



## SH 4749 EN

Translation of original instructions



## Type 4749 Position Transmitter

## Definition of signal words

### **DANGER**

*Hazardous situations which, if not avoided, will result in death or serious injury*

### **WARNING**

*Hazardous situations which, if not avoided, could result in death or serious injury*

### **NOTICE**

*Property damage message or malfunction*

### **Note**

*Additional information*

### **Tip**

*Recommended action*

## Purpose of this manual

The Safety Manual SH 4749 contains information relevant for the use of the Type 4749 Position Transmitter in safety-instrumented systems according to IEC 61508 and IEC 61511. The safety manual is intended for planners, constructors and operators of safety-instrumented systems.

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### **!** NOTICE

**Risk of malfunction due to incorrect mounting, connection or start-up of the device.**

- Refer to *Mounting and Operating Instructions* ▶ EB 4749 for details on how to mount the device, perform the electric and pneumatic connections as well as start up.
  - Observe the warnings and safety instructions written in the *Mounting and Operating Instructions* ▶ EB 4749.
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## Further documentation

The documents listed below contain descriptions of the start-up, functioning and operation of the device. You can download these documents from the SAMSON website.

### Type 4749

- ▶ T 4749: Data sheet
- ▶ EB 4749: Mounting and operating instructions

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### **i** Note

*In addition to the device documentation, observe the documentation for the pneumatic actuator, valve and other valve accessories.*

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# 1 Field of application

## 1.1 General

The Type 4749 Position Transmitter is mounted onto control valves and converts the linear or rotary motion of a control valve into a 4 to 20 mA standardized signal. The angle of the position transmitter's axis is measured by the magnetoresistive measuring system and converted into an electric signal.

Two pushbuttons are used to operate the device and change device settings. Two LEDs (red and green) indicate the menu items and settings.

## 1.2 Use in safety-instrumented systems

Observing the requirements of IEC 61508, the systematic capability of the position transmitter for the safety-related output of a 4 to 20 mA signal proportional to the linear or rotary motion of a control valve as a component in safety-instrumented systems is given.

Use of the position transmitter is possible on observing the requirements of IEC 61511 and the required hardware fault tolerance in safety-instrumented systems up to SIL 2 (single device/HFT = 0) and SIL 3 (redundant configuration/HFT = 1).

The safety-instrumented function of the safety-related output of an analog 4 to 20 mA signal proportional to the linear or rotary motion of a control valve is to be regarded as a Type B element in accordance with IEC 61508-2.

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**i Note**

*The functional safety assessment of the position transmitter includes the basic device with its main electronics and sensors. We recommend only using a forcibly guided follower pin in safety-instrumented systems. Only use the specified original mounting parts and accessories.*

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## 1.3 Versions and ordering data

The Type 4749 Position Transmitter is available in various versions. Position transmitters with firmware  $\geq 1.00.04$  in the **Type 4749-xxxxxx13x00xxxx** version are approved for the use in safety-instrumented systems.

The article code provides information on the version:

## Technical data (excerpt from EB 4749)

Position transmitter	Type 4749-	x	x	x	x	x	x	x	x	x	0	0	x	x	x	x
Special applications																
Without									0	0/1						
SIL									1	3						
Temperature range																
-35 to +75 °C (SIL version with metal cable gland)										3						
Firmware version																
1.00.04															9	7

## 1.4 Mounting

For use in safety-instrumented system, the Type 4749 Position Transmitter is suitable for the following types of attachment in combination with various mounting parts:

- Attachment to linear actuators according to IEC 60534-6 (NAMUR)
- Attachment to Type 3277 Linear Actuator
- Attachment to SAMSON Type 3510 Micro-flow Valve
- Attachment to rotary actuators according to VDI/VDE 3845, fixing levels 1 and 2

## 2 Technical data (excerpt from EB 4749)

Type 4749 Position Transmitter	
<b>Measuring range</b>	
Measurement method	Magneto-resistive measuring system
<b>Power supply</b>	
Input voltage	12 to 36 V DC
Output	4 to 20 mA · Two-wire device, reverse polarity protection
Permissible load $R_B$ in $\Omega$	$R_B = (U_B - 12 \text{ V})/0.020 \text{ A}$
Static destruction limit	38 V DC, 30 V AC
<b>Environmental conditions and permissible temperatures</b>	
Permissible environmental conditions according to EN 60721-3	
Storage	1K6 (relative humidity $\leq 95\%$ )
Transport	2K4

