

## SP7-20, SP7-21 and SP7-22 Smart Positioner

### Quick start guide

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Throughout the document SP7-2\* is written where the information is relevant to all versions; the SP7-20, SP7-21 and SP7-22. Where the information is specific it will be referenced as the version appropriate.

1. Safety information
2. Installation
3. Approvals
4. Declaration of conformity

# 1. Safety information

Safe operation of these products can only be guaranteed if they are properly installed, commissioned, used and maintained by qualified personnel (see SP7-20, SP7-21 and SP7-22 Installation manual IM-P706-03) in compliance with the operating instructions. General installation and safety instructions for pipeline and plant construction, as well as the proper use of tools and safety equipment must also be complied with.

## Explosion Proof Warning

Please ensure the unit is being used and installed in conformity with local, regional, and national explosion proof regulations.

- Refer to "8. Approvals"
- Explosion proof type of cables and gaskets should be used, when explosive gases are present at the installation site.
- Power should be turned off completely when opening the product's cover. When opening the cover, ensure that there is no power remaining in any electrical parts nearby.
- Flameproof enclosure type positioner has 2 ports for power connection. Explosion proof type wires and packing should be used. A blanking plug is required for any port that is not being used.
- For external ground terminal, ring terminal with surface area of more than 5.5 mm<sup>2</sup> should be used.
- There is risk of explosion due to static electricity charge. Static electricity charge may develop when cleaning the product with a dry cloth. It is imperative to avoid static electricity charge in the hazardous environment. A damp cloth must be used, when cleaning the surface of the product.
- To meet explosion-proof marking information and ingress protection of IP66, use certified Ex-cable glands and Ex-plugs.
- The cable entry must be equipped with a cable entry device, which must be an Ex cable entry device approved by the explosion-proof inspection agency (For NEPSI - according to the requirements of GB3836.1-2010 and GB3836.2-2010) and meet the requirements of the product explosion-proof mark, and the installation of the cable entry device Use must follow its instructions.
- The positioner is designed for use at an ambient temperature range of -40 °C up to 85 °C at maximum.
- If the positioner is used at an ambient temperature above 60 °C or below -20 °C, cable glands and cables approved for a service temperature corresponding to the maximum ambient temperature increased by 10 K or corresponding to the minimum ambient temperature shall be used.
- The dimensions of the flameproof joints are in parts other than the relevant minimum or maximum values of IEC 60079-1:2014. For information on the dimensions of the flameproof joints contact the manufacturer.
- Fasteners with a minimum property class of 10.12, A2-70 or A2-80 must be used for the closing of the flameproof enclosure.

## 2. Installation



Operators must wear ear protection when commissioning the positioner

### 2.1 Measuring and operating ranges of the positioner

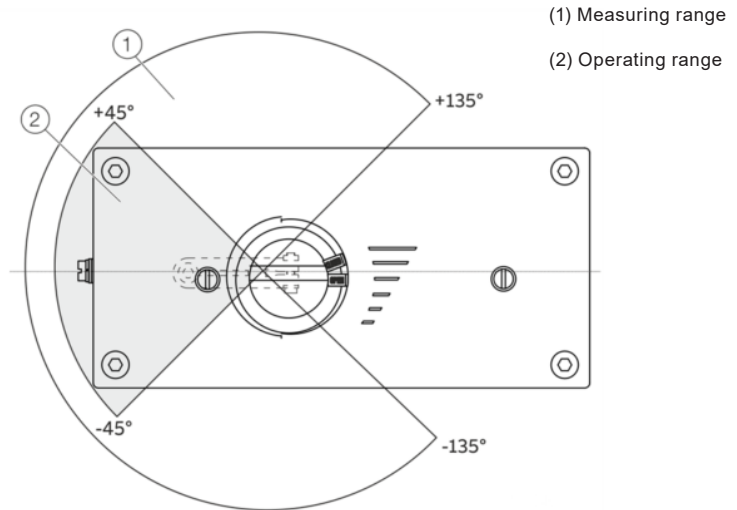


Fig. 1

#### Operating range for linear actuators:

The operating range for linear actuators is  $\pm 45^\circ$  symmetrically to the longitudinal axis. The usable span within the operating range is at least  $25^\circ$  (recommended figure  $40^\circ$ ). The usable span does not necessarily need to run symmetrically to the longitudinal axis.

