

MANUFACTURER DOCUMENT PACKAGE

Manufacturer's Manual

Reference package for procurement and maintenance review

SIEMENS

6DR5010-0EN01-0AA0

ELECTROPNEUMATIC VALVE POSITIONER

Used with the applicable SIPART PS2 configuration.

REFERENCE PACKAGE

OFFICIAL DOCUMENT

Selected official manufacturer pages follow this cover.

Source: SIPART PS2 Compact Operating Instructions, 09/2020, A5E03436620-AF

1.6 Security information

Siemens provides products and solutions with industrial security functions that support the secure operation of plants, systems, machines and networks.

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial security concept. Siemens' products and solutions constitute one element of such a concept.

Customers are responsible for preventing unauthorized access to their plants, systems, machines and networks. Such systems, machines and components should only be connected to an enterprise network or the internet if and to the extent such a connection is necessary and only when appropriate security measures (e.g. firewalls and/or network segmentation) are in place.

For additional information on industrial security measures that may be implemented, please visit
<https://www.siemens.com/industrialsecurity>.

Siemens' products and solutions undergo continuous development to make them more secure. Siemens strongly recommends that product updates are applied as soon as they are available and that the latest product versions are used. Use of product versions that are no longer supported, and failure to apply the latest updates may increase customer's exposure to cyber threats.

To stay informed about product updates, subscribe to the Siemens Industrial Security RSS Feed under
<https://www.siemens.com/industrialsecurity>.

1.7 Transportation and storage

To guarantee sufficient protection during transport and storage, observe the following:

- Keep the original packaging for subsequent transportation.
- Devices/replacement parts should be returned in their original packaging.
- If the original packaging is no longer available, ensure that all shipments are properly packaged to provide sufficient protection during transport. Siemens cannot assume liability for any costs associated with transportation damages.

NOTICE
Insufficient protection during storage
The packaging only provides limited protection against moisture and infiltration.
• Provide additional packaging as necessary.

Special conditions for storage and transportation of the device are listed in Technical data (Page 59).

1.8 Notes on warranty

The contents of this manual shall not become part of or modify any prior or existing agreement, commitment or legal relationship. The sales contract contains all obligations on the part of Siemens as well as the complete and solely applicable warranty conditions. Any statements regarding device versions described in the manual do not create new warranties or modify the existing warranty.

The content reflects the technical status at the time of publishing. Siemens reserves the right to make technical changes in the course of further development.

Safety instructions

2.1 Precondition for use

This device left the factory in good working condition. In order to maintain this status and to ensure safe operation of the device, observe these instructions and all the specifications relevant to safety.

Observe the information and symbols on the device. Do not remove any information or symbols from the device. Always keep the information and symbols in a completely legible state.

2.2 Warning symbols on the device

Symbol	Explanation
	Consult operating instructions

2.3 Laws and directives

Observe the test certification, provisions and laws applicable in your country during connection, assembly and operation. These include, for example:

- National Electrical Code (NEC - NFPA 70) (USA)
- Canadian Electrical Code (CEC) (Canada)

Further provisions for hazardous area applications are for example:

- IEC 60079-14 (international)
- EN 60079-14 (EU)

- For Korea only:

이 기기는 업무용(A 급) 전자파 적합기기로서 판매자
또는 사용자는 이 점을 주의하시기 바라며 가정 외의

지역에서 사용하는 것을 목적으로 합니다

2.4 Conformity with European directives

The CE marking on the device shows conformity with the regulations of the following European guidelines:

Electromagnetic compatibility EMC 2014/30/EU	Directive of the European Parliament and of the Council on the harmonization of the laws of the Member States relating to electromagnetic compatibility.
Atmosphère explosive ATEX 2014/34/EU	Directive of the European Parliament and of the Council on the harmonization of the laws of the Member States relating to equipment and protective systems intended for use in potentially explosive atmospheres.
2011/65/EU RoHS	Directive of the European Parliament and of the Council on the restriction of the use of certain hazardous substances in electrical and electronic equipment

The directives applied can be found in the EU declaration of conformity for the associated device.

2.5 Product approval and UL compliance

Classification according to pressure equipment directive (PED 2014/68/EU)	For fluid group 1 gases; fulfills requirements according to article 4, paragraph 3 (good engineering practice SEP)
CE conformity	The applicable directives and applied standards with their revision levels can be found in the EU declaration of conformity on the Internet.
UL conformity	You can find the appropriate "Standard(s) for Safety", including the relevant versions, in the UL-CERTIFICATE OF COMPLIANCE on the Internet.

2.6 Improper modifications

 WARNING
Improper device modifications Risk to personnel, system and environment can result from modifications to the device, particularly in hazardous areas. Only carry out modifications that are described in the instructions for the device. Failure to observe this requirement cancels the manufacturer's warranty and the product approvals.

! WARNING**Improper modification on positioner 6DR5...6**

Danger of explosion. The pneumatic terminal plate on the SIPART PS2 positioner 6DR5..6 is a safety-related component of the flameproof enclosure.

- Never loosen the screws ① of the pneumatic terminal plate.

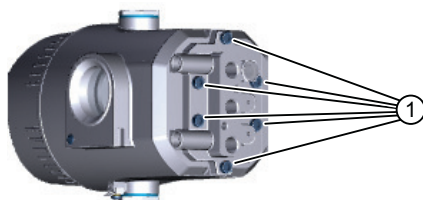


Figure 2-1 Screws of the pneumatic terminal plate on the positioner 6DR5..6

2.7 Use in areas subject to explosion hazard

Qualified personnel for hazardous area applications

Persons who install, connect, commission, operate, and service the device in a hazardous area must have the following specific qualifications:

- They are authorized, trained or instructed in operating and maintaining devices and systems according to the safety regulations for electrical circuits, high pressures, aggressive, and hazardous media.
- They are authorized, trained, or instructed in carrying out work on electrical circuits for hazardous systems.
- They are trained or instructed in maintenance and use of appropriate safety equipment according to the pertinent safety regulations.

! WARNING**Use in hazardous area**

Risk of explosion.

- Only use equipment that is approved for use in the intended hazardous area and labeled accordingly.
- Do not use devices that have been operated outside the conditions specified for hazardous areas. If you have used the device outside the conditions for hazardous areas, make all Ex markings unrecognizable on the nameplate.



WARNING

Loss of safety of device with type of protection "Intrinsic safety Ex i"

If the device or its components have already been operated in non-intrinsically safe circuits or the electrical specifications have not been observed, the safety of the device is no longer ensured for use in hazardous areas. There is a risk of explosion.

- Connect the device with type of protection "Intrinsic safety" solely to an intrinsically safe circuit.
- Observe the specifications for the electrical data on the certificate and/or in Technical data (Page 59).

Installing/mounting

3.1 Basic safety instructions

** WARNING****High operating force with pneumatic actuators**

Risk of injury when working on control valves due to the high operating force of the pneumatic actuator.

- Please observe the corresponding safety instructions for the pneumatic actuator in use.

** WARNING****It is possible to damage the cover gasket**

If the cover gasket is not positioned correctly in the groove of the base plate, it could be damaged when the cover is mounted and screwed tight.

- Therefore make sure that the gasket is seated correctly.

** WARNING****Exceeded maximum permissible operating pressure**

Risk of injury or poisoning.

The maximum permissible operating pressure depends on the device version, pressure limit and temperature rating. The device can be damaged if the operating pressure is exceeded. Hot, toxic and corrosive process media could be released.

Ensure that maximum permissible operating pressure of the device is not exceeded. Refer to the information on the nameplate and/or in Technical data (Page 59).

** WARNING****Electrostatic charging of nameplates**

The nameplates used on the device can reach a charging capacity of 5 pF.

- Keep the device and the cables at a distance from strong electromagnetic fields.

 CAUTION

Unsuitable compressed air

Device damage. As a general rule, the positioner must only be operated with dry and clean compressed air.

- Use the customary water separators and filters. An additional dryer is required in extreme cases.
- Use dryers, especially if you operate the positioner at low ambient temperatures.

 CAUTION

Adhere to the following instructions before working on the control valve and when attaching the positioner

Danger of injury.

- Prior to working on the control valve, you must move the actuator and the process valve into a completely pressureless state. Proceed as follows:
 - Depressurize the actuator chambers.
 - Switch off the supply pressure PZ.
 - Secure the process valve.
- Make sure that the actuator has reached the pressureless state.
- If you interrupt the supply pressure PZ to the positioner, the pressureless position can only be reached after a certain waiting time.
- When mounting, adhere strictly to the following order to avoid injuries or mechanical damage to the positioner/mounting kit:
 - Mount the positioner mechanically.
 - Electric connection.
 - Connect supply pressure PZ.
 - Commission the positioner.

 WARNING

Mechanical impact energy

In order to ensure the degree of protection of the housing (IP66), protect the housing versions of the positioners listed here from mechanical impact energy:

- 6DR5..3; not greater than 2 Joule
- 6DR5..0; not greater than 1 Joule
- 6DR5..1 with inspection window; not greater than 1 Joule

NOTICE

Torque with NPT screwed gland

Device damage. The maximum torque of the cable gland must not be exceeded.

- To avoid damage to the device, the NPT adapter must be held in place while the NPT gland is screwed into the NPT adapter. Refer to the section "Technical specifications > Construction (Page 61)" for the torque value.

3.1.1 Proper mounting

NOTICE

Incorrect mounting

The device can be damaged, destroyed, or its functionality impaired through improper mounting.

