SAFETY MANUAL

SH 8493S EN

Translation of original instructions

TROVIS SAFE 3793 Smart Positioner
Communication: HART®

SIL/PL Capability
TÜVRheinland CERTIFIED
www.tuv.com ID 0600000000

Edition September 2025

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

ℹ *Note*

Additional information

☼ *Tip*

Recommended action

☼ *Tip*

Experimental function

Purpose of this manual

The Safety Manual SH 8493S EN contains information relevant to the use of the device listed below in safety-instrumented systems according to IEC 61508/IEC 61511. The safety manual is intended for planners, constructors and operators of safety-instrumented systems.

Device:
TROVIS SAFE 3793 Smart Positioner

❗ *NOTICE*

Risk of malfunction due to incorrect installation or start-up of the device.

⇨ *Refer to the Mounting and Operating Instructions EB 8493S EN on how to install and start-up the device.*

⇨ *Observe the warnings and safety instructions written in the Mounting and Operating Instructions EB 8493S EN.*

Further documentation

The documents listed below contain descriptions of the start-up, functioning and operation of the device. You can download these documents from our website (▶ www.samsongroup.com).

TROVIS SAFE 3793 Positioner

▶ T 8493S: Data sheet

▶ EB 8493S: Mounting and operating instructions

▶ KH 8384-3: Configuration manual for HART® communication

EXPERTplus diagnostics

▶ T 8389-2S: Data sheet

▶ EB 8389-2S: Operating instructions

ℹ *Note*

In addition to the positioner documentation, observe the technical documentation for the pneumatic actuator, control valve and other valve accessories.

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1 Scope

The TROVIS SAFE 3793 Smart Positioner is a single- or double-acting positioner in a modular design for attachment to pneumatic rotary and linear actuators with spring-return mechanism. It is combined with single-acting pneumatic actuators with spring-return mechanism in safety-instrumented systems.

The positioner is used for discrete control of control valves.

The positioner is ready configured for 'On/off valve' type of application. In this type of application, it is used to shut off or open on/off valves on demand. The positioner is used to position control valves when the 'Control valve' is selected as the type of application. The type of application does not have any effect on the safety-instrumented function.

1.1 Use in safety-instrumented systems

i ***Note***

For use in safety-instrumented systems, control valves must only be used in combination with a pneumatic actuator which does not have a pneumatic or electric lock-up device, travel stop or handwheel.

Observing the requirements of IEC 61508, the systematic capability of the pilot valve for emergency venting as a component in safety-instrumented systems is given.

Use of the positioner 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 positioner and its safety-instrumented functions are regarded as type A according to IEC 61508-2.

i ***Note***

The architecture and the interval between proof tests must be changed accordingly for a higher safety integrity level.

1.2 Versions and ordering data

The positioner is suitable up to +80 °C for use in safety-instrumented systems. This does not include versions for low temperatures.

The positioner can be upgraded by installing pneumatic and/or option modules.

The following pneumatic modules are suitable for use in safety-instrumented systems:

- Single/double acting, K_V = 0.35
- Single/double acting, K_V = 0.70
- Single acting, 2x independent K_V = 0.35

The optional forced venting additional function of the option modules Z3799-xx21 [F] and Z3799-xxx80 [V] is suitable for use in safety-instrumented systems.

The outputs of the pneumatic modules are vented according to Chapter 4.1.1.

1.2.1 Article code

Positioner	**TROVIS SAFE 3793-**	**x**	**x**	**x**	**5**	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**0**	**x**	**x**	**x**	**x**	**0**	**x**	**0**	**0**	**x**	**x**	**x**	**x**
With LCD, autotune, HART® communication						|	|	|	|	|	|				|	|	|						|	|		
Pneumatics						|	|	|	|	|	|				|	|	|						|	|		
Single/double acting, K_V = 0.35						0	1	|	|	|	|						|	|	|						|	|		
Single/double acting, K_V = 0.70						0	2	|	|	|	|						|	|	|						|	|		
Single acting, 2x independent K_V = 0.35						0	3	|	|	|	|						|	|	|						|	|		

