SAFEMASTER STS

Mounting and operating instruction

Modular safety switches and key transfer systems for the highest requirements.

DOLD

Our experience. Your safety.

Index

0258068

1. General

1.1 Safety notes

ATTENTION!
Please read these mounting instructions before starting the installation. Mounting, electrical connection and test must only be carried out by trained staff that have read these instructions and have a full understanding of their content. Before installing the system the user has to decide if the suggested key transfer plan solution fulfils the application requirements and that the gates are secured according to the relative standards. The suggested key transfer plan has been designed and forms one solution based on the requirements as advised to Dold.

For a safe installation all the available mounting points must be used. When making changes to an existing system please take care to follow the mounting rules as described in this document. Do not remove or re-adjust any parts inside the (electrical) units. Please note that the mechanical modules have two cleaning holes. Please make sure that at least one hole remains open so that dirt can exit. Please make sure that appropriate seals are used for all the cable entries. The connection (integration of electrical modules) must be carried out according to the required safety category DIN EN ISO 13849-1. A validation in conformity with DIN EN ISO 13849-2 is mandatory. Before starting the system it must be checked for function according to the corresponding key transfer plan. After completing the tests the covers of the electrical units must then be fitted and fixed with the appropriate screws. Maximum torque = 1 Nm ± 0.1 Nm. Please make sure that the front covers of the electrical units are mounted properly before operation. Only when the lids are mounted correctly, function and protection class will be as specified.

It is recommended to carry out planned maintenance min. twice a year to remove dirt and other contaminants from the units to keep the system working correctly. In case of intense fouling, cleaning should be carried out more often.

ATTENTION!
Do not use grease for lubrication! If lubrication is necessary please check the table on page 14 for chosing the lubricant.

Please also pay attention to the standards DIN EN ISO 14119, DIN EN ISO 13849-1 and DIN ISO 12100.
For correct mounting and usage of devices with Auxiliary-, Emergency-, or Escape release, refer to the requirements of DIN EN ISO 14119
Please contact DOLD if you have any doubts or questions regarding the installation.
Take notice of the requirements of EN ISO14119:2013 in reference to foreseeable manipulation, especially to §7.1 and 7.2
Upon installation electric modules must be connected to the ground, to avoid any potential differences.

The statements and safety notes contained in these mounting instructions must be strictly adhered too.

The STS-system made of stainless steel can be within limitation used as mechanical stop.

Follow values must not be exceeded:

- **F = 50 N**
- **v = 500 mm/s**

ATTENTION!
The STS-system made of plastic must not be used as mechanical stop.

1.2 Mounting rules and type numbering

The type identification of a combined unit is built up from the bottom module to the top.

Mechanical key module numbers are added together, e.g. on a mechanical lock with 2 keys to be inserted (10 + 10) and one to be extracted (01). This sums up to be 21. At the upper end of the mechanical guard lock an actuator module (A) is required. The type reference for this assembly is then, M21A.

An M module should always be mounted on the open end of a unit.

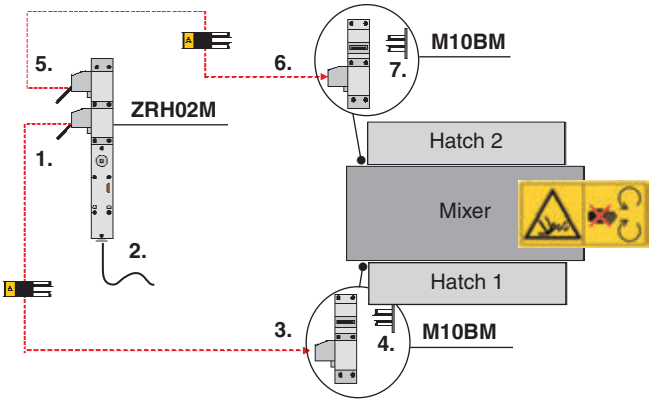
If a key module 10, a padlock module W or an actuator module K is mounted directly on a switch or on a solenoid locking switch, the position of the key or actuator has to be monitored for category 3 or 4 as shown in wiring examples 3 and 4 on page 15 and 16.

Above a B, D, K and E actuator module there should **always** be mounted one or more mechanical modules or an M end module.
Below A, B, D, K and E actuator modules there should **always** be mounted one or more mechanical modules or an electrical module.

Products of the SAFEMASTER STS plastic series are indicated with a **/K** at the end of the type name.
Example: M10A/K, Key module 01/K, Actuator module B/K, End module M/K.