#### Operating range of rotary actuators:

The usable span is  $90^\circ$ , which must be entirely within the measuring range, but does not necessarily need to run symmetrically to the longitudinal axis.

**Note:** During installation make sure that the actuator travel or rotation angle for position feedback is implemented correctly.

## 2.2 Attaching a follower guide to the actuator

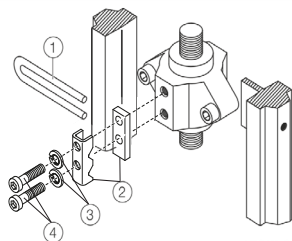


Fig. 2

1. Tighten the screws so that they are hand tight
2. Attach the follower guide (1) and clamp plates (2) with screws (4) and spring washers (3) to the actuator stem.

## 2.3 Mounting lever and bracket on the positioner

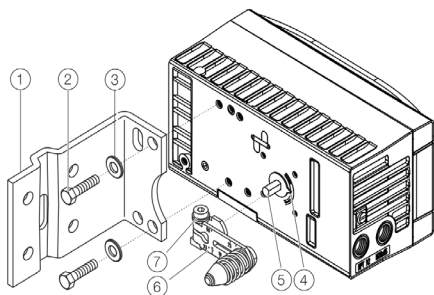


Fig. 3

1. Attach the lever (6) to the feedback shaft (5) of the positioner (can only be mounted in one position due to the cut shape of the feedback shaft).
2. Using the arrow marks (4), check whether the lever moves within the operating range (between the arrows).
3. Hand-tighten the screw (7) on the lever.
4. Hold the prepared positioner (with the mount bracket 1 still loose) on the actuator so that the follower pin for the lever enters the follower guide to determine which tap holes on the positioner must be used for the mount bracket.
5. Secure the mount bracket 1 with screws 2 and washers 3 using the relevant tap holes on the positioner housing.

### Note

Positioner mounting threaded holes and bracket holes, depend on the actuator type used. Select to suit, to ensure the follower pin has free movement in the follower guide over entire valve travel.

Tighten the screws as evenly as possible to ensure subsequent linearity. Align the mount bracket in the oblong hole to ensure that the operating range is symmetrical. Set the valve mid stroke and align the lever horizontal (item 6 Fig. 3) then tighten mounting bolt (item 4 Fig. 4) (lever moves between the arrow marks Item 4 Fig. 6).

## 2.4 Mounting on a yoke

1. Attach the mount bracket (2) with screw (4) and washer (3) to the yoke (1)

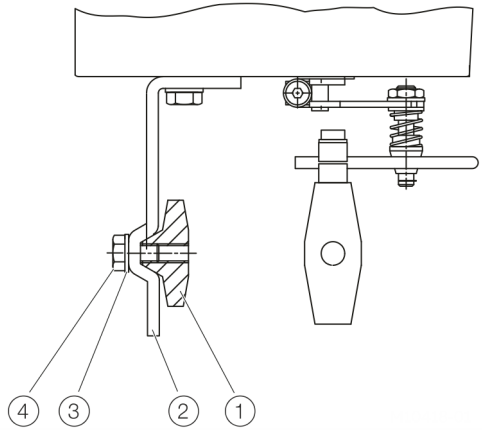


Fig. 4

## 2.5 Mounting on a column

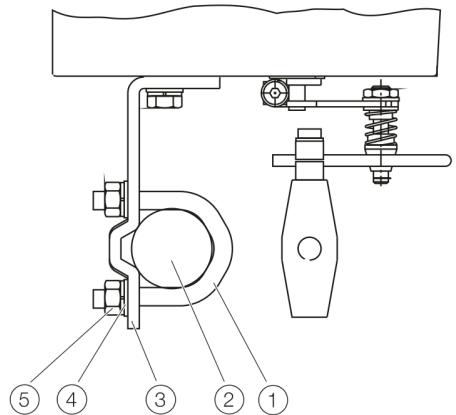


Fig. 5

1. Hold the mount bracket (3) in the proper position on the column (2).
2. Insert the U-bolts (1) from the inside of the column (2) through the holes of the mount bracket.
3. Add the washers (4) and nuts (5).
4. Tighten the nuts so that they are hand-tight.

