

TBL Series Safety Interlock Original Instructions



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1 Overview

1.1 Introduction

The TBL series safety interlocking device is used for interlocking and guard locking, with RFID monitoring and a coded actuator. The safety locking device can be actuated horizontally within a 180° radius with infinite adjustment. When the actuator is close to the sensor, the actuator is activated by the electromagnetic field of the sensor and obtains energy. The actuator responds to the instructions and information sent by the sensor. The sensor determines and identifies the actuator identity, after received the information sent by the device. The actuator is within the detection range or not by whether the sensor received the response message of actuator correctly. The sensor is installed in a fixed position of the door frame, and the actuator is installed on a movable part such as a door. Thus, you can know the door is open or closed by test the detection results of the sensor.

The TBL series safety interlocks are suitable for the following usage scenarios:

- Removable physical protective equipment
- Safe location monitoring

This operating instruction explains the function and operation, describes the installation and precautions, provides guidelines on how to connect the product. Please read this instruction carefully and fully understand its contents before use the product.

1.2 Definition of symbols

 DANGER!	This means that failure to follow these precautions may result in personal injury or death.
 WARNING!	This means that failure to follow these precautions may result in product damage or property damage.

1.3 Precautions

 DANGER!	Please do not use in environments outside the scope specified in this instruction (temperature, humidity, shock, vibration etc.)
	Please ensure there is no one in the danger zone before use reset function to restart the device.
	Equipment designers need to pay attention to the inertia of the equipment and consider the time required to stop.
	Please make sure to cut off the power supply before carrying out electrical wiring.
	Please use cables within the length specified in this instruction. If cables beyond this specified length are used, safety functions may not normal.
 WARNING!	Please do not apply too much force to avoid damage when using the manual unlock knob.

1.4 Related standards

The TBL series safety interlock has passed the EU CE certification and meets the following standards:

ISO 13849-1 PLe

IEC 61508 SIL3

IEC 62061 SIL3

EN 60947-5-3

ISO 14119

2 Safety

2.1 Intended use

The safety interlocking device is a locking unit with a safety locking function and is suitable for the following applications:

- Temporarily preventing access to a hazardous area (protection of people)
- Monitoring of movable physical guards (protection of people)
- Locking for process protection

In conjunction with a movable physical guard and the machine controller, the safety locking device prevents the movable physical guard from being opened. The locking function remains active for as long as the hazardous machine function is performed or until the production step has finished.

The product may be used in safety functions.

The product is only suitable for use in industrial environments.

Incorrect use, improper modification of or tampering with the safety locking device will invalidate any warranty from SHENZHEN TONGCHUANG; in addition, any responsibility and liability of SHENZHEN TONGCHUANG for damage and secondary damage caused by this is excluded.

2.2 Safety assessment

Before using a device, a safety assessment in accordance with the Machinery Directive is required.

The product as an individual component fulfils the functional safety requirements in accordance with ISO 13849, IEC 61508 and IEC 62061. However, this does not guarantee the functional safety of the overall plant/machine. To achieve the relevant safety level of the overall machine's required safety functions, each safety function needs to be considered separately.

2.3 Qualification of personnel

The products may only be assembled, installed, programmed, commissioned, operated, maintained and decommissioned by persons who are competent to do so. A competent person is a qualified and knowledgeable person who, because of their training, experience and current professional activity, has the specialist knowledge required. In order to inspect, assess and handle products, devices, systems, plant and machinery, this person must be familiar with the state of the art and the applicable national, European and international laws, directives and standards.

2.4 Disposal

If there is any malfunction or damage, do not attempt to repair. The unit must be replaced before machine operation is allowed.

When decommissioning, please comply with local regulations regarding the disposal of electronic devices (e.g. Electrical and Electronic Equipment Act).

3 Product overview

3.1 Structure



3.2 Actuator

Name	Right door bending actuator	Left door bending actuator	Direct actuator	Flexible actuator
Model	TBL-K3R	TBL-K3L	TBL-K2	TBL-K1
Illustration				

 DANGER!	Replacing actuator (such as defective actuator) with unsuitable actuator in interlocking and protective locking systems may result in severe casualties. - The interlocking and protective locking systems shall be protected against inappropriate manipulation by actuators. - Place the alternative actuator (optional) in a secure location and prevent unauthorized access.
---	--

4 Model Description

4.1 Model Definition

TBL 1 - H 1 M P □ □ SE

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨

① : Product series

② : OSSD Output

1: OSSD output is linked with gate lock state;

2: OSSD output is linked with gate close state;

③ : Function

H: High function

D: Basic function

④ : Locking type

0: Power-to-Lock;

1: Power-to-release;

⑤ : Encoding type

M:Universal encoding ;

U:Unique encoding;

⑥ : Output mode

P: PNP;

N: NPN;

⑦ : Optional Auxiliary Output features: ※(Table 4 1 Optional Auxiliary Output features)

⑧ : Escape Released

None: support

E: Not support

⑨ : SE: Senor

None: Sensor + Actuator

Table 4-1 Optional Auxiliary Output features

Optional Function	High function type		Basic function type (AUX1)
	AUX1	AUX2	
0	Safety input gate close (P)	Safety input gate lockout (P)	Safety input gate close(P) (Default)
1	Safety input gate close (P)	Safety input auxiliary output (P)	Safety input gate lockout(P)
2	Safety input gate close (P)	Safety input status (P)	Safety input auxiliary output(N)
3	Safety input gate close (P)	Safety input system fault indication (P)	Safety input status(P)
4	Safety input gate close (N)	Cascade in put gate lockout (N)	Non-safety input gate approach(P)
5	Safety input gate close (N)	Safety input auxiliary output (N)	Non-safety input gate lockout(P)
6	Safety input gate close (N)	Safety input status (N)	Non-safety input auxiliary output(N)
7	Safety input gate close (N)	Safety input system fault indication (N)	Safety input system fault indication(P)
8	Non-safety input gate approach (P)	Non-safety input gate lockout (P)	Non-safety input system fault indication(P)
9	Non-safety input gate approach (P)	Non-safety input auxiliary output (P)	Safety input gate close(N)
A	Non-safety input gate approach (P)	Non-safety input system fault indication (P)	Safety input gate lockout(N)
B	Non-safety input gate approach (N)	Non-safety input gate lockout (N)	Safety input auxiliary output(P)
C	Non-safety input gate approach (N)	Non-safety input auxiliary output (N)	Safety input status(N)
D	Non-safety input gate approach (N)	Non-safety input system fault indication (N)	Non-safety input gate approach(N)
E			Non-safety input gate lockout(N)
F			Non-safety input auxiliary output(P)
G			Safety input system fault indication(N)
H			Non-safety input system fault indication(N)

4.2 TBL1 Safety Interlock selection guide

Function	Coding	Locking type	OSSD Output	Model Type	Remarks
High function	Universal	Power-to-Lock	PNP	TBL1-H0MP*	*: Representative Optional Auxiliary Output features; Refer Table 4-1 Optional Auxiliary Output features.
			NPN	TBL1-H0MN*	
		Power-to-Release	PNP	TBL1-H1MP*	
			NPN	TBL1-H1MN*	
	Unique	Power-to-Lock	PNP	TBL1-H0UP*	
			NPN	TBL1-H0UN*	
		Power-to-Release	PNP	TBL1-H1UP*	
			NPN	TBL1-H1UN*	
Basic function	Universal	Power-to-Lock	PNP	TBL1-D0MP*	
			NPN	TBL1-D0MN*	
		Power-to-Release	PNP	TBL1-D1MP*	
			NPN	TBL1-D1MN*	
	Unique	Power-to-Lock	PNP	TBL1-D0UP*	
			NPN	TBL1-D0UN*	
		Power-to-Release	PNP	TBL1-D1UP*	
			NPN	TBL1-D1UN*	
High function	Universal	Power-to-Lock	PNP	TBL2-H0MP*	*: Representative Optional Auxiliary Output features; Refer Table 4-1 Optional Auxiliary Output features.
			NPN	TBL2-H0MN*	
		Power-to-Release	PNP	TBL2-H1MP*	
			NPN	TBL2-H1MN*	
	Unique	Power-to-Lock	PNP	TBL2-H0UP*	
			NPN	TBL2-H0UN*	
		Power-to-Release	PNP	TBL2-H1UP*	
			NPN	TBL2-H1UN*	
Basic function	Universal	Power-to-Lock	PNP	TBL2-D0MP*	
			NPN	TBL2-D0MN*	
		Power-to-Release	PNP	TBL2-D1MP*	
			NPN	TBL2-D1MN*	
	Unique	Power-to-Lock	PNP	TBL2-D0UP*	
			NPN	TBL2-D0UN*	
		Power-to-Release	PNP	TBL2-D1UP*	
			NPN	TBL2-D1UN*	

5 Product parameters

Safety Level	
Standard	ISO 13849-1 IEC 61508 IEC 62061 EN 60947-5-1 EN 60947-5-3 ISO 14119
Safety level	Refer 5.1
Certification	CE CQC
Electrical parameters	
Power supply	24V DC±15% (SELV)
Current consumption (no-load)	100mA
OSSD Output current	Max. 250mA
OSSD Output on-voltage drop	< 2.5V (Max. load)
Lock / Unlock Operating frequency	≤ 1HZ
Response time	100ms
Risk time	100ms
Protection Class	III
Contamination level	3
Category of use	DC-13/DC-12
Rated insulation voltage Ui	32V
Rated impulse withstand voltage U _{imp}	800V
Technical parameters	
Locking force Fzh	2000N
Actuating force	20N
Enclosure rating	IP65
Operating temperature	-20°C ~ +55°C
Storage temperature	-20°C ~ +70°C
Relative humidity	5% ~ 95%
Impact resistance	30g/11ms
Vibration resistance	10 ~ 55Hz, 1mm
Materials	Thermoplastic / stainless steel
Range of altitude	0~2000m

