BUCHER automation

Description of STO safety function



60887420_01

JM-100x-S1

Servo Amplifier

This document has been compiled by Bucher Automation AG with due diligence based on the state of the art as known to them. Any revisions and technical advancements of our products are not automatically made available in a revised document.
Bucher Automation AG shall not be liable for any errors either in form or content, or for any missing updates, as well as for any damage or detriment resulting from such failure.

Bucher Automation AG
Thomas-Alva-Edison-Ring 10
71672 Marbach/Neckar, Germany
T +49 7141 2550-0
info@bucherautomation.com

Technical support
T +49 7141 2550-444
support@bucherautomation.com

Sales
T +49 7141 2550-663
sales@bucherautomation.com

www.bucherautomation.com

Translation of the german original User Manual

Revision	1.11
Date of issue	7/23/2024

Table of Contents

1 Introduction ... 4
1.1 Information on this document ... 4
1.2 Acronyms ... 5
1.3 Risk assessment ... 5
2 Safety ... 6
2.1 General Information ... 6
2.2 Purpose ... 6
2.2.1 Intended use ... 6
2.2.2 Usage other than intended ... 6
2.3 Warnings used in this document ... 7
2.4 General Safety Instructions ... 8
3 System overview ... 9
4 Technical data ... 10
4.1 Interfaces to the STO safety function ... 10
5 Electrical connection ... 11
5.1 I/O interface (X10) pinout ... 11
5.2 Control voltage +24 V (X10:1, X10:2) ... 11
5.3 24 V SI input ... 12
5.4 STO checkback contact ... 12
5.5 Components for selecting the STO safety function ... 13
5.5.1 Requirements for passive safety sensors ... 13
5.5.2 Requirements for active safety sensors (OSSD signals) ... 13
6 Description of STO safety function ... 14
6.1 Definition of terms ... 14
6.2 24 V SI input (X10:5 ... X10:8) ... 15
6.3 STO checkback contact ... 16
6.4 LED indicators ... 17
6.5 Application examples according to SIL 3 and PL e ... 18
6.5.1 Passive safety sensors ... 18
6.5.2 Active safety sensors ... 19
6.6 Testing the STO safety function ... 20
6.7 Test protocol checklist ... 20
6.7.1 Procedure for testing the STO safety function ... 20
6.8 Safety parameters - STO ... 21
7 Konformitätserklärung ... 22

1 Introduction

1.1 Information on this document

This document forms an integral part of the product and must be read and understood prior to using it. It contains important and safety-related information for the proper use of the product as intended.

Target Groups

This document is intended for specialists with appropriate qualifications.
Only competent and trained personnel are allowed to put this device into operation.
During the whole product life cycle, safe handling and operation of the device must be ensured. In the case of missing or inadequate technical knowledge or knowledge of this document any liability is excluded.

Availability of Information

Make sure this document is kept at the ready in the vicinity of the product throughout its service life.
For information on new revisions of this document, visit the download area on our website. This document is not subject to any updating service.

Start | Bucher Automation - We automate your success.

For further information refer to the following information products:

– User manuals
  Information on commissioning Bucher-Automation products
– Online help for the JetSym software
  Functions of software products with application examples

ⓘ Info

EtherCAT®

EtherCAT® is a registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.

Contents

This description of the STO safety function contains information on how to commission and test the “Safe Torque Off (STO)” safety function.

NOTICE! The complete documentation can be found on the USB stick included with delivery (article number 60888000).

Designation

The servo amplifier hereinafter is referred to as **“drive module”.**

1.2 Acronyms

Term	Description
PFH	Probability of an accidental dangerous hardware failure per hour (EN 61800-5-2:2007)
OSSD	Output signal switching device
SFF	Safe failure fraction
STO	Safe torque off
T_M	Mission time
PLr	Required performance level

Tab. 1: Acronyms

1.3 Risk assessment

Before a machine can be enabled for regular operation, its manufacturer must carry out a risk assessment procedure according to the Machinery Directive 2006/42/EC. The manufacturer should thereby identify the relevant health and safety requirements for its machinery and take the appropriate measures to that end. To reduce the risk, the manufacturer is obliged to adopt protective measures. These include:

1. An inherently safe design (see EN ISO 12100:2010).
2. Use of guards and protective devices (see EN ISO 12100:2010).
3. Provision of user information that informs about the machine's intended use, warns the user about the residual risk, and defines the required behavior (see EN ISO 12100:2010).

The risk assessment procedure is a multi-stage process and is described in more detail in EN ISO 12100:2010.

Following a risk assessment, which has been successfully prepared by the machine manufacturer, the prerequisites have been met to define the requirements for the safety-related controllers according to EN ISO 13849-1.

A required performance level (PLr) must be defined and documented for each safety function carried out by the safety-related controller. The achieved performance level (PL) of the respective safety function must meet the requirements of PLr. It is the task of the user of the integrated safety equipment to thoroughly study the associated guidelines and standards, and the legal situation.

2 Safety

2.1 General Information

When placed on the market, this product corresponds to the current state of science and technology.

In addition to the operating instructions, the laws, regulations and guidelines of the country of operation or the EU apply to the operation of the product. The operator is responsible for compliance with the relevant accident prevention regulations and generally accepted safety rules.

2.2 Purpose

2.2.1 Intended use

The servo amplifier is intended solely for connecting electric motors of various types and various position encoders according to the user manual.

The STO safety function is only available for servo amplifiers with the "S1" option according to the type code.

You may only use the servo amplifier in the closed IP54 control cabinet, taking ambient conditions into account.

The servo amplifier is a product that can be used in electrical installations or machines in the second environment (industrial) with category C1 according to EN 61800-3. This requires EMC-compliant installation.