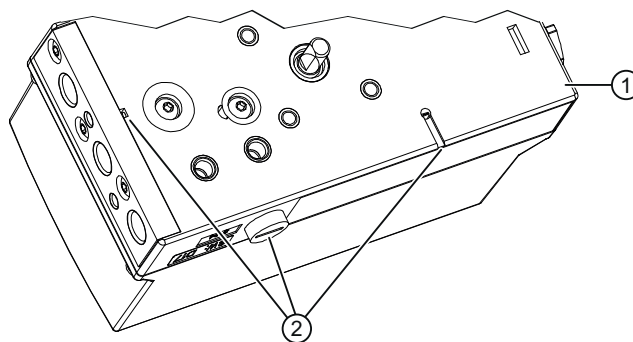
- Before installing ensure there is no visible damage to the device.
- Make sure that process connectors are clean, and suitable gaskets and glands are used.
- Mount the device using suitable tools. Refer to the information in Construction (Page 61).

NOTICE

Freezing of the exhaust air outlets

When devices of the type 6DR5..0/1/2/3 are used, the exhaust air outlets ② may freeze. The function of the device is impaired.

- Do **not** install the positioner with the base plate ① pointing up.



- ① Base plate
- ② Exhaust air outlets

Figure 3-1 Exhaust air outlets, base plate

3.2 Mounting to linear actuator

For linear actuators, use the "linear actuator" mounting kit 6DR4004-8V or the integrated attachment.

You require different installation parts depending on the selected actuator type. The mounting kit is suitable for a stroke of 3 to 35 mm. For a larger stroke range, you require a separately ordered lever 6DR4004-8L. Refer to the detailed operating instructions for further information on mounting.

3.3 Mounting to part-turn actuator

You require an actuator-specific VDI/VDE 3845 mount to install the positioner on a part-turn actuator. You receive the mount and screws from the actuator manufacturer. Ensure that the mount has a sheet metal thickness of > 4 mm and reinforcements. You also need the mounting kit 6DR4004-8D or the stainless steel coupling TGX: 16300-1556. Refer to the detailed operating instructions for further information on mounting.

3.4 Installing option modules

Depending on the version of the positioner, the following option modules are available:

- Digital I/O Module (DIO) 6DR4004-6A / -8A
- Analog Input Module (AIM) 6DR4004-6F / -8F
- Inductive Limit Switches (ILS) 6DR4004-6G / -8G
- Analog Output Module (AOM) 6DR4004-6J / -8J
- Mechanic Limit Switches (MLS) 6DR4004-6K / -8K
- Internal NCS module 6DR4004-5L / -5LE
- NCS sensor 6DR4004-6N / -8N

For additional information and the corresponding safety notes to be observed when installing the option modules, refer to the detailed operating instructions for your respective device version.

3.4.1 Internal NCS module

The internal NCS module is used for wear-free position detection and is an optional equipment version in the positioner. The internal NCS module is installed as an alternative to the Analog Output Module (AOM) at the same slot in the positioner.

Connecting

4.1 Basic safety instructions

WARNING

Lever for position detection

Danger of crushing and shearing with mounting kits which use a lever for position detection. During commissioning and ongoing operation, severing or squeezing of limbs could occur as a result of the lever. Risk of injury when working on control valves due to the high operating force of the pneumatic actuator.

- Do not reach into the range of motion of the lever following mounting of the positioner and mounting kit.

WARNING

With intrinsically device version (Ex i)

Risk of explosion in hazardous areas.

For intrinsically safe device versions only the certified circuits may be connected as auxiliary power supply, control and signal circuits.

- Make sure that the power source of the used circuits is marked as intrinsically safe.

WARNING

Unsuitable cables, cable glands and/or plugs

Risk of explosion in hazardous areas.

- Use only cable glands/plugs that comply with the requirements for the relevant type of protection.
- Tighten the cable glands in accordance with the torques specified in Construction (Page 61).
- Close unused cable inlets for the electrical connections.
- When replacing cable glands, only use cable glands of the same type.
- After installation, check that the cables are seated firmly.

NOTICE**Condensation in the device**

Damage to device through formation of condensation if the temperature difference between transportation or storage and the mounting location exceeds 20 °C (36 °F).

- Before taking the device into operation, let the device adapt for several hours in the new environment.

NOTICE**Ambient temperature too high**

Damage to cable sheath.

- At an ambient temperature ≥ 60 °C (140 °F), use heat-resistant cables suitable for an ambient temperature at least 20 °C (36 °F) higher.

**WARNING****Improper power supply**

Risk of explosion in hazardous areas as result of incorrect power supply.

- Connect the device in accordance with the specified power supply and signal circuits. The relevant specifications can be found in the certificates, in Technical data (Page 59) or on the nameplate.

**WARNING****Lack of equipotential bonding**

Risk of explosion through compensating currents or ignition currents through lack of equipotential bonding.

- Ensure that the device is potentially equalized.

Exception: It may be permissible to omit connection of the equipotential bonding for devices with type of protection "Intrinsic safety Ex i".

**WARNING****Unprotected cable ends**

Risk of explosion through unprotected cable ends in hazardous areas.

- Protect unused cable ends in accordance with IEC/EN 60079-14.

! WARNING**Improper laying of shielded cables**

Risk of explosion through compensating currents between hazardous area and the non-hazardous area.

- Shielded cables that cross into hazardous areas should be grounded only at one end.
- If grounding is required at both ends, use an equipotential bonding conductor.

! WARNING**Connecting device in energized state**

Risk of explosion in hazardous areas.

- Connect devices in hazardous areas only in a de-energized state.

Exceptions:

- Devices having the type of protection "Intrinsic safety Ex i" may also be connected in energized state in hazardous areas.
- Exceptions for type of protection "Increased safety ec" (Zone 2) are regulated in the relevant certificate.

! WARNING**Incorrect selection of type of protection**

Risk of explosion in areas subject to explosion hazard.

This device is approved for several types of protection.

1. Decide in favor of one type of protection.
2. Connect the device in accordance with the selected type of protection.
3. In order to avoid incorrect use at a later point, make the types of protection that are not used permanently unrecognizable on the nameplate.

NOTICE**Standard cable gland/torque**

Device damage.

- Owing the reasons pertaining to tightness (IP enclosure rating) and the required tensile strength, only use the cables having a diameter ≥ 8 mm for standard M20x1.5 cable gland, or use a suitable seal insert in case of smaller diameters.
- In the NPT version, the positioner is delivered with a coupling. When inserting a counter piece in the coupling, ensure that the maximum permissible torque of 10 Nm is not exceeded.



CAUTION

Maximum AC/DC switching voltage with UL approval E344532

Mechanic Limit Switches (MLS) 6DR4004-**6K**/-**8K** are approved for use with positioners with UL approval. The maximum switching voltage in this case is ≤ 30 V AC/DC.

If switching voltages greater than 30 V are connected, the UL approval for the positioner becomes invalid.

Two-wire mode

NOTICE

Connection of voltage source to current input

Device damage if a voltage source is connected to the current input I_w (terminals 6 and 7).

- Never connect the current input I_w to a low-resistance voltage source, otherwise the positioner may be destroyed.
- Always use a high-impedance power source.
- Observe the static destruction limit specified in the "Electrical data (Page 68)".

Note

Improvement of interference immunity

- Lay signal cables separate from cables with voltages > 60 V.
- Use cables with twisted wires.
- Keep device and cables at a distance from strong electromagnetic fields.
- Take account of the conditions for communication specified in the Technical data (Page 59).
- Use shielded cables to guarantee the full specification according to HART/PA/FF/Modbus/EIA-485/Profibus DP.