5.1 Safety characteristic data

Operating mode	ISO 13849-1			IEC 61508; IEC62061	
	PL	Category	MTTFd [year]	SIL	PFHd [1/h]
Safety interlock	PL e	4	73	SIL3	2.73E-09
Safety interlock with lock monitor	PL e	4	55	SIL3	8.05E-09
2 channels guard locking	PL e	4	54	SIL3	8.05E-09
1 lock input channel guarding locking	PL d	2	54	SIL2	8.17E-09

5.1.1 Cat 4, PLe, SIL3

HFT	1
Architecture	1oo2
Device Type	Type B
Operation Mode	High Demand Mode
MRT&MTTR [hour]	8
λ_{DD} [FIT]	2111.48
λ_{DU} [FIT]	21.33
λ_s [FIT]	582.22
DC	99.00%
T_M [year]	20

5.1.2 Cat 2, PLd, SIL2

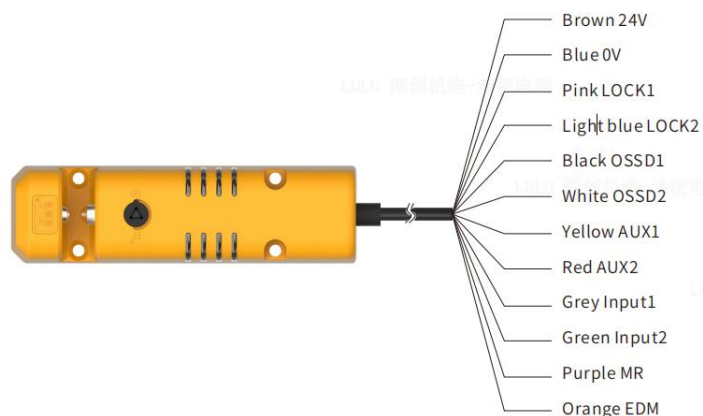
HFT	Input: HFT = 0
	Logic and output: HFT =1
Architecture	Input: 1oo1
	Logic and output: 1oo2
Device Type	Type B
Operation Mode	High Demand Mode
MRT&MTTR [hour]	8
λ_{DD} [FIT]	2079.90
λ_{DU} [FIT]	21.01
λ_s [FIT]	570.72
DC	99.00%
T_M [year]	20

6 Interface signal definition

6.1 Cables color and function

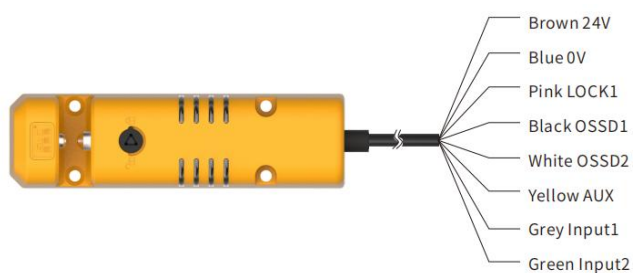
 WARNING!	The color marking for the connection lead only applies for the cable that SHENZHEN TONGCHUANG supplies as an accessory
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6.1.1 High function type



NO.	Signal definition	Colour	Instructions
1	24V	Brown	Power supply +
2	0V	Blue	Power supply -
3	LOCK1	Pink	Lock/unlock 1
4	LOCK2	Light blue	Lock/unlock 2
5	OSSD1	Black	Safety output 1
6	OSSD2	White	Safety output 2
7	AUX1	Yellow	Auxiliary output 1
8	AUX2	Red	Auxiliary output 2
9	Input1	Grey	Safety input 1
10	Input2	Green	Safety input 2
11	MR	Purple	Reset input
12	EDM	Orange	EDM monitor input

6.1.2 Basic functional type

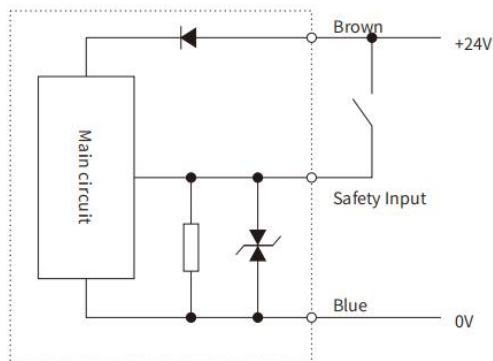


NO.	Signal definition	Colour	Instructions
1	24V	Brown	Power supply +
2	0V	Blue	Power supply -
3	LOCK1	Pink	Lock/unlock 1
4	OSSD1	Black	Safety output 1
5	OSSD2	White	Safety output 2
6	AUX	Yellow	Auxiliary output
7	Input1	Grey	Safety input 1
8	Input2	Green	Safety input 2

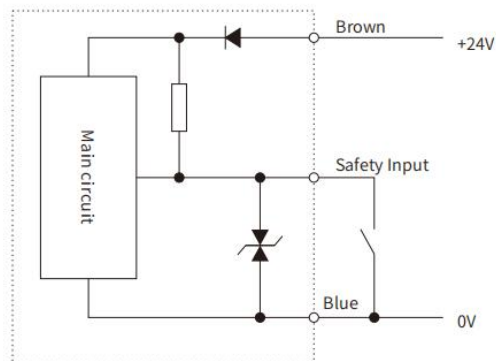
6.2 Input and output circuit diagram

6.2.1 Safety Input Circuit

Safety Input Circuit (PNP type)

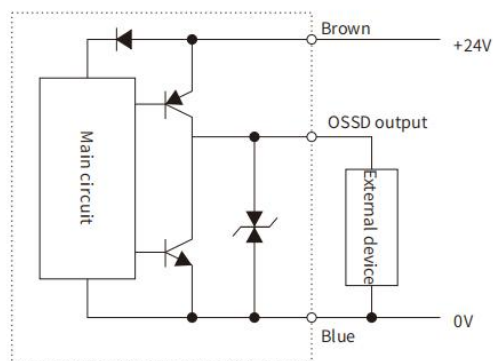


Safety Input Circuit (NPN type)

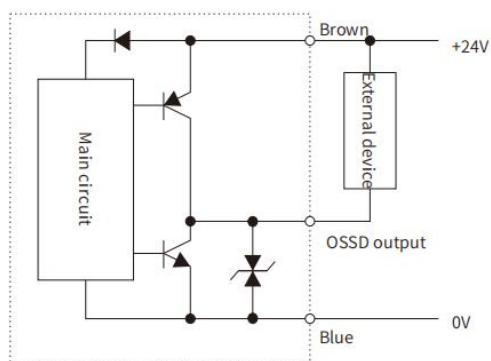


6.2.2 OSSD Output Circuit

OSSD Output Circuit (PNP type)

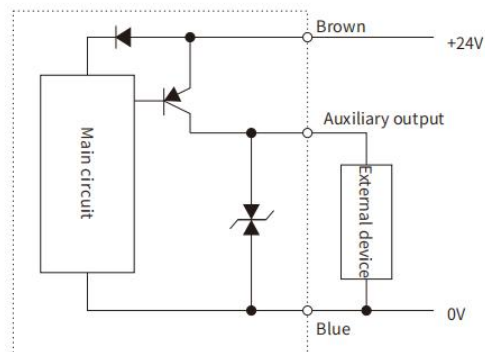


OSSD Output Circuit (NPN type)

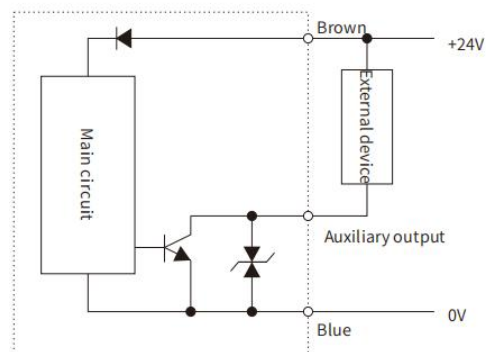


6.2.3 AUX output circuit

AUX output circuit diagram (PNP type)



AUX output circuit diagram (NPN type)