<table>
<tr><td>Option module 1 (slot C)</td><td>| | | | | | | | |</td></tr>
<tr><td>Forced venting + binary input (24 V DC) +</td><td>8 0 | | | | | | |</td></tr>
<tr><td>binary output (NAMUR), [V]</td><td>| | | | | | | | |</td></tr>
<tr><td>Option module 2 (slot D)</td><td>| | | | | | |</td></tr>
<tr><td>Inductive limit contacts (NAMUR NC) + forced venting[1)] [F];</td><td>2 1 | | | | |</td></tr>
<tr><td>-50 to +85 °C</td><td>| | | | | | |</td></tr>
<tr><td>Additional certification</td><td>| | | | |</td></tr>
<tr><td>SIL</td><td>1 0/1 | | |</td></tr>
<tr><td>Permissible ambient temperature</td><td>| | | |</td></tr>
<tr><td>Standard: -20 to +85 °C, plastic cable gland</td><td>0 | | |</td></tr>
<tr><td>-40 to +85 °C, metal cable gland</td><td>1 | | |</td></tr>
<tr><td>Emergency shutdown</td><td>| | |</td></tr>
<tr><td>3.8 mA</td><td>0 | |</td></tr>
<tr><td>4.4 mA</td><td>1 | |</td></tr>
<tr><td>Hardware version</td><td>| |</td></tr>
<tr><td>02.00.00</td><td>9 8</td></tr>
</table>

1) Forced venting is only suitable for use in safety-instrumented systems. The inductive limit contacts are not suitable for use in safety-instrumented systems (no SIL certification).

1.3 Attachment

The positioner is suitable for the following types of attachment in combination with various mounting parts:

– Direct attachment to SAMSON Type 3277 Linear Actuators
– Attachment to linear actuators according to IEC 60534-6 (NAMUR)
– Attachment to linear actuators according to VDI/VDE 3847-1
– Attachment to rotary actuators acc. to VDI/VDE 3845, fixing level 1
– Attachment to rotary actuators acc. to VDI/VDE 3845, fixing level 2
– Attachment to rotary actuators according to VDI/VDE 3847

2 Technical data

Only the data relevant to the safety-instrumented function are listed below. The Mounting and Operating Instructions EB 8493S EN lists all the technical data.

Table 1: *Technical data · Positioner*

Set point w	
Signal range	4 to 20 mA, two-wire device, reverse polarity protection, split-range operation (can be configured as required, minimum span 4 mA)
Static destruction limit	40 V, internal current limit approx. 40 mA
Minimum current	3.75 mA for display/operation (HART® communication and configuration) 3.90 mA for pneumatic function
Load impedance	≤9.9 V (corresponding to 495 Ω at 20 mA)
Supply (compressed air)	
Supply air	2.5 to 10 bar (30 to 150 psi)
Max. particle size and density	Class 4 according to ISO 8573-1
Oil content	Class 3 according to ISO 8573-1
Pressure dew point	Class 3 according to ISO 8573-1 or at least 10 K below the lowest ambient temperature to be expected
Signal pressure (output)	0 bar up to supply pressure
Hysteresis	≤0.3 %
Sensitivity	≤0.1 %, adjustable by software
Start-up time	After interrupted operation < 300 ms: 100 ms After interrupted operation > 300 ms: ≤2 s
Transit time	Up to 10000 s separately adjustable for exhaust and supply by software
Air output capacity (when Δp = 6 bar)	
Actuator (supply)	32 m_n^3/h with one pneumatic module ($K_{V\ max\ (20\ °C)}$ = 0.34) 60 m_n^3/h with two pneumatic modules of the same sort ($K_{V\ max\ (20\ °C)}$ = 0.64)
Actuator (exhaust)	37 m_n^3/h with one pneumatic module ($K_{V\ max\ (20\ °C)}$ = 0.40) 70 m_n^3/h with two pneumatic modules of the same sort ($K_{V\ max\ (20\ °C)}$ = 0.75)
Permissible environmental conditions according to EN 60721-3	
Storage	1K6 (relative humidity ≤95 %)
Transport	2K4
Operation	4K4 All versions: -20 to +85 °C[1)] with metal cable gland: -40 to +85 °C[2)] Low-temperature version with metal cable glands: -55 to +85 °C[3)] **Observe the limits in the test certificate for explosion-protected versions.**

1) Up to +80 °C suitable for use in safety-instrumented systems.