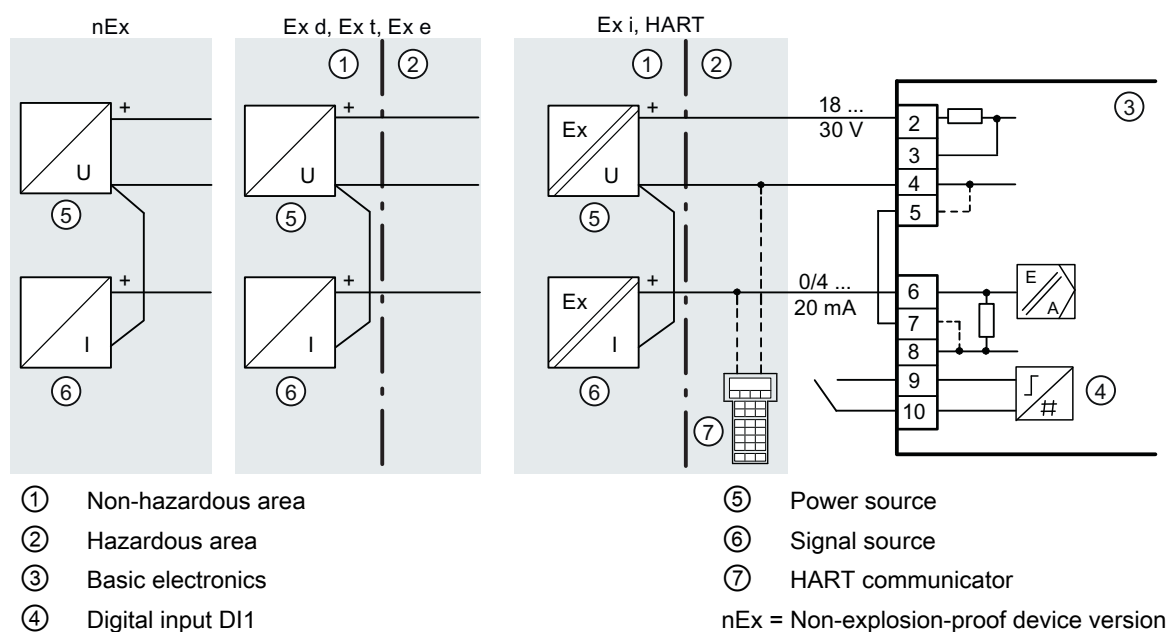


Figure 4-3 Device version 2-/3-/4-wire, with connection type 3-wire

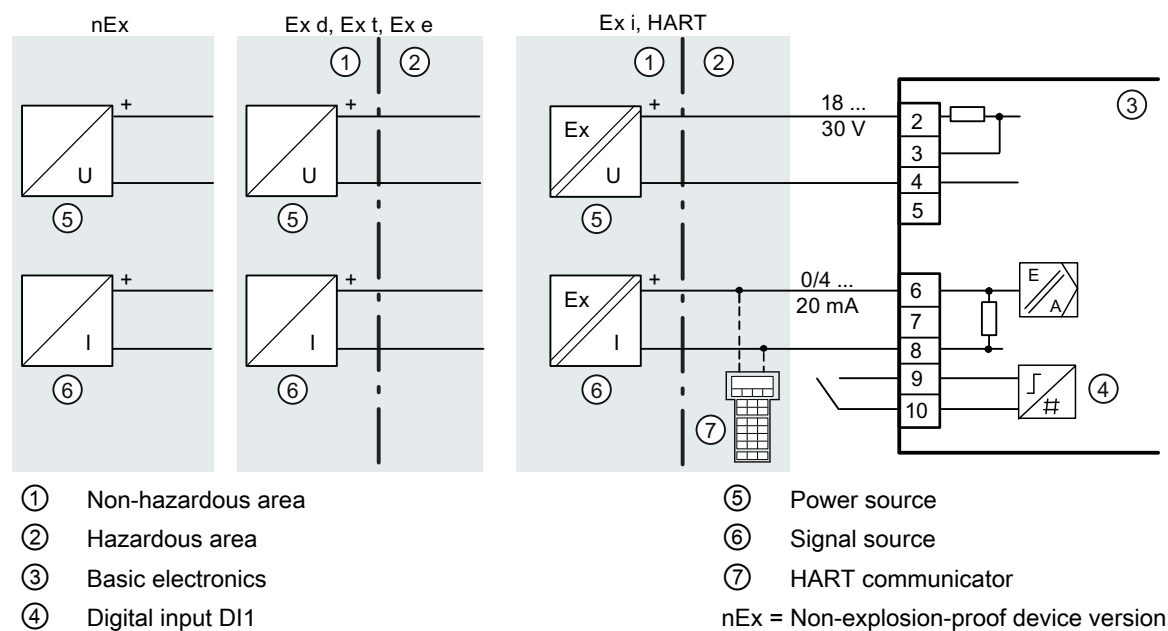


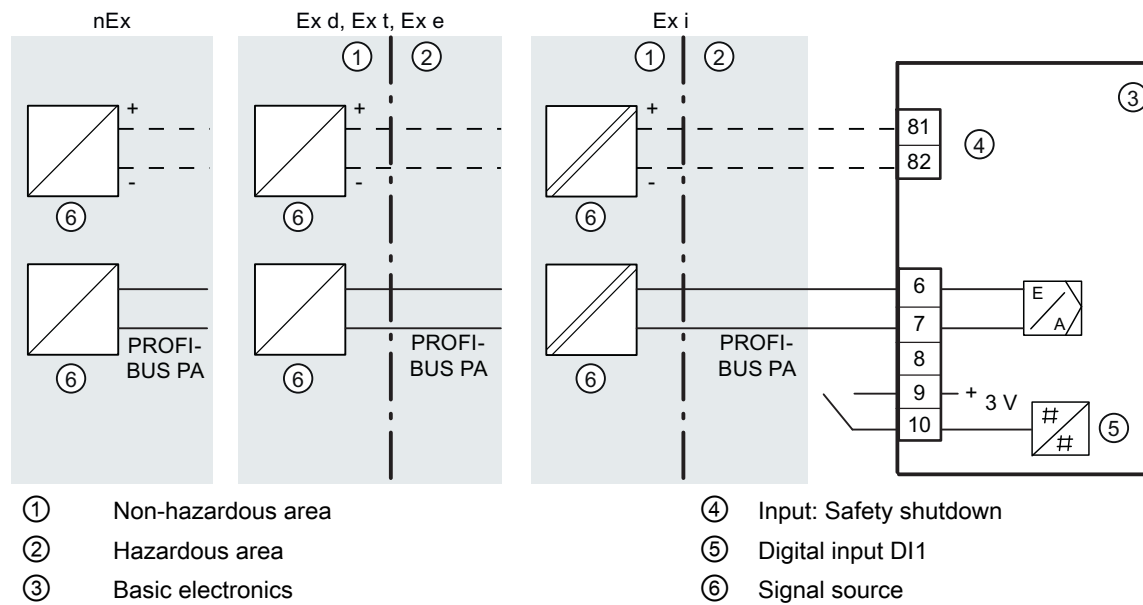
Figure 4-4 Device version 2-/3-/4-wire, with connection type 4-wire

See also

Electrical data (Page 68)

Technical data (Page 59)

4.2.2 SIPART PS2 with PROFIBUS PA



nEx = Non-explosion-proof device version

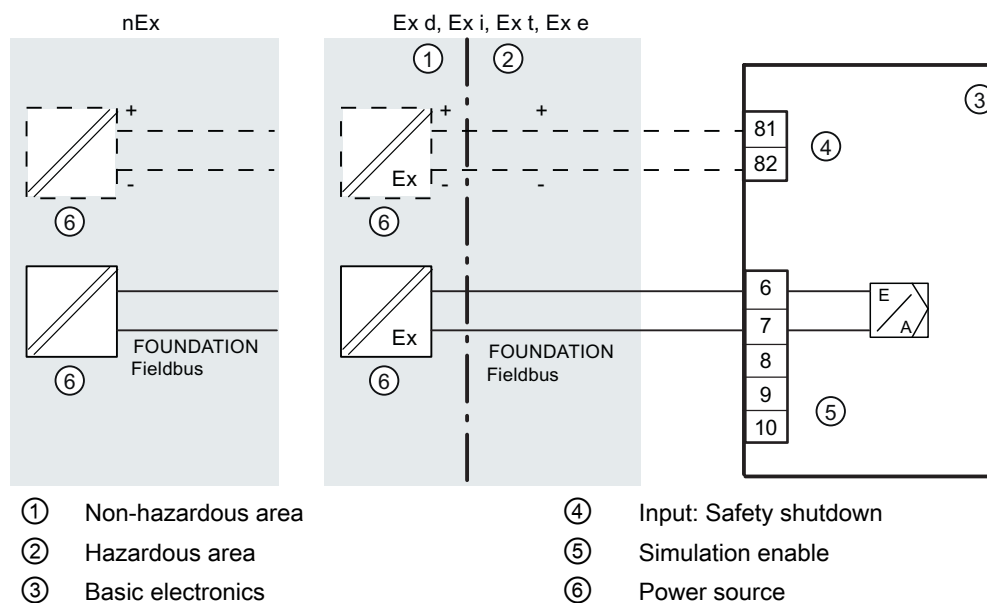
Figure 4-5 Device version with PROFIBUS PA

See also

Electrical data (Page 71)

Technical data (Page 59)

4.2.3 SIPART PS2 with FOUNDATION Fieldbus



nEx = Non-explosion-proof device version

Figure 4-6 Device version with FOUNDATION Fieldbus

See also

Electrical data (Page 71)

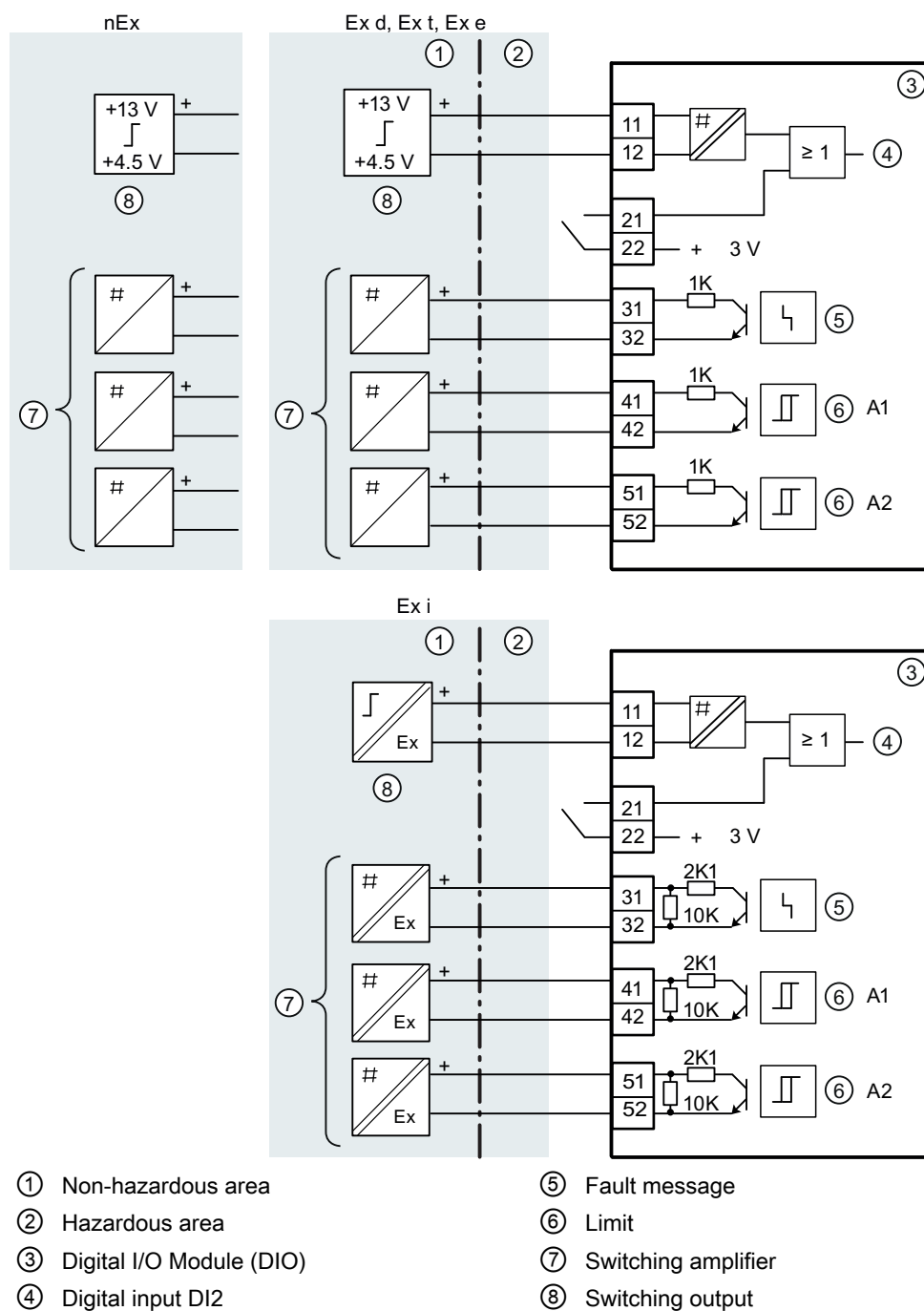
Technical data (Page 59)

4.2.4 Split range

For further information about "Split-range" operation, refer to the detailed operating instructions for your respective device version.