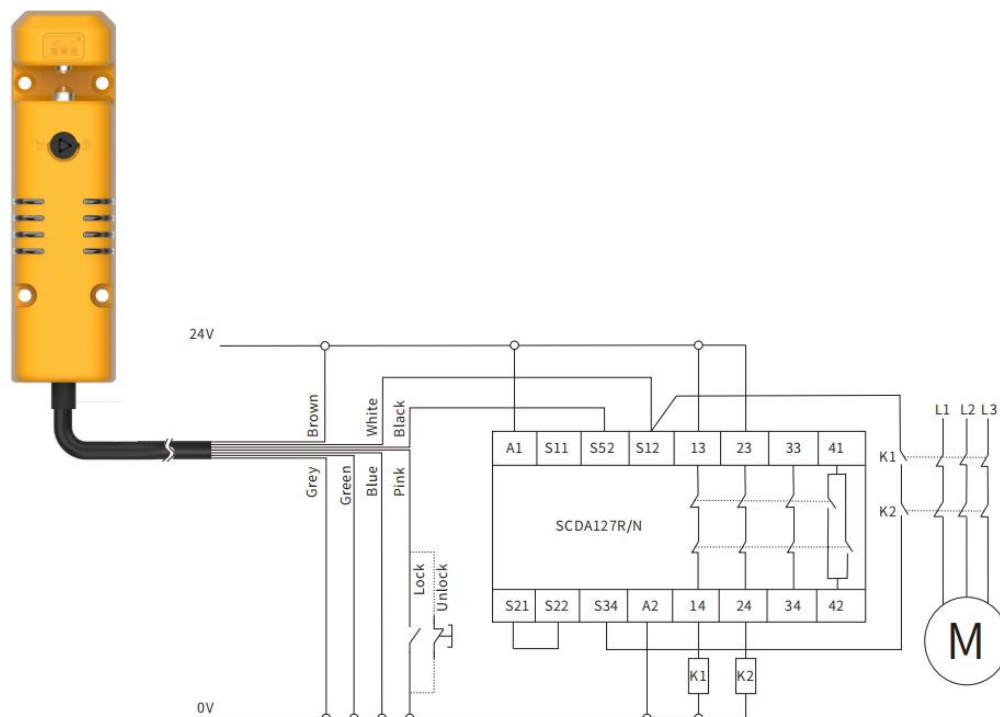


6.3 Wiring diagrams for typical applications

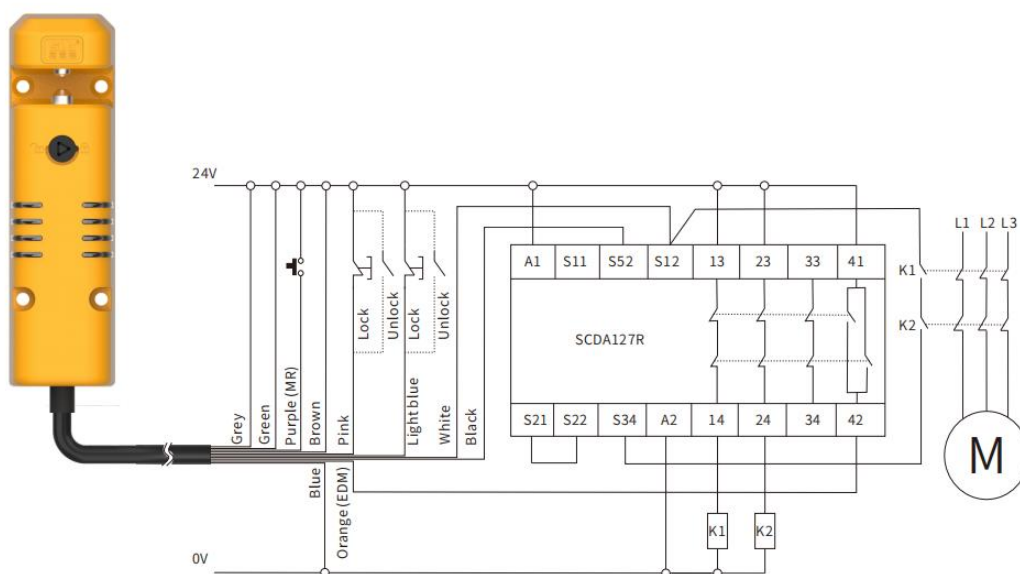
6.3.1 Single connection for safety interlock application

6.3.1.1 Power-on lock type application

Basic functional power-on release NPN security interlock and SCDA127R/N application wiring diagram



High functional power-on lock PNP safety interlock manual reset and EDM monitoring functions (configured via the upper computer) with SCDA127R application wiring diagram



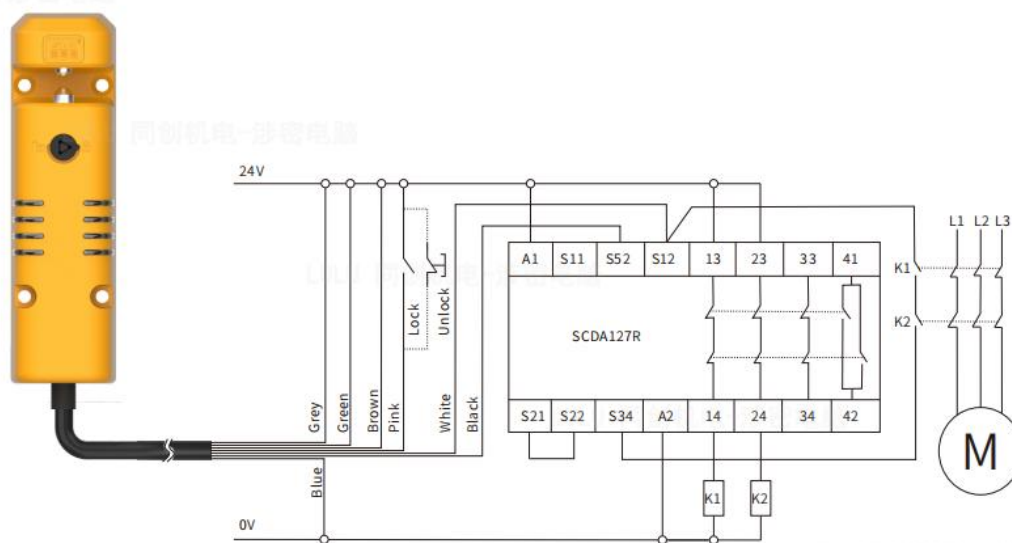


WARNING!

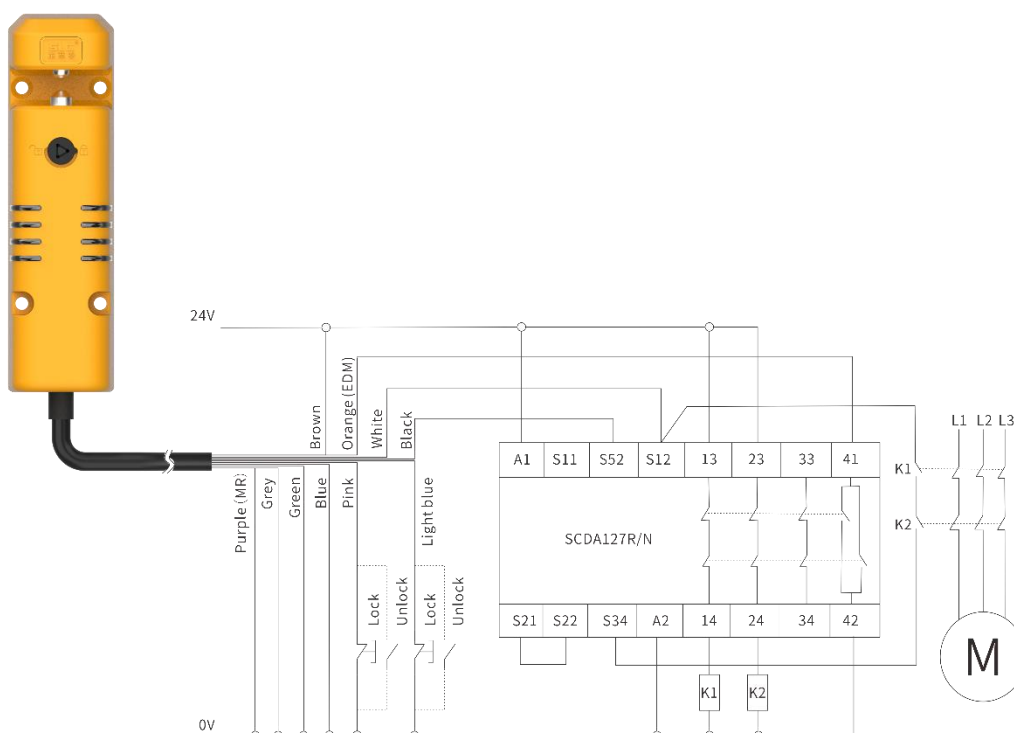
Only use safety relays with a 24 VDC supply voltage. Safety relays with a wide-range power supply or in AC device versions have internal potential isolation and are not suitable as evaluation devices.

6.3.1.2 Power-on release type application

Basic functional power-on release PNP safety interlock and SCDA127R application wiring diagram

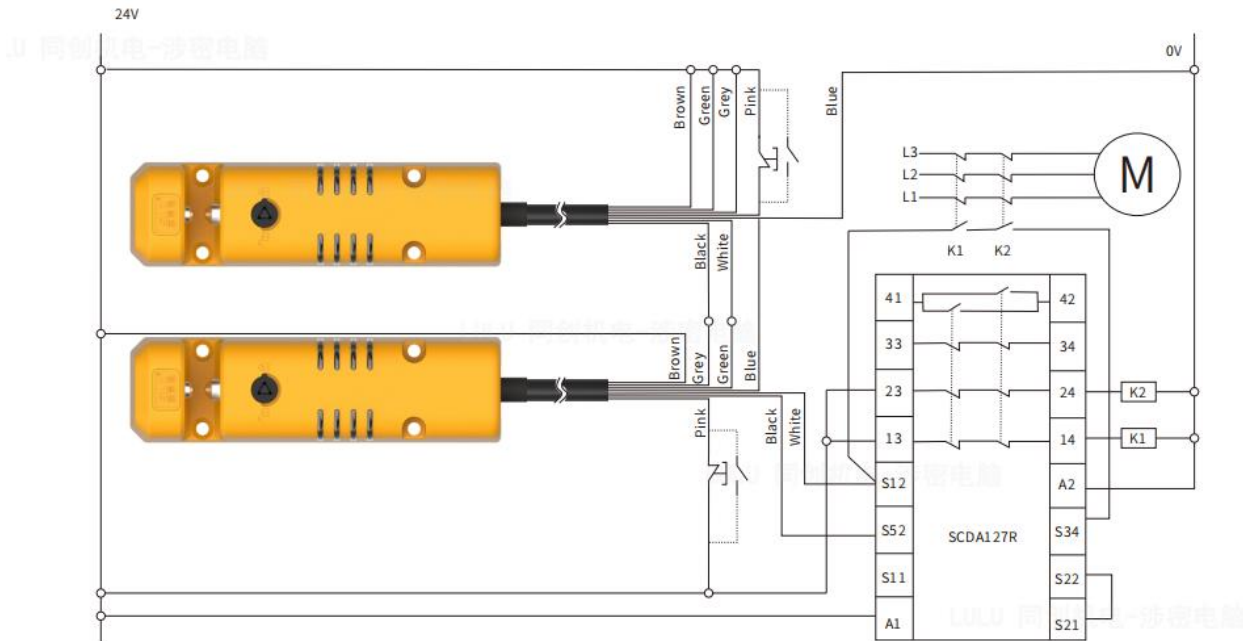


High function power-on release NPN safety interlock safety interlock automatic reset and EDM monitoring functions (configured via the upper computer) with SCDA127R/N application wiring diagram