### Notes:

- Adjust the height of the positioner on the yoke or column until the lever is horizontal (based on a visual check) at half stroke of the valve.
- Items 1, 4 and 5 to be ordered separately

## 2.6 Positioner linkage

The scale on the lever indicates the link points for the various stroke ranges of the valve.

Move the bolt with the follower pin in the oblong hole of the lever to adjust the stroke range of the valve to the working range for the position sensor.

Moving the link point inwards increases the rotation angle of the sensor. Moving the link point outwards reduces the rotation angle of the sensor.

Adjust the actuator stroke to make use of as large an angle of rotation as possible (symmetrical around the center position) on the position sensor.

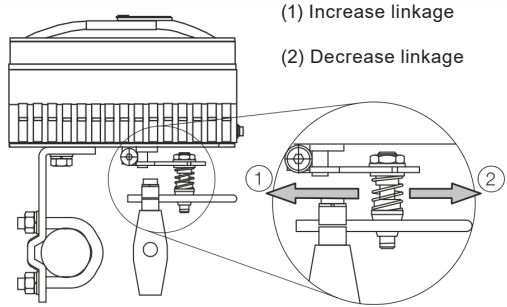


Fig. 6

Recommended range for linear actuators:	-28 to 28 °
Minimum angle:	25 °

**Note:** After mounting, check whether the positioner is operating within the measuring range.

## 2.7 Position of the actuator bolt

The actuator bolt for moving the potentiometer lever can be mounted permanently on the lever itself or on the valve stem. Depending on the mounting method, when the valve moves the actuator bolt performs either a circular or a linear movement with reference to the center of rotation of the potentiometer lever. Select the chosen bolt position in the HMI menu in order to ensure optimum linearisation. The default setting is actuator bolt on lever

## 2.8 Actuator bolts on the lever (Rear view)

1	Potentiometer lever
2	Actuator bolts
3	Valve stem
4	Valve yoke
5	Positioner

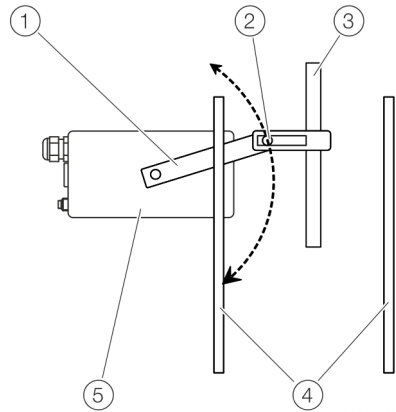


Fig. 7

## 2.9 Actuator bolts on the Valve (Rear view)

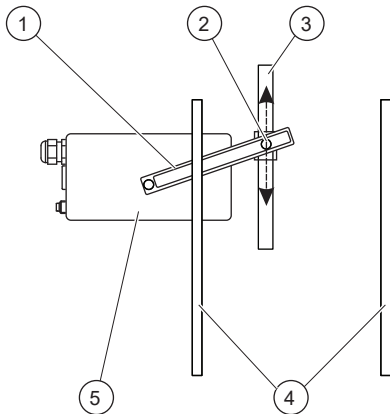


Fig. 8

- |   |                     |
|---|---------------------|
| 1 | Potentiometer lever |
| 2 | Actuator bolts      |
| 3 | Valve stem          |
| 4 | Valve yoke          |
| 5 | Positioner          |

## 2.10 Mounting the adapter on the positioner

1. Determine the mounting position (parallel to actuator or at 90 ° angle)
2. Calculate the rotational direction of the actuator (right or left).
3. Move the part-turn actuator into the home position.
4. Pre-adjust feedback shaft.

