SAFETY MANUAL



SH 8384-2 EN

Translation of original instructions



Type 3730-2 Electropneumatic Positioner



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

-\rac{\tip}

Recommended action

Purpose of this manual

The Safety Manual SH 8384-2 contains information relevant to the use of the Type 3730-2 Positioner 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.

• NOTICE

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

- → Refer to Mounting and Operating Instructions EB 8384-2 for details on how to mount the positioner, perform the electric and pneumatic connections as well as start up the positioner.
- → Observe the warnings and safety instructions written in the Mounting and Operating Instructions EB 8384-2.

Further documentation

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

Type 3730-2 Positioner

► T 8384-2: Data sheet

► EB 8384-2: Mounting and operating instructions

► KA 8384-2/3: Quick guide

EXPERTplus diagnostics (Type 3730-2 Positioner in firmware version 1.50 and higher)

► T 8389: Data sheet

► EB 8389: Operating instructions

EXPERT+ diagnostics (Type 3730-2 Positioner up to firmware version 1.49)

► T 8388: Data sheet

► EB 8388: Operating instructions

i Note

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

Contents

1	Scope	5
1.1	General	
1.2	Use in safety-instrumented systems	5
1.3	Versions and ordering data	
1.4	Attachment	6
2	Technical data (excerpt from EB 8384-2)	6
3	Safety-related functions	8
3.1	Fail-safe action	8
3.2	Protection against unauthorized changes to the configuration	10
4	Mounting, connection and start-up	10
5	Required conditions	11
5.1	Selection	
5.2	Mechanical and pneumatic installation	11
5.3	Electrical installation.	12
5.4	Operation	12
6	Proof testing	13
6.1	Visual inspection to avoid systematic failure	13
6.2	Function testing	14
7	Maintenance and repair	15
8	Safety-related data and certificates	16

1 Scope

1.1 General

The Type 3730-2 Electropneumatic Positioner is a single-acting, venting positioner for attachment to pneumatic rotary and linear actuators with spring-return mechanism. The positioner is used to position control valves.

1.2 Use in safety-instrumented systems

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 individual safety-instrumented functions of the positioner are to be regarded as Type A elements in accordance with IEC 61508-2.

1.3 Versions and ordering data

All versions of the Type 3730-2 Positioner are suitable for use in safety-instrumented systems. The positioner can be fitted with options. The options enhance the safety-instrumented functions of the positioner. These options are the **inductive limit switch SJ2-SN and solenoid valve**.

The article code written on the nameplate provides details on the optional equipment of the positioner:

Type 3730-2 Positioner	x x x x x x x x x 0 x 0 0 x 0 x 3
Option (additional equipment)	
Without inductive limit switch With inductive limit switch SJ2-SN (NAMUR NC contact)	0 1
Without solenoid valve With 24 V DC solenoid valve	0 4

1.4 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
- 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 8384-2)

	Type 3730-2 Positioner: the technical data for the explosion-protected devices may be restricted by the limits specified in the test certificates.			
Reference	Signal range	4 to 20 mA · Two-wire device, reverse polarity protection · Minimum span 4 mA		
variable w	Static destruction limit	00 mA		
Minimum c	urrent	3.6 mA for display · 3.8 mA for operation		
Load impedance		Without explosion protection: \leq 6 V (corresponding to 300 Ω at 20 mA) \cdot Explosion protection: \leq 7 V (corresponding to 350 Ω at 20 mA)		
	Supply air	1.4 to 7 bar (20 to 105 psi)		
Supply	Air quality acc. to ISO 8573-1	Max. particle size and density: Class 4 · Oil content: Class 3 · Pressure dew point: Class 3 or at least 10 K below the lowest ambient temperature to be expected		
Signal pressure (output)		0 bar up to the supply pressure \cdot Can be limited to 1.4 bar/2.4 bar/3.7 bar \pm 0.2 bar by software		
Hysteresis		≤0.3 %		
Sensitivity		≤0.1 %		
Transit time		Exhaust and supply adjustable separately up to 240 s by software		
Air output capacity	Actuator (supply)	At $\Delta p = 6$ bar: $8.5 \text{ m}_n^3/\text{h} \cdot \text{At } \Delta p = 1.4 \text{ bar: } 3.0 \text{ m}_n^3/\text{h} \cdot \text{K}_{Vmax(20 ^{\circ}\text{C})} = 0.09$		
	Actuator (exhaust)	At $\Delta p = 6$ bar: 14.0 $m_n^3/h \cdot At \Delta p = 1.4$ bar: 4.5 $m_n^3/h \cdot K_{Vmax(20 {}^{\circ}C)} = 0.15$		