2) Up to -40 °C suitable for use in safety-instrumented systems.

3) Not suitable for use in safety-instrumented systems

Table 2: *Optional additional functions*

Forced venting · Approval acc. to IEC 61508/SIL	
Version	Galvanic isolation, reverse polarity protection
Voltage input	0 to 24 V DC
Input current	When V_{in} = 24 V: approx. 7 mA, in the switching point (at approx. 13 V): approx. 3.3 mA
Signal state (active)	Ue <11 V
Signal state (inactive)	Ue >18 V
Static destruction limit	38 V DC/30 V AC

Table 3: *Permissible ambient temperatures of SIL functions*

Function	**Permissible temperature range**
Emergency venting 3.8 mA	-40 to +80 °C
Emergency venting 4.4 mA	-40 to +80 °C
Emergency venting by the forced venting function	-40 to +80 °C

3 Safety-related functions

The TROVIS SAFE 3793 Positioner is fitted with the following safety-instrumented functions. They become effective independently from the microcontroller and software.

Emergency venting by an mA signal

⇨ See Fig. 1, path ———

Fail-safe action is triggered when a signal below 3.8 mA or 4.4 mA is applied to terminals 11/12. The i/p converter is de-energized and the pneumatic module triggers the fail-safe action depending on the spring-return mechanism of the actuator (see Table 4).

Emergency venting by the optional forced venting additional function

⇨ See Fig. 1, path .....

If the voltage falls below 11 V at the terminals of the option module, the pneumatic outputs of the positioner are vented depending on the combination of the pneumatic modules (see Table 4). This occurs regardless of the set point. A voltage above 15 V keeps the forced venting function inactive.

3.1 Fail-safe action

Upon failure of the air supply, the positioner vents the actuator, causing the valve to move to the fail-safe position determined by the actuator.

Upon failure of the electrical signal, the pneumatic outputs of the positioner are either vented or supplied with air depending on the combination of the pneumatic modules (see Table 4). As a result, the valve moves to the fail-safe position.

The fail-safe position depends on how the springs are arranged in the pneumatic actuator (air-to-close or air-to-open).

When the air supply fails and the forced venting is triggered, all positioner functions, except open/closed loop control, remain active (including diagnostics, HART® communication as well as position and status feedback).

NOTICE

The pneumatic output of the positioner can also be vented to the atmosphere over the software, e.g. by entering a corresponding set point. This procedure is not a safety-instrumented function.

3.2 Protection against unauthorized changes to the configuration

A change to the configuration in the firmware cannot affect the safety-instrumented function nor cause it to be deactivated.