To make sure that the positioner runs within the operating range (refer to 'Measuring and operating ranges of the positioner' on page 3), the mounting position as well as the basic position and rotation direction of the actuator must be considered when determining the adapter position on axis (1). For this purpose, the feedback shaft can be adjusted manually so that the adapter (3) can be attached in the correct position.

5. Place the adapter in the proper position on the feedback shaft and fasten with threaded pins (2). One of the threaded pins must be locked in place on the flat side of the feedback shaft.

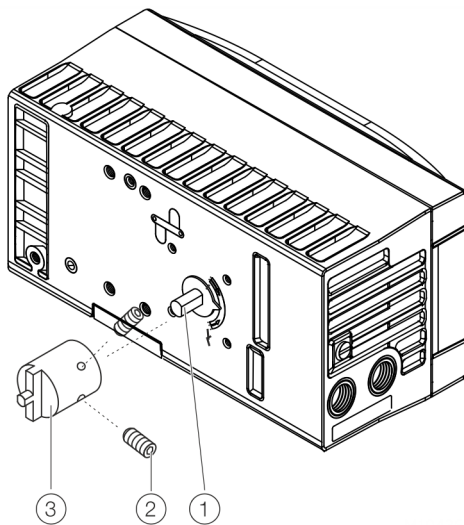


Fig. 9

## 2.11 Screwing the attachment bracket onto the positioner

(1) Attachment bracket

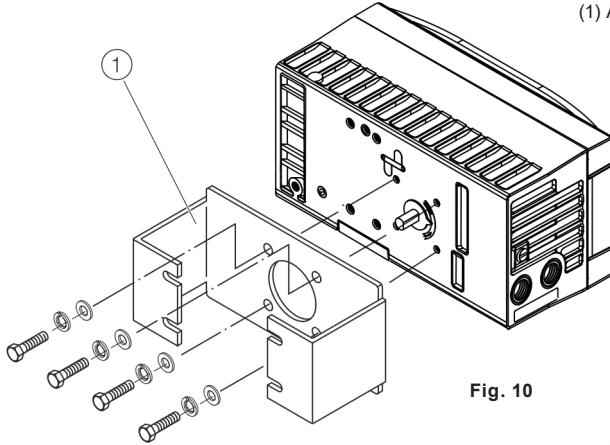


Fig. 10

## 2.12 Screwing the positioner onto the actuator

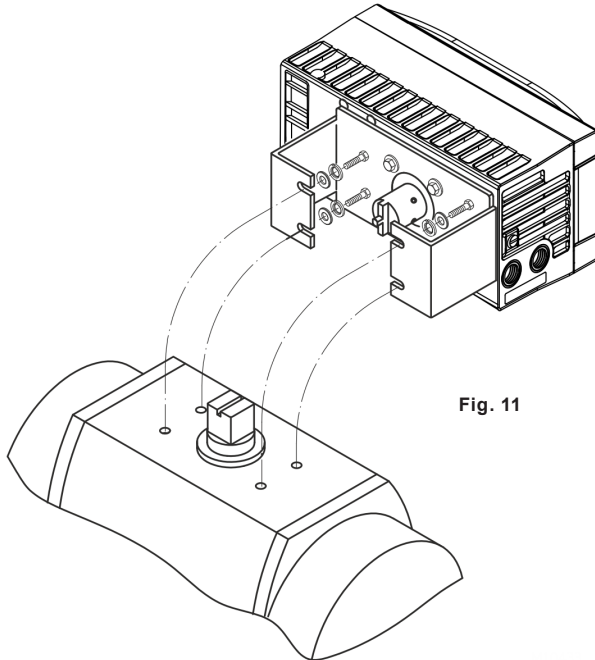


Fig. 11



## 2.13 Electrical connections

### Positioner SP7-20 Electrical Connection

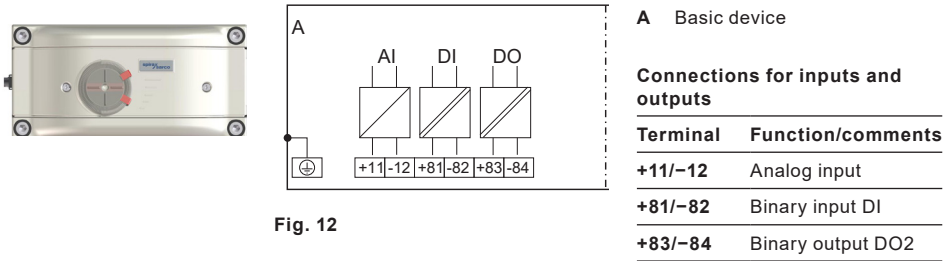


Fig. 12

### 2.14 Positioner SP7-21/22 Electrical Connection



Fig. 13

### 2.15 Electrical data for inputs and outputs

**Note :** When using the device in potentially explosive atmospheres, note the additional connection data in Use in potentially explosive atmospheres in IM-P706-03.

## 2.16 Analog input

Only for devices with HART Communication.

### Set point signal analog (two-wire technology)

Terminals	+11/-12
Nominal operating range	4 to 20 mA
Split range configuration between	20 to 100 % of the nominal operating range can be parameterized
Maximum	50 mA
Minimum	3.6 mA
Starting at	3.8 mA
Load voltage	9.7 V at 20 mA
Impedance at	20 mA 485 Ω