6.3.2 Series connection for safety interlock applications

Basic functional power-on lock PNP safety interlock multi-lock cascade and SCDA127R application wiring diagram



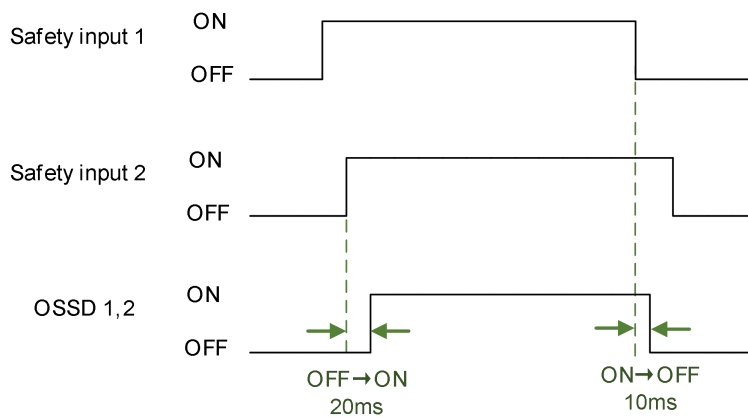
7 Function description

7.1 Cascade function

Safety input is one of the conditions for controlling the ON output of OSSD, and it is also the input signal for series connection application. Safety input 1 and safety input 2 are a pair of safety inputs. If safety input 1 or safety input 2 turns OFF state, OSSD turns OFF.

Connecting OSSD with other safety interlocks on the safety input can cascade multiple sets of safety interlocks.

Timing diagram:



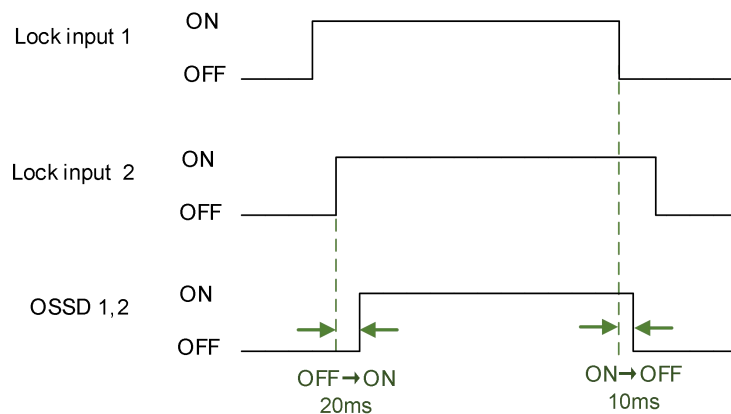
Note: OSSD turns ON only when all conditions except for safety input are met.

7.2 Lock function

7.2.1 Lock input for high function model

The high function model has 2 lock control inputs. The Lock input is considered valid only when both input signals are active simultaneously.

Sequence Diagram:

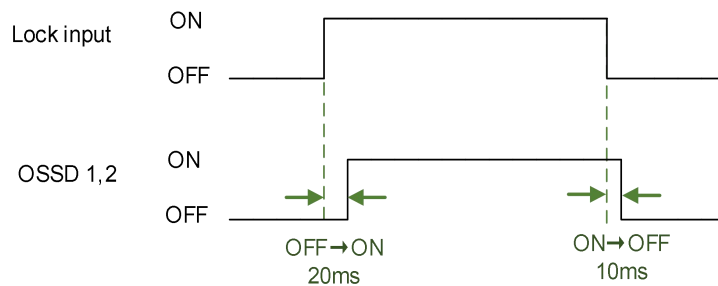


Note: OSSD turns ON only when all conditions except for lock input are met.

7.2.2 Lock input for basic function model

The basic functional Lock input has only one input signal.

Sequence Diagram:



Note: OSSD turns ON only when all conditions except for lock input are met.

7.2.3 Lock states

After power on, during normal operation, locking can only be performed when the key sensing is valid. Logic relationship table:

P/N type	Lock control input	Power ON lock	Power ON release
PNP	24V	Lock	Lock release
	0V	Lock release	Lock
NPN	24V	Lock release	Lock
	0V	Lock	Lock release

 DANGER!	Power ON lock type: Lock will release when product is power OFF, which may cause harm to people depending on device's operating conditions. Power ON release type: NPN type may lock release when product is power OFF, which may cause harm to people depending on device's operating conditions.
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7.3 Reset function

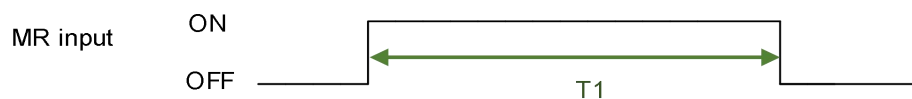
The reset function is used to start/restart the safety output. When all other conditions are met, a valid reset signal can be input to enable the safety output. This feature can prevent the device from accidentally starting or restarting.

Reset signal is a single channel input signal with two reset modes: automatic reset and manual reset.

Automatic reset mode: without reset signal input detection, so the reset result is valid in any state of reset signal.

Manual reset mode: detect the positive pulse of the reset signal input as OFF->ON->OFF, and it is effective when the pulse width is within the range of 50~3000ms.

The reset timing of manual reset mode is shown in the following figure:



Note: $T1 = 50 \sim 3000\text{ms}$

7.4 EDM function

EDM is used to monitor the function of external devices whether work properly, and to determine based on the logical relationship between OSSD output states and EDM input signals.

7.5 Safety output

OSSD1 and OSSD2 are a pair of safe outputs that output the same state, and OSSD1 and OSSD2 are always turned on/off at the same time.

When there is a fault, the OSSD output will immediately shut down.

7.5.1 Open-close linkage mode:

Automatic reset: During normal operation, OSSD will only ON when the key sensing and safety input are valid; Otherwise, OSSD will turn OFF.

Manual reset: During normal operation, OSSD will only open when a valid reset pulse is inputted under the conditions of effective key sensing and safety input; Otherwise, OSSD will turn OFF.

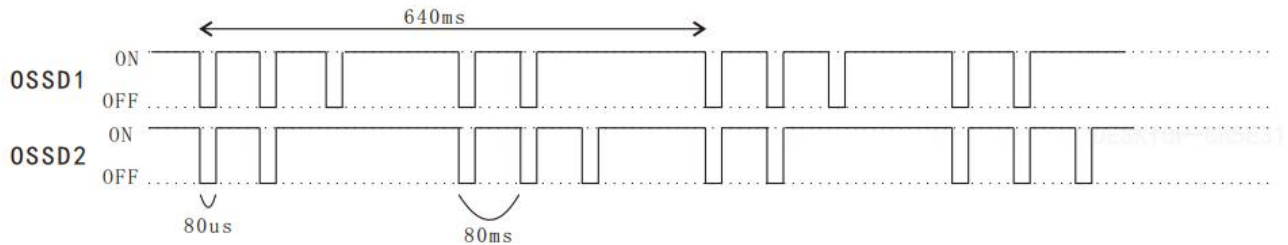
7.5.2 Lock linkage mode:

Automatic reset: During normal operation, OSSD will only ON when the key sensing, safety input, and Lock input are valid; Otherwise, OSSD will turn OFF.

Manual reset: During normal operation, the OSSD will only ON when a valid reset pulse is input, provided that the key sensing is effective, the safety input is effective, and the Lock input is effective; Otherwise, OSSD will turn OFF.

7.5.3 OSSD Self-diagnostic

Self-diagnostic timing diagram when the OSSD output is ON:



The OSSD will turn OFF state immediately when the OSSD output detects a fault.

7.6 AUX output

AUX1 and AUX2 are respectively auxiliary outputs indicating different working states.