1.3 Key transfer plan

For assembly, mounting and function testing a key transfer plan must be used.
Dold will be happy to assist you creating one.



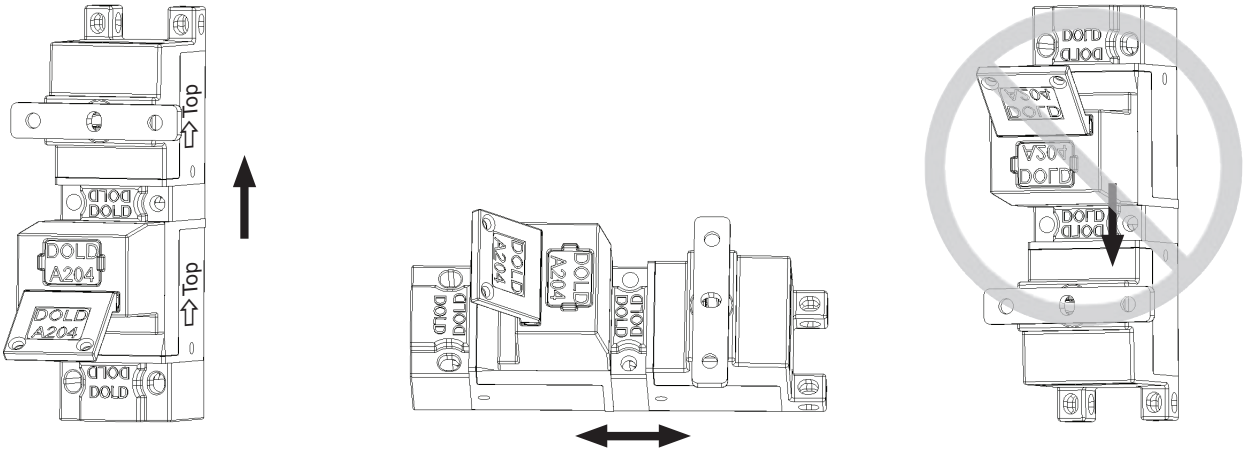
Example ZRH02M with 2 x M10BM

1. When the machine is in safe mode and the solenoid lock is released, the 1st key can be removed.
2. Removal of the key can be monitored and a signal can be integrated into the machine control.
3. Key is inserted into mechanical lock.
4. Hatch 1 can be opened
5. Only when the 1st key is removed, the 2nd key can be obtained.
6. 2nd key is inserted into mechanical lock.
7. Hatch 2 can be opened.

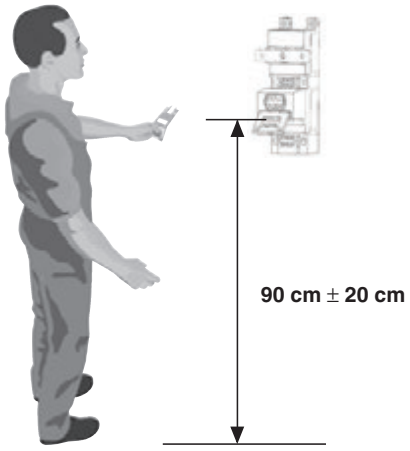
To restart the machine, steps 7-1 have to be processed in reverse order.
Both keys have the same code and can operate both covers.

1.4 Recommended mounting position

0° **90° / 270°** **180°**



1.5 Recommended ergonomic mounting height



1.6 Safety condition of the modules during assembly / modification

When assembling or modifying STS-units, the individual modules must be in a safe condition, as described in the table below.