Type 3730-2 Positioner: the technical data for the explosion-protected devices may be restricted by the limits specified in the test certificates.			
Permissible ambient temperature -20 to +80 °C (all versions) -45 to +80 °C with metal cable gland The temperature limits for the explosion-protected devices may be further restricted by the limits specified in the test certificates.			
	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 in safety-instrumented systems (SIL)	Use 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).		

Safety-relevant options

Solenoid valve · Approval according to IEC 61508/SIL · Emergency venting function			
Input	24 V DC \cdot Electrical isolation and reverse polarity protection \cdot Static destruction limit 40 V Current consumption I = $\frac{\text{U} - 5.7 \text{ V}}{3840 \ \Omega}$ (corresponding to 4.8 mA at 24 V/114 mW)		
Signal '0' (no response)	<12 V (emergency shutdown at 0 V)		
Signal '1' (response)	>19 V		
Service life	>5 x 10 ⁶ switching cycles		
K _V coefficient	0.15		
Use in safety-instrumented systems acc. to IEC 61508/	Same as positioner pneumatics		
Inductive limit switch by Pepperl+Fuchs · Function: safety-related end position monitoring			
For connection to switching amplifier according to EN 60947-5-6. Can be used in combination with a software limit switch.			
SJ2-SN proximity switch	Measuring plate not detected: ≥3 mA · Measuring plate detected: ≤1 mA		

3 Safety-related functions

Emergency venting over the i/p converter (Fig. 1 path ———)

In automatic mode, the PD controller (3) compares the valve position to the DC control signal from 4 to 20 mA issued by the microcontroller. In case of a system deviation, the activation of the i/p converter is changed so that the actuator (1) is either vented or supplied with air. Fail-safe action is triggered when no signal (0 mA) is applied to terminals 11/12 and, as a result, to the i/p converter.

Emergency venting over the optional solenoid valve (Fig. 1 path)

The solenoid valve (12) is energized by a 24 V DC voltage signal. Fail-safe action is triggered when no signal (0 V DC) is applied to terminals 81/82. This causes the solenoid valve (12) to vent the output of the i/p converter to the atmosphere. The actuator is vented as well.

Safety-related end position monitoring over the optional inductive limit switch (Fig. 1 path —————)

The inductive limit switch SJ2-SN (NAMUR NC contact) indicates the adjusted safety-related end position at terminals 41/42. See ► EB 8384-2 for adjusting the limit switches.

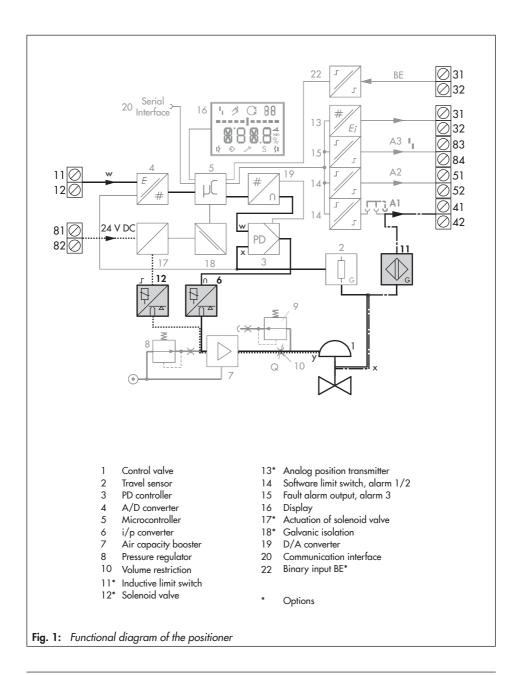
3.1 Fail-safe action

Fail-safe action is triggered by the i/p converter or solenoid valve and upon supply air failure. The positioner fully discharges its pneumatic output to the atmosphere, causing the pneumatic actuator to be vented. 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 optional solenoid valve is de-energized, all positioner functions, except for open/closed-loop control, remain active (including diagnostics, position and status feedback).