SELV

PELV

A 24 V DC power supply unit (SELV or PELV) is required for the control voltage.

Always use the servo amplifier as intended. The following instructions must be followed as a prerequisite for intended use.

– Always follow the safety instructions. Unauthorized modifications and changes to the servo amplifier are not permitted.
– The operator is obliged to immediately report any changes that affect the safety of the servo amplifier.
– Install and operate the servo amplifier only as specified in this description.
– The servo amplifier may only be installed and operated in flawless technical condition.

2.2.2 Usage other than intended

NOTICE! The STO safety function cannot be used for DC motors with brushes.

– Do not operate the servo amplifier outside its specifications and application examples specified in the user manual.
– The servo amplifier must not be operated under operating conditions that differ from the specified ambient conditions.
– Bucher Automation AG assumes no liability and will not honor warranty claims for damage in the event of usage other than intended.

2.3 Warnings used in this document

⚠ DANGER



High risk

Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING



Medium risk

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION



Low risk

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE



Material damage

Indicates a situation which, if not avoided, could result in malfunctions or material damage.

2.4 General Safety Instructions

The safety instructions must be read before commissioning the drive module. If the content is not properly understood in this language, then please consult the supplier.

Target groups

Only competent staff trained in electrotechnical engineering are allowed to put this device into operation. This document is intended for competent staff trained in electrotechnical engineering.

During the whole product life cycle, safe handling and operation of the device must be ensured. In the case of missing or inadequate technical knowledge or knowledge of this document any liability is excluded.

⚠ DANGER



Risk of electric shock

Incorrect connection causes high electrical voltage.

- ► Mind the relevant safety regulations.
- ► This function may only be put into operation by competent and trained personnel.

⚠ WARNING



Risk of contusion due to uncontrolled axis movements

Axis movements and accelerations cause high mechanical forces.

- ► Keep out of the danger zone of the machine.
- ► Do not disable any safety equipment.
- ► Have malfunctions eliminated by qualified personnel.

⚠ WARNING



Risk of burns due to hot surfaces

The device heats up during operation with can cause burns when touching it.

- ► Take protective measures to prevent inadvertent contact with the device, e.g. install protective covers.
- ► Allow the device to cool down for some time before you start working on it.
- ► Wear personal protective equipment.

⚠ WARNING



Danger for persons with pacemakers and implants!

Operating the device generates an electromagnetic field. Electric, magnetic and electromagnetic fields are a health risk in particular to persons with pacemakers and implants.

- ► If you belong to the above group of persons you must not be in the immediate vicinity of the device.
- ► Keep a minimum distance as specified below:
  300 mm from a de-energized device, for example when doing installation work;
  600 mm from an energized device running in normal operation.