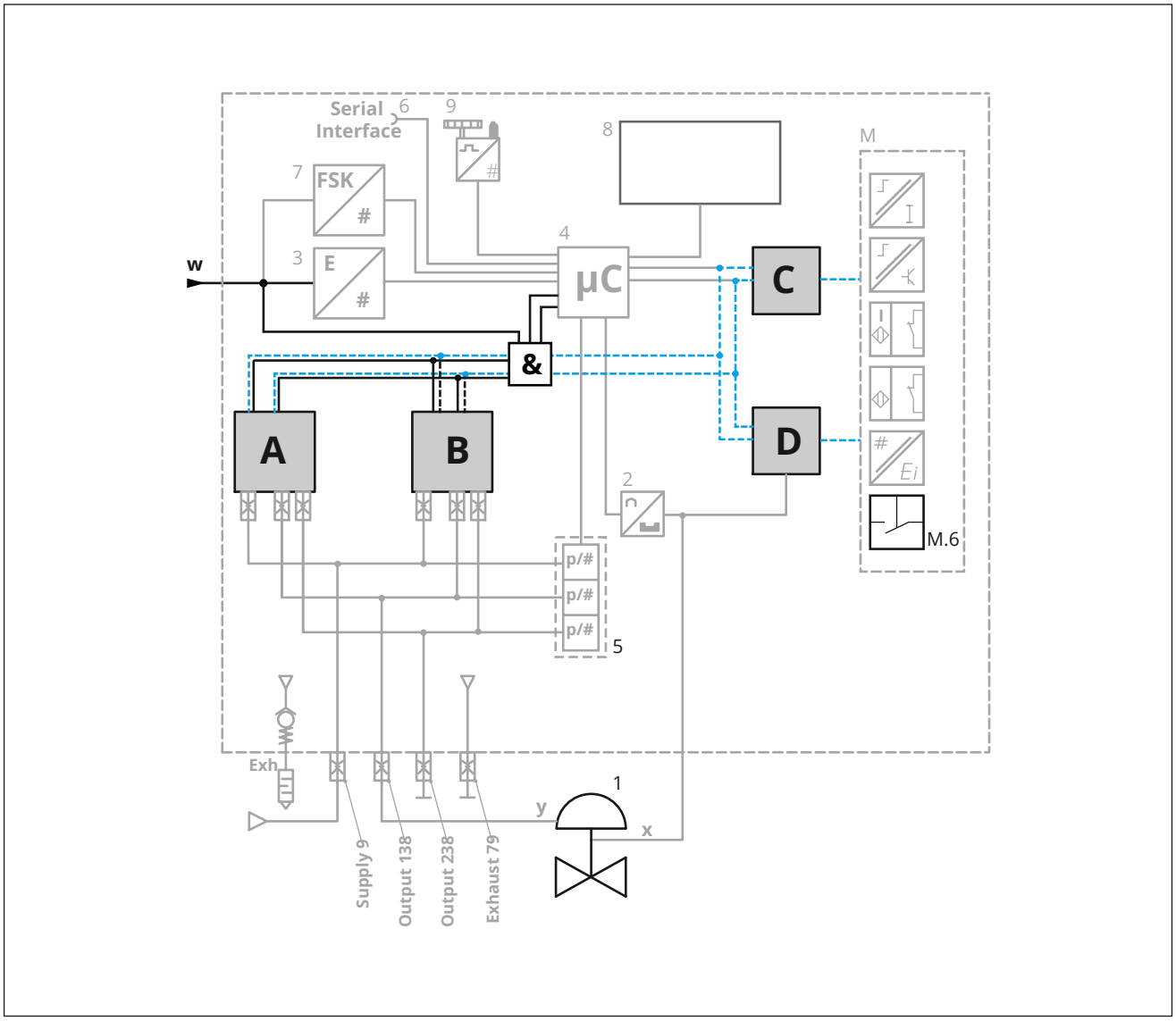


Fig. 1: *Functional diagram of the positioner*

1 Control valve
2 Travel sensor
3 A/D converter
4 Microcontroller
5 Pressure sensors
6 Communication interface
7 HART® connection
8 Display
9 Rotary pushbutton
A Slot for pneumatic module A
B Slot for pneumatic module B
C Slot for option module C
D Slot for option module D
M Available option modules
M6 Forced venting

4 Mounting, connection and start-up

Refer to Mounting and Operating Instructions EB 8493S EN for details on how to mount, perform the electric and pneumatic connections as well as start up the positioner.

Only use the specified original mounting parts and accessories.

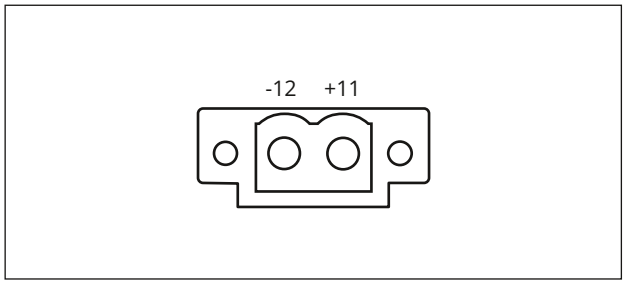


Fig. 2: *Terminal assignment of the terminals*

4.1 Optional modules

4.1.1 Pneumatic modules

The air capacity and direction of action in the TROVIS 3793 Positioner can be varied by using and combining different pneumatic modules. A maximum of two pneumatic modules can be used in a positioner.