The indication states of AUX output are as follows:

- Door approaching (positive): when Door is closed (RFID is valid), AUX output ON, otherwise output OFF;
- Door approaching (negative): when Door is closed (RFID is valid), AUX output OFF, otherwise output ON;
- Door approaching (positive): when Door is closed and locked (RFID is valid), AUX output ON, otherwise output OFF;
- Door approaching (negative): when Door is closed and locked (RFID is valid), AUX output OFF, otherwise output ON;
- Door locking (positive): when Door is closed and locked (RFID is valid), AUX output ON, otherwise output OFF;
- Door locking (negative): when Door is closed and locked (RFID is valid), AUX output OFF, otherwise output ON;
- Safety input state (positive): when safety input is valid, AUX output ON, otherwise output OFF;
- Safety input state (negative): when safety input is valid, AUX output OFF, otherwise output ON;
- Auxiliary output (positive): when OSSD state is ON, AUX output ON, otherwise output OFF;
- Auxiliary output (negative): when OSSD state is ON, AUX output OFF, otherwise output ON;
- System fault indicator (positive): when system is in fault state, AUX output ON, otherwise output OFF;

- System fault indicator (negative): when system is in fault state, AUX output OFF, otherwise output ON;

 DANGER!	AUX output cannot be use as safety input for safety-related control system.
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7.7 Actuator code

The actuators are divided into universal code types and unique code types.

Universal code: the actuator can be matched with any safety interlock;

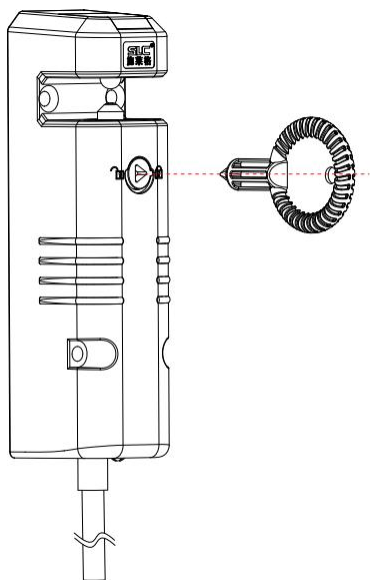
Unique code: The actuator can only match one safety interlock and does not allow the actuator to simultaneously match multiple safety interlocks. Once an actuator is successfully matched, the actuator will have no response to safety interlocks other than the one that has been matched.

In the unique code mode, the match process of the actuator is:

1. Ensure that the output is in safe state;
2. After the safety interlock is activated, it enters the waiting state for unique code match, indicting: red, green light 4Hz flashing alternatively;
3. Insert the to be matched actuator into safety interlock and waiting for it to complete match;
4. The safety interlock will enter normal operate sate after successfully matching.

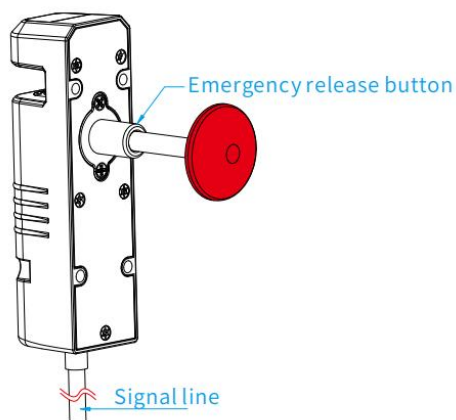
7.8 Escape release

7.8.1 Manual release



1. in order to prevent the manual release key damage, when the rotation torque is too large, the manual release knob will slide out of the triangular groove of the auxiliary unlock knob
2. When the manual release knob is rotated to UNLOCK position, the actuator will not be locked and can be pulled out directly;
3. When the manual release knob is rotated to the LOCK position, the actuator will be locked and cannot be pulled out directly.

7.8.1 Emergency release on the backside



1. Manual press the red emergency release button.
2. Note that the pressed stroke must meet the requirements in order to unlock successfully (refer to "emergency release button size" for specific stroke parameters)

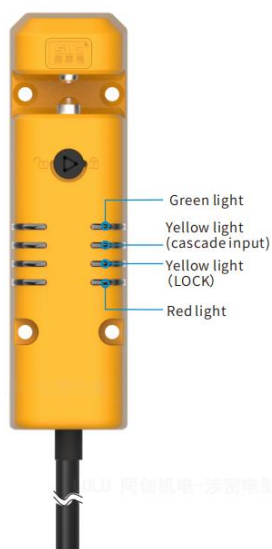
8 Status indication and troubleshooting



DANGER!

- Immediately shut the machine down if the behavior of the machine cannot be clearly identified.
- Immediately put the machine out of operation if you cannot clearly identify or allocate the error and if you cannot safely remedy the error.
- Secure the machine so that it cannot switch on unintentionally.

8.1 Indicator light description



8.2 TBL1 mode status indication

Operation state		Red light	Green light	Yellow light 1-Input	Yellow light 2-Lock
Power ON initialization	EEPROM data error	OFF	1Hz flash	OFF	OFF
	EEPROM roof error	1Hz flash	OFF	OFF	OFF
	Initialization completed	OFF	Rapidly flash 3-time	OFF	OFF

Operation state		Red light	Green light	Yellow light 1-Input	Yellow light 2-Lock
Normal operation	No RFID tag (universal code)	ON	OFF	OFF	OFF
	No RFID tag (unique code)	Double-flash	OFF	OFF	OFF
	Detected unmatched RFID tag (unique code)	Simultaneously Double-flash		OFF	OFF
	With RFID tag, no LOCK signal	ON	OFF	OFF	1Hz flash
	With RFID tag, locked, no input	OFF	1Hz flash	1Hz flash	ON
	With RFID tag, locked, input signal	OFF	ON	ON	ON
	Waiting for reset	OFF	1Hz flash	ON	ON
	Power supply data writing correctly	OFF	4Hz flash	OFF	OFF
Fault status	Input or lock signal self-diagnostic fault	4Hz flash	OFF	4Hz flash	OFF
	OSSD self-diagnostic/ voltage fault	1Hz flash	OFF	OFF	OFF
	Power-off recovery (power-ON lock type)	Simultaneously 4Hz flash		OFF	OFF
	Power supply exceeds the range	1Hz flash	OFF	1Hz flash	OFF
	Optocoupler self- diagnostic fault	4Hz flash	OFF	OFF	OFF
	Communication error between primary and sub MCU	Alternately 1Hz flash		OFF	OFF
	Unique encode not matching	Alternately 4Hz flash		OFF	OFF
	Open door timeout (attempting to unlock)	3-time red and 1-time green cyclically flash		OFF	1Hz flash
	Lock door timeout (attempting to lock)	OFF	OFF	OFF	4Hz flash
	EDM malfunction	Simultaneously 1Hz flash		OFF	OFF
	Power supply data writing error	ON	4Hz flash	OFF	OFF

8.3 BL1 mode Troubleshooting

Operation state	Indicator light state	Reason	Method
OSSD cannot ON (Unexpected OFF)	RED - ON / Double-flashing GREEN - OFF YELLOW (Input) - OFF YELLOW (Lock) - OFF	No key was detected	Check the installation status of the key
	RED - ON GREEN - OFF YELLOW (Input) - OFF YELLOW (Lock) - 1HZ flashing	Invalid Lock input	Check the Lock input wiring
	RED - OFF GREEN - 1HZ flashing YELLOW (Input) - 1HZ flashing YELLOW (Lock) - ON	Invalid Safety input	Check the safety input wiring
	RED - OFF GREEN - 1HZ flashing	Invalid Reset input	Check the reset input wiring

Operation state	Indicator light state	Reason	Method
	YELLOW (Input) - ON YELLOW (Lock) - ON		
	RED - 1HZ flashing GREEN - OFF YELLOW (Input) - OFF YELLOW (Lock) - OFF	OSSD output shout circuit, OSSD hardware failure	Check OSSD output wiring, Return for repair
	RED&GREEN - simultaneously 1HZ flashing YELLOW (Input) - OFF YELLOW (Lock) - OFF	EDM fault	Check the EDM input wiring
	RED&GREEN - Alternately 1HZ flashing YELLOW (Input) - OFF YELLOW (Lock) - OFF	MCU communication fault	Return for repair
	Automatically enter unlock state RED&GREEN - simultaneously 4HZ flashing YELLOW (Input) - OFF YELLOW (Lock) - OFF	Power jitter (Power on lock type)	Check the power supply voltage
	RED - 1HZ -flashing GREEN - OFF YELLOW (Input) - 1HZ flashing YELLOW (Lock) - OFF	Power supply fault	Check the power supply voltage
OSSD output is by turns on and by turns off	OSSD the output is turned off, the key is invalid	Key sensing is in a critical state	Check the installation status of the key
Fail to Lock	RED - ON / Double-flashing GREEN - OFF YELLOW (Input) - OFF YELLOW (Lock) - OFF	Invalid key	Check the installation status of the key
	RED - OFF GREEN - OFF YELLOW (Input) - OFF YELLOW (Lock) - 4HZ flashing	Key does not match sensor, forced unlock button triggered	Check the installation status of the key; Check the forced unlock button
	\	Hardware fault	Return for repair
Fail to release	3-time red and 1-time green cyclically flashing YELLOW (Input) - OFF YELLOW (Lock) - 1HZ flashing	Abnormal locking action	Check the position of the lock and key
	\	Hardware fault	Return for repair
All lights are OFF	The power supply is undervoltage or turned OFF	Power supply fault	Check the power wiring and voltage
	Can control locking/unlocking	LED fault	Return for repair