Operation	4K2 or 4K3 (depending on the temperature range) -20 to +85 °C: All versions -40 to +85 °C: With metal cable glands Observe the limits in the test certificate for explosion-protected versions.
<b>Requirements</b>	
EMC	Complying with EN 61000-6-1, EN 61000-6-2, EN 61000-6-3, EN 61000-6-4, EN 61000-6-7, EN 61326 and NAMUR Recommendation NE 21
Degree of protection	IP 66
Conformity	<b>CE</b>

### 3 Safety-instrumented function

#### Safety function

Output of an analog signal (4 to 20 mA) proportional to the valve position.

#### Safety-related signal

The safety-related signal is the analog 4 to 20 mA output signal. The safety-instrumented function refers only to this signal.

Internal device errors (e.g. deviations between the set point and actual current output) lead to a failure current at the analog output. The failure current of <3.6 mA is issued as the LO alarm according to NAMUR Recommendation NE 43.

- A lower limit violation of the measuring range causes the position transmitter to issue a proportional output signal up to a minimum value of 3.8 mA.
- An upper limit violation of the measuring range causes the position transmitter to issue a proportional output signal up to a maximum value of 20.8 mA.

### 3.1 Protection against unauthorized changes to the configuration

A change to the configuration cannot affect the output of the failure current nor cause it to be deactivated.

## 4 Mounting, connection and start-up

Refer to Mounting and Operating Instructions ► EB 4749 for details on how to mount, perform the electric and pneumatic connections as well as start up the device. Only use the specified original mounting parts and accessories.

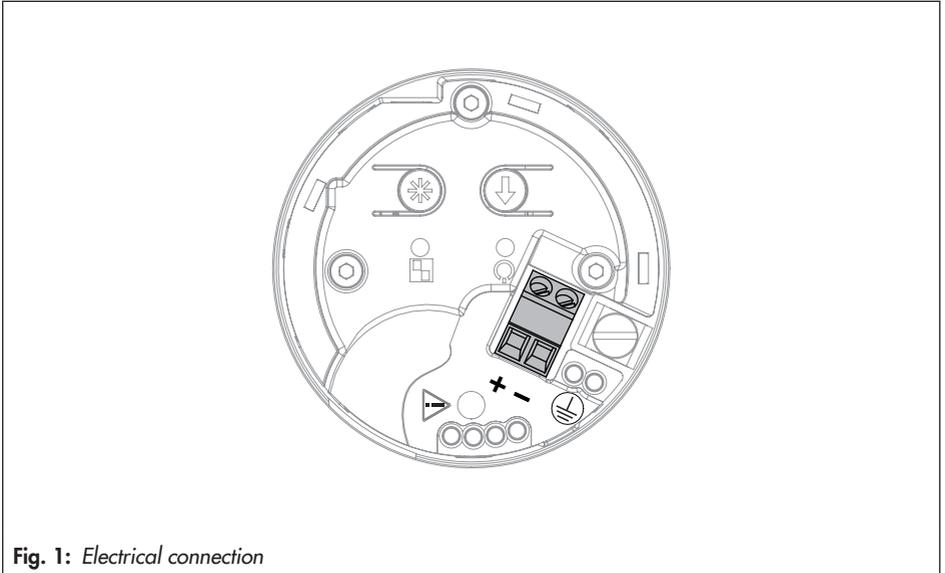


Fig. 1: Electrical connection

## 5 Required conditions

### **⚠ WARNING**

*Risk of malfunction due to incorrect selection or wrong installation and operating conditions.*

→ *Only use control valves in safety-instrumented systems if the necessary conditions in the plant are fulfilled. The same applies to the mounted position transmitter.*

### 5.1 Selection

- The position transmitter is suitable for the mounting situation on site.
- The position transmitter is suitable for the prevailing ambient temperature.

### 5.2 Mechanical installation

- The position transmitter is installed properly as described in the mounting and operating instructions.
- Only the types of attachment described in section 4 with the approved mounting parts are used.
- A forcibly guided follower pin is used in safety-instrumented systems.