Table 4: *Permissible combinations of pneumatic modules*

Slot A	Slot B	Function	Air capacity	Fail-safe action	
				Output 138	Output 238
P3799-0001	P3799-0000	Single/double acting	K_{VS} 0.35	Exhaust	Supply
P3799-0001	P3799-0001	Single/double acting	K_{VS} 0.70	Exhaust	Supply
P3799-0002	P3799-0003	Single acting, 2x independent	K_{VS} 0.35	Exhaust	Exhaust

⚠ WARNING

The use of the incorrect or old pneumatic modules will impair the safety-instrumented functions.

⇨ *Only use original pneumatic modules according to Table 4.*
The P3799-0004 module described in the Mounting and Operating Instructions EB 8493S EN must not be used in safety-instrumented systems.

⇨ *Only use new modules when retrofitting or replacing pneumatic modules.*

❗ *NOTICE*

Risk of malfunction due to the incorrect combination of pneumatic modules.

⇨ *Do not combine modules P3799-0001 and P3799-003.*

4.1.2 Safety-relevant additional functions (optional)

Additional optional functions are available for the positioner, which can be added to the positioner as option modules. The forced venting function included in the option module [V] is safety relevant.

Table 5: *Option module with the forced venting option suitable for use in safety-instrumented systems*

Option module	Function			
	Inductive limit contacts	Binary input (24 V)	Forced venting	Binary output
Z3799-xxx21 [F][1)]	•		•	
Z3799-xxx80 [V]		•	•	•

1) Forced venting is only suitable for use in safety-instrumented systems. The inductive limit contacts are not suitable for use in safety-instrumented systems (no SIL certification).

⚠ WARNING

The use of the incorrect or old option modules will impair the safety-instrumented function.

⇨ *Only use the original option module listed in Table 5 for the forced venting safety-instrumented function.*

⇨ *Only use new modules when retrofitting or replacing option modules.*

Forced venting

If the voltage falls below 11 V at the terminals of the option module, the pneumatic outputs of the positioner are either vented or supplied with air depending on the combination of the pneumatic modules. This occurs regardless of the set point. A voltage above 15 V keeps the forced venting function inactive.

Table 6: *Connection of the option module [V] (option module with the 'forced venting' option suitable for use in safety-instrumented systems)*

Z3799-xxx80 [V] · Forced venting, binary input (24 V) and binary output (NAMUR) · Slot C or D

NOTICE

Set the rotary switch for forced venting accordingly (see the Mounting and Operating Instructions EB 8493S EN).

Terminal assignment

Terminal		Description
V	+81	Forced venting
	-82	
V	+87	Binary input 24 V
	-88	
V	+83	Binary output (NAMUR)
	-84	

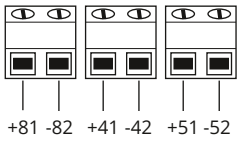
Z3799-xxx21 [F] · Inductive limit contacts and forced venting · Slot D

NOTICE

The option module will be damaged.

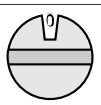
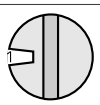
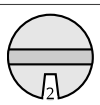
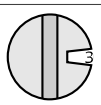
Set the rotary switch for forced venting accordingly (see the Mounting and Operating Instructions EB 8493S EN).

Terminal assignment



Terminal		Description
M	+81	Forced venting
	-82	
M	+41	Inductive limit contact 1
	-42	
M	+51	Inductive limit contact 2
	-52	

Table 7: *Switch position at the positioner*

	Option module for forced venting function			
Slot C	Not used	Used	Not used	Used
Slot D	Not used	Not used	Used	Used
Switch position				

⚠ WARNING

The incorrect switch position for the forced venting option module will impair the safety-instrumented function.

⇨ *Set the rotary switch on the positioner according to Table 7.*

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 positioner.*

5.1 Selection

⇨ The inserted pneumatic modules are selected to allow single-acting actuators to move to the required fail-safe position on demand (see Table 4).

⇨ Only the original option modules listed in Table 5 are used to use the forced venting safety-instrumented function.

⇨ The required transit times of the control valve are observed.
The transit times to be implemented are determined by the process engineering requirements.

Tip

The minimum transit times for supply and exhaust can be read in menu items 7.95.70 and 7.95.74 respectively after the positioner (firmware 1.01.xx or higher) has been initialized.