## 2.17 Fieldbus input

Only for devices with PROFIBUS PA or FOUNDATION Fieldbus Communication.

Bus Connection	PROFIBUS PA FOUNDATION fieldbus	
Terminals	+11/-12	+11/-12
Supply voltage (Power feed from the Fieldbus)	9 to 32 Vdc	9 to 32 Vdc
Max. permissible voltage	35 Vdc	35 Vdc
Input Current	10.5 mA	11.5 mA
Current in the event of an error	15 mA (10.5 mA + 4.5 mA)	15 mA (11.5 mA + 3.5 mA)

## 2.18 Binary Data

Only for devices with HART Communication. Output configurable as alarm output by software.

### Binary output DO

Terminals	+83/-84
Supply voltage (Control circuit in accordance with DIN 19234/NAMUR)	5 to 11 Vdc
Output 'logical 0' >	0.35 mA to < 1.2 mA
Output 'logical 1' >	2.1 mA
Direction of action	Configurable 'logical 0' or 'logical 1'

### Binary input DI

Terminals	+81/-82
Supply voltage	24 Vdc (12 to 30 Vdc)
Input 'logical 0'	0 to 5 Vdc
Input 'logical 1'	11 to 30 Vdc
Input Current	Maximum 4 mA

## 2.19 Connection on the device

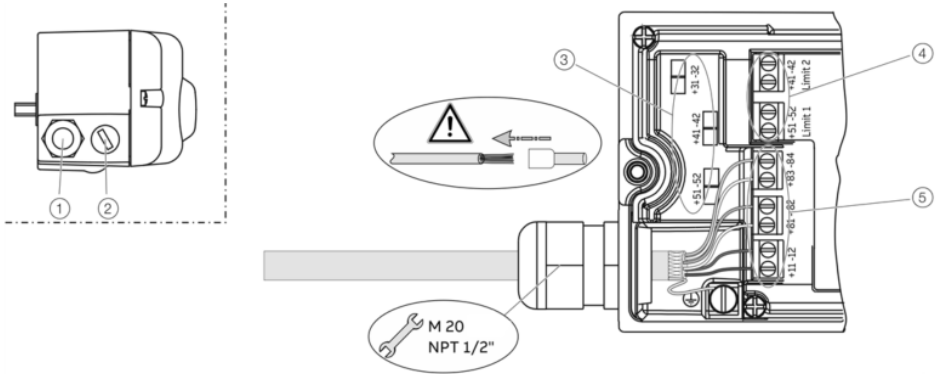


Fig. 14

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- 1 Cable gland

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  - 2 Blind plug

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  - 3 Terminals for option modules

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  - 4 Terminal attachment kit for digital feedback

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  - 5 Terminals for basic unit

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2 tap holes  $\frac{1}{2}$  14 NPT or M20  $\times$  1.5 are provided on the left side of the housing for cable entry in the housing. One of the tap holes is fitted with a cable gland, while the other tap hole has a blind plug.