3 System overview

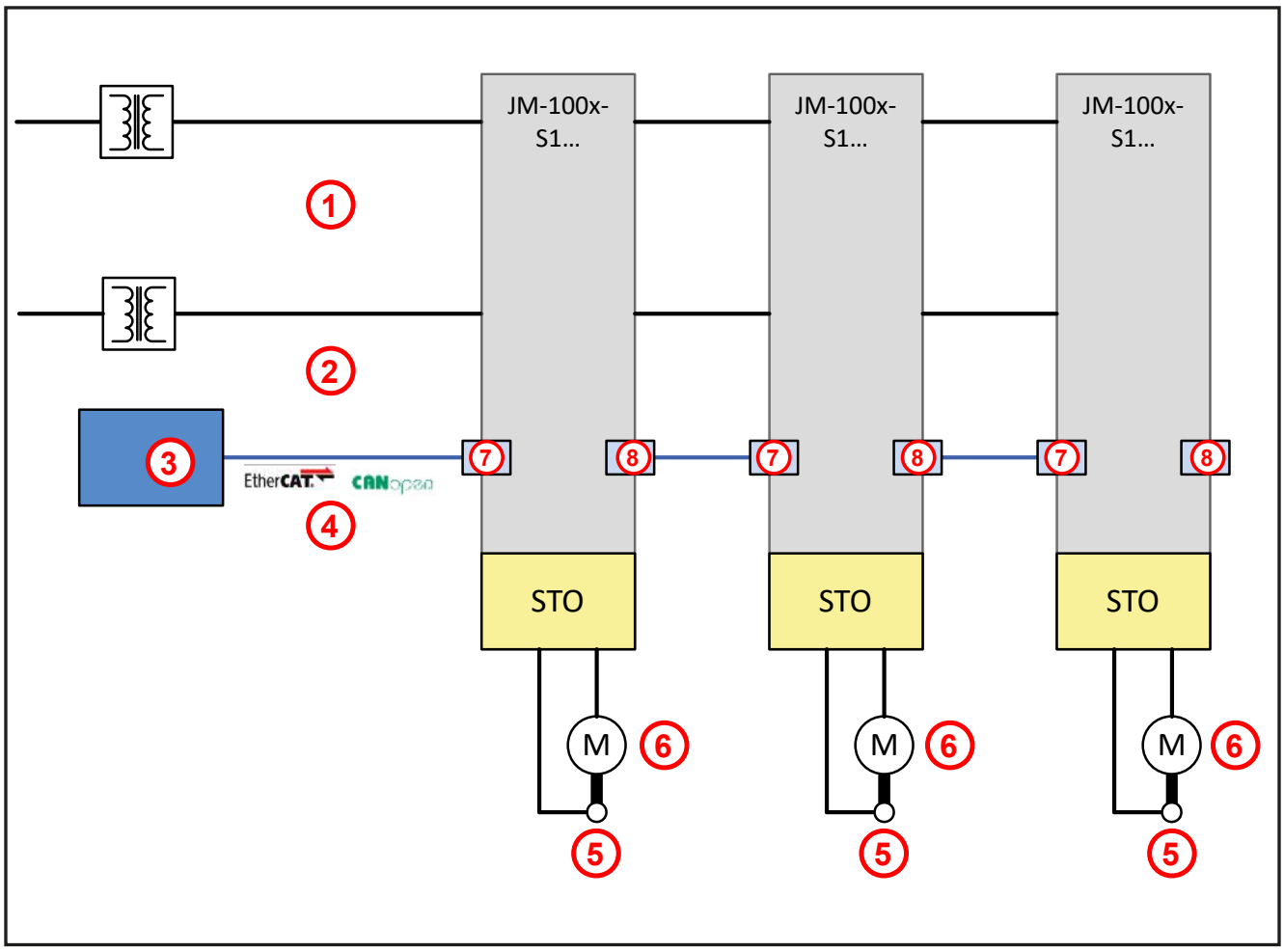


Fig. 1: System overview

1	Power connection (X1), (power supply), SELV / PELV, DC 24 V to DC 48 V
2	Control voltage (X10), (logic supply), SELV / PELV, DC 24 V
3	Controller
4	Field bus
5	Encoder
6	Motor
7	Field bus input
8	Field bus output

4 Technical data

For a complete description of the connections refer to the user manual. Only the connections for selecting the STO safety function are described here.

4.1 Interfaces to the STO safety function

The STO safety function can be selected only via a 24 V SI input at the I/O interface (X10).

5 Electrical connection

5.1 I/O interface (X10) pinout

It is mandatory to wire the 24 V SI input (X10:5 ... X10:8) with insulated wire end ferrules.

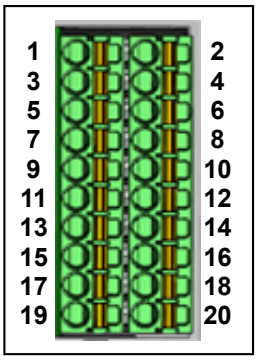


Fig. 2: I/O connector X10

PIN	Pin assignment
X10:1	Power supply for logic circuitry +24 V
X10:2	Control voltage GND
X10:3	Motor holding brake -
X10:4	Motor holding brake+
X10:5	STO1
X10:6	GND_STO1
X10:7	STO2
X10:8	GND_STO2
X10:9	STO_REL1
X10:10	STO_REL2
X10:11	Digital input 1
X10:12	Digital input 2
X10:13	Digital input 3
X10:14	Digital input 4
X10:15	A_GND
X10:16	D_GND
X10:17	Analog input 1+
X10:18	Analog input 2+
X10:19	Analog input 1-
X10:20	Analog input 2-

Tab. 2: X10 pinout

5.2 Control voltage +24 V (X10:1, X10:2)

Parameter	Description
Input voltage	DC 24 V (-15 % ... +20 %) SELV or PELV
Input current	300 mA at 24 V

Tab. 3: Power supply

5.3 24 V SI input

The technical specifications apply to the STO1 and STO2 inputs.

Parameter	Description		
Pins	X10: 5 … X10: 8		
Input voltage	**Min.**	**Typ.**	**Max.**
Low level (OFF) (Select STO)	-3 V	0 V	+5 V
High level (ON)	+17 V	+24 V	+30 V
Transition range	+5 V		+17 V
Input current			35 mA
Short inrush current			0.6 A
OSSD signals			<1 ms
Max. cable length	Observe the sensor manufacturer's information		

Tab. 4: Properties of the 24 V SI input

5.4 STO checkback contact

Parameter	Description		
Design	PhotoMOS relay (floating)		
	NO contact, not short-circuit-proof		
	Min.	**Typ.**	**Max.**
Power supply voltage (STO_REL1 (X10:9))			30 V
Rated current (STO_REL2 (X10:10))		120 mA	
Cycle time, closing		0.23 ms	0.5 ms
Cycle time, opening		0.04 ms	0.2 ms

Tab. 5: Properties of the STO checkback contact

5.5 Components for selecting the STO safety function

– The STO safety function is selected via a logical low (0) at both the STO1 and STO2 inputs.
– The following components for selecting the STO safety function can be connected to the 24 V SI input.
– A separate parameterization is not required for making a selection.

Parameter	Example	Comment
Active safety sensors	Laser scanner	Non-mechanical protective devices; units with dual-channel semiconductor outputs (OSSD signals)
	Light curtain	
	Light barrier	
	Light curtain	
Safety PLC		OSSD signals
Passive safety sensors	Safety switches with relay outputs	
	Door contact switch	NC contact/NC contact combination
	Emergency stop control devices	

Tab. 6: Components

5.5.1 Requirements for passive safety sensors

– Passive safety sensors are dual-channel, contact-dependent switching elements.
– The connecting cables and the function of the sensors must be monitored by the higher-level controller.
– The contacts must switch at the same time. The STO safety function becomes active when at least one input has switched to Low (0).
– Safe wiring is required, for which the following fault exclusions apply:
  – Short-circuit to other potentials,
  – Short-circuit to 24 V,
  – Short-circuit to ground.
– Fault exclusions are possible when the connecting cables are permanently (fixed) routed and protected against external damage (e.g. in the cable duct).
– Furthermore, wiring with insulated wire end ferrules is absolutely necessary.
– Fault exclusions must be checked during commissioning.

5.5.2 Requirements for active safety sensors (OSSD signals)

Active safety sensors are safety devices with 2-channel semiconductor outputs. Monitoring short circuits of the outputs and cables is performed by the active safety sensor.

Test pulses of <1 ms are tolerated, which means they do not lead to a request of the STO safety function.

6 Description of STO safety function

6.1 Definition of terms

The safe torque off (STO) function is defined in the EN 61800-5-2 standard.