4.2.5 Option modules

4.2.5.1 Digital I/O Module (DIO) 6DR4004-6A / -8A



nEx = Non-explosion-proof device version

Figure 4-7 Digital I/O Module (DIO)

4.2.5.2 Analog Output Module (AOM) 6DR4004-6J / -8J

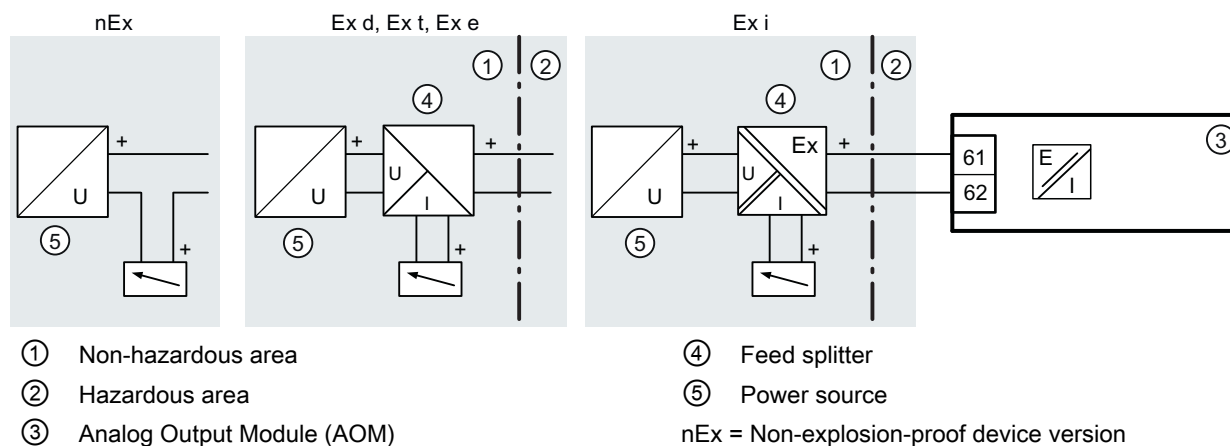


Figure 4-8 Analog Output Module (AOM)

4.2.5.3 Inductive Limit Switches (ILS) 6DR4004-6G / -8G

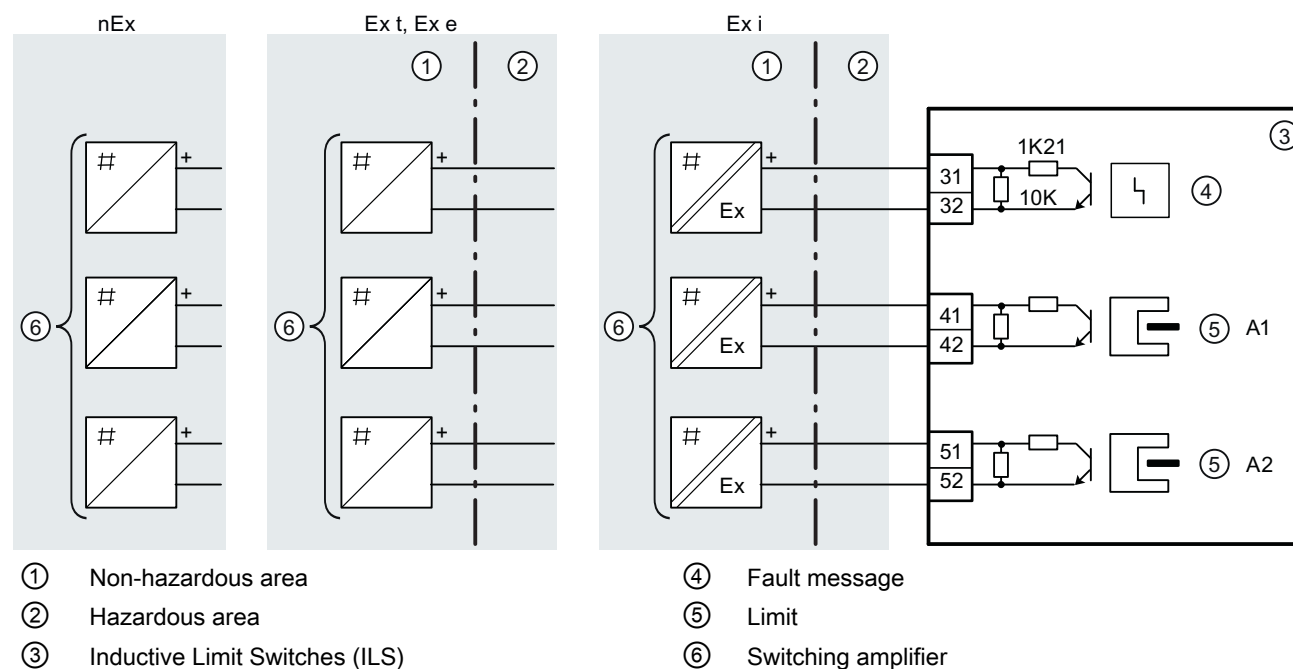


Figure 4-9 Inductive Limit Switches (ILS)

See also

Inductive Limit Switches (ILS) 6DR4004-6G / -8G (Page 75)

4.2.5.4 Mechanic Limit Switches (MLS) 6DR4004-6K / -8K

! DANGER**Supply with hazardous voltage**

If you connect the switching contacts of the 6DR4004-8K module to a hazardous voltage, observe the following safety rules:

1. Isolate the device from power. Use a circuit breaker positioned near the device to do this.
2. Make sure that the device cannot be switched back on inadvertently.
3. Make sure the device is truly isolated from power.

! CAUTION**Maximum AC/DC switching voltage with UL approval E344532**

Mechanic Limit Switches (MLS) 6DR4004-6K/-8K are approved for use with positioners with UL approval. The maximum switching voltage in this case is ≤ 30 V AC/DC.

If switching voltages greater than 30 V are connected, the UL approval for the positioner becomes invalid.

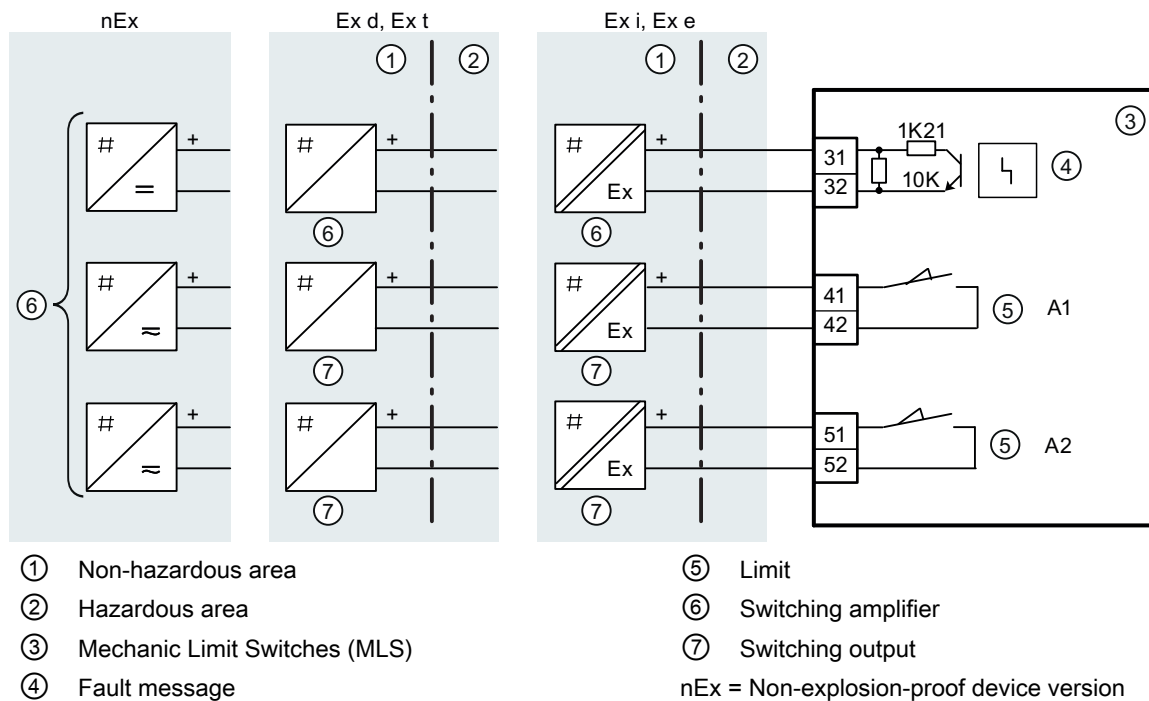


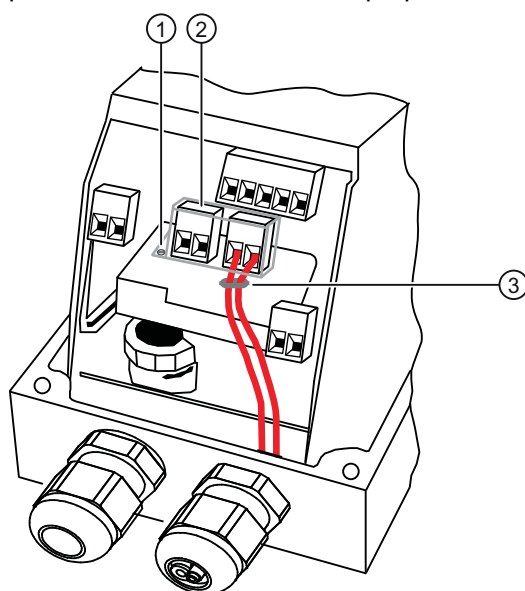
Figure 4-10 Mechanic Limit Switches (MLS)