### 5.3 Electrical installation

- The position transmitter is connected to the electric power supply properly as described in the mounting and operating instructions.
- Only cables whose outside diameters are suitable for the cable glands are used.
- The electrical cables in Ex i circuits comply with the data that planning was based on.
- The cable glands and cover screws are fastened tightly to ensure that the degree of protection is met.
- The installation requirements for the applicable explosion protection measures are observed.
- The special conditions specified in the explosion protection certificates are observed.

### 5.4 Operation

To operate the position transmitter in safety-instrumented systems, we recommend observing the maximum deviation.

- After setting the parameters, configuration has been locked.
- The measuring range of the position transmitter is adapted to the mounting situation.



**Tip**

*The adjustment of the measuring range is described in the Mounting and Operating Instructions ► EB 4749.*

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- After start-up, function testing has been completed as described in section 6.2.
- No critical error exists in the position transmitter.  
Critical errors are indicated by the output of a failure current and a permanently illuminated red LED.

## 6 Proof testing (periodic testing)

The proof test interval and the extent of testing lie within the operator's responsibility. The operator must draw up a test plan, in which the proof tests and the interval between them are specified. We recommend summarizing the requirements of the proof test in a checklist.

### WARNING

***Risk of dangerous failure due to malfunction in the event of emergency.***

*Malfunction in the case of emergency include:*

- *An incorrect output signal that differs from the actually measured value by more than 2 to 3 %, yet the output signal still remains within the 4 to 20 mA range.*
- *Other deviations from specified safety-relevant properties.*
- ➔ *Only use devices in safety-instrumented systems that have passed the proof test according to the test plan drawn up by the operator.*

Regularly check the safety-instrumented function of the entire SIS loop. The test intervals are determined, for example on calculating each single SIS loop in a plant ( $PFD_{avg}$ ).

### 6.1 Visual inspection to avoid systematic failure

To avoid systematic failure, inspect the position transmitter regularly. The frequency and the scope of the inspection lie within the operator's responsibility. Take application-specific influences into account, such as:

- Wear at the travel pick-off or incorrect fastening
- Corrosion (destruction primarily of metals due to chemical and physical processes)
- Material fatigue
- Aging (damage caused to organic materials, e.g. plastics or elastomers, by exposure to light and heat)
- Chemical attack (organic materials, e.g. plastics or elastomer, which swell, leach out or decompose due to exposure to chemicals)

### NOTICE

***Risk of malfunction due to the use of unauthorized parts.***

- ➔ *Only use original parts to replace worn parts.*

### 6.2 Function testing

Regularly check the safety-instrumented function according to the test plan drawn up by the operator.

Two different proof tests to detect dangerous undetected device failures are described below. They have different detection rates.

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#### **i** Note

*Record any position transmitter faults and e-mail (aftersaleservice@samsongroup.com) them to SAMSON.*

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#### **Test A**

This test places the position transmitter in a simulation mode during which the current is moved to target points within the output signal range. Check the correct output and transmission to the logic solver for the measured values of the simulation. Also check the transmission accuracy achieved during the simulation.

Around 50 % of safety loop errors up to the logic solver can be detected by this test.

1. Perform a visual inspection.
2. Check whether the current measured value is plausible.
3. Take appropriate measures to prevent a false triggering of alarms.
4. Remove the device cover and enable configuration.
5. Set the current output of the position transmitter to 20 mA and check whether the analog current signal reaches this value (see the function description 'Issue a test current' in the Mounting and Operating Instructions ► EB 4749).
6. Set the current output of the position transmitter to 4 mA and check whether the analog current signal reaches this value.
7. Lock configuration and remount the device cover properly.
8. Restore the safety equipment to normal operation and check that it functions.
9. Document and archive the test results appropriately.

### Test B

The analog current signal can be tested by the logic solver or by an analog ammeter. Make sure the measuring equipment is sufficiently accurate.

This test detects around 90 % of device errors.

