_LEVEL1 Threshold 1 (F1 – LEVL1) Read & Write	88.2	Threshold 1 for monitoring the bottom hard stop must be entered in this parameter. If the valve is in the 'Sealing bottom' position, there is a check as to whether the bottom stop has changed from its value on initialization (zero point P0). If the current zero point shift (17 – ZERO) exceeds threshold 1, the device outputs the diagnostic message 'Maintenance required'. This message is only output if threshold 2 or 3 is not exceeded. Data format: Float–Value (4 Byte) Value range: 0.1 …. 10.0 Default value: 1.0

Transducer Block		
Label/Name/Handling	**Index (rel.)**	**Description/Format**
3. ZERO_LEVEL2 Threshold 2 (F2 – LEVL2) Read & Write	88.3	Threshold 2 for monitoring the bottom hard stop must be entered in this parameter. If the valve is in the 'Sealing bottom' position, there is a check as to whether the bottom stop has changed from its value on initialization (zero point P0). If the current zero point shift (17 – ZERO) exceeds threshold 2, the device outputs the diagnostic message 'Maintenance demand'. This message is only output if threshold 3 is not exceeded as well. Data format: Float–Value (4 Byte) Value range: 0.1 …. 10.0 Default value: 2.0
4. ZERO_LEVEL3 Threshold 3 (F3 – LEVL3) Read & Write	88.4	Threshold 3 for monitoring the bottom hard stop must be entered in this parameter. If the valve is in the 'Sealing bottom' position, there is a check as to whether the bottom stop has changed from its value on initialization (zero point P0). If the current zero point shift (17 – ZERO) exceeds threshold 3, the device outputs the diagnostic message 'Maintenance alarm'. Data format: Float–Value (4 Byte) Value range: 0.1 …. 10.0 Default value: 4.0
ZERO_POINT_P0 Zero point P0 (20 – P0) Read only	71	This is the position detection value (potentiometer voltage in %) measured at the lower limit, as determined at automatic installation. In the case of manual initialization, the value of the lower end position approached manually appears here. Data format: Float–Value (4 Byte) Default value: 0.0
ZERO_VALUE Current zero point shift (17 – ZERO) Read only	89	This parameter indicates the current shift in the bottom hard stop from its value on initialization (zero point P0). Data format: Float–Value (4 Byte) Default value: 0.0

5.4.3 Device Description

The device description contains a description of all parameters, a hierarchical parameter menu and a collection of methods.

5.5 PID Function Block (PID)

5.5.1 Overview

The PID function block implements a PID control algorithm. The source of setpoint SP depends on the actual block mode and can be the parameter SP itself (in mode AUTO), the input CAS_IN (in mode CAS) or the value of RCAS_IN (in mode RCAS). In mode MAN the output OUT can be set directly to the desired value.

The Process Value to be controlled is connected to the IN input. This value is passed through a filter whose time constant is PV_FTIME.

There is a switch for BYPASS, which is available to the operator if the Bypass Enable control option is true. Bypass is used in secondary cascade controllers that have a bad PV. The Bypass Enable option is necessary because not all cascade control schemes will be stable if BYPASS is true. BYPASS can only be changed when the block mode is Man or O/S. While it is set, the value of SP, in percent of range, is passed directly to the target output, and the value of OUT is used for BKCAL_OUT. When the mode is changed to Cas, the upstream block is requested to initialize to the value of OUT. When a block is in Cas mode, then on the transition out of bypass, the upstream block is requested to initialize to the PV value, regardless of the ”Use PV for BKCAL_OUT” option.

GAIN, RESET, and RATE are the tuning constants for the P, I, and D terms, respectively. Gain is a dimensionless number. RESET and RATE are time constants expressed in seconds. There are existing controllers that are tuned by the inverse value of some or all of them, such as proportional band and repeats per minute. The human interface to these parameters should be able to display the user’s preference.

If RESET is set to infinity, the integral part of the PID has no effect during normal operation. But it is still used interally to allow bumpless switching from Manual to Automatic mode by adjusting the working point accordingly. If RESET is set to 0s, the integral part is set to zero, thus giving a fixed working point.

The derivative part defined by RATE is smoothend by a first order filter to reduce the effect of process noise. The time constant of this filter is 0.2*RATE, if its not limited by the loop time.

The Direct Acting control option, if true, causes the output to increase when the PV exceeds the SP. If false, the output will decrease when the PV exceeds the SP. It will make the difference between positive and negative feedback, so it must be set properly, and never changed while in an automatic mode. The setting of the option must also be used in calculating the limit state for BKCAL_OUT.

The output supports the feed forward algorithm. The FF_VAL input brings in an external value which is proportional to some disturbance in the control loop. The value is converted to percent of output span using the values of parameter FF_SCALE. This value is multiplied by the FF_GAIN and added to the target output of the PID algorithm. If the status of FF_VAL is Bad, the last usable value will be used, because this prevents bumping the output. When the status returns to good, the block will adjust its integral term to maintain the previous output.

The output supports the track algorithm.

There is an option to use either the SP value after limiting or the PV value for the BKCAL_OUT value.