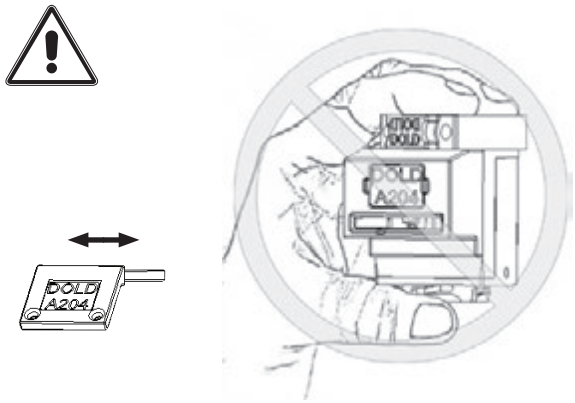
Safety mounting state of the modules

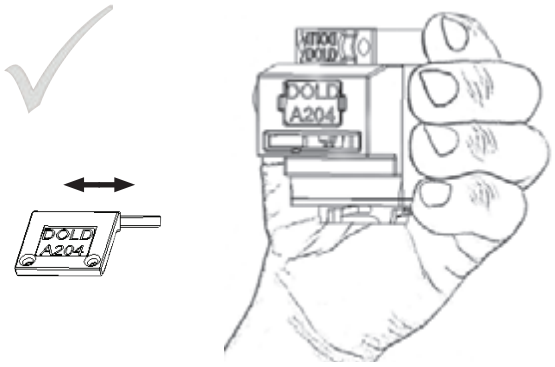
Module	State
Switch module SX / SV	switched off
Switch module RX / RV	switched off
Solenoid locking switch ZR_ / YR_ (closed circuit operation)	switched off, operate solenoid manually
Solenoid locking switch ZA_ / YA_ (open circuit operation)	switched off
Key module 10 / 10S	key inserted, at mounting on RX, RV or Y-modules the key is extracted
Key module 01 / 01S	key extracted
Padlock module V	key extracted
Padlock module W	key inserted, see key module 10, 10S
Actuator module A / B / D	actuator extracted
Actuator module K / E	actuator inserted, at mounting on RX, RV or Y- modules the der actuator is extracted

1.7 Operating a module during composition of a unit

Example: Module 10

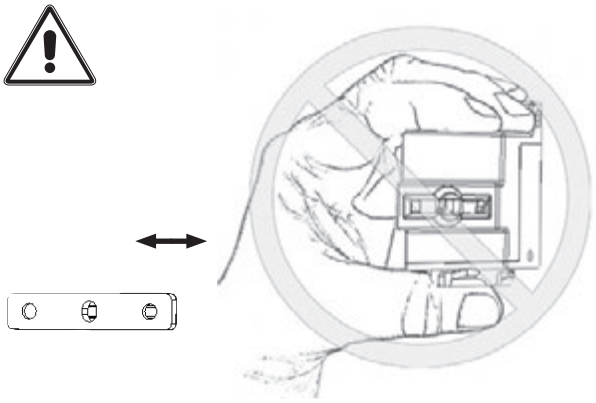
Function check of the modules 10, 10S, 01, 01S, B, D, K, E, V and W