1. Perform steps 1 to 8 of Test A.
2. Check the analog current signal in relation to the actual valve position. For this test, use appropriate procedure, measuring equipment and references (e.g. external electric or mechanical travel sensors).
  - ➔ Compare the actual valve position with the analog current signal for the lower measuring range value (4 mA) and upper measuring range value (20 mA).
  - ➔ Compare the analog current output signal with the actual valve position again. If a deviation remains, contact SAMSON's After-sales Service.
3. Perform steps 7 to 8 of Test A.

## 7 Repairs

Only perform the work on the device described in ► EB 4749.

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### **!** NOTICE

***Safety-instrumented function will be impaired if repair work is performed incorrectly.***  
*Only allow trained staff to perform service and repair work.*

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➔ After completing service and repair work, perform testing as described in section 6.

## 8 Safety-related data and certificates

The safety-related data are listed in the following certificate.

# Certificate



Functional  
Safety

www.tuv.com  
ID 0600000000

No.: 968/FSP 2354.00/22

<b>Product tested</b>	Analog Position Transmitter	<b>Certificate holder</b>	SAMSON AG Weismüllerstr. 3 60314 Frankfurt / Main Germany
<b>Type designation</b>	Type 4749		
<b>Codes and standards</b>	IEC 61508 Parts 1-7:2010		
<b>Intended application</b>	The evaluation of the certification body comes to the result that the device complies with the requirements of IEC 61508 (Hardware safety integrity SIL 2 and systematic capability SIL 3) and can be used in applications up to SIL 2 (HFT=0) resp. SIL 3 (HFT=1) acc. to IEC 61508. The product was also reviewed in reference to the requirements of IEC 61511-1:2016+Corr.1:2016+AMD1:2017 applicable during a type examination and can be used in application as such.		
<b>Specific requirements</b>	The instructions of the associated Installation, Operating and Safety Manual shall be considered.		

The issue of this certificate is based upon an examination, whose results are documented in Report No. 968/FSP 2354.00/22 dated 2022-03-03.

This certificate is valid only for products which are identical with the product tested.

TÜV Rheinland Industrie Service GmbH  
Bereich Automation  
Funktionale Sicherheit

Köln, 2022-03-28

Certification Body Safety & Security for Automation & Grid

  
Dipl.-Ing. (FH) Wolf Rückwart

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 TÜVRheinland®  
Precisely Right.

Holder: SAMSON AG  
 Weismüllerstr. 3  
 60314 Frankfurt am Main  
 Germany

Product tested: Analog Position Transmitter Type 4749  
 Safety Function: Safe output of an analog output signal (4 to 20 mA)  
 proportional to the valve position

#### Results of Assessment

Route of Assessment		$1_H / 1_S$
Type of Sub-system		Type B
Mode of Operation		Low Demand Mode (LDM)
Hardware Fault Tolerance	HFT	0
Systematic Capability		SC 3

#### Safe output of an analog output signal (4 to 20 mA) proportional to the valve position

Safe Failure Rate	$\lambda_S$	6,51 E-07 / h	651 FIT
Dangerous Detected Failure Rate	$\lambda_{DD}$	2,65 E-07 / h	265 FIT
Dangerous Undetected Failure Rate	$\lambda_{DU}$	6,10 E-08 / h	61 FIT
Diagnostic Coverage	DC		>90%
Average Probability of Failure on Demand 1001	$PFD_{avg}(T_1)$	3.10 E-04	
Average Probability of Failure on Demand 1002	$PFD_{avg}(T_1)$	6.30 E-06	

Assumptions for the calculations above:  $T_1 = 1$  year,  $MRT = 72$  h,  $\beta_{1002} = 5$  %

#### Origin of failure rates

##### Mechanical part:

The stated failure rates for low demand are the result of an FMEDA with tailored failure rates for the design and manufacturing process.

##### Electronic part:

The source of failure rate data is SN 29500, so far no data from the component manufacturer were available. Failure rates include failures that occur at a random point in time and are due to degradation mechanisms such as ageing.

The stated failure rates do not release the end-user from collecting and evaluating application-specific reliability data.

#### Periodic Tests and Maintenance

The given values require periodic tests and maintenance as described in the Safety Manual.

The operator is responsible for the consideration of specific external conditions (e.g. ensuring of required quality of media, max. temperature, time of impact), and adequate test cycles.

SH 4749 EN



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