### Note

The connecting terminals are delivered closed and must be unscrewed before inserting the wire.

1. Strip the wires to approximately 6 mm (0.24").
2. Connect the wires to the connecting terminals in line with the connection diagram.

## 2.20 Pneumatic connections

### Information on double acting actuators with spring-return mechanism

On double-acting actuators with spring-return mechanism, a pressure that significantly exceeds the supply air pressure value can be generated during operation by the springs in the chamber opposite the springs.

This may damage the positioner or adversely affect control of the actuator.

To eliminate the possibility of this occurring, it is recommended to install a pressure compensation valve between the springless chamber and the supply air for these types of applications. It enables the increased pressure to be transferred back to the air inlet line.

The opening pressure of the check valve should be  $< 250 \text{ mbar}$  ( $< 3.6 \text{ psi}$ ).

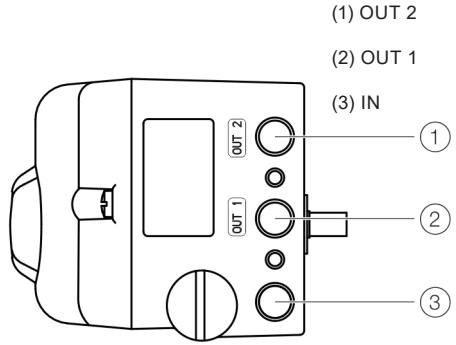


Fig. 15

Marking	Pipe connection
IN	Supply air, pressure 1.4 to 6 bar (20 to 90 psi)
OUT1	Output pressure to the actuator
OUT2	Output pressure to the actuator (2. Connection with double acting actuator)

## 2.21 Pneumatic connections - Air supply

### Instrument air\*

Purity	Maximum particle size: $5 \mu\text{m}$ Maximum particle density: $5 \text{ mg/m}^3$
Oil content	Maximum concentration $1 \text{ mg/m}^3$
Pressure dew point	$10 \text{ K}$ below operating temperature
Supply pressure**	Standard design: $1.4 \text{ to } 6 \text{ bar}$ ( $20 \text{ to } 90 \text{ psi}$ )
Air consumption***	$< 0.03 \text{ kg/h}$ / $0.015 \text{ scfm}$

\* Free of oil, water and dust in accordance with DIN/ISO 8573-1. Pollution and oil content in accordance with Class 3:3:3

\*\* Do not exceed the maximum output pressure of the actuator

\*\*\* Independent of supply pressure

## 2.22 Commissioning the positioner:

1. Open the pneumatic power supply.
2. Power-up the electric power supply and feed in the set point signal 4 to 20 mA.
3. Checking mechanical mounting:
  - Press and hold MODE; in addition, press ARROW UP or ARROW DOWN until operating mode 1.3 (manual adjustment in the measuring range) is displayed. Release MODE.
  - Press ARROW UP or ARROW DOWN to move the actuator into the mechanical end position; check the end positions; rotational angle is displayed in degrees; for high-speed mode, press ARROW UP or ARROW DOWN simultaneously.

## 2.23 Recommended rotational angle range

Linear actuators	-28 to 28 °	Rotary actuators	-57 to 57 °	Minimum angle	25 °
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4. Perform standard automatic adjustment in accordance with Standard automatic adjustment.

Commissioning of the positioner is now complete, and the device is ready for operation.

## 2.24 Standard automatic adjustment

**Note :** Standard Auto Adjust does not always result in optimum control conditions.

### Standard automatic adjustment for linear actuators\*

1. MODE Press and hold until ADJ\_LIN is displayed.
2. MODE Press and hold until the countdown ends.
3. Release MODE; this starts Auto-adjust.