i Note

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

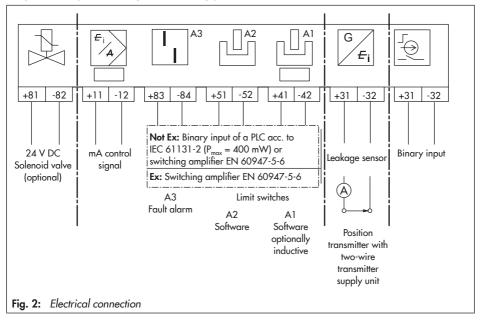


3.2 Protection against unauthorized changes to the configuration

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

4 Mounting, connection and start-up

Refer to Mounting and Operating Instructions EB 8384-2 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.



5 Required conditions

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



The minimum OPEN and CLOSE transit times can be read in Codes 40 and 41 after the positioner has been initialized.

→ The positioner is suitable for the prevailing ambient temperature.

Versions	Temperature range
All	-20 to +80 °C
With metal cable gland	-45 to +80 °C

The temperature limits for the explosion-protected devices may be further restricted by the limits specified in the test certificates.

→ The temperature limits are observed.

5.2 Mechanical and pneumatic installation

→ The positioner is mounted properly as described in the mounting and operating instructions and connected to the air supply.



Error codes 50 to 58 indicate incorrect attachment. For safety-instrumented systems, we recommend assigning the 'Failure' status to these errors to quickly recognize them when they occur (indicated by on the display).

Required conditions

- → The maximum supply pressure does not exceed 7 bar.
- → The pneumatic air supply meets the instrument air specifications.

Particle size and quantity	Oil content	Pressure dew point
Class 4	Class 3	Class 3
≤5 µm and 1000/m³	≤1 mg/m³	-20 °C or at least 10 K below the lowest ambient temperature to be expected



We recommend 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 supply air line has a minimum inside diameter of 4 mm.

 Select the cross section and length of the line to ensure that the supply pressure at the device on supplying air does not fall below the minimum limit.
- → The positioner is mounted as prescribed.
- → The vent opening at the back of the positioner remains open when the positioner is installed on site.

5.3 Electrical installation

- → The positioner 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

- → When the optional inductive limit switch is used, Code 38 is set to YES.
- → The inductive limit switch is adjusted mechanically to meet the specifications.

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.

A WARNING

Risk of dangerous failure due to malfunction in the event of emergency (actuator is not vented 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_{ava}).

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.

6.2 Function testing

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

i Note

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

Emergency venting by applying a 0 mA signal to terminals 11/12 (control signal):

- 1. Supply the positioner with air within the permissible supply pressure range (max. 7 bar) which allows the valve to move to the maximum travel/angle of rotation.
- 2. Connect an electric input signal ≥3.6 mA to the positioner (terminals 11/12).
- 3. Switch the positioner to automatic mode (if it has not already been done).
- 4. Set the input signal (terminals 11/12) over a local current source or over the control system in such a way that the valve moves to 50 % of its travel/angle of rotation.

-\(\overline{\pi}\)- Tip

The travel in automatic mode can be read at the positioner in Code 0.

- 5. Set the electric input signal to 0 mA or disconnect it.

 This must cause the valve to move to its fail-safe position (terminals 11/12).
- 6. Check whether the actuator is fully vented within the demanded time.



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

Emergency venting by applying a 0 V signal to terminals 81/82 (solenoid valve):

- 1. Supply the positioner with air within the permissible supply pressure range (max. 7 bar) which allows the valve to move to the maximum travel/angle of rotation.
- 2. Connect an electric input signal ≥3.6 mA to the positioner (terminals 11/12).
- 3. Supply the solenoid valve with a voltage >19 V DC (terminals 81/82).
- 4. Set the input signal (terminals 11/12) over a local current source or over the control system in such a way that the valve moves to 50 % of its travel/angle of rotation.