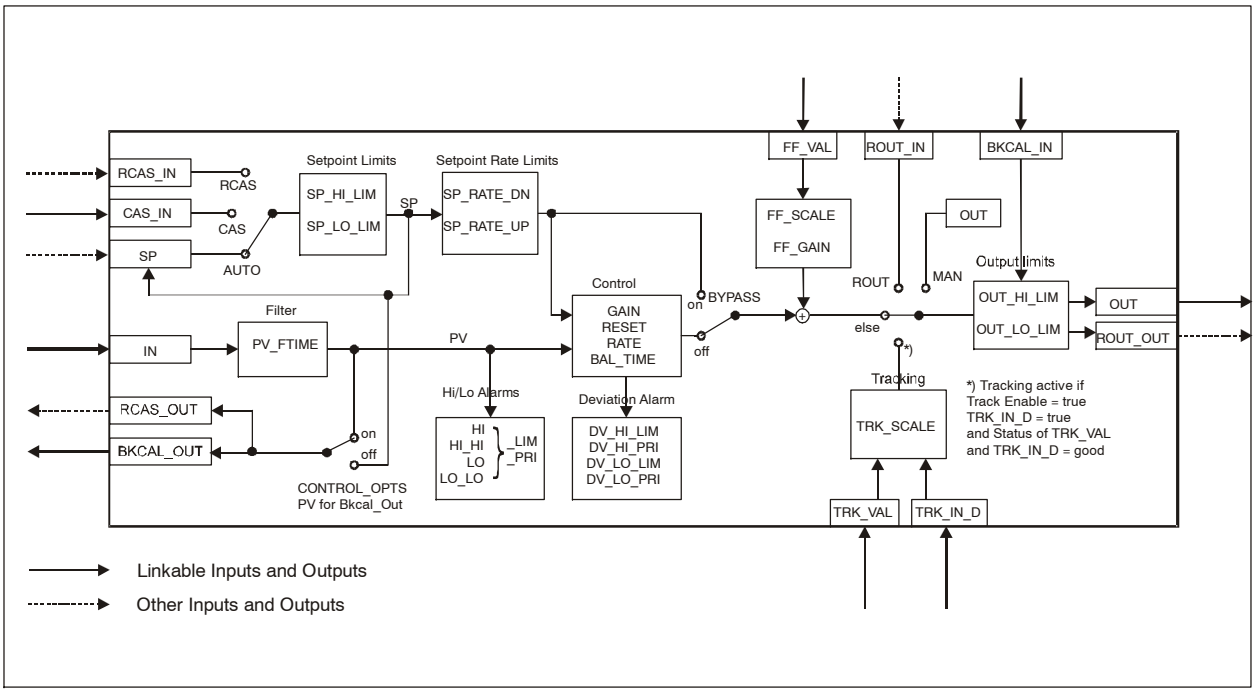


Figure 5-4 Overview Function Blocks

5.5.2 Parameter description

The PID block contains all standard parameters as specified in [FF–891–1.5]. There are no additional manufacturer specific parameters.

PID Block		
Label/Name/Handling	**Index (rel.)**	**Description/Format**
ACK_OPTION Acknowledge Option Read & Write	46	Selection of whether alarms associated with the block will be automatically acknowledged. Bit Clear: Auto acknowledge disabled Bit Set: Auto acknowledge enabled Bit 0: Write has been disabled Bit 1: High High Alarm Bit 2: High Alarm Bit 3: Low Low Alarm Bit 4: Low Alarm Bit 5: Deviation High Alarm Bit 6: Deviation Low Alarm Bit 7: Block Alarm Data format: Bit–String with 16 Bits (2 Byte) Default value: 0
ALARM_HYS Alarm Hysteresis Read & Write	47	Amount the PV must return within the alarm limits before the alarm condition clears. Alarm hysteresis expressed as a percent of the span of the PV. Data format: Float–Value (4 Byte) Value range: 0.0 % …. 50.0 % Default value: 0.5 %
ALARM_SUM (Record) **1. CURRENT** **2. UNACKNOWLEDGED** **3. UNREPORTED** **4. DISABLED**	45 45.1 45.2 45.3 45.4	See Resource Block
ALERT_KEY Alert Key Read & Write	4	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc. Data format: Unsigned8 Value range: 1 …. 255 Default value: 0
BAL_TIME Balance Time Read & Write	25	This specifies the time for the internal working value of bias or ratio to return to the operator set bias or ratio, in seconds. In the PID block, it may be used to specify the time constant at which the integral term will move to obtain balance when the output is limited and the mode is Auto, Cas, or RCas. Data format: Float–Value (4 Byte) Value range: ≥ 0.0 Sec Default value: 0.0 Sec