8.4 TBL2 mode status indication

Operation state		Red light	Green light	Yellow light 1-Input	Yellow light 2-Lock
Power ON initialization	EEPROM data error	OFF	1Hz flash	OFF	\
	EEPROM roof error	1Hz flash	OFF	OFF	\
	Initialization completed	OFF	Rapidly flash 3-time	OFF	\
Normal operation	No RFID tag (universal code)	ON	OFF	OFF	\
	No RFID tag (unique code)	Double-flash	OFF	OFF	\
	Detected unmatched RFID tag (unique code)	Simultaneously Double-flash		OFF	\
	With RFID tag, no input	OFF	1Hz flash	1Hz flash	\
	With RFID tag, input	OFF	ON	ON	\
	Waiting for reset	OFF	1Hz flash	ON	\
	Power supply data writing correctly	OFF	4Hz flash	OFF	\
Fault status	Input or lock signal self-diagnostic fault	4Hz flash	OFF	4Hz flash	\
	OSSD self-diagnostic/ voltage fault	1Hz flash	OFF	OFF	\
	Power-off recovery (power-ON lock type)	Simultaneously 4Hz flash		OFF	\
	Power supply exceeds the range	1Hz flash	OFF	1Hz flash	\
	Optocoupler self- diagnostic fault	4Hz flash	OFF	OFF	\
	Communication error between primary and sub MCU	Alternately 1Hz flash		OFF	\
	Unique encode not matching	Alternately 4Hz flash		OFF	\
	EDM malfunction	Simultaneously 1Hz flash		OFF	\
	Power supply data writing error	ON	4Hz flash	OFF	\
Lock status	No LOCK signal, unlocked	\	\	\	OFF
	With LOCK signal, locked	\	\	\	ON
	No LOCK signal, unlocked fault	\	\	\	1Hz flash
	With LOCK signal, locked fault	\	\	\	4Hz flash

8.1 BL2 mode Troubleshooting

Operation state	Indicator light state	Reason	Method
OSSD cannot ON (Unexpected OFF)	RED - ON / Double- Flashing GREEN - OFF YELLOW (Input) - OFF YELLOW (Lock) - \	No key was detected	Check the installation status of the key
	RED - \ GREEN - \ YELLOW (Input) - \ YELLOW (Lock) - OFF	Invalid Lock input	Check the Lock input wiring
	RED - OFF GREEN - 1HZ Flashing	Invalid Safety input	Check the safety input wiring

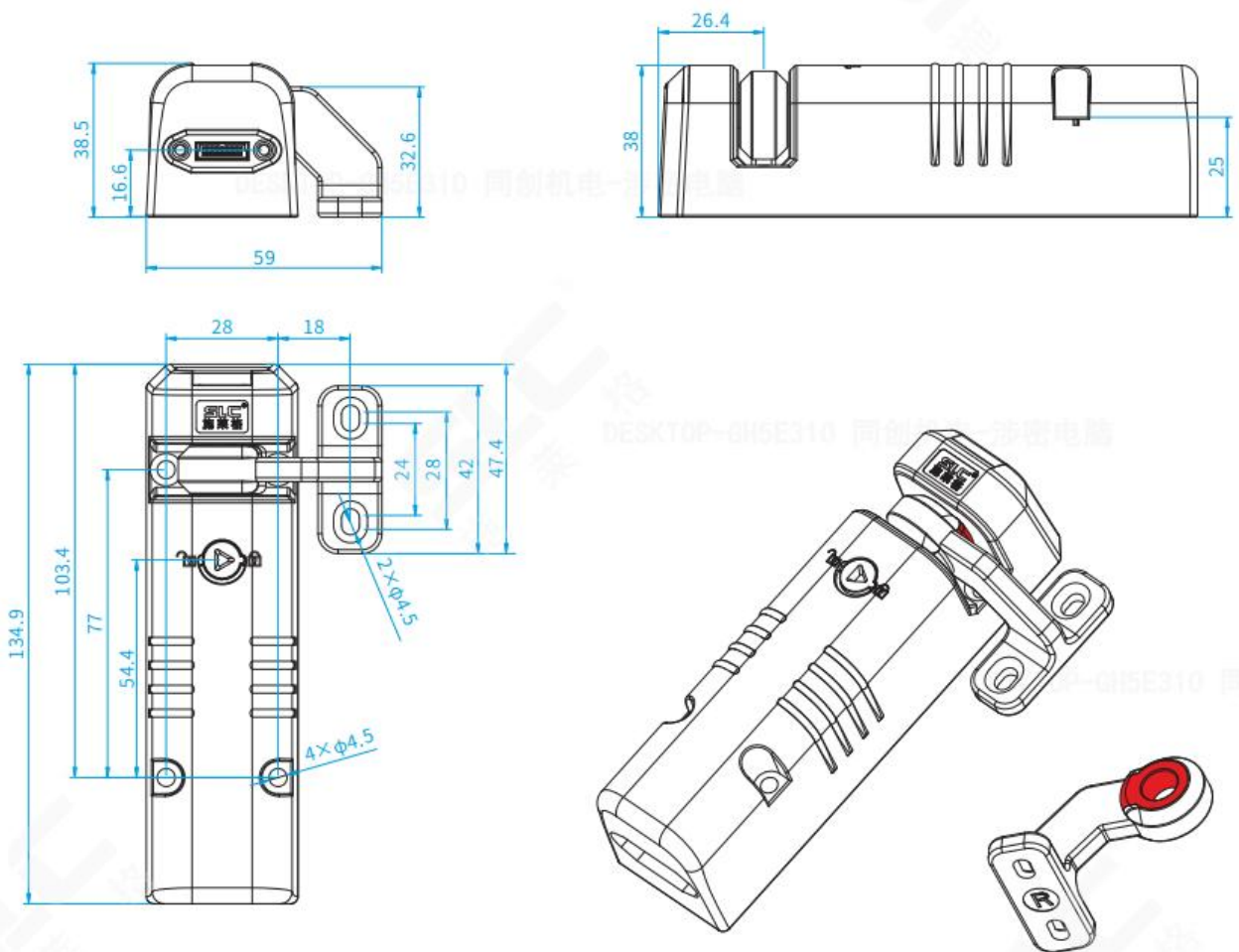
Operation state	Indicator light state	Reason	Method
	YELLOW (Input) - 1HZ Flashing YELLOW (Lock) - \		
	RED - OFF GREEN - 1HZ Flashing YELLOW (Input) - ON YELLOW (Lock) - ON	Invalid Reset input	Check the reset input wiring
	RED - 1HZ Flashing GREEN - OFF YELLOW (Input) - OFF YELLOW (Lock) - \	OSSD output short circuit, OSSD hardware failure	Check OSSD output wiring, Return for repair
	RED&GREEN – Simultaneously 1HZ Flashing YELLOW (Input) - OFF YELLOW (Lock) - \	EDM fault	Check the EDM input wiring
	RED和GREEN – Alternately 1HZ Flashing YELLOW (Input) - OFF YELLOW (Lock) - \	MCU communication fault	Return for repair
	Automatically enter unlock state RED&GREEN - Simultaneously 4HZ Flashing YELLOW (Input) - OFF YELLOW (Lock) - \	Power jitter (Power on lock type)	Check the power supply voltage
	RED - 1HZ Flashing GREEN - OFF YELLOW (Input) - 1HZ Flashing YELLOW (Lock) - \	Power supply fault	Check the power supply voltage
OSSD output is by turns on and by turns off	OSSD the output is turned off, the key is invalid	Key sensing is in a critical state	Check the installation status of the key
Fail to Lock	RED - ON / Double Flashing GREEN - OFF YELLOW (Input) - OFF YELLOW (Lock) - \	Invalid key	Check the installation status of the key
	RED - OFF GREEN - OFF YELLOW (Input) - OFF YELLOW (Lock) - 4HZ Flashing	Key does not match sensor, forced unlock button triggered	Check the installation status of the key; Check the forced unlock button
	\	Hardware fault	Return for repair
Fail to release	3-time red and 1-time green cyclically flashing YELLOW (Input) - OFF YELLOW (Lock) - 1HZ Flashing	Abnormal locking action	Check the position of the lock and key
	\	Hardware fault	Return for repair
All lights are OFF	The power supply is undervoltage or turned OFF	Power supply fault	Check the power wiring and voltage
	Can control locking/unlocking	LED fault	Return for repair