See also

Mechanic Limit Switches (MLS) 6DR4004-6K / -8K (Page 77)

Procedure

1. Loosen the screw ① on the transparent cover ②.
2. Pull the transparent cover ② up to the front end stop.
3. Tighten every cable in the corresponding terminal.
4. Slide the transparent cover ② up to the end stop of the basic electronics.
5. Tighten the screw ① of the transparent cover ②.
6. Connect the cables of each switch to the lug of the printed circuit board in pairs. Use the provided cable ties ③ for this purpose.



- ① Screw
- ② Cover
- ③ Cable tie

Figure 4-11 Connecting the cables

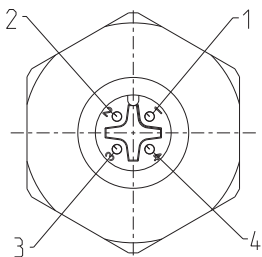
4.2.6 Option device version M12 connector

This section describes which terminal of the devices and option modules listed below is connected with the respective pole of the M12 connector.

Note

Technical specifications

Observe the specifications for the electrical data in the certificate and/or in section "Technical data (Page 59)".

View of the mating side pole pattern

Pole designation	Wire color of M12 basic connector socket
1	Brown
4	Black
3	Blue
2	White

4.2.6.1 In the basic unit with 4 to 20 mA/HART

You have a positioner 6DR50/1..-0.R.. or 6DR50/1..-0.S. In this version of the positioner, the current input I_W 4 to 20 mA of the basic electronics is connected via the M12 connector.

Table 4-1 Assignment diagram

Current input terminal	Pole designation
6 (+)	1 - Brown
Shield support of enclosure	4 - Black
7 and 8 (-)	3 - Blue

4.2.6.2 In the basic unit with PROFIBUS PA

You have a positioner 6DR55..-0.R.. or 6DR55..-0.S. In this case the M12 connector is connected to the bus circuit of the basic electronics.

Table 4-2 Assignment diagram

Bus circuit terminal	Pole designation
7	1 - Brown
Shield support of enclosure	4 - Black
6	3 - Blue

4.2.6.3 In the basic unit with FOUNDATION Fieldbus

You have a positioner 6DR56..-0.R.. or 6DR56..-0.S.. In this case the M12 connector is connected to the bus circuit of the basic electronics.

Table 4-3 Assignment diagram

Bus circuit terminal	Pole designation
7	1 - Brown
Shield support of enclosure	4 - Black
6	3 - Blue

4.2.6.4 In the basic unit with Analog Output Module (AOM) 6DR4004-6J / -8J (-Z D53)

You have a positioner with order suffix -Z order code D53. In this version of the positioner, the current output of Analog Output Module (AOM) is electrically connected to the M12 connector.

Table 4-4 Assignment diagram

Current output terminal	Pole designation
61 (+)	1 - Brown
Shield support of enclosure	4 - Black
62 (-)	3 - Blue

4.2.6.5 In the basic unit with Position Transmitter (-Z D54)

You have a positioner with order suffix -Z order code D54. In this version of the positioner, the installed Analog Input Module (AIM) 6DR4004-6F/-8F is electrically connected to the M12 connector. You connect the Position Transmitter 6DR4004-1ES/-2ES using the M12 connector.

Table 4-5 Assignment diagram

Terminal	Pole designation
REF	2 - White
POS	3 - Blue
GND	4 - Black
VCC	1 - Brown

4.2.6.6 In the basic unit with Digital I/O Module (DIO) 6DR4004-6A / -8A (-Z D55)

You have a positioner with order suffix -Z order code D55. In this version of the positioner, the current output of Digital I/O Module (DIO) is electrically connected to the M12 connector.

Table 4-6 Assignment diagram

Terminal of digital outputs A1 and A2	Pole designation
41 (+)	1 - Brown
52 (-)	4 - Black
42 (-)	3 - Blue
51 (+)	2 - White

4.2.6.7 In the basic unit with Inductive Limit Switches (ILS) 6DR4004-6G /-8G (-Z D56)

You have a positioner with order suffix -Z order code D56. In this version of the positioner, the digital outputs A1 and A2 of the Inductive Limit Switches (ILS) are electrically connected to the M12 device plug.

Table 4-7 Assignment diagram

Terminal of digital outputs A1 and A2	Pole designation
41 (+)	1 - Brown
52 (-)	4 - Black
42 (-)	3 - Blue
51 (+)	2 - White

4.2.6.8 In the basic unit with Mechanic Limit Switches (MLS) 6DR4004-6K (-Z D57)

You have a positioner with order suffix -Z order code D57. In this version of the positioner, the digital outputs A1 and A2 of the Mechanic Limit Switches (MLS) are electrically connected to the M12 connector.

Table 4-8 Assignment diagram

Terminal of digital outputs A1 and A2	Pole designation
41 (+)	1 - Brown
52 (-)	4 - Black
42 (-)	3 - Blue
51 (+)	2 - White

4.3 Pneumatic connection

WARNING

Supply pressure PZ

For safety reasons, the supply pressure PZ can be fed after installation only if the positioner is switched to "P-Manual mode" when an electrical signal is present. This operating mode is preset in the delivery state.

Note

Specifications regarding air quality

Observe the specifications regarding the air quality in section "Technical specifications > Pneumatic data (Page 60)".

Note**Leakage**

Besides continuous air consumption, a leakage can cause the positioner to try to compensate the position deviation. This will result in premature wear in the entire control device.

- Check offline for leakage using the "11.LEAK" diagnostic parameter.
- If there is leakage, check the pneumatic connections for leaks.

4.3.1 Pneumatic connection for 6DR5..0/1/2/3

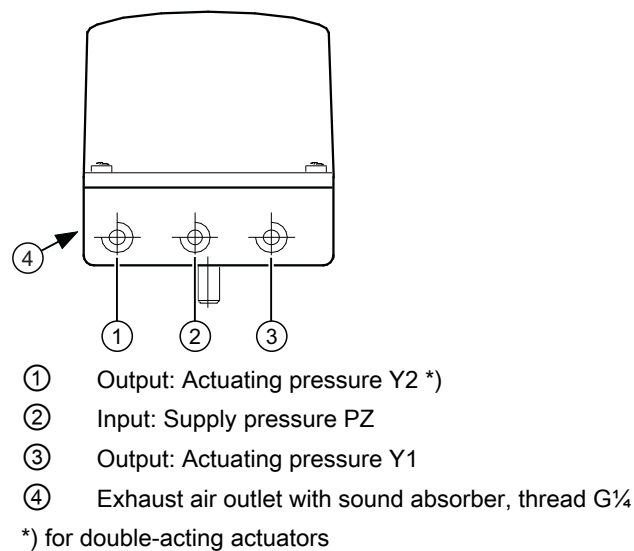
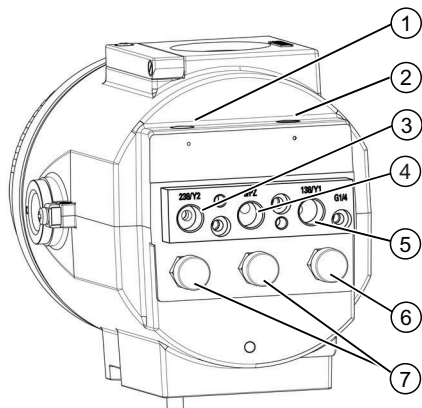


Figure 4-12 Pneumatic connection, example

4.3.2 Pneumatic connection for 6DR5..5 and 6DR5..6

Structure

The pneumatic connections are provided on the right side of the positioner.



① Restrictor Y2 *)

② Restrictor Y1

③ Output: Actuating pressure Y2 *)

④ Input: Supply pressure PZ

*) for double-acting actuators

⑤ Output: Actuating pressure Y1

⑦ Enclosure ventilation (2x)

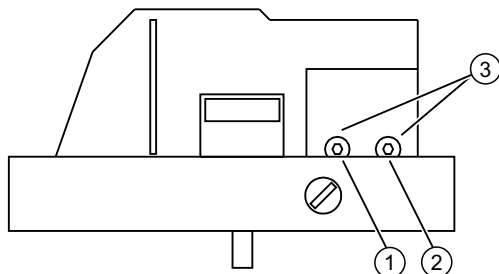
⑥ Exhaust air outlet

Figure 4-13 Pneumatic connection in the flameproof enclosure

4.4 Restrictors

- Reduce the air output to achieve travel times of $T > 1.5$ s for small actuators. Use restrictors Y1 ① and Y2 ② for this purpose.
- When turned clockwise, they reduce the air output and finally shut it off.

- In order to set the restrictors, we recommend closing them and then opening slowly.
- In case of double-acting valves, ensure that both restrictors have approximately the same setting.