PID Block

Label/Name/Handling	Index (rel.)	Description/Format
BKCAL_HYS Back Calculation Hysteresis Read & Write	30	The amount that the block output must change away from its output limit before the limit status is turned off, expressed as a percent of the span of the output. Data format: Float–Value (4 Byte) Value range: 0.0 % …. 50.0 % Default value: 0.5 %
BKCAL_IN (Record) Back Calculation Input	27	The value and status used for backwards tracking of the output, provided by a link to a downstream block's back calculation output parameter. Data format: Record with 2 Parameters (5 Byte)
1. STATUS QUALITY Status SUBSTATUS LIMITS Read & Write	27.1	This additional, valuable information will be passed along with each transmission of a data value in the form of a status attribute. Bit 7, 6 QUALITY Bit 5, 4, 3, 2 SUBSTATUS Bit 1, 0 LIMITS See **FF–890 FS 1.5** Data format: Unsigned8
2. VALUE Value Read & Write	27.2	A numerical quantity received by the block parameter from another block parameter to which this block is linked. Or a default or user entered value if the parameter has not been linked. Data format: Float–Value (4 Byte)
BKCAL_OUT (Record) Back Calculation Output **1. STATUS** **2. VALUE**	31 31.1 31.2	The output value and status provided to an upstream block for output tracking when the loop is broken or limited, as determined by the status bits. This information is used to provide bumpless transfer to closed loop control and to prevent windup under limited conditions when that becomes possible. See PID–Block → BKCAL_IN
BLOCK_ALM (Record) **1. UNACKKNOWLEDGED** **2. ALARM_STATE** **3. TIME_STAMP** **4. SUB_CODE** **5. VALUE**	44 44.1 44.2 44.3 44.4 44.5	See Resource Block
BYPASS Bypass Read & Write	17	The normal control algorithm may be bypassed through this parameter. When bypass is set, the setpoint value (in percent) will be directly transferred to the output. To prevent a bump on transfer to/from bypass, the setpoint will automatically be initialized to the output value or process variable, respectively, and the path broken flag will be set for one execution. 0: Uninitialized 1: Off 2: On Data format: Unsigned8 Default value: 0 (Uninitialized)

PID Block		
Label/Name/Handling	**Index (rel.)**	**Description/Format**
BLOCK_ERR Block Error Read only	6	This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string, so that multiple errors may be shown. Bit 1: Block Configuration Bit 15: Out Of Service Data format: Bit–String with 16 Bits (2 Byte)
CAS_IN (Record) Cascade Input **1. STATUS** **2. VALUE**	18 18.1 18.2	This parameter is the remote setpoint value, which must come from another Fieldbus block, or a DCS block through a defined link. See PID–Block → BKCAL_IN
CONTROL_OPTS Control Options Read & Write	13	Options which the user may select to alter the calculations done in a control block. Bit 0: Bypass Enable Bit 1: Setpoint–Process variable Track Man Bit 2: Setpoint–Process variable Track Rout Bit 3: Setpoint–Process variable Track LO–IMan Bit 4: Setpoint Track retain Bit 5: Direct acting Bit 7: Track enable Bit 8: Track in manual Bit 9: Process variable for BKCal_Out Bit 12: Restrict Setpoint to limits in Cas and RCas Bit 13: No output limits in Man Data format: Bit–String with 16 Bits (2 Byte) Default value: 0
DV_HI_ALM (Record) Deviation High Alarm **1. UNACKKNOWLEDGED** **2. ALARM_STATE** **3. TIME_STAMP** **4. SUB_CODE** **5. VALUE**	64 64.1 64.2 64.3 64.4 64.5	The status and time stamp associated with the high deviation alarm. See Resource Block
DV_HI_LIM Deviation High Limit Read & Write	57	The setting of the high deviation alarm limit in engineering units. Data format: Float–Value (4 Byte) Default value: 1.#INF (Not active)
DV_HI_PRI Deviation High Priority Read & Write	56	Priority of the high deviation alarm. Data format: Unsigned8 Value range: 0 …. 15 Default value: 0

PID Block		
Label/Name/Handling	**Index (rel.)**	**Description/Format**
DV_LO_ALM (Record) Deviation Low Alarm	65	The status and time stamp associated with the low deviation alarm.
1. UNACKKNOWLEDGED	65.1	See Resource Block
2. ALARM_STATE	65.2	
3. TIME_STAMP	65.3	
4. SUB_CODE	65.4	
5. VALUE	65.5	
DV_LO_LIM Deviation Low Limit Read & Write	59	Setting of the low deviation alarm limit in engineering units. Data format: Float–Value (4 Byte) Default value: –1.#INF (Not active)
DV_LO_PRI Deviation Low Priority Read & Write	58	Priority of the low deviation alarm. Data format: Unsigned8 Value range: 0 …. 15 Default value: 0
FF_GAIN Feed Forward Gain Read & Write	42	The gain that the feed forward input is multiplied by before it is added to the calculated control output. Data format: Float–Value (4 Byte) Default value: 0.0
FF_SCALE (Record) Feed Forward Scale	41	The feed forward input high and low scale values, engineering units code, and number of digits to the right of the decimal point. Data format: Record with 4 Parameters (11 Byte)
1. EU_100 EU at 100% Read & Write	41.1	The engineering unit value which represents the upper end of range of the associated block parameter. Data format: Float–Value (4 Byte) Default value: 100.0 %
2. EU_0 EU at 0% Read & Write	41.2	The engineering unit value which represents the lower end of range of the associated block parameter. Data format: Float–Value (4 Byte) Default value: 0.0 %
3. UNITS_INDEX Units Index Read & Write	41.3	Device Description units code index for the engineering unit descriptor for the associated block value. Data format: Unsigned16 Default value: 0
4. DECIMAL Decimal Read & Write	41.4	The number of digits to the right of the decimal point which should be used by an interface device in displaying the specified parameter. Data format: Unsigned8 Default value: 0
FF_VAL (Record) Feed Forward Value	40	The feed forward value and status. See PID–Block → BKCAL_IN
1. STATUS	40.1	
2. VALUE	40.2	
GAIN Gain Read & Write	23	Dimensionless value used by the block algorithm in calculating the block output. Data format: Float–Value (4 Byte) Default value: 0.0