9 Installation

9.1 Installation dimensions for safety interlock with actuator

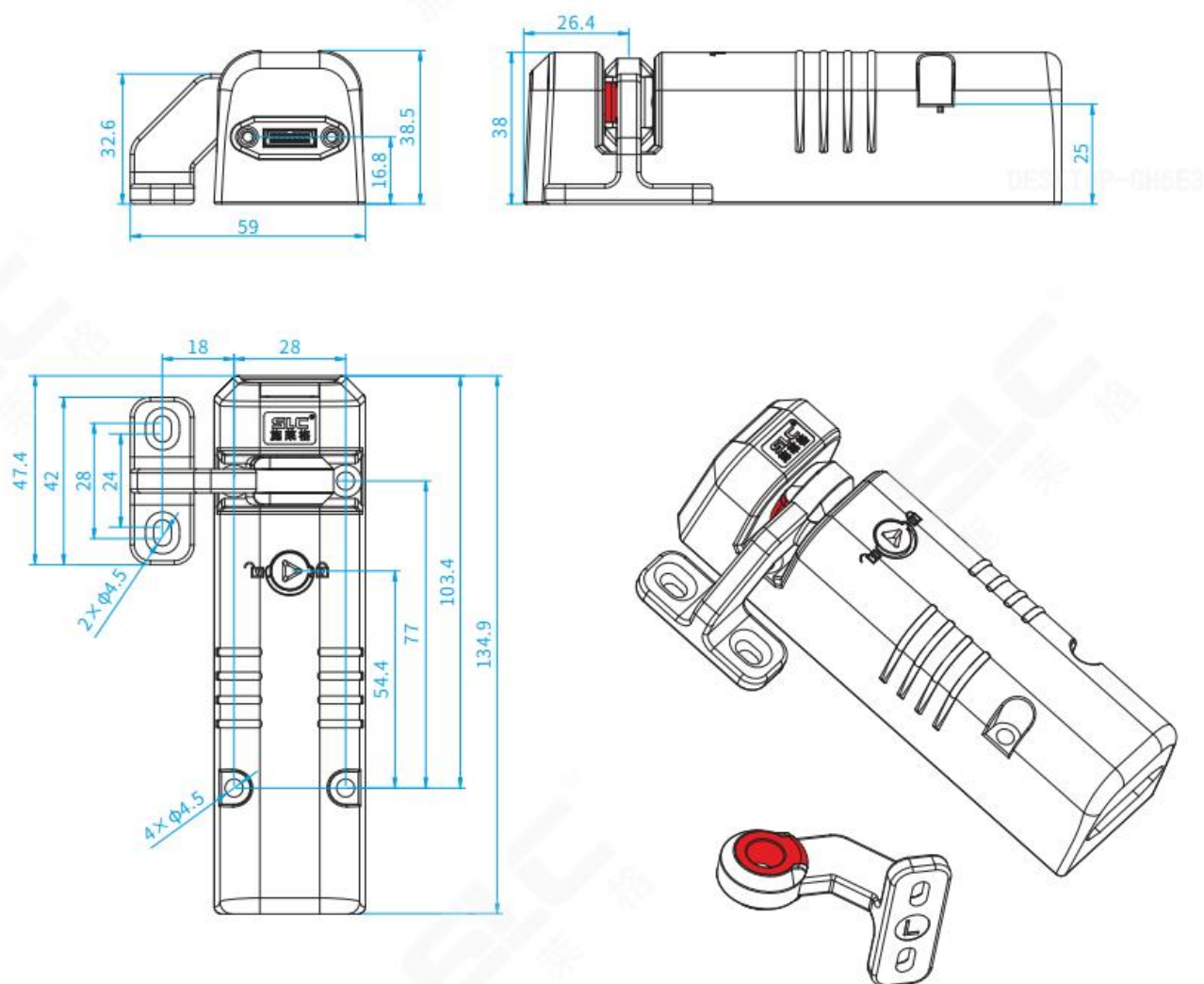
 WARNING!	• Install the safety switch and actuator so that the possibilities of defeat are reduced to a minimum (see guidelines for reducing the possibilities for defeating interlocking devices in ISO 14119). • Install safety switch and actuator so that it is not possible to reach through with hand or finger.
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9.1.1 TBL standard TBL-K3R curvy actuator

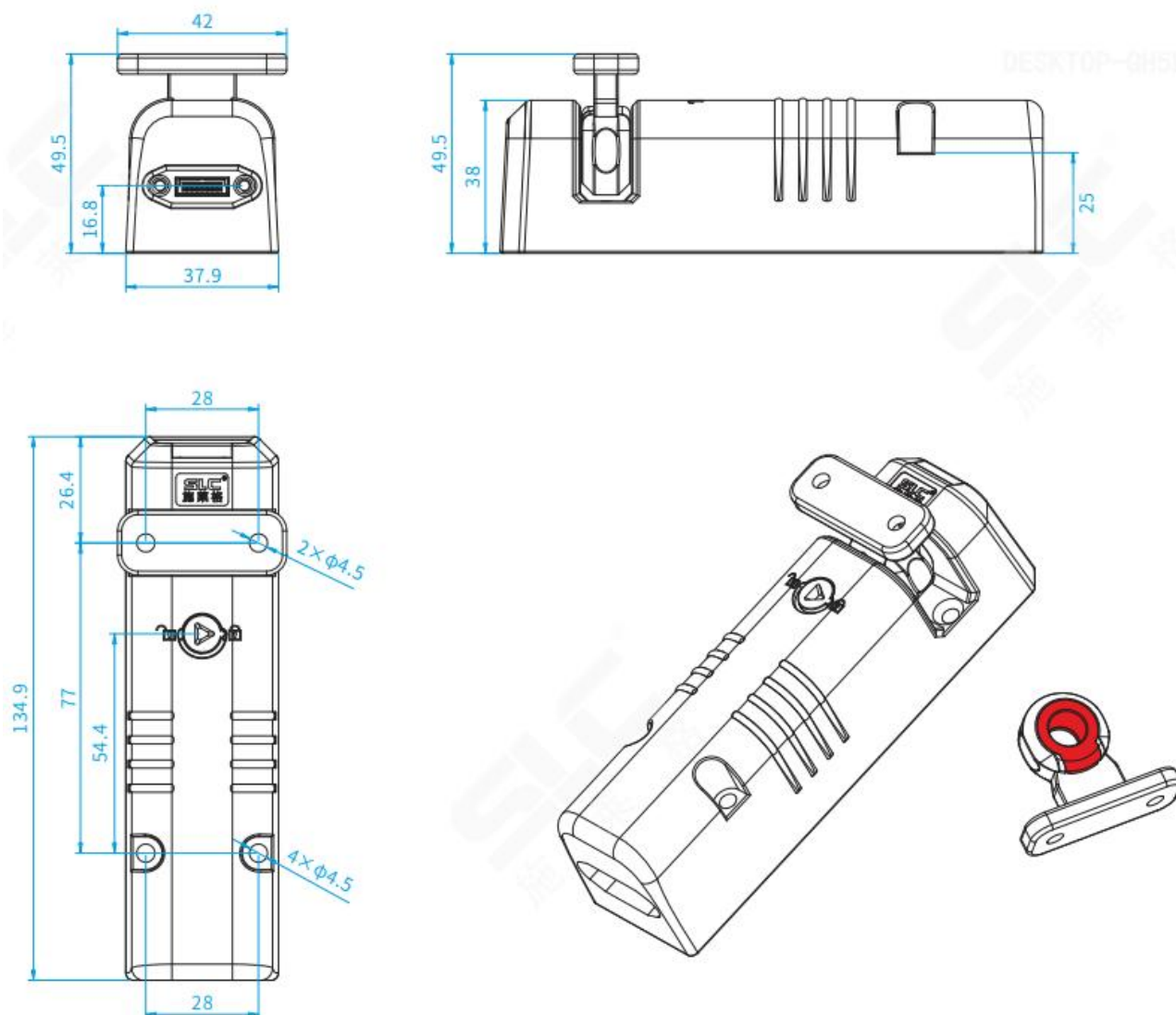


 WARNING!	• Arrange the safety interlock and actuator so that damage due to unintentional outside influences is prevented. • Protect the switch head against damage and ingress of foreign bodies, e.g., chips, sand, abrasives, etc. • Check for environmental influences before using the safety locking device, e.g., UV radiation or corrosion. Mount with protection if necessary.
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9.1.2 TBL optional TBL-K3L curvy actuator