⇨ The positioner is suitable for the prevailing ambient temperature (see Table 1) and for use in safety-instrumented systems (see Table 3).

⇨ The temperature limits are observed.

5.2 Mechanical and pneumatic installation

⇨ The positioner is mounted properly as described in the Mounting and Operating Instructions EB 8493S EN and connected to the air supply.

Tip

The corresponding error messages indicate incorrect attachment (see EB 8493S EN, 'Malfunctions' chapter). For safety-instrumented systems, SAMSON recommends assigning the 'Failure' status to these errors to quickly recognize them when they occur.

⇨ The actuator used is single acting with a spring-return mechanism.

⇨ The actuator does not have a travel stop.

⇨ The actuator does not have a handwheel.

⇨ The actuator does not have a pneumatic or electric lock-up device.

⇨ The maximum supply pressure does not exceed 10 bar.

⇨ The actuator bench range is designed to ensure that a sufficient tight-closing force exists even with 0.2 bar pressure at the pneumatic outputs. The maximum pressure at the output has been taken into account when observing the safety-instrumented function of downstream pneumatic devices.

⇨ The pneumatic air supply meets the instrument air specifications.

Particle size and quantity	Oil content	Moisture and water
Class 4	Class 3	Class 3
≤5 µm and 1000/m³	≤1 mg/m³	

Tip

SAMSON recommends installing a supply pressure regulator/filter upstream of the device. For example, the SAMSON Type 4708 Supply Pressure Regulator with 5 µm filter cartridge can be used.

⇨ The positioner is mounted as prescribed.

⇨ The vent opening at the back of the positioner remains open when the positioner is installed on site. The maximum pressure at the output may increase due to the higher backpressure while venting to a connected chamber.

5.3 Electrical installation

⇨ The positioner is connected to the electric power supply properly as described in the Mounting and Operating Instructions EB 8493S EN.

⇨ 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

⇨ The positioner is put into operation and initialized (a positioner that has not yet been initialized is in the fail-safe position) according to the Mounting and Operating Instructions EB 8493S EN.

⇨ The rotary switch at the positioner is set as shown in Table 7 for the forced venting safety-instrumented function.

6 Proof 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.

NOTICE

Risk of dangerous failure due to malfunction in the event of emergency (actuator is not vented and/or the valve does not move to the fail-safe position).

⇨ *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 positioner regularly. The frequency and the scope of the inspection lie within the operator's responsibility. Take application-specific influences into account, such as:

- Dirt blocking the pneumatic connections
- 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.*

⇨ *Only use new modules when retrofitting or replacing pneumatic and option modules.*

6.2 Function testing

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

Note

Record any positioner faults and e-mail (aftersalesservice@samsongroup.com) them to SAMSON.

Emergency venting by an mA signal applied to terminals 11/12 (control signal)

1. Supply the initialized positioner with air within the permissible supply pressure range (max. 10 bar) which allows the valve to move to the maximum travel.
2. Connect an electric input signal >3.8 mA or >4.4 mA to the positioner (terminals 11/12), depending on the emergency shutdown.
3. Switch the positioner to automatic or manual mode (if it has not already been done).

   Tip

   The travel/angle of rotation in automatic mode can be read at the positioner in the main display.

4. Disconnect the electric input signal or apply <3.8 mA or <4.4 mA. This must cause the valve to move to its fail-safe position.
5. Check whether the actuator is fully vented within the demanded time.

Tip

Connect a pressure gauge to check that the actuator has completely vented.

Emergency venting by forced venting (signal <11 V at terminals 81/82)

1. Supply the initialized positioner with air within the permissible supply pressure range (max. 10 bar) which allows the valve to move to the maximum travel.
2. Connect an electric input signal >3.8 mA or >4.4 mA to the positioner (terminals 11/12), depending on the emergency shutdown.
3. Switch the positioner to automatic mode (if it has not already been done).
4. Supply the forced venting with a voltage >15 V DC (terminals 81/82).
5. Adjust the set point of the positioner in such a way that the valve moves to a position between 50 and 100 % (full supply).