The travel in automatic mode can be read at the positioner in Code 0.

- 5. Set the voltage to 0 V DC (terminals 81/82).
- 6. Check whether the actuator is fully vented within the demanded time.



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

Safety-related end position monitoring

- 1. Supply the positioner with air within the permissible supply pressure range (max. 7 bar) which allows the valve to move to the maximum travel/angle of rotation.
- 2. Connect an electric input signal ≥3.6 mA to the positioner (terminals 11/12).
- 3. Switch the positioner to automatic mode (if it has not already been done).
- 4. Set the input signal (terminals 11/12) over a local current source or over the control system in such a way that the valve moves to 50 % of its travel/angle of rotation.
- 5. Set the input signal (terminals 11/12) over a local current source or over the control system in such a way that the valve moves to the end position.
- 6. Check whether a signal is issued at terminals 41/42 when the valve has reached the end position.

Proof test

A full stroke test must be performed as the proof test. The following value can be used for Proof Test Coverage to calculate PFD_{avg} :

PTC (Proof Test Coverage) = 92 % for a proof test

7 Maintenance and repair

Only perform the work on the positioner described in EB 8384-2.



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

→ Only allow trained staff to perform service and repair work.

Safety-related data and certificates

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.

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

PSTC (Partial Stroke Test Coverage)	68 %
PTC (Proof Test Coverage)	92 %
MTC (Maintenance Coverage)	>99 %

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



SIL/PL Capability

www.buv.com ID 0600000000

No.: 968/V 1161.02/22

Product tested

Electro pneumatic positioners

Certificate holder

SAMSON AG

Weismüllerstr. 3 60314 Frankfurt / Main

Germany

Type designation

see Revisionlist

Codes and standards

IEC 61508 Parts 1-2 and 4-7:2010

Intended application

Safety Function: Safe venting (and safe indication of the end positions)

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 the positioners may be used in a redundant architecture up to SIL 3 according to IEC 61508 and IEC 61511:2016 + AMD1:2017.

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.

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 1161.0:2/22 dated 2022-08-25. This certificate is valid only for products, which are identical with the product tested.

> TÜV Rheinland Industrie Service GmbH Bereich Automation

Funktionale Sicherheit Certification Body Selety & Security for Pulsahelium & Grid

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Köln, 2022-09-08



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Certificate







No.: 968/V 1161.02/22

Product tested

Electro pneumatic positioners

Certificate holder SAMSON AG Weismüllerstr. 3

60314 Frankfurt / Main Germany

Type designation

see Revisionlist

Codes and standards

IEC 61508 Parts 1-2 and 4-7:2010

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> TÜV Rheinland Industrie Service GmbHi Bereich Automation

Funktionale Sicherheit
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Revision List referred to on Certificate No.: 968/V 1161.02/22 Certified Product: Electromagnetic positioners



Safety related modules / components

Type Designation	Description	Report-No.:	Certification Status
3730-0	Electropneumatic positioner	968/V 1161.00/20	Valid
3730-1	Electropneumatic positioner	968/V 1161.00/20	Valid
3730-2	Electropneumatic positioner	968/V 1161.00/20	Valid
3730-3	Electropneumatic positioner	968/V 1161.00/20	Valid
3730-4	Electropneumatic positioner	968/V 1161.00/20	Valid
3730-5	Electropneumatic positioner	968/V 1161.00/20	Valid
3730-6	Electropneumatic positioner	968/V 1161.00/20	Valid
TROVIS SAFE 3730-6	Electropneumatic positioner	968/V 1161.00/20	Valid
3731-3	Electropneumatic positioner	968/V 1161.00/20	Valid
TROVIS SAFE 3731-3	Electropneumatic positioner	968/V 1161.00/20	Valid
3731-5	Electropneumatic positioner	968/V 1161.00/20	Valid

Manufacturing locations

Type Designation	Description	Report-No.:	Certification Status
SAMSON AG	Weismüllerstraße 3 60314 Frankfurt am Main	968/V 1161.00/20	Valid
Samson Controls Solutuions (Beijing) Co., Ltd.	Building 1, No. 15, Yong Chang Nan Lu, BDA, Beijing, 100176, P.R. China	968/V 1161.02/22	Valid