PID Block		
Label/Name/Handling	**Index (rel.)**	**Description/Format**
GRANT_DENY (Record) Grant Deny **1. GRANT** **2. DENY**	12	Options for controlling access of host computers and local control panels to operating, tuning, and alarm parameters of the block. See Resource Block
HI_ALM (Record) High Alarm **1. UNACKKNOWLEDGED** **2. ALARM_STATE** **3. TIME_STAMP** **4. SUB_CODE** **5. VALUE**	61 61.1 61.2 61.3 61.4 61.5	The status for high alarm and its associated time stamp. See Resource Block
HI_HI_ALM (Record) High High Alarm **1. UNACKKNOWLEDGED** **2. ALARM_STATE** **3. TIME_STAMP** **4. SUB_CODE** **5. VALUE**	60 60.1 60.2 60.3 60.4 60.5	The status for high high alarm and its associated time stamp. See Resource Block
HI_HI_LIM High High Limit Read & Write	49	The setting for high high alarm in engineering units. Data format: Float–Value (4 Byte) Default value: 1.#INF (Not active)
HI_HI_PRI High High Priority Read & Write	48	Priority of the high high alarm. Data format: Unsigned8 Value range: 0 …. 15 Default value: 0
HI_LIM High Limit Read & Write	51	The setting for high alarm in engineering units. Data format: Float–Value (4 Byte) Default value: 1.#INF (Not active)
HI_PRI High Priority Read & Write	50	Priority of the high alarm. Data format: Unsigned8 Value range: 0 …. 15 Default value: 0
IN (Record) Input **1. STATUS** **2. VALUE**	15 15.1 15.2	Primary input value of the block, required for blocks that filter the input to get the PV. See PID–Block → BKCAL_IN
LO_ALM (Record) Low Alarm **1. UNACKKNOWLEDGED** **2. ALARM_STATE** **3. TIME_STAMP** **4. SUB_CODE** **5. VALUE**	62 62.1 62.2 62.3 62.4 62.5	The status of the low alarm and its associated time stamp. See Resource Block

PID Block		
Label/Name/Handling	**Index (rel.)**	**Description/Format**
LO_LIM Low Limit Read & Write	53	The setting for the low alarm in engineering units. Data format: Float–Value (4 Byte) Default value: –1.#INF (Not active)
LO_LO_ALM (Record) Low Low Alarm **1. UNACKKNOWLEDGED** **2. ALARM_STATE** **3. TIME_STAMP** **4. SUB_CODE** **5. VALUE**	63 63.1 63.2 63.3 63.4 63.5	The status of the low low alarm and its associated time stamp. See Resource Block
LO_LO_LIM Low Low Limit Read & Write	55	The setting of the low low alarm in engineering units. Data format: Float–Value (4 Byte) Default value: –1.#INF (Not active)
LO_LO_PRI Low Low Priority Read & Write	54	Priority of the low low alarm. Data format: Unsigned8 Value range: 0 …. 15 Default value: 0
LO_PRI Low Priority Read & Write	52	Priority of the low alarm. Data format: Unsigned8 Value range: 0 …. 15 Default value: 0
MODE_BLK (Record) Block Mode	5	The actual, target, permitted, and normal modes of the block. Data format: Record with 4 Parameters (4 Byte)
1. TARGET Target Read & Write	5.1	This is the mode requested by the operator. Only one mode from those allowed by the permitted mode parameter may be requested. Bit 0: ROut (Remote Ouput) Bit 1: RCas (Remote Cascade) Bit 2: Cas (Cascade Mode) Bit 3: Auto (Automatic Mode) Bit 4: Man (Manual Mode) Bit 7: O/S (Out Of Service) Data format: Bit–String with 8 Bits (1 Byte)
2.ACTUAL Actual Read only	5.2	This is the current mode of the block, which may differ from the target based on operating conditions. Its value is calculated as part of block execution. Bit 0: ROut (Remote Ouput) Bit 1: RCas (Remote Cascade) Bit 2: Cas (Cascade Mode) Bit 3: Auto (Automatic Mode) Bit 4: Man (Manual Mode) Bit 5: LO (Local Override) Bit 6: IMan (Initializ. Man.) Bit 7: O/S (Out Of Service) Data format: Bit–String with 8 Bits (1 Byte)