“Power, that can cause rotation (or motion in the case of a linear motor), is not applied to the motor. The PDS(SR) will not provide energy to the motor which can generate torque (or force in the case of a linear motor).” (EN 61800-5-2). This safety function corresponds to an uncontrolled stopping in accordance with stop category 0 as defined in EN 60204-1. (EN 61800-5-2)

A “selection” corresponds to an “activation” of the STO safety function. There is no standstill position monitoring.

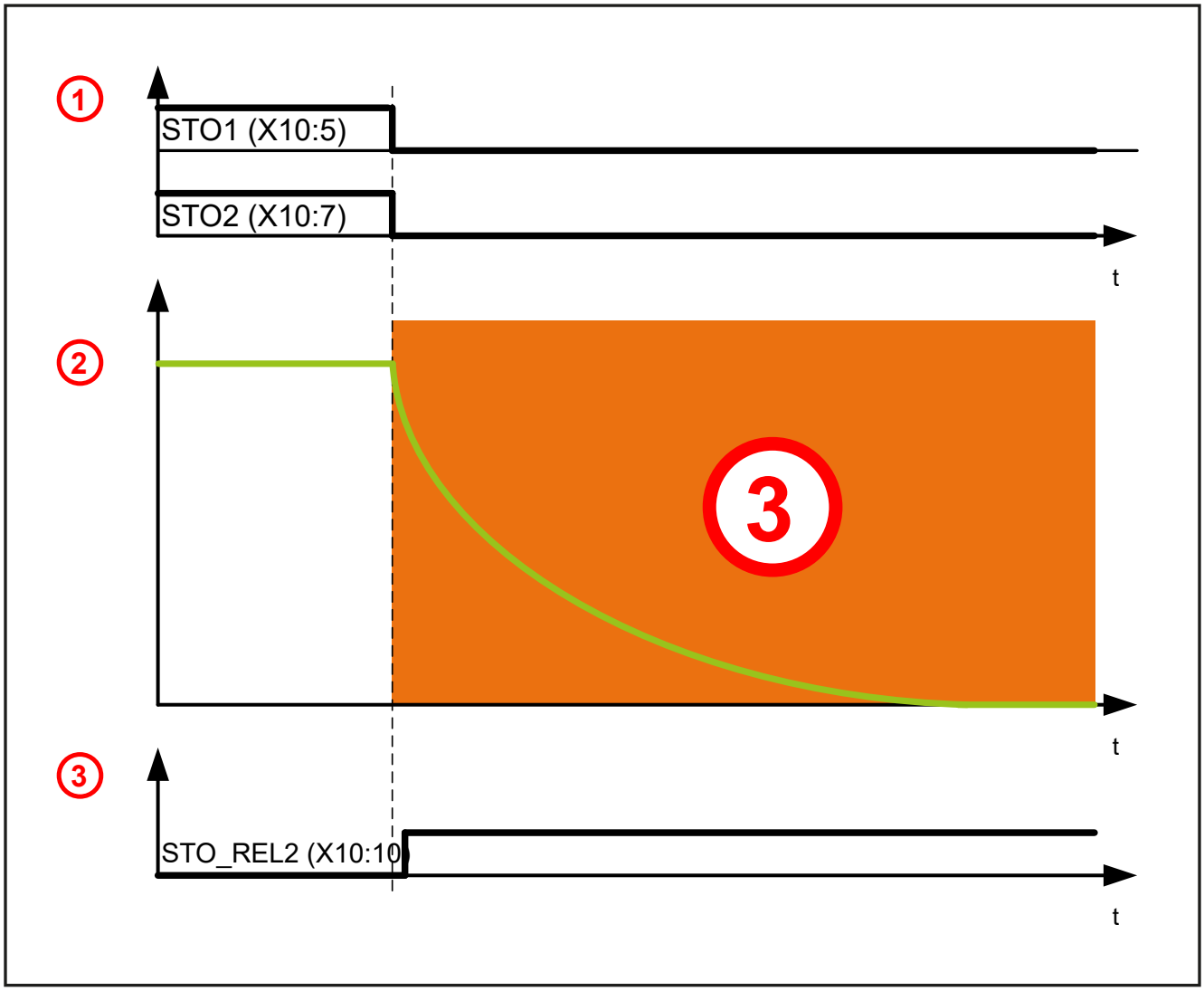


Fig. 3: Flow chart - selecting STO while the motor is revolving

1	STO activation
2	Speed
3	STO active

⚠ DANGER



Risk of injury due to unintended axis movement!

Loads or mechanical influences can cause unintended movement of vertical axes.

► Take additional protective measures such as using mechanical brakes.

NOTICE



Unintended axis movement due to short circuit

► A brief axis movement can be triggered by a short-circuit in offset branches of the drive. Example: synchronous motor: The movement can be up to 60 degrees in a 6-pin synchronous motor.

6.2 24 V SI input (X10:5 ... X10:8)

The STO safety function is activated through two channels with the two STO1 and STO2 inputs. This allows for a direct connection of active safety sensors (OSSD signals) and passive safety sensors. If both STO1 and STO2 inputs simultaneously switch to logical low (0), and the STO shutdown circuitry does not show a fault, the STO checkback contact closes (1), thereby enabling the STO safety function.

⚠ WARNING



Risk of injury due to uncontrolled restart!

The device restarts when the safety function is deactivated.

► Take external measures designed to ensure that the drive resumes operation only after explicit confirmation.

6.3 STO checkback contact

If there is no 2-channel activation of the STO safety function, the STO checkback contact is open (0). This state occurs if

– the control voltage (logic supply) is not connected,
– the supply voltage (STO_REL1 (X10:9)) is not connected,
– only one SI input (STO1 or STO2) is low (0),
– a fault has occurred in the STO shutdown circuitry.