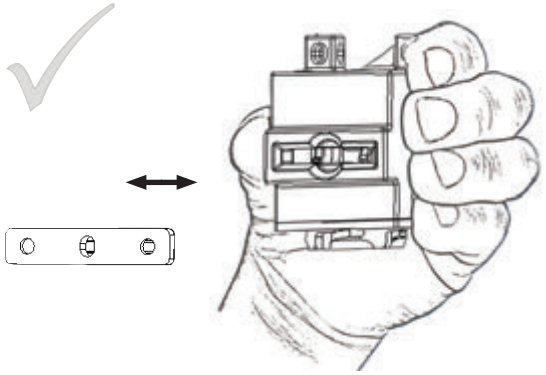




Example: Module A

Function check module A



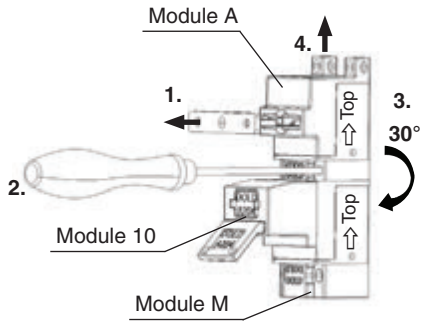


2. Mounting

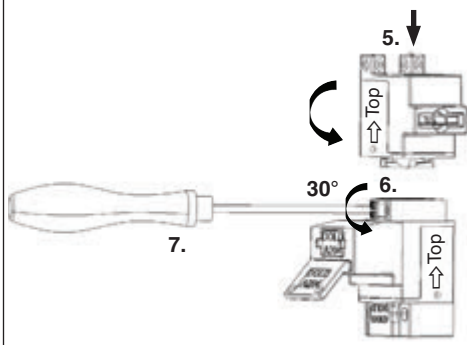
2.1 Actuator modules and key modules

Example M10A; module A rotated at 90°

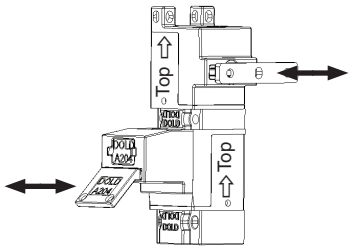
A: Disassembling



B: Rotation / Mounting



C: Test

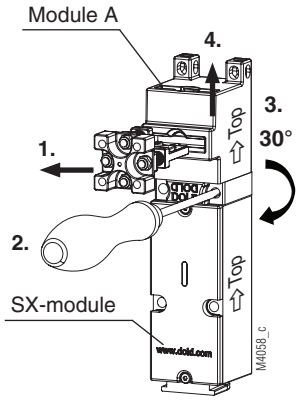


2.2 Modifying a unit or extending

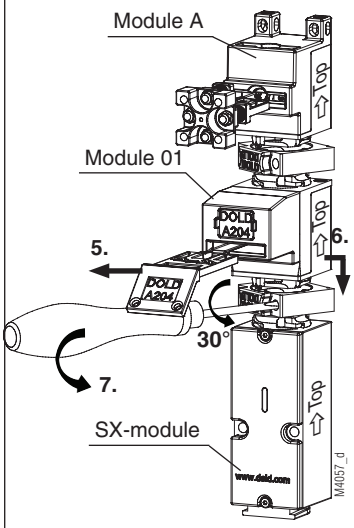
Example STS-SXA into STS-SX01A

Special case: ZR_ / YR_ Modul

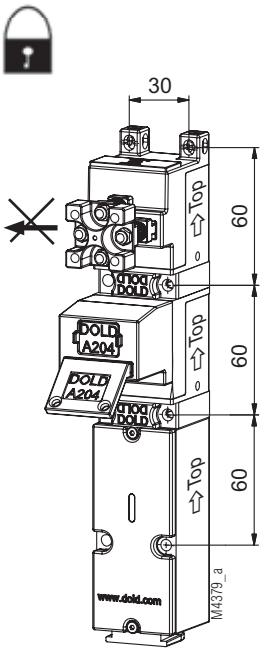
A: Disassembling



B: Add 01 module

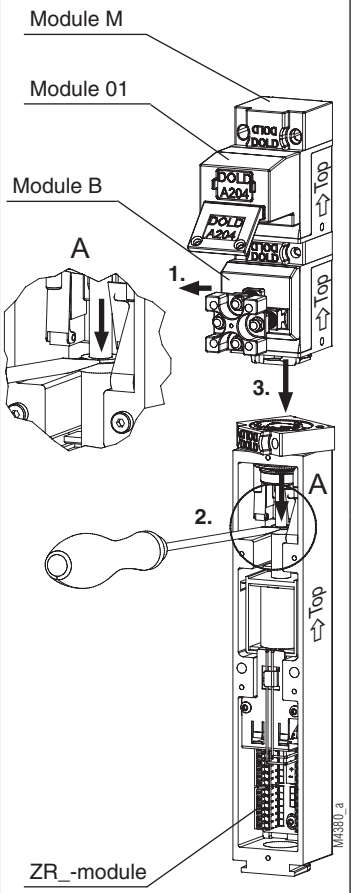


E: Test

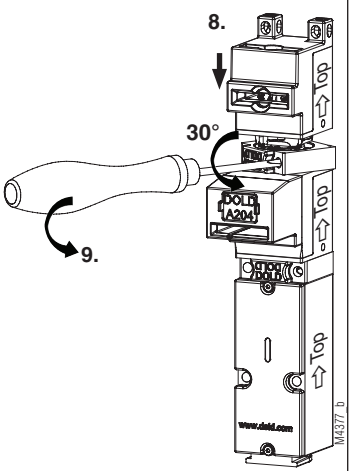