PID Block

Label/Name/Handling	Index (rel.)	Description/Format
3. PERMITTED Permitted Read & Write	5.3	Defines the modes which are allowed for an instance of the block. The permitted mode is configured based on application requirement. Bit 0: ROut (Remote Ouput) Bit 1: RCas (Remote Cascade) Bit 2: Cas (Cascade Mode) Bit 3: Auto (Automatic Mode) Bit 4: Man (Manual Mode) Bit 7: O/S (Out Of Service) Data format: Bit–String with 8 Bits (1 Byte). Default value: 0xF9 (Rout | Rcas | Cas | Auto | Man | O/S)
4. NORMAL Normal Read & Write	5.4	This is the mode which the block should be set to during normal operating conditions. Bit 0: ROut (Remote Ouput) Bit 1: RCas (Remote Cascade) Bit 2: Cas (Cascade Mode) Bit 3: Auto (Automatic Mode) Bit 4: Man (Manual Mode) Bit 7: O/S (Out Of Service) Data format: Bit–String with 8 Bits (1 Byte) Default value: 0x10 (Auto)
OUT (Record) Output **1. STATUS** **2. VALUE**	9 9.1 9.2	The primary analog value calculated as a result of executing the function block. See PID–Block → BKCAL_IN
OUT_HI_LIM Output High Limit Read & Write	28	Limits the maximum output value for modes other than Manual. Data format: Float–Value (4 Byte) Default value: 100.0
OUT_LO_LIM Output Low Limit Read & Write	29	Limits the minimum output value for modes other than Manual. Data format: Float–Value (4 Byte) Default value: 0.0
OUT_SCALE (Record) Output Scale **1. EU_100** **2. EU_0** **3. UNITS_INDEX** **4. DECIMAL**	11 11.1 11.2 11.3 11.4	The high and low scale values, engineering units code, and number of digits to the right of the decimal point to be used in displaying the OUT parameter and parameters which have the same scaling as OUT. See PID–Block → FF_SCALE
PV (Record) Process Value Read only **1. STATUS** **2. VALUE**	7 7.1 7.2	Either the primary analog value for use in executing the function, or a process value associated with it. May also be calculated from the READBACK value of an AO block. See PID–Block → BKCAL_IN

PID Block		
Label/Name/Handling	**Index (rel.)**	**Description/Format**
PV_FTIME Process Value Filter Time Read & Write	16	Time constant of a single exponential filter for the PV, in sec. Data format: Float–Value (4 Byte) Value range: ≥ 0.0 Sec Default value: 0.0 Sec
PV_SCALE (Record) Process Value Scale **1. EU_100** **2. EU_0** **3. UNITS_INDEX** **4. DECIMAL**	10 10.1 10.2 10.3 10.4	The high and low scale values, engineering units code, and number of digits to the right of the decimal point to be used in displaying the PV parameter and parameters which have the same scaling as PV. See PID–Block → FF_SCALE
RATE Rate Read & Write	26	Defines the derivative time constant, in seconds. Data format: Float–Value (4 Byte) Default value: 0.0
RCAS_IN (Record) Remote Cascade Input **1. STATUS** **2. VALUE**	32 32.1 32.2	Target setpoint and status provided by a supervisory Host to a analog control or output block. See PID–Block → BKCAL_IN
RCAS_OUT (Record) Remote Cascade Output **1. STATUS** **2. VALUE**	35 35.1 35.2	Block setpoint and status after ramping – provided to a supervisory Host for back calculation and to allow action to be taken under limiting conditions or mode change. See PID–Block → BKCAL_IN
RESET Reset Read & Write	24	The integral time constant, in seconds per repeat. Data format: Float–Value (4 Byte) Default value: 1.#INF Sec
ROUT_IN (Record) Remote Out Input **1. STATUS** **2. VALUE**	33 33.1 33.2	Target output and status provided by a Host to the control block for use as the output (ROut mode) See PID–Block → BKCAL_IN
ROUT_OUT (Record) Remote Out Output **1. STATUS** **2. VALUE**	36 36.1 36.2	Block output and status – provided to a Host for back calculation in ROut mode and to allow action to be taken under limited conditions or mode change. See PID–Block → BKCAL_IN
SHED_OPT Shed Options Read & Write	34	Defines action to be taken on remote control device timeout. 0: Uninitialized 1: Normal Shed_Normal Return 2: Normal Shed_No Return 3: Shed To Auto_Normal Return 4: Shed To Auto_No Return 5: Shed To Manual_Normal Return 6: Shed To Manual_No Return 7: Shed To Retained Target_Normal Return 8: Shed To Retained Target_No Return Data format: Unsigned8 Default value: 0 (Uninitialized)