If the safety function STO has been activated through both channels, and if there is no fault in the STO shutdown circuitry, the safety function STO is active (safe state) and the STO checkback contact is closed (1).

State	STO1 input	STO2 input	Checkback contact	Safety function STO
1	High (1)	High (1)	Open (0)	Not active
2	High (1)	Low (0)	Open (0)	Active
3	Low (0)	High (1)	Open (0)	Active
4	Low (0)	Low (0)	Closed (1)	Active

Tab. 7: Plausibility table – STO checkback contact

NOTICE! The STO checkback contact is single-channel. It can be used for diagnostic purposes by the higher-level controller, but not in the safety circuit.

⚠ WARNING



Risk of injury due to uncontrolled drive behavior!

If the plausibility check performed by the higher-level controller returns an error, this malfunction is shown; the STO's proper functioning is no longer guaranteed.

► Take immediate steps to prevent further operation, e.g. by removing the Power Enable signal or by switching off the mains contactor.

6.4 LED indicators

Enabling visual diagnostics, the servo amplifier is equipped with 8 status LEDs located vertically to the left of the X10 I/O interface.

The LEDs are controlled by the microcontroller. Therefore, the indicated operating states depend on its firmware.

NOTICE! In the following illustration, the LEDs are arranged horizontally (rotated by 90° to the right) for reasons of space. The red error LED is located at the bottom of the device.

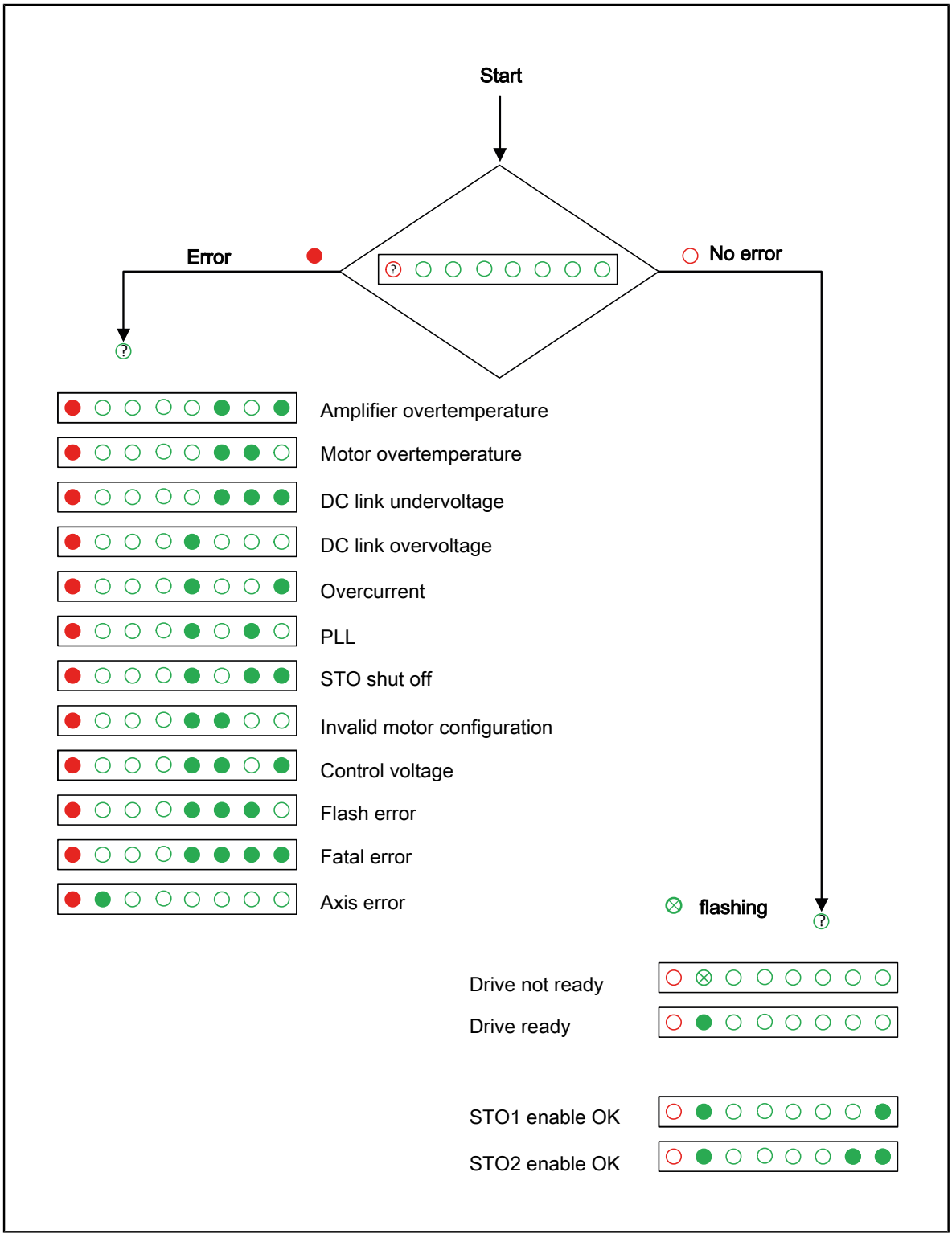


Fig. 4: Servo amplifier operating states

6.5 Application examples according to SIL 3 and PL e

Dual-channel selection of the STO safety function can be performed by passive and active safety sensors.