- ① Restrictor Y1
- ② Restrictor Y2, only in the version for double-acting actuators *)
- ③ Hexagon socket-head screw 2.5 mm

Figure 4-14 Restrictors

*) Restrictor Y2 ② is not active for single-acting Fail in Place F01



WARNING

Opening device in energized state

Risk of explosion in hazardous areas

- Only open the device in a de-energized state.
- Check prior to commissioning that the cover, cover locks, and cable inlets are assembled in accordance with the directives.

Exception: Devices having the type of protection "Intrinsic safety Ex i" may also be opened in energized state in hazardous areas.



WARNING

Water in compressed air line

Device damage and possibly loss of type of protection. The factory setting for the purging air selector is "IN". In the "IN" position, water from the compressed air line may enter the device from the pneumatics during initial commissioning.

- Before commissioning, make sure that no water is present in the compressed air line.

If you cannot be sure that there is no water in the compressed air line:

- Set the purging air selector to "OUT". In this way, you prevent water from the compressed air line from penetrating the device.
- Only set the purging air selector to "IN" again when all water has been discharged from the compressed air line.



CAUTION

Increased sound pressure level

Changes to the sound absorber of the positioner or the mounting of pneumatic components or pneumatic options on the positioner can cause a sound pressure with a level of 80 dBA to be exceeded.

- Wear suitable hearing protection to protect yourself against hearing damage.

When operating the positioner with natural gas, you must follow and adhere to the following safety notes:

 WARNING

Operation with natural gas

1. Only positioners and option modules which are connected to power supplies with type of protection "Intrinsic safety, protection level [ia]" may be operated with natural gas.
2. Do not operate the positioner with natural gas in closed spaces.
3. Natural gas is continuously blown off, depending on the model. Special care must therefore be taken during maintenance activities near the positioner. Always ensure that the immediate surroundings of the positioner are adequately ventilated. The maximum values for ventilation are listed in section "Natural gas as actuator medium (Page 67)".
4. If you operate the positioner with natural gas, it is not permitted to use Mechanic Limit Switches (MLS).
5. Depressurize the devices operated with natural gas adequately during maintenance activities. Open the cover in an explosion-free atmosphere and depressurize the device for at least two minutes.

Note

Quality of natural gas

Only use natural gas which is clean, dry and free from additives.

5.2 Overview

Note

- During the initialization process, the operating pressure must be at least one bar more than that required to close or open the valve. However, the operating pressure should not be greater than the maximum permissible operating pressure for the actuator.

General information about commissioning

1. After installing the positioner on a pneumatic actuator, you must supply electric and pneumatic auxiliary power to it.
2. The positioner is in the "P manual mode" before initialization. At the same time, "NOINI" blinks in the lower line of the display.
3. Position feedback: You can adjust the range of position detection using the friction clutch if necessary.
4. Adjust the positioner as per the respective actuator with the help of the initialization process and by setting the parameters. If required, use the "PRST" parameter to cancel the adjustment of the positioner on the actuator. The positioner is again in the "P manual mode" after this process.

Types of initialization

You can initialize the positioner as follows:

- Automatic initialization:
during automatic initialization, the positioner determines the following one after the other:
 - The direction of action
 - The actuator travel and angle of rotation
 - The travel time of the actuator

The positioner also adjusts the control parameters as per the dynamic response of the actuator.

- Manual initialization:
the actuator travel and the angle of rotation of the actuator are set manually. The remaining parameters are automatically determined. This function is useful for valves which are lined, for example, with PTFE.
- Copying the initialization data when replacing a positioner:
the initialization data of a positioner can be read and copied into another positioner. A defective device can thus be replaced without interrupting an ongoing process through initialization.

You have to define a few parameters for the positioner before initialization. Owing to the preset values, you cannot adjust further parameters for initialization.

With a suitable parameter assignment of the parameter "BIN1" and enabled digital input "DI1", you protect the configured settings against accidental adjustment.

5.3 Sequence of automatic initialization

See detailed operating instructions for information on sequence of automatic initialization.

5.4 Parameter

Introduction

Parameters 1 to 5 are the same for all versions of the positioner. These parameters are used to adjust the positioner to the actuator. Normally, setting these parameters is sufficient to be able to operate the positioner on an actuator.

If you want to get to know all details of the positioner, gradually try out the effects of the remaining parameters by systematic testing.

Note

Factory-set parameter values are printed in bold in the following table.

Overview

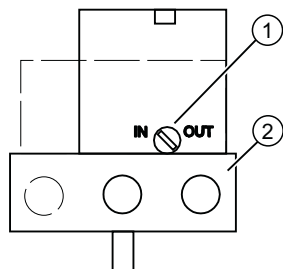
Parameter	Function	Parameter values		Unit
1.YFCT	Type of actuator	Normal	Inverted	
	Part-turn actuator	turn	-turn	
	Linear actuator	WAY	-WAY	
	Linear actuator - carrier pin on actuator spindle	FWAY	-FWAY	
	Linear actuator - external linear potentiometer (e.g. with cylinder drives)	LWAY	-LWAY	
	Part-turn actuator with NCS/iNCS	ncSt	-ncSt	
	Linear actuator with NCS	ncSL	-ncSL	
	Linear actuator with NCS/iNCS and lever	ncSLL	-ncLL	
2.YAGL	Rated angle of rotation of positioner shaft ¹⁾			Degrees
		33°		
		90°		
3.YWAY ²⁾	Range of stroke (optional setting) ³⁾			mm
		OFF		
		5 10 15 20 (Short lever 33°, range of stroke 5 mm to 20 mm)		
		25 30 35 (Short lever 90°, range of stroke 25 mm to 35 mm)		
		40 50 60 70 90 110 130 (Long lever 90°, range of stroke 40 mm to 130 mm)		
4.INITA	Initialization (automatic)	NOINI no / ###.# Strt		
5.INITM	Initialization (manual)	NOINI no / ###.# Strt		

¹⁾	Set the transmission ratio selector accordingly.
²⁾	Parameter only appears with "WAY", "-WAY", "ncSLL", and "-ncLL"
³⁾	If used, the value on the actuator must correspond to the set range of stroke on the lever arm. Carrier must be set to the value of the actuator travel or, if this value is not scaled, to the next larger scale value.

5.5 Purge air switching

When the enclosure is open, the purge air switch above the pneumatic terminal strip on the valve block can be accessed.

- In the IN position, the enclosure is flushed from inside with a small volume of clean and dry instrument air.
- In the OUT position, the purge air is directly directed towards outside.



- ① Purging air selector
② Pneumatic connections Y1, PZ and Y2

Figure 5-1 Purge air switch on the valve block; view of the positioner on the pneumatic connection side when the cover is open

The factory setting is the "IN" position.

5.6 Commissioning linear actuators

5.6.1 Preparing linear actuators for commissioning

Requirement

You have already installed the positioner using the suitable mounting kit.

Setting the transmission ratio selector

Commissioning

The setting of the transmission ratio selector is extremely important to commission the positioner.

Stroke [mm]	Position of the transmission ratio selector
5 ... 20	33°
25 ... 35	90°
40 ... 130	90°

Connecting the positioner

1. Connect a suitable power supply. The positioner is now in the "P manual mode". The current potentiometer voltage (P) in percent is shown in the upper line of the display, e.g. "P37.5", and "NOINI" flashes in the bottom line:



2. Connect the actuator and the positioner to the pneumatic lines.
3. Supply the pneumatic auxiliary power to the positioner.

Setting the actuator

1. Check whether the mechanical unit can be moved freely in the entire travel range. Move the actuator to the respective end position for this purpose using the $\triangle$ or ∇ button.
2. Now move the actuator to the horizontal position of the lever.
3. A value between "P48.0" and "P52.0" is shown on the display.
4. If a value beyond this range is shown on the display, you must move the friction clutch. Move the friction clutch until a value between "P48.0" and "P52.0" is reached. The closer this value is to "P50.0", the more accurately the positioner determines the stroke travel.

The following applies to the flameproof enclosure version:

The inner friction clutch is fixed. Therefore, only move the outer friction clutch. This also applies when using an internal NCS module.

The following applies to device versions without flameproof enclosure with internal NCS module 6DR4004-5L.:

The inner friction clutch has no function. This means you should only adjust the adjustment wheel of the magnet clamp. Requirement: 'YFCT (Page 44)' parameter is set.

5.6.2 Automatic initialization of linear actuators

Requirements

The following conditions must be fulfilled before activating the automatic initialization:

1. The actuator spindle can be moved completely.
2. The actuator spindle is at a central position after travel.

Initializing the linear actuator automatically

Note

Interrupting initialization

An ongoing initialization can be interrupted at any time. To do this, press . The settings configured until then are retained.

All parameters are reset to factory settings only if you have explicitly activated the preset settings in the "PRST" parameter.

Note

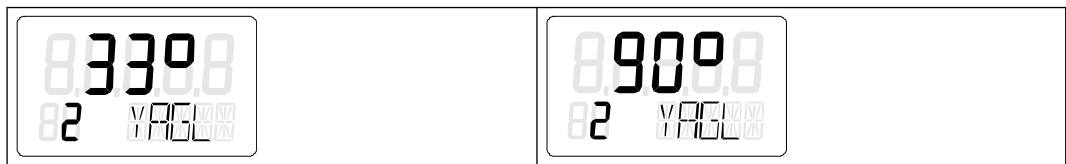
Commissioning of a tight-closing valve

If the valve is tight-closing, set the "YCLS" parameter before commissioning. This ensures that the end positions are approached for at least 15 seconds during initialization.

1. Switch to the "Configuration" mode. To do this, keep the  button pressed for at least 5 seconds. The display shows the following:



2. Call the "2.YAGL" parameter. To do this, press . The following is shown on the display depending on the setting:



3. Check whether the value displayed in the "2.YAGL" parameter matches the setting of the transmission ratio selector. If required, change the setting of the transmission ratio selector to 33° or 90°.