PID Block		
Label/Name/Handling	**Index (rel.)**	**Description/Format**
SP (Record) Setpoint **1. STATUS** **2. VALUE**	8 8.1 8.2	The analog setpoint of this block. See PID–Block → BKCAL_IN
SP_HI_LIM Setpoint High Limit Read & Write	21	The setpoint high limit is the highest setpoint operator entry that can be used for the block. Data format: Float–Value (4 Byte) Default value: 100.0
SP_LO_LIM Setpoint Low Limit Read & Write	22	The setpoint low limit is the lowest setpoint operator entry that can be used for the block. Data format: Float–Value (4 Byte) Default value: 0.0
SP_RATE_DN Setpoint Rate Down Read & Write	19	Ramp rate at which downward setpoint changes are acted on in Auto mode, in PV units per second. If the ramp rate is set to zero or the block is in a mode other than Auto, then the setpoint will be used immediately. Data format: Float–Value (4 Byte) Value range: ≥ 0.0 [PV/Sec] Default value: 1.#INF (Not active)
SP_RATE_UP Setpoint Rate Up Read & Write	20	Ramp rate at which upward setpoint changes are acted on in Auto mode, in PV units per second. If the ramp rate is set to zero or the block is in a mode other than Auto, then the setpoint will be used immediately. Data format: Float–Value (4 Byte) Value range: ≥ 0.0 [PV/Sec] Default value: 1.#INF (Not active)
ST_REV Static Revision Read only	1	The revision level of the static data associated with the function block. The revision value will be incremented each time a static parameter value in the block is changed. Data format: Unsigned16
STATUS_OPTS Status Options Read & Write	14	Options which the user may select in the block processing of status. Bit 0: Initiate Fault State if Bad IN Bit 1: Initiate Fault State if Bad CAS_IN Bit 2: Uncertain as Good Bit 5: Target to Man if Bad IN Bit 9: Target to next permitted mode if BAD CAS_IN Data format: Bit–String with 16 Bits (2 Byte) Default value: 0
STRATEGY Strategy Read & Write	3	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block. Data format: Unsigned16 Default value: 0x0000
TAG_DESC Tag Description Read & Write	2	The user description of the intended application of the block. Data format: Octet–String (32 Byte)

PID Block		
Label/Name/Handling	**Index (rel.)**	**Description/Format**
TRK_IN_D (Record) Tracking Input Discrete	38	This discrete input is used to initiate external tracking of the block output to the value specified by TRL_VAL. Data format: Record with 2 Parameters (2 Byte)
1. VALUE Value Read & Write	38.1	A numerical quantity received by the block parameter from another block parameter to which this block is linked. Or a default or user entered value if the parameter has not been linked. 0 Discrete state 0 (False/Off/Close) 1 Discrete state 1 (True/On/Open) Data format: Unsigned8
2. STATUS QUALITY Status SUBSTATUS Read & Write LIMITS	38.2	This additional, valuable information will be passed along with each transmission of a data value in the form of a status attribute. See PID–Block → BKCAL_IN
TRK_SCALE (Record) Tracking Scale	37	The high and low scale values, engineering units code, and number of digits to the right of the decimal point associated with TRK_VAL.
1. EU_100	37.1	See PID–Block → FF_SCALE
2. EU_0	37.2	
3. UNITS_INDEX	37.3	
4. DECIMAL	37.4	
TRK_VAL (Record) Tracking Value	39	This input is used as the track value when external tracking is enabled by TRK_IN_D.
1. STATUS	39.1	See PID–Block → BKCAL_IN
2. VALUE	39.2	
UPDATE_EVT (Record) Update Event	43	This alert is generated by any change to the static data. See Resource Block
1. UNACKNOWLEDGED	43.1	
2. UPDATE_STATE	43.2	
3. TIME_STAMP	43.3	
4. STATIC_REVISION	43.4	
5. RELATIVE_INDEX	43.5	

5.5.3 Options

The effect of the option bits of the parameters CONTROL_OPTS, STATUS_OPTS and SHED_OPT are described in the following sections.

CONTROL_OPTS

These are options the user may select to alter the calculation done in the PID block.

Bypass Enable

This parameter, if true, allows BYPASS to be set. Some control algorithm applications cannot provide closed loop control if bypassed.

SP–PV Track in Man

Permits the setpoint to track the process variable when the target mode of the block is Man.

SP–PV Track in ROut

Permits the setpoint to track the process variable when the actual mode of the block is ROut.

SP–PV Track in LO or IMan

Permits the setpoint to track the process variable when the actual mode of the block is LO or IMan.

SP Track retained target

Permits the setpoint to track the RCas or Cas parameter based on the retained target mode when the actual mode of the block is IMan, LO, Man, or ROut. When SP–PV track options are enabled, then SP Track retained target will have precedence in the selection of the value to track when the actual mode is Man, IMan, Rout, and LO.

Direct Acting

Defines the relationship between a change in PV and corresponding change in output. When Direct is selected, an increase in PV results in an increase in the output.

Track Enable

This enables the external tracking function. If true, the value in TRK_VAL will replace the value of OUT if TRK_IN_D becomes true and the target mode is not Man.

Track in Manual

This enables TRK_VAL to replace the value of OUT when the target mode is Man and TRK_IN_D is true. The actual mode will then be LO.

Use PV for BKCAL_OUT

The BKCAL_OUT and RCAS_OUT values are normally the working SP. If this option is enabled, then the PV value will be used after the cascade is closed.

Obey SP limits if Cas or RCas

Normally the setpoint will not be restricted to the setpoint limits except when entered by a human interface device. However, if this option is selected, the setpoint will be restricted to the setpoint absolute limits in the Cas and RCas modes.

No OUT limits in Manual

Do not apply OUT_HI_LIM or OUT_LO_LIM when target and actual modes are Man. Trust the operator to do the right thing.

STATUS_OPTS

Options which the user may select in the block processing of status.

IFS if BAD IN

Set Initiate Fault State status in the OUT parameter if the status of the IN parameter is BAD.

IFS if BAD CAS_IN

Set Initiate Fault State status in the OUT parameter if the status of the CAS_IN parameter is BAD.