6.5.1 Passive safety sensors

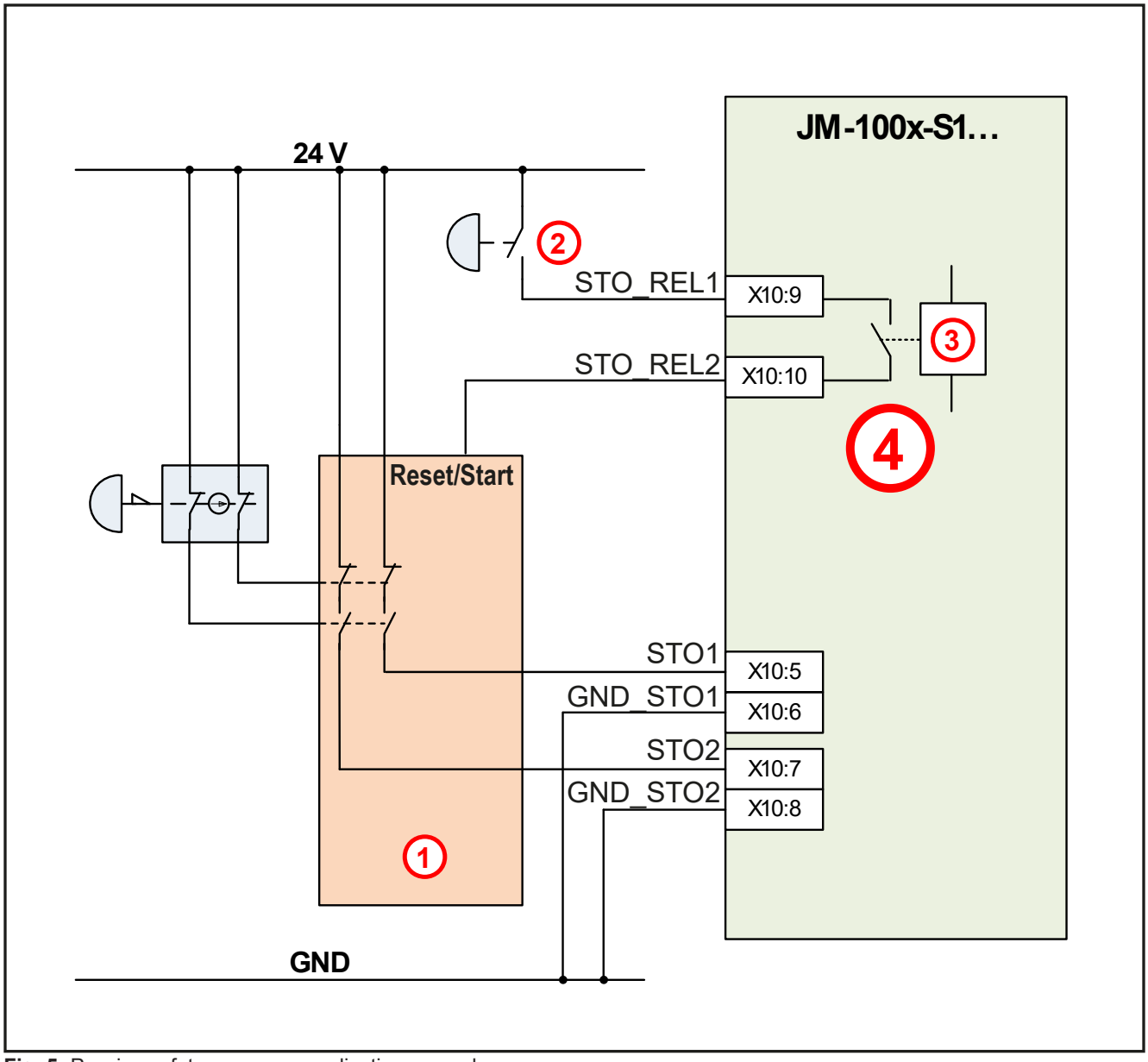


Fig. 5: Passive safety sensors – application example

1	Safety relay
2	Reset/Start
3	PhotoMOS relay
4	STO checkback contact
GND	Ground

6.5.2 Active safety sensors

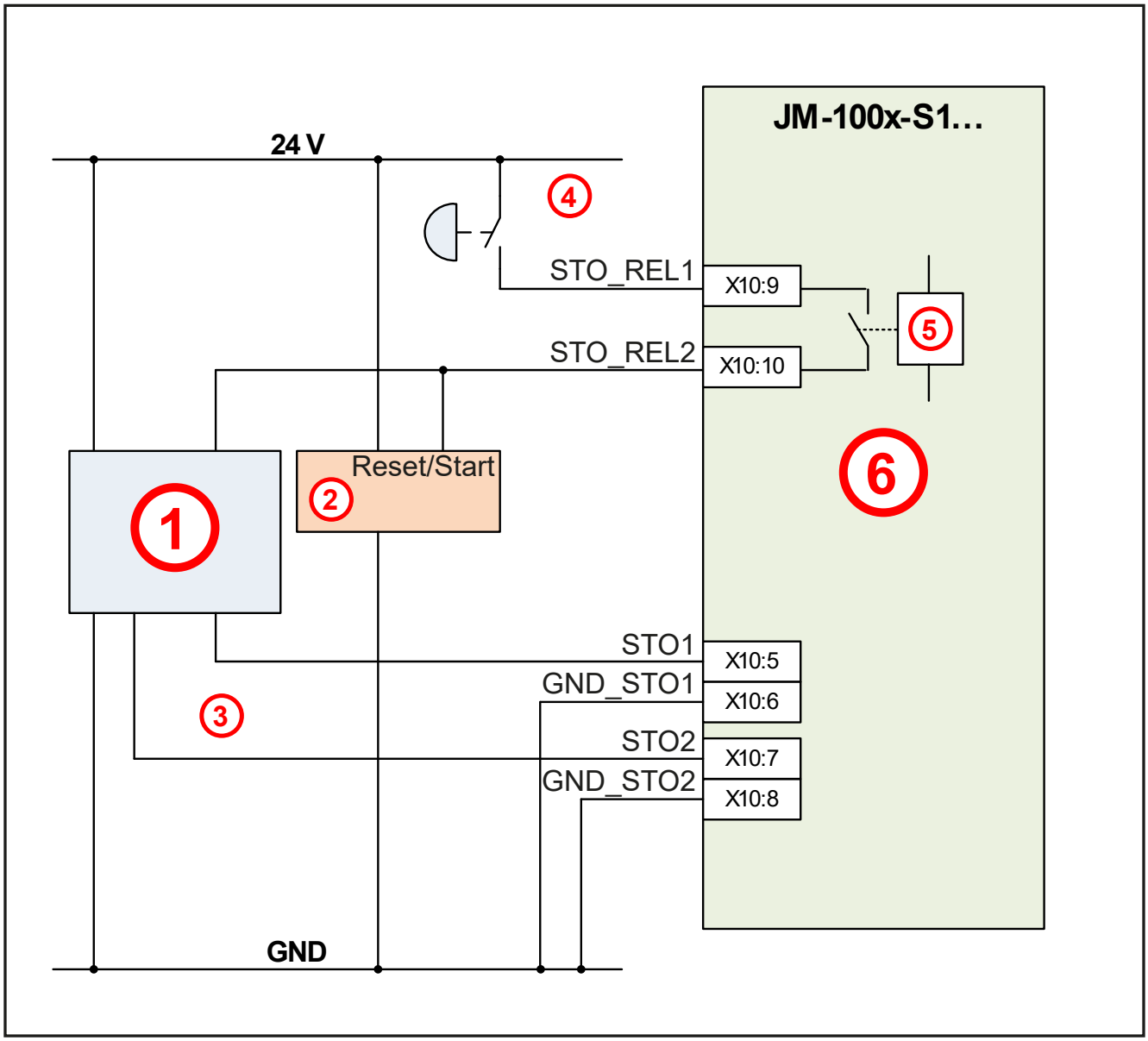


Fig. 6: Active safety sensors – application example

1	Active safety sensors or safety PLC
2	Standard SPS
3	OSSD signals
4	Reset/Start
5	PhotoMOS relay
6	STO checkback contact
GND	Ground

6.6 Testing the STO safety function

The STO safety function test is often referred to as an “acceptance test” or “configuration test” (EN 61800-5-2:2007).

Testing the STO safety function is necessary:

– upon initially commissioning the plant or machine,
– when replacing the drive module,
– when making changes to the installation,
– at the specified diagnostic test interval.

The required diagnostic test interval depends on the application and should be performed at least once a year for category 3 PL d and every 3 months for category 3 PL e.

One part of the acceptance test of the entire machine or plant is the acceptance test of the drive module. The acceptance test of the drive module is a check whether the drive-integrated safety functions are configured to match the projected safety function of the machine.

6.7 Test protocol checklist

NOTICE! It is mandatory that a record be kept of all modifications and STO safety function tests.

6.7.1 Procedure for testing the STO safety function

The prerequisite for testing the STO safety function is completed assembly and installation of the drive module according to the user manual.

The procedure does not apply to vertical axes, where a holding brake is necessary. The fieldbus interface cannot be used to test the STO safety function.

No.	Description	Status indication
1	Initial state – Drive module is in the “operation enabled” state. – STO safety function is not active.	EtherCAT® master
	“STO1 Enable OK” and “STO2 Enable OK” are **ON**.	See LED indicators