SAMSON AG Weismüllerstraße 3 60314 Frankfurt am Main

Page 1 of 3

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Revision List referred to on Certificate No.: 968/V 1161.02/22 Certified Product: Electromagnetic positioners



Safety Manual

Document No.	Description	Report-No.:	Certification Status	
e8384mde 3730-0.pdf	Safety manual for type 3730-0	968/V 1161.00/20	Valid	
e8384ode 3730-1.pdf	Safety manual for type 3730-1	968/V 1161.00/20	Valid	
e8384qde3730-2.pdf	Safety manual for type 3730-2	968/V 1161.00/20	Valid	
e8384sde 3730-3.pdf	Safety manual for type 3730-3	968/V 1161.00/20	Valid	
e8384nde 3730-4.pdf	Safety manual for type 3730-4	968/V 1161.00/20	Valid	
e8384pde 3730-5.pdf Safety manual for type 3730-5		968/V 1161.00/20	Valid	
e8384rde 3730-6.pdf Safety manual for type 3730-6		968/V 1161.00/20	Valid	
e8384bde TROVIS SAFE 3730- 6.pdf	Safety manual for type TROVIS SAFE 3730-6	968/V 1161.00/20	Valid	
e8387yde 3731-3.pdf	Safety manual for type 3731-3	968/V 1161.00/20	Valid	
e8387xde. TROVIS SAFE 3731- 3.pdf		968/V 1161.00/20	Valid	
e8387zde 3731-5.pdf	Safety manual for type 3731-5	968/V 1161.00/20	Valid	

SAMSON AG Weismüllerstraße 3 60314 Frankfurt am Main TÜV Rheinland Industrie Service GmbH Automation - Functional Safety (A-FS) Am Grauen Stein 51105 Köln / Germany

Page 2 of 3

Revision List referred to on Certificate No.: 968/V 1161.02/22 Certified Product: Electromagnetic positioners



Drawings

Document No.	Revision	Description	Report-No.:	Certification Status
GI03_1040_0002_8.pdf	8.a / 20.02.2015	Drawing for type 3730-0	968/V 1161.00/20	Valid
GI03_1040_0018_8.pdf	8.a / 20.02.2015	Drawing for type 3730-1	968/V 1161.00/20	Valid
GI03_1040_0013_11.pdf	11.a / 19.02.2015	Drawing for type 3730-2	968/V 1161.00/20	Valid
GI03_1040_0007_15.pdf	15.a / 18.11.2016	Drawing for type 3730-3	968/V 1161.00/20	Valid
GI03_1040_0014_11.pdf	11.a / 19.02.2015	Drawing for type 3730-4	968/V 1161.00/20	Valid
GI03_1040_0015_10.pdf	10.a / 20.02.2015	Drawing for type 3730-5	968/V 1161.00/20	Valid
GI01_1040_0347_6.pdf	6.a / 18.11.2016	Drawing for type 3730-6	968/V 1161.00/20	Valid
GI01_1040_0347_6.pdf	6.a / 18.11.2016	Drawing for type TROVIS SAFE 3730-6	968/V 1161.00/20	Valid
1170-2964_SWD_000_13_de.pdf	13 / 16.04.2019	Drawing for type 3731-3	968/V 1161.00/20	Valid
1170-2964_SWD_000_13_de.pdf	13 / 16.04.2019	Drawing for type TROVIS SAFE 3731-3	968/V 1161.00/20	Valid
1170-2964_SWD_000_13_de.pdf	13 / 16.04.2019	Drawing for type 3731-5	968/V 1161.00/20	Valid

The content of this Revision List has been agreed between Manufacturer and Certification Body.

Revision:

Date	Rev.	Description / Changes	Author
2020-05-04	1.0	Initial creation, based on Report-No.: 968/V 1161.00/20	JCz/A-FS
2022-08-17	2.0	Addition of manufacturing facility in P.R. China Report-No.: 968/V 1161.02/22	JCz/A-FS

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Page 3 of 3