### Standard automatic adjustment for rotary actuators\*

1. ENTER Press and hold until ADJ\_ROT is displayed.
2. ENTER Press and hold until the countdown ends.
3. Release ENTER; this starts Auto-adjust.

If Auto-adjust is successful, the parameters will be stored automatically and the positioner will revert to operating mode 1.1.

If an error occurs during Auto-adjust, the process will be terminated with an error message.

### Perform the following steps if an error occurs:

1. Press and hold down operating button ARROW UP or ARROW DOWN for approximately three seconds.  
The unit will switch to the operating level, mode 1.3 (manual adjustment within the measuring range).
2. Check mechanical mounting in accordance with Mechanical Mounting on page XX and repeat the standard automatic adjustment.

\* The zero position is determined automatically and saved during standard automatic adjustment, counter-clockwise (CTCLOCKW) for linear actuators and clockwise (CLOCKW) for rotary actuators.

# 3. Approvals

## **ATEX**

Rating: ATEX II 2G Ex db IIC T6/T5/T4 Gb

Certification number: BVS 21 ATEX E 073 X

Ambient temperature: -40 ~ 65 °C/80 °C/85 °C (-40 ~ 149 °F/176 °F/185 °F)

## **IECEX**

Rating: IECEX Ex db IIC T6/T5/T4 Gb

Certification number: IECEX BVS 21.0078X

Ambient temperature: -40 ~ 65 °C/80 °C/85 °C (-40 ~ 149 °F/176 °F/185 °F)

## **CCC/NEPSI**

Rating: NEPSI Ex db IIC T4/T5/T6 Gb

Certification number: GYJ22.1768X

Ambient temperature: -40 °C ~ 65 °C/80 °C/85 °C (-40 °F ~ 149 °F/176 °F/185 °F)

## **INMETRO**

Rating: INMETRO Ex db IIC T6...T4 Gb

Certification number: 22.0117 X

Ambient temperature: -40 ~ 65 °C/80 °C/85 °C (-40 ~ 149 °F/176 °F/185 °F)

# 4. Declaration of conformity

spiraxsarco.com

**spirax**  
**sarco** EN

## EU DECLARATION OF CONFORMITY

Apparatus model/Product: **Smart Positioners**  
**SP7-20**  
**SP7-21**  
**SP7-22**

Name and address of the manufacturer or his authorised representative: **Spirax Sarco Ltd.**  
Runnings Road  
Cheltenham  
GL51 9NQ  
United Kingdom

This declaration of conformity is issued under the sole responsibility of the manufacturer.

The object of the declaration described above is in conformity with the relevant Union harmonisation legislation:

2014/30/EU EMC Directive  
2014/34/EU ATEX Directive


References to the relevant harmonised standards used or references to the other technical specifications in relation to which conformity is declared:

EMC Directive EN 61326-1:2013  
ATEX Directive EN IEC 60079-0:2018  
EN 60079-1:2014

Where applicable, the notified body:

<i>Notified Body</i>	<i>number</i>	<i>Performed</i>	<i>Certificate</i>
Element Materials Technology Rotterdam B.V. Voorerf 18, 4824 GN Breda Netherlands	2812	Issue of Quality Assurance Notification	TRAC13QAN0002
DEKRA Testing and Certification GmbH, Handwerkstraße 15, 70565 Stuttgart, Germany	0158	Issue of EC Type examination certificate	BVS 21 ATEX E 073 X

Additional information:

ATEX coding:  II 2G Ex db IIC T6/T5/T4 Gb  
-40°C ≤ Ta ≤ 65°C / 80°C / 85°C

On behalf of: Spirax Sarco Ltd,

(name, function): M Sadler  
Steam Business Development Engineering  
Product Integrity & Compliance Manager

(place and date of issue): Cheltenham  
2021-11-01

[GNP237-EU-C/03 issue 1 \(EN\)](#)

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