Tip

The travel/angle of rotation in automatic mode can be read at the positioner in the main display.

6. Disconnect the voltage supply or set it to <11 V DC (terminals 81/82).
7. Check whether the actuator is fully vented within the demanded time.

Tip

Connect a pressure gauge to check that the actuator has completely vented.

7 Servicing and repairs

Only perform the work on the positioner described in the Mounting and Operating Instructions EB 8493S EN.

NOTICE

Safety-instrumented function will be impaired if repair work is performed incorrectly.

⇨ *Only allow trained staff to perform service and repair work.*

For devices operated in the low demand mode, a useful lifetime of 11 years (plus 1.5 years storage time) is confirmed by TÜV Rheinland® from the date of manufacture while taking into account the specific conditions of use specified in the Safety Manual and the Mounting and Operating Instructions EB 8493S EN. The results of the proof test must be assessed and the maintenance scheduled based on it. In particular, after changes (e.g. signs of aging in elastomers, changed switching times or leakage etc.), it is essential that the manufacturer performs maintenance or repair work on the device.

MTC (Maintenance Coverage) > 99 %

8 Safety-related data and certificates

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

Certificate

SIL/PL Capability

TÜVRheinland® CERTIFIED

www.tuv.com
ID 0600000000

No.: 968/V 1264.00/22

Product tested	Electro Pneumatic Positioner	**Certificate holder**	SAMSON AG Weismüllerstr. 3 60314 Frankfurt / Main Germany
Type designation	TROVIS 3793 TROVIS SAFE 3793		
Codes and standards	IEC 61508 Parts 1-2 and 4-7:2010		
Intended application	Safety functions: - Safe venting via the setpoint input - Safe venting via the forced venting option The positioners are suitable for use in a safety instrumented system up to SIL 2 (low demand mode). Under consideration of the minimum required hardware fault tolerance HFT = 1 for the complete final element the positioners may be used up to SIL 3.		
Specific requirements	The instructions of the associated Installation, Operating and Safety Manual shall be considered.		

Summary of test results see back side of this certificate.

Valid until 2027-01-27

The issue of this certificate is based upon an evaluation in accordance with the Certification Program CERT FSP1 V1.0:2017 in its actual version, whose results are documented in Report No. 968/V 1264.00/22 dated 2022-01-21. This certificate is valid only for products, which are identical with the product tested.

TÜV Rheinland Industrie Service GmbH
Bereich Automation
Funktionale Sicherheit
Am Grauen Stein, 51105 Köln

Köln, 2022-01-27

Certification Body Safety & Security for Automation & Grid

Dipl.-Ing. (FH) Wolf Rückwart

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TÜVRheinland®
Precisely Right.

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

Product tested: **Electro pneumatic positioner**
TROVIS 3793
TROVIS SAFE 3793

Results of Assessment

Route of Assessment		2_H / 1_S
Type of Sub-system		Type A
Mode of Operation		Low Demand Mode
Hardware Fault Tolerance	HFT	0
Systematic Capability		**SC 3**

Safe venting by setpoint input

Dangerous Failure Rate	λ_D	1.08 E-07 / h	**108 FIT**
Safe Failure Rate	λ_S	7.55 E-07 / h	755 FIT
Average Probability of Failure on Demand 1oo1	$PFD_{avg}(T_1)$	4.81 E-04	
Average Probability of Failure on Demand 1oo2	$PFD_{avg}(T_1)$	4.83 E-05	

Safe venting via forced venting option

Dangerous Failure Rate	λ_D	1.08 E-07 / h	**108 FIT**
Safe Failure Rate	λ_S	7.30 E-07 / h	730 FIT
Average Probability of Failure on Demand 1oo1	$PFD_{avg}(T_1)$	4.81 E-04	
Average Probability of Failure on Demand 1oo2	$PFD_{avg}(T_1)$	4.83 E-05	

Assumptions for the calculations above: DC = 0 %, T_1 = 1 year, MRT = 72 h, β_{1oo2} = 10 %

Origin of failure rates

The stated failure rates for low demand are the result of an FMEDA with tailored failure rates for the design and manufacturing process.
Furthermore the results have been verified by qualification tests.
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.

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