4. Set the "3.YWAY" parameter to determine the total stroke in mm. The setting of parameter 3 is optional. The display shows the determined total stroke at the end of the initialization phase.
 - Press the  button if you do not require any information about the total stroke in mm. You then reach parameter 4.
 - Call the "3.YWAY" parameter. To do this, press . The display shows the following:



Note

Set the "3.YWAY" parameter

1. On the scale of the lever, read the value marked by the carrier pin.
2. Set the parameter with the buttons  and  to the read value.

5. Call the "4.INITA" parameter. To do this, briefly press the  button. The display shows the following:



6. Start the initialization process. To do this, keep the  button pressed for at least 5 seconds until the display shows the following:



The positioner runs through five initialization steps during the automatic initialization process. The displays for the initialization steps from "RUN 1" to "RUN 5" are located in the lower line of the display. The initialization process depends on the actuator used, and takes up to 15 minutes.

7. The following display indicates that the automatic initialization is complete:



5.6.3 Manual initialization of linear actuators

See detailed operating instructions for information on manual initialization of linear actuators.

5.7 Commissioning part-turn actuators

5.7.1 Preparing part-turn actuators for commissioning

Note

Setting of the adjustment angle

The usual adjustment angle for part-turn actuators is 90°.

- Set the transmission ratio selector in the positioner to 90°.
-

Condition

The following conditions must be fulfilled before activating the initialization:

1. You have installed the positioner for the part-turn actuators using the suitable mounting kit.
2. You have connected the actuator and the positioner to the pneumatic lines.
3. Supplying the positioner with the supply pressure PZ.
4. The positioner has been connected to a suitable power supply.

Setting the actuator

1. The positioner is in the "P manual mode". The current potentiometer voltage P in percent is shown on the upper line in the display. "NOINI" blinks in the lower line of the display. Examples of corresponding displays are given below:



2. Check whether the mechanical unit can be moved freely in the entire travel range. Move the drive to the respective end position for this purpose using the  or  button.

Note

End position

By simultaneously pressing the  and  buttons, you reach the end position faster.

3. After checking, move the actuator to a central position. This accelerates the initialization process.

5.7.2 Automatic initialization of part-turn actuators

Requirement

The following conditions must be fulfilled before activating the automatic initialization:

1. The travel range of the actuator can be passed through completely.
2. The actuator shaft is at a central position.

Initializing the part-turn actuator automatically

Note

Interrupting initialization

An ongoing initialization can be interrupted at any time. To do this, press . The settings configured until then are retained.

All parameters are reset to factory settings only if you have explicitly activated the preset settings in the "PRST" parameter.

Note

Commissioning of a tight-closing valve

If the valve is tight-closing, set the "YCLS" parameter before commissioning. This ensures that the end positions are approached for at least 15 seconds during initialization.

1. Switch to the "Configuration" mode. To do this, press the  button for at least 5 seconds until the display shows the following:



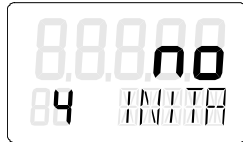
2. Use the  button to change from linear actuator to part-turn actuator until the display shows the following:



3. Call the "2.YAGL" parameter. To do this, briefly press the  button. This parameter has already been set to 90° automatically. The display shows the following:



4. Call the "4.INITA" parameter. To do this, briefly press the  button. The display shows the following:



5. Start the initialization process. To do this, press the  button for at least 5 seconds until the display shows the following:



The positioner runs through five initialization steps during the automatic initialization process. The displays for the initialization steps from "RUN 1" to "RUN 5" are located in the lower line of the display. The initialization process depends on the actuator used, and takes up to 15 minutes.

6. The following display indicates that the automatic initialization is complete. The total angle of rotation of the actuator is shown on the upper line on the display:



5.7.3 Manual initialization of part-turn actuators

See detailed operating instructions for information on manual initialization of part-turn actuators.

5.8 Canceling initialization

1. Press the  button.
 - Canceling automatic initialization: the display shows "INITA".
 - Canceling manual initialization: the display shows "INITM".

The positioner is in the "Configuration" mode.

2. Exit the "Configuration" mode. To do this, press the  button for at least 5 seconds. The software version is displayed.
After releasing the  button, the positioner is in "P manual mode". The positioner is not initialized.

Service and maintenance

6.1 Basic safety instructions

6.1.1 Maintenance

The device is maintenance-free. However, a periodic inspection according to pertinent directives and regulations must be carried out.

An inspection can include, for example, check of:

- Ambient conditions
- Seal integrity of the process connections, cable entries, and cover
- Reliability of power supply, lightning protection, and grounds

WARNING

Dust layers above 5 mm

Risk of explosion in hazardous areas.

Device may overheat due to dust build up.

- Remove dust layers in excess of 5 mm.

CAUTION

Releasing button lock

Improper modification of parameters could influence process safety.

- Make sure that only authorized personnel may cancel the button locking of devices for safety-related applications.

NOTICE

Penetration of moisture into the device

Device damage

- Make sure when carrying out cleaning and maintenance work that no moisture penetrates the inside of the device.

Technical data

7.1 All device versions

7.1.1 Rated conditions

Rated conditions	
Ambient conditions	For use indoors and outdoors.
Ambient temperature	In hazardous areas, observe the maximum permissible ambient temperature corresponding to the temperature class.
Permissible ambient temperature for operation ²⁾³⁾	-30 ... +80 °C (-22 ... +176 °F)
Height	2000 m above sea level. At altitudes greater than 2000 m above sea level, use a suitable power supply.
Relative humidity	0 ... 100%
Degree of pollution	2
Overvoltage category	II
Degree of protection ¹⁾	IP66 / Type 4X to UL 50E
Mounting position	Any; pneumatic connections and exhaust air outlet not facing up in wet environment, Proper mounting (Page 19)
Vibration resistance	
Harmonic oscillations (sine) according to EN 60068-2-6/10.2008	3.5 mm (0.14"), 2 ... 27 Hz, 3 cycles/axis 98.1 m/s ² (321.84 ft/s ²), 27 ... 300 Hz, 3 cycles/axis
Bumping (half-sine) according to EN 60068-2-27/02.2010	150 m/s ² (492 ft/s ²), 6 ms, 1000 shocks/axis
Noise (digitally controlled) according to EN 60068-2-64/04.2009	10 ... 200 Hz; 1 (m/s ²) ² /Hz (3.28 (ft/s ²) ² /Hz) 200 ... 500 Hz; 0.3 (m/s ²) ² /Hz (0.98 (ft/s ²) ² /Hz) 4 hours/axis
Recommended range of continuous operation of the entire control valve	≤ 30 m/s ² (98.4 ft/s ²) without resonance peak
Climate class	According to IEC/EN 60721-3
Storage	1K5, but -40 ... +80°C (1K5, but -40 ... +176°F)
Transport	2K4, but -40 ... +80°C (2K4, but -40 ... +176°F)

¹⁾ Max. impact energy 1 Joule for enclosure with inspection window 6DR5..0 and 6DR5..1 or max. 2 Joule for 6DR5..3

²⁾ At ≤ -10 °C (≤ 14 °F) the display refresh rate of the indicator is limited.

³⁾ The following applies to order suffix (order code) **-Z M40**: -40 ... +80 °C (-40 ... +176°F)

7.1.2 Pneumatic data

Pneumatic data	
Auxiliary power (air supply)	Compressed air, carbon dioxide (CO ₂), nitrogen (N), noble gases or cleaned natural gas
• Pressure ¹⁾	1.4 ... 7 bar (20.3 ... 101.5 psi)
Air quality to ISO 8573-1	
• Solid particulate size and density	Class 3
• Pressure dew point	Class 3 (min. 20 K (36 °F) below ambient temperature)
• Oil content	Class 3
Unrestricted flow (DIN 1945)	
• Pressurize actuator ²⁾	
2 bar; 0.1 KV (29 psi; 0.116 CV)	4.1 Nm ³ /h (18.1 USgpm)
4 bar; 0.1 KV (58 psi; 0.116 CV)	7.1 Nm ³ /h (31.3 USgpm)
6 bar; 0.1 KV (87 psi; 0.116 CV)	9.8 Nm ³ /h (43.1 USgpm)
• Depressurize actuator for all versions except fail in place ²⁾	
2 bar; 0.2 KV (29 psi; 0.232 CV)	8.2 Nm ³ /h (36.1 USgpm)
4 bar; 0.2 KV (58 psi; 0.232 CV)	13.7 Nm ³ /h (60.3 USgpm)
6 bar; 0.2 KV (87 psi; 0.232 CV)	19.2 Nm ³ /h (84.5 USgpm)
• Depressurize actuator for fail in place version	
2 bar; 0.1 KV (29 psi; 0.116 CV)	4.3 Nm ³ /h (19.0 USgpm)
4 bar; 0.1 KV (58 psi; 0.116 CV)	7.3 Nm ³ /h (32.2 USgpm)
6 bar; 0.1 KV (87 psi; 0.116 CV)	9.8 Nm ³ /h (43.3 USgpm)
Valve leakage	< 6·10 ⁻⁴ Nm ³ /h (0.0026 USgpm)
Throttle ratio	Adjustable up to ∞: 1
Auxiliary power consumption in the controlled state	< 3.6·10 ⁻² Nm ³ /h (0.158 USgpm)
Sound pressure level	L _{Aeq} < 75 dB L _{Amax} < 80 dB
Sound pressure with installed booster ³⁾	L _{Aeq} < 95.2 dB L _{Amax} < 98.5 dB

¹⁾ The following applies to fail in place double acting: 3 ... 7 bar (43.5 ... 101.5 psi)

²⁾ When using device versions Ex d (6DR5..5-... and 6DR5..6-...), values are reduced by approximately 20%.

³⁾ Read the warning notice "Increased sound pressure level".