Dimension tolerance ± 2%

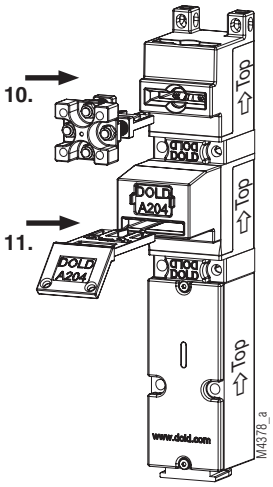
Example: ZR_B01M



C: Mounting



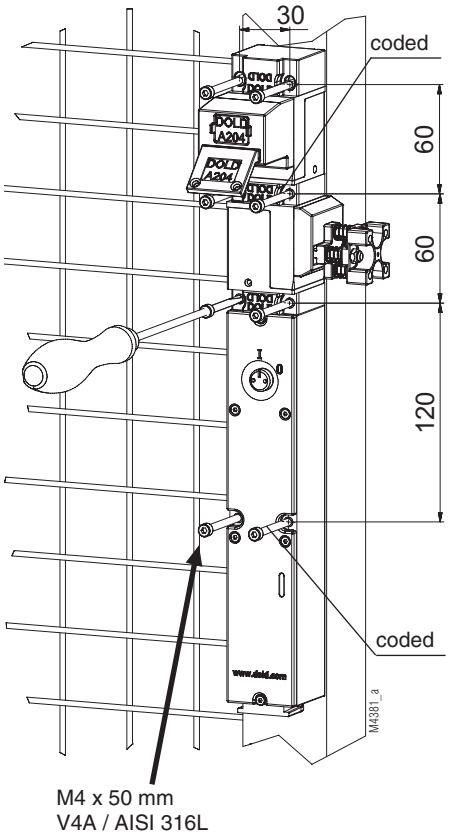
D: Insert acuator and key



2.3 Units and a safety guards

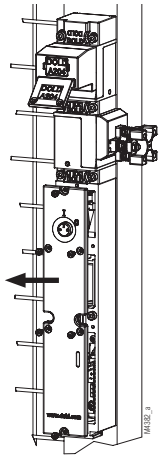
Example STS-ZRHB01M; All threads and cut-outs in a guard have to be made by the user

A: Unit mounting

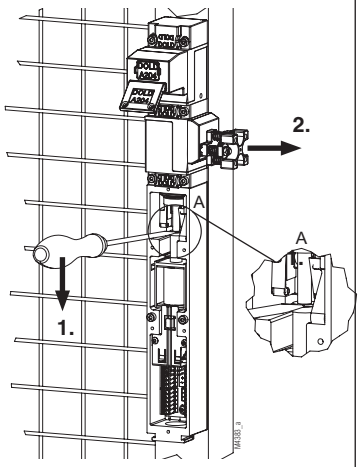


Dimension tolerance ± 2%

B: Remove lid

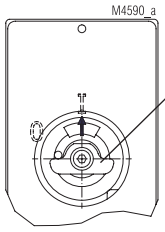


C: Release actuator



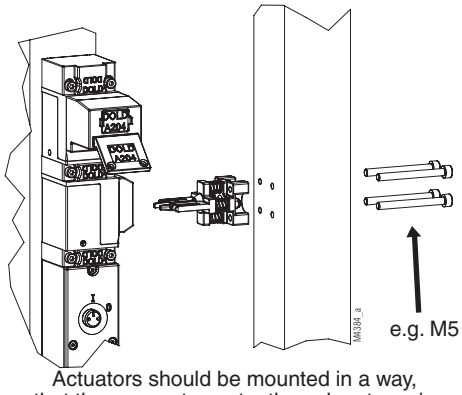
D: Lid mounting

Mount lid only when key or actuator is removed e.g actuator
and horizontal eccentric tappet 1 (Position 1) of the manual / e-stop / emergency unlocking