Use Uncertain as Good

If the status of the IN parameter is Uncertain, treat it as Good. Otherwise, treat it as BAD.

Target to Manual if BAD IN

Set the target mode to Man if the status of the IN parameter is BAD. This latches a PID block into the Man state if the input ever goes bad.

Set the output status of an input or calculation block to uncertain if the actual mode of the block is Man.Target to Next Permitted Mode if BAD

CAS_IN

Set the target mode to next permitted mode if the target mode is CAS and the status of CAS_IN is BAD. This latches a control block into the next permitted mode if the CAS_IN is being used in control and the status goes bad.

SHED_OPTS

Defines action to be taken on remote control device timeout.

0 = Undefined – Invalid

1 = Normal shed, normal return – Actual mode changes to the next lowest priority non–remote mode permitted but returns to the target remote mode when the remote computer completes the initialization handshake.

2 = Normal shed, no return – Target mode changes to the next lowest priority non–remote mode permitted. The target remote mode is lost, so there is no return to it.

3 = Shed to Auto, normal return

4 = Shed to Auto, no return – Target mode changes to Auto on detection of a shed condition.

5 = Shed to Manual, normal return

6 = Shed to Manual, no return – Target mode changes to Man on detection of a shed condition. When the target mode is set to Manual, the Retained bits will be set to zero (0).

7 = Shed to Retained target, normal return

8 = Shed to Retained target, no return
(change target to retained target)

5.5.4 Device Description

The device description is based on the standard device description for PID function blocks. An additional hierarchical parameter menu has been added.

Service and Maintenance

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The positioner is largely maintenance-free. The positioners are fitted with filters in the pneumatic connections as protection against coarse particles of dirt. This dirt will be deposited under pressure on to the filter and the filters may clog and impair the function of the positioner. In this case the filters can be cleaned as follows.

Positioner in metal housing and explosion-proof version

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

Positioner in plastic housing

Removal

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

Installation

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

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

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

DANGER

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

Repair/Upgrade

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

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

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

Technical Data

7

(see following pages)

Technical specifications

SIPART PS2 (all versions)	
General data	
Travel range (linear actuators)	3 ... 130 mm (0.12 ... 5.12 inch) (angle of feedback shaft 16 ... 90°)
Angle of rotation (part-turn actuators)	30 ... 100°
Installation	
• On linear actuators	Using attachment set 6DR4004-8V and where necessary with an additional lever arm 6DR4004-8L on actuators according to IEC 534-6 (NAMUR) with ribs, bars or flat face
• On part-turn actuators	Using attachment set 6DR4004-8D on actuators with mounting plane according to VDI/VDE 3845 and DIN 3337: The required mounting console has to be provided on the actuator side; shaft with groove and female thread M6
Controller	
• Five-point switch	Self-adjusting
• Dead zone	
- dEbA = Auto	Self-adjusting or can be set as fixed value
- dEbA = 0.1 ... 10%	Self-adjusting or can be set as fixed value
A/D converter	
• Scan time	10 ms
• Resolution	≤ 0.05%
• Transmission error	≤ 0.2%
• Temperature effect	≤ 0.1%/10 K (≤ 0.1%/18 °F)
Cycle time	
• 20 mA/HART device	20 ms
• PA device	60 ms
• FF device	60 ms (min. loop time)
Binary input BE1 (terminals 9/10; electrically connected to the basic device)	Suitable only for floating contact; max. contact load < 5 mA with 3 V
Degree of protection[1]	IP66 to EN 60 529/NEMA 4x
Mounting position	Any; pneumatic connections and exhaust opening not facing up in wet environment
CE marking	Conformity as regards EMC Directive 89/336 EC in accordance with the following standards
EMC requirements	EN 61326/A1 Appendix A.1 and NAMUR NE21 August 98
Material	
• Housing	
- 6DR5..0-... (plastic)	Glass-fiber-reinforced Macrolon
- 6DR5..1-... (metal)	GD AlSi12
- 6DR5..2-... (stainless steel)	Austenitic stainless steel mat. No. 1.4581
- 6DR5..5-... (metal, pressure-proof)	GK AlSi12
• Pressure gauge block	Aluminium AlMgSi, anodized
Vibration resistance	
• Harmonic oscillations (sine-wave) according to DIN EN 60062-2-6/05.96	3.5 mm (0.14 inch), 2 ... 27 Hz 3 cycles/axis 98.1 m/s² (321.84 ft/s²), 27 ... 300 Hz, 3 cycles/axis
• Bumping (half-sine) to DIN EN 60068-2-29/03.95	150 m/s² (492 ft/s²), 6 ms, 1000 shocks/axis
• Noise (digitally controlled) to DIN EN 60068-2-64/08.95	10 ... 200 Hz; 1 (m/s²)²/Hz (3.28 (ft/s²)²/Hz) 200 ... 500 Hz; 0.3 (m/s²)²/Hz (0.98 (ft/s²)²/Hz) 4 hours/axis
• Recommended continuous duty range of the complete fitting	≤ 30 m/s² (≤ 98.4 ft/s²) without resonance sharpness
Weight, basic device	
• Plastic casing	Approx. 0.9 kg (0.90 kg)
• Metal casing, aluminium	Approx. 1.3 kg (1.30 kg)
• Metal casing, stainless steel	Approx. 3.9 kg (3.90 kg)
• Metal casing EEx d version	Approx. 5.2 kg (11.46 lb)
Dimensions	See Dimensional drawings
Climate class 4	To DIN EN 60721-3-4
• Storage[2]	1K5, but -40 ... +80 °C (1K5, but -40 ... +176 °F)
• Transport[2]	2K4, but -40 ... +80 °C (2K4, but -40 ... +176 °F)
• Operation[3]	4K3, but -30 ... +80 °C (4K3, but -22 ... +176 °F)
Certificate and approvals	
Classification according to pressure equipment directive (DRGL 97/23/EC)	For gases of fluid group 1, complies with requirements of article 3, paragraph 3 (sound engineering practice SEP)
Pneumatic data	
Power supply (inlet air)	
• Pressure	1.4 ... 7 bar (20.3 ... 101.5 psi): Sufficiently greater than max. drive pressure (actuating pressure)
Air quality to ISO 8573-1	
• Solid particle size and density	Class 2
• Pressure dew point	Class 2 (min. 20 K (36 °F) below ambient temperature)
• Oil content	Class 2
Unthrottled flow	
• Inlet air valve (ventilate actuator)[4]	
- 2 bar (29 psi)	4.1 Nm³/h (18.1 USgpm)
- 4 bar (58 psi)	7.1 Nm³/h (31.3 USgpm)
- 6 bar (87 psi)	9.8 Nm³/h (43.1 USgpm)
• Outlet air valve (ventilate actuator)[4]	
- 2 bar (29 psi)	8.2 Nm³/h (36.1 USgpm)
- 4 bar (58 psi)	13.7 Nm³/h (60.3 USgpm)
- 6 bar (87 psi)	19.2 Nm³/h (84.5 USgpm)
Valve leakage	$< 6 \cdot 10^{-4}$ Nm³/h (0.0026 USgpm)
Throttle ratio	Adjustable up to ∞ : 1
Power consumption in the controlled state	$< 3.6 \cdot 10^{-2}$ Nm³/h (0.158 USgpm)
Types of actuators	
• In plastic casing	Single-action and double-action
• In aluminium casing	Single-action
• In flameproof casing	Single-action and double-action
• In stainless steel casing	Single-action and double-action