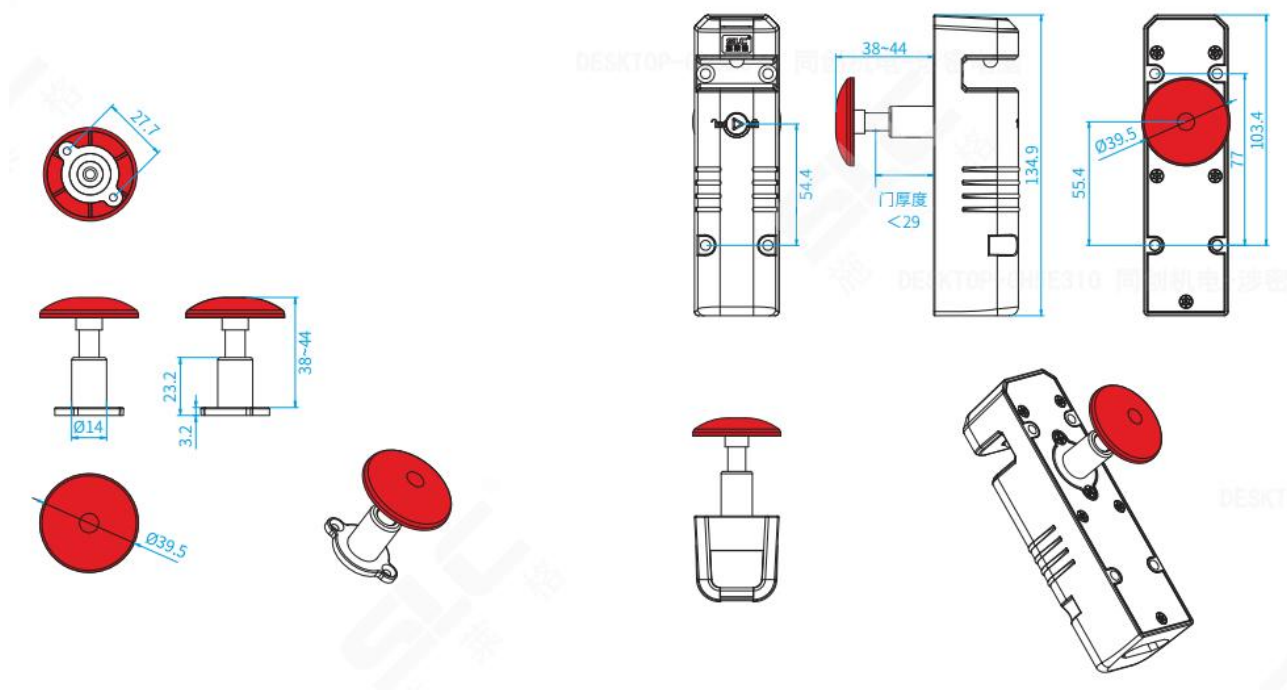


9.1.3 TBL optional TBL-K2 straight actuator

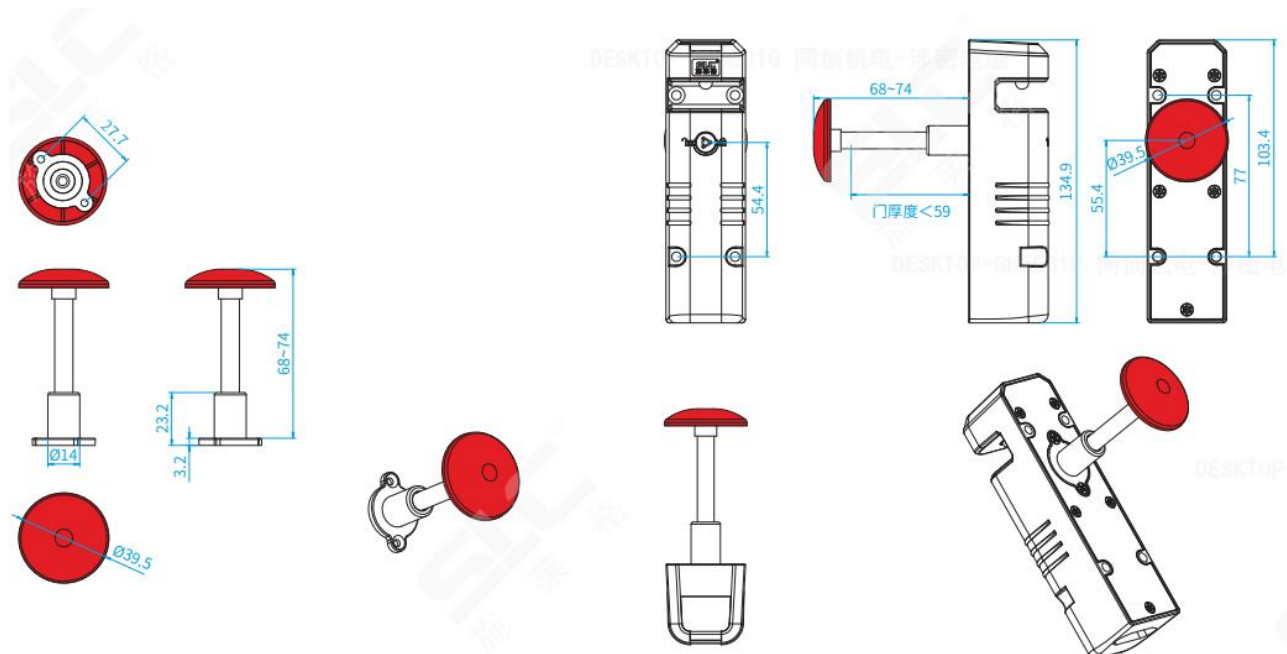


9.2 Emergency unlock button size

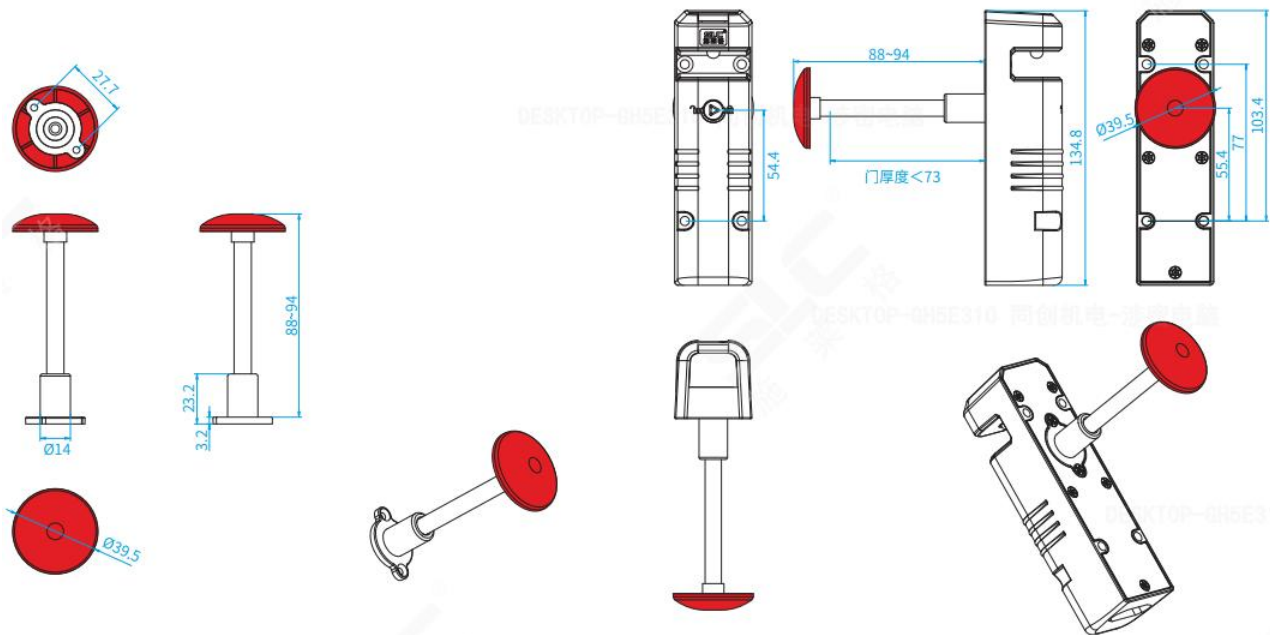
9.2.1 TBL-H44 Emergency unlock button (Press 38mm, Reset 44mm)



9.2.2 TBL-H74 Emergency unlock button (Press 68mm, Reset 74mm)



9.2.3 TBL-H94 Emergency unlock button (Press 88mm, Reset 94mm)



WARNING!

- Incorrect installation of the escape release means that the button of the escape release pin can be accessed from the outside. This may mean that the guard locking is unlocked from the outside and the safety gate is opened, although the hazardous machine is switched on.
- The escape release should be installed so that it is only accessible from inside the danger zone.

- The button of the escape release pin must be impossible to reach from a position outside the protected area.
- Prevent any unintended operation of the escape release.
- Prevent the effect of transverse forces on the escape release.
- Secure the screw connections with a medium-strength thread locker.
- The button of the escape release pin must be clearly visible and it must not be concealed.

10 Commissioning

 DANGER!	• Hazard due to unexpected starting of the machine-Death or severe injury • Before the function check-out, make sure there is no danger to people. • Immediately put the machine out of operation if you cannot clearly identify or allocate the error and if you cannot safely remedy the error.
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After installation, after every error and after modifications to the application, check that the device is functioning correctly. Perform the following checks.

10.1 Mechanical check

Open the movable physical guard and close it again. The components of the safety locking device must not collide with other parts while doing so.

10.2 Function check

1. Switch on the supply voltage.
2. Close all movable physical guards and activate the locking function. The machine must not start independently.
3. Check the locking device. The movable physical guard must not be able to be opened.
4. Start the machine function.
5. Ensure that the locking function cannot be deactivated as long as the dangerous machine function is active.
6. Stop the machine function and deactivate the locking function.
7. Check whether the movable physical guard remains locked until no risk of injury is present anymore (e.g. due to overrun movements).
8. It must not be possible to start the machine function as long as the movable physical guard is open and not locked.
9. For emergency escape release: Check the function of the escape release.

 WARNING!	The safety functions should be checked after initial commissioning and each time the plant/machine is changed. The safety functions may only be checked by qualified personnel
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11 Maintenance

It is not necessary to perform maintenance work on the product in normal operation. Please return any faulty products to SHENZHEN TONGCHUANG.

Regular inspection of the switch function is required to guarantee the trouble-free, long-term function.

If the interlock and guard locking system is only used rarely (opening and closing the safety gate and activating/deactivating the guard locking device), a manual function test is required.

The correct function of the device should be checked at regular intervals and after each error.

11.1 Cleaning

- Do not use aggressive cleaning agents (e.g. isopropanol, methylated spirits or peroxides).
- Do not use any substances that hinder the wetting properties of lacquers.
- We recommend anti-static cleaning agents.

11.2 Regular thorough check

The safety switch must be checked regularly.

The regular thorough checks serve to investigate the effectiveness of the safety switch and detect any ineffectiveness due to modifications or external influences (e.g., damage or manipulation).

Check the functionality of the equipment at least once every 6 months.

To ensure the continuous normal use of the function, the following items need to be checked:

- Proper switching function
- Safe mounting of all components
- No damage, contamination, deposits or wear
- No loose plug connectors
- No signs of tampering

Revision History

Revision	Date	Author	Status	Modifications	Reviewer
A/1.0	2025/11/26	Yanxin Du	Replaced	First release	Han Chen
A/1.1	2026/1/4	Yanxin Du	Replaced	Added related Safety characteristic data	Han Chen
A/1.2	2026/2/3	Yanxin Du	Replaced	Updated related Safety characteristic data	Han Chen
A/1.3	2026/2/5	Yanxin Du	Replaced	Updated related Safety characteristic data	Han Chen
A/1.4	2026/2/6	Yanxin Du	Active	Updated related Safety characteristic data	Han Chen
A/1.5	2026/3/5	Yanxin Du	Active	Modified Operating 1 Channel Lock Input mode Name of Table 5.1 Safety characteristic data	Han Chen

12 FCC Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This equipment complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference, and
- (2) This device must accept any interference received, including interference that may cause undesired operation.

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20cm between the radiator and any part of your body.