2	Moving the motor – Specify a speed reference value unequal to 0 via the fieldbus and check whether the motor is revolving.	
3	Activating the STO safety function via STO1 – Low (0) at port X10:5 (STO1) – Check whether the STO safety function is active.	
	“STO1 Enable OK” is **OFF**.	See LED indicators
	– Motor coasts to stop.	
4	Deactivating the STO safety function	
	“STO1 Enable OK” and “STO2 Enable OK” are **ON**.	See LED indicators
	The drive module does not report any errors of the safety function.	EtherCAT® master

No.	Description	Status indication
5	Activating the STO safety function via STO2 – Low (0) at port X10:7 (STO2) – Check whether the STO safety function is active.	
	“STO2 Enable OK” is **OFF**.	See LED indicators
	– Motor coasts to stop.	
6	Deactivating the STO safety function	
	“STO1 Enable OK” and “STO2 Enable OK” are **ON**.	See LED indicators
	The drive module does not report any errors of the safety function.	EtherCAT® master
7	Activating the STO safety function via STO1 and STO2 – Low (0) at ports X10:5 (STO1) and X10: 7(STO2). – Check whether the STO safety function is active.	
	“STO1 Enable OK” and “STO2 Enable OK” are **OFF**.	See LED indicators
	– Evaluate the STO checkback contact (X10:10) for category 3 according to the ***Plausibility table STO – checkback contact***.	
	– Motor coasts to stop.	
8	Deactivating the STO safety function	
	“STO1 Enable OK” and “STO2 Enable OK” are **ON**.	See LED indicators
	The drive module does not report any errors of the safety function.	CAN master, EtherCAT® master

Tab. 8: Process flow

6.8 Safety parameters - STO

The safety parameters are based on an ambient temperature of 40 °C and a mission time (MT) of 20 years.

You must not operate the drive module with the integrated STO safety function for more than 20 years. This period of 20 years begins with the date of manufacture. The mission time cannot be extended if you temporarily put the drive module out of operation.

The STO safety function is implemented with two type B channels (complex hardware) in order to achieve the hardware fault tolerance of 1.