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

Technical specifications

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

SIPART PS2 FF	**Basic device without Ex protection**	**Basic device with EEx d protection, flameproof casing**	**Basic device with EEx ia/ib protection**
Communication			
Communications group and class	According to technical specification of the Fieldbus Foundation for H1 communication		
Function blocks	Group 3, Class 31PS (publisher, subscriber) 1 resource block (RB2) 1 analog output function block (AO) 1 PID function block (PID) 1 transducer block (standard advanced positioner valve)		
Execution times of the blocks	AO: 60 ms PID: 80 ms		
Physical layer profile	123, 511		
FF registration	Tested with ITK 4.6		
Connections			
Electric	Screw terminals 2.5 AWG28-12 Cable gland M20 x 1.5 or ½-14 NPT	Screw terminals 2.5 AWG28-12 EEx d certified cable gland M20 x 1.5, ½-14 NPT or M25 x 1.5	Screw terminals 2.5 AWG28-12 Cable gland M20 x 1.5 or ½-14 NPT
Pneumatic	Female thread G¼ DIN 45 141 (¼-18 NPT)	Female thread G¼ DIN 45 141 (¼-18 NPT)	Female thread G¼ DIN 45 141 (¼-18 NPT)
External position sensor (potentiometer or NCS; as option)			
• U_o	–	–	< 5 V
• I_o	–	–	< 75 mA
• I_s	–	–	< 160 mA
• P_o	–	–	< 120 mW
Maximum permissible external capacitance C_o	–	–	< 1 µF
Maximum permissible external inductance L_o	–	–	< 1 mH

Technical specifications

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

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

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

Scope of Delivery/Spare parts/Accessories 8

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

WARNING

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

8.1 Option modules

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

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

8.2 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 non-explosion-proof explosion-proof cable length 6 m for rotary actuator for linear actuator up to 14 mm	6DR4004-_ N_ _ 0 6DR4004-8N 6DR4004-6N 6DR4004-_NN 6DR4004-_N_10 6DR4004-_N_20
EMC filter rmodule	C73451-A430-D23
External position detection system	C73451-A430-D78

8.3 List of Spare Parts

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

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

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

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Appendix 10

10.1 Literature and catalogs

No.	Title	Issued by	Order number
[1]	Field Instruments for Process Automation Catalog FI01	Siemens AG	E86060–D4001–A110–B9–7600
[FF–890 FS 1.5]	Function Block Application Process Part 1, Revision FS 1.5	Fieldbus Foundation	
[FF–891 FS 1.5]	Function Block Application Process Part 2, Revision FS 1.5	Fieldbus Foundation	
[FF–903 PS 3.0]	Transducer Block Application Process Part 2, Revision PS 3.0	Fieldbus Foundation	

10.2 Certificates

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

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A5E00214569-03

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