See also

Basic safety instructions (Page 41)

7.1.3 Construction

Construction		
How does it work?		
Range of stroke (linear actuator)	3 ... 130 mm (0.12 ... 5.12") (angle of rotation of the positioner shaft 16 ... 90°)	
Angle of rotation (part-turn actuator)	30 to 100°	
Mounting method		
On the linear actuator	Using mounting kit 6DR4004-8V and, where necessary, an additional lever arm 6DR4004-8L on actuators according to IEC 60534-6-1 (NAMUR) with a fin, columns, or a plane surface.	
On the part-turn actuator	Using mounting kit 6DR4004-8D or TGX:16300-1556 on actuators with mounting plane according to VDI/VDE 3845 and IEC 60534-6-2: The required mount must be provided on the actuator-side.	
Weight, positioner without option modules or accessories		
6DR5..0 Glass-fiber reinforced polycarbonate enclosure	Approx. 0.9 kg (1.98 lb)	
6DR5.11 aluminum enclosure, only single-acting	Approx. 1.3 kg (2.86 lb)	
6DR5..2 stainless steel enclosure	Approx. 3.9 kg (8.6 lb)	
6DR5..3 aluminum enclosure	Approx. 1.6 kg (3.53 lb)	
6DR5..5 aluminum enclosure, flameproof, rugged	Approx. 5.2 kg (11.46 lb)	
6DR5..6 stainless steel enclosure, flameproof, rugged	Approx. 8.4 kg (18.5 lb)	
Material		
Enclosure		
6DR5..0 polycarbonate	Glass-fiber reinforced polycarbonate (PC)	
6DR5.11 aluminum, only single-acting	GD AlSi12	
6DR5..2 stainless steel	Austenitic stainless steel 316Cb, mat. No. 1.4581	
6DR5..3 aluminum	GD AlSi12	
6DR5..5 aluminum, flameproof, rugged	GK AlSi12	
6DR5..6 stainless steel enclosure, flameproof, rugged	Austenitic stainless steel 316L, mat. No. 1.4409	
Pressure gauge block	Aluminum AlMgSi, anodized or stainless steel 316	
Versions		
In the polycarbonate enclosure 6DR5..0	Single-acting and double-acting	
In aluminum enclosure 6DR5.11	Single-acting	
In aluminum enclosures 6DR5..3 and 6DR5..5	Single-acting and double-acting	
In stainless steel enclosures 6DR5..2 and 6DR5..6	Single-acting and double-acting	
Torques		
Part-turn actuator fixing screws DIN 933 M6x12-A2	5 Nm (3.7 ft lb)	
Linear actuator fixing screws DIN 933 M8x16-A2	12 Nm (8.9 ft lb)	
Gland pneumatic G¼	15 Nm (11.1 ft lb)	
Pneumatic gland 1/4-18 NPT		
Without sealant	12 Nm (8.9 ft lb)	

7.1 All device versions

Construction	
With sealant	6 Nm (4.4 ft lb)
• Cable glands	
Screw-in torque for plastic gland in all enclosures	4 Nm (3 ft lb)
Screw-in torque for cable gland made of metal/stainless steel in polycarbonate enclosure	6 Nm (4.4 ft lb)
Screw-in torque for metal/stainless steel glands in aluminum/stainless steel enclosure	6 Nm (4.4 ft lb)
Screw-in torque for NPT adapter made of metal/stainless steel in polycarbonate enclosure	8 Nm (5.9 ft lb)
Screw-in torque for NPT adapter made of metal/stainless steel in aluminum/stainless steel enclosure	15 Nm (11.1 ft lb)
Screw-in torque for NPT gland in the NPT adapter NOTE: To avoid damage to the device, the NPT adapter must be held in place while the NPT gland is screwed into the NPT adapter.	68 Nm (50 ft lb)
Tightening torque for union nut made of plastic	2.5 Nm (1.8 ft lb)
Tightening torque for union nut made of metal/stainless steel	4 Nm (3 ft lb)
• Pressure gauge block fixing screws	6 Nm (4.4 ft lb)
Manometer	
• Degree of protection	
Manometer made of plastic	IP31
Manometer, steel	IP44
Manometer made of stainless steel 316	IP54
• Vibration resistance	In accordance with DIN EN 837-1
Connections, electrical	
• Screw terminals	2.5 mm ² AWG30-14
• Cable gland	
Without Ex protection as well as with Ex i	M20 x 1.5 or 1/2-14 NPT
With explosion protection Ex d	Ex d-certified M20 x 1.5; 1/2-14 NPT or M25 x 1.5
Connections, pneumatic	Female thread G¼ or ¼-18 NPT

7.1.4 Controller

Controller	
Control unit	
• Five-point controller	Adaptive
• Dead zone	
dEbA = auto	Adaptive
dEbA = 0.1 ... 10 %	Can be set as fixed value
Analog-to-digital converter	

Note

The following applies for exhaust air outlet with sound absorber ③:

The positioner is supplied as standard with a sound absorber. To provide an outlet for the exhaust air, replace the sound absorber by a G $\frac{1}{4}$ pipe coupling.

The following applies for enclosure ventilation ② and control air outlet ④:

1. With the "flameproof enclosure" device version in an aluminum enclosure with order suffix -Z K50 "Operation with natural gas", you can completely collect and discharge the escaping natural gas.
2. In all other device versions, the escaping natural gas is released into the environment.

Maximum values for escaping natural gas

- The quantity of escaping natural gas is negligible during regulated operation.
- If a control error occurs, a maximum of 30 NI/min of natural gas will escape at the enclosure vent ② and a maximum of 89 NI/min at the control air outlet ④.

7.2 With 4 to 20 mA/HART

7.2.1 Electrical data

	Basic electronics without explosion protection	Basic electronics with explosion pro- tection Ex "db"	Basic electronics with explosion pro- tection Ex "ia", "db ia"	Basic electronics with explosion pro- tection Ex "ic", "ec", "tb"
Current input I_w				
• Rated signal range	4 ... 20 mA			
• Test voltage	840 V DC, 1 s			
• Digital input DI1 (terminals 9/10; galvanically connected to basic device)	Suitable only for floating contact; max. contact load < 5 µA with 3 V			
2-wire connection 6DR50.. and 6DR53.. 4 ... 20 mA 6DR51.. and 6DR52.. HART				
Current to maintain the auxiliary power	≥ 3.6 mA			
Required load voltage U _B (corresponds to Ω at 20 mA)				
• 4 to 20 mA 6DR50..				
Typical	6.36 V (= 318 Ω)	6.36 V (= 318 Ω)	7.8 V (= 390 Ω)	7.8 V (= 390 Ω)

	Basic electronics without explosion protection	Basic electronics with explosion pro- tection Ex "db"	Basic electronics with explosion pro- tection Ex "ia", "db ia"	Basic electronics with explosion pro- tection Ex "ic", "ec", "tb"
Max.	6.48 V (= 324 Ω)	6.48 V (= 324 Ω)	8.3 V (= 415 Ω)	8.3 V (= 415 Ω)
• 4 to 20 mA 6DR53..				
Typical	7.9 V (= 395 Ω)	-	-	-
Max.	8.4 V (= 420 Ω)	-	-	-
• HART 6DR51..				
Typical	6.6 V (= 330 Ω)	6.6 V (= 330 Ω)	-	-
Max.	6.72 V (= 336 Ω)	6.72 V (= 336 Ω)	-	-
HART 6DR52..				
Typical	-	8.4 V (= 420 Ω)	8.4 V (= 420 Ω)	8.4 V (= 420 Ω)
Max.	-	8.8 V (= 440 Ω)	8.8 V (= 440 Ω)	8.8 V (= 440 Ω)
• Static destruction limit	± 40 mA	± 40 mA	-	-
Effective inner capacitance C_i	-	-		
• 4 to 20 mA	-	-	11 nF	"ic": 11 nF
• HART	-	-	11 nF	"ic": 11 nF
Effective inner inductance L_i	-	-		
• 4 to 20 mA	-	-	209 μH	"ic": 209 μH
• HART	-	-	312 μH	"ic": 312 μH
For connecting to circuits with the following peak values	-	-	$U_i \leq 30 \text{ V}$ $I_i \leq 100 \text{ mA}$ $P_i \leq 1 \text{ W}$	"ic": $U_i \leq 30 \text{ V}$ $I_i \leq 100 \text{ mA}$ "ec"/"tb": $U_n \leq 30 \text{ V}$ $I_n \leq 100 \text{ mA}$

3-/4-wire connection

6DR52.. HART, explosion proof

6DR53.. 4 ... 20 mA, non-explosion-proof

Load voltage at 20 mA	$\leq 0.2 \text{ V} (= 10 \Omega)$	$\leq 0.2 \text{ V} (= 10 \Omega)$	$\leq 1 \text{ V} (= 50 \Omega)$	$\leq 1 \text{ V} (= 50 \Omega)$
Auxiliary power U_{Aux}	18 ... 35 V DC	18 ... 35 V DC	18 ... 30 V DC	18 ... 30 V DC
• Current consumption I_{Aux}	$(U_{Aux} - 7.5 \text{ V}) / 2.4 \text{ k}\Omega [\text{mA}]$			
For connecting to circuits with the following peak values	-	-	$U_i \leq 30 \text{ V}$ $I_i \leq 100 \text{ mA}$ $P_i \leq 1 \text{ W}$	"ic": $U_i \leq 30 \text{ V}$ $I_i \leq 100 \text{ mA}$ "ec"/"tb": $U_n \leq 30 \text{ V}$ $I_n \leq 100 \text{ mA}$
Effective inner capacitance C_i	-	-	22 nF	22 nF
Effective inner inductance L_i	-	-	0.12 mH	0.12 mH
Galvanic isolation	Between U_{Aux} and I_W	Between U_{Aux} and I_W	Between U_{Aux} and I_W (2 intrinsically safe circuits)	Between U_{Aux} and I_W