Safety parameter	Value	Comment
Values according to EN ISO 13849-1:2015		
Category	Cat. 3	
Performance level	PL e	
PFH_D	4.29 x 10^{-8}1/h	
$MTTF_D$	>100 years	
Values according to EN 61800-5-2:2007		
Safety integrity level	SIL 3	

Tab. 9: STO safety parameters

EU-Konformitätserklärung

EC declaration of conformity

BUCHER automation

Hersteller / *manufacturer*	**Bucher Automation AG** **Thomas-Alva-Edison-Ring 10** **D-71672 Marbach am Neckar**
Geräteart / *model*	**Servoverstärker** / ***servo amplifier***
Produkt / *product*	**JM-1005-S1A0** **JM-1005-S1TDA0** **JM-1008-S1A0** **JM-1008-S1TDA0** **JM-1008-S1TLA0** **JM-1008-S1T6A0**

Das aufgeführte Produkt entspricht unter Beachtung der Informationen und Anweisungen in der zugehörigen Produktdokumentation den folgenden EG-Richtlinien und Normen.

Die Inbetriebnahme des genannten Produktes ist so lange untersagt, bis das Produkt in die Maschine eingebaut wird und den zutreffenden Richtlinien entspricht. Die Informationen und Anweisungen in der Dokumentation des gelieferten Produkts sind zusätzlich zu beachten.

The listed product complies with the following EC directives and standards, taking into account the information and instructions in the associated product documentation.

Commissioning of the listed product is prohibited until the product is installed in the machine and complies with the applicable directives. The information and instructions in the documentation of the supplied product must also be observed.

- EG-Richtlinien / *EU directives*

2014/30/EU	EMV-Richtlinie *EMC directive*
2006/42/EG	Maschinen-Richtlinie *machinery directive*
2011/65/EU	RoHS *RoHS*

- harmonisierte, internationale oder nationale Normen / *harmonized, international or national standards*

Normen der Maschinen-Richtlinie / *Standards of the machinery directive*

EN ISO 13849-1: 2015 — OJ C 173 - 13/05/2016

Sicherheit von Maschinen - Sicherheitsbezogene Teile von Steuerungen - Allgemeine Gestaltungsleitsätze;
Safety of machinery - Safety-related parts of control systems - General principles for design;

EN ISO 13849-2: 2012

Sicherheit von Maschinen - Sicherheitsbezogene Teile von Steuerungen - Validierung;
Safety of machinery - Safety-related parts of control systems - Validation;

EN 61800-5-2: 2007 — OJ C 309 - 18/12/2009

Elektrische Leistungsantriebssysteme mit einstellbarer Drehzahl - Anforderungen an die Sicherheit - Funktionale Sicherheit;
Adjustable speed electrical power drive systems - Safety requirements - Functional;

Normen der EMV-Richtlinie / *Standards of the EMC directive*

EN 61800-3: 2004 + A1: 2012 — OJ C 173 - 13/05/2016

Drehzahlveränderbare elektrische Antriebe - EMV-Anforderungen einschließlich spezieller Prüfverfahren;
Adjustable speed electrical power drive systems - EMC requirements and specific test methods;

Normen der Niederspannungsrichtlinie / *Standards of the low voltage directive*

EN 61800-5-1: 2007 + A1: 2017 — OJ L 457 - 21/12/2021

Elektrische Leistungsantriebssysteme mit einstellbarer Drehzahl - Anforderungen an die Sicherheit - Elektrische, thermische und energetische Anforderungen;
Adjustable speed electrical power drive systems - Safety requirements - Electrical, thermal and energy;

EU-Konformitätserklärung

EC declaration of conformity

BUCHER automation

Geräteart / *model*	**Servoverstärker / *servo amplifier***	
Produkt / *product*	**JM-1005-S1A0**	**JM-1005-S1TDA0**
	JM-1008-S1A0	**JM-1008-S1TDA0**
	JM-1008-S1TLA0	**JM-1008-S1T6A0**

*** Fortsetzung des Dokuments / *Continuation of the document* ***

EG-Baumusterprüfverfahren / *EC type examination*

Benannte Stelle / *Notified body:*	NSBIV AG, Zertifizierungsstelle SIBE Schweiz Brünigstrasse 18 6005 Luzern, Schweiz
Kenn-Nr. / *Identification no.:*	NB1247
Bescheinigungs-Nr. / *Certificate no.:*	1544

Die alleinige Verantwortung für die Ausstellung dieser Konformitätserklärung trägt der Hersteller.
This declaration of conformity is issued under the sole responsibility of the manufacturer.

Zur Zusammenstellung technischer Unterlagen bevollmächtigte Person
Authorised person for compiling technical files
Bucher Automation AG, Thomas-Alva-Edison-Ring 10, 71672 Marbach am Neckar

Ort / *place*:	Marbach am Neckar
Datum / *date*:	15.07.2024
Unterzeichner / *signed by*:	Christian Benz Vorstandsvorsitzender / CEO



List of figures

Fig. 1 System overview 9
Fig. 2 I/O connector X10 11
Fig. 3 Flow chart - selecting STO while the motor is revolving 14
Fig. 4 Servo amplifier operating states 17
Fig. 5 Passive safety sensors – application example 18
Fig. 6 Active safety sensors – application example 19

List of tables

Tab. 1 Acronyms 5
Tab. 2 X10 pinout 11
Tab. 3 Power supply 11
Tab. 4 Properties of the 24 V SI input 12
Tab. 5 Properties of the STO checkback contact 12
Tab. 6 Components 13
Tab. 7 Plausibility table – STO checkback contact 16
Tab. 8 Process flow 20
Tab. 9 STO safety parameters 21

Bucher Automation AG
Thomas-Alva-Edison-Ring 10
71672 Marbach/Neckar, Germany
T +49 7141 2550-0
info@bucherautomation.com

www.bucherautomation.com