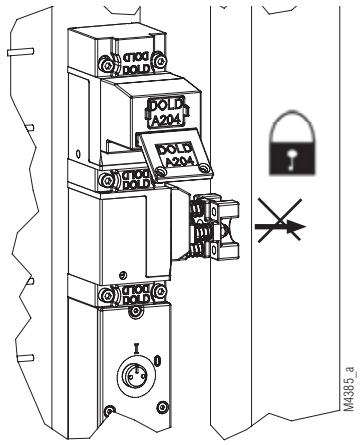
Cover inside

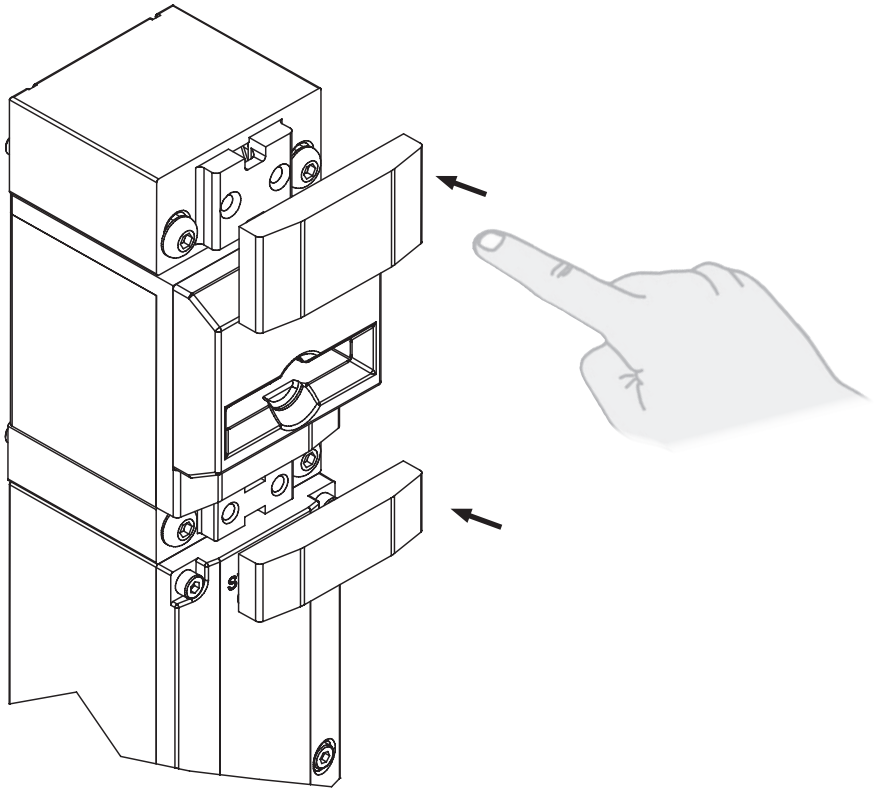
E: Mount actuator



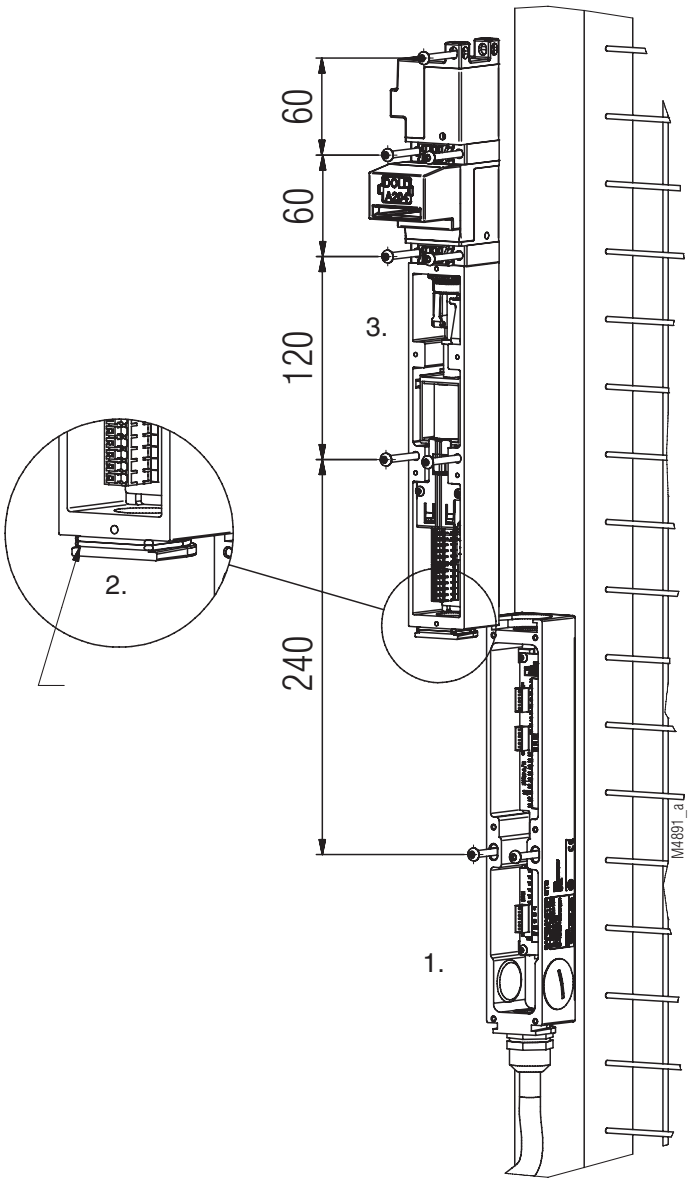
Actuators should be mounted in a way, that they are not constantly under stress in closed state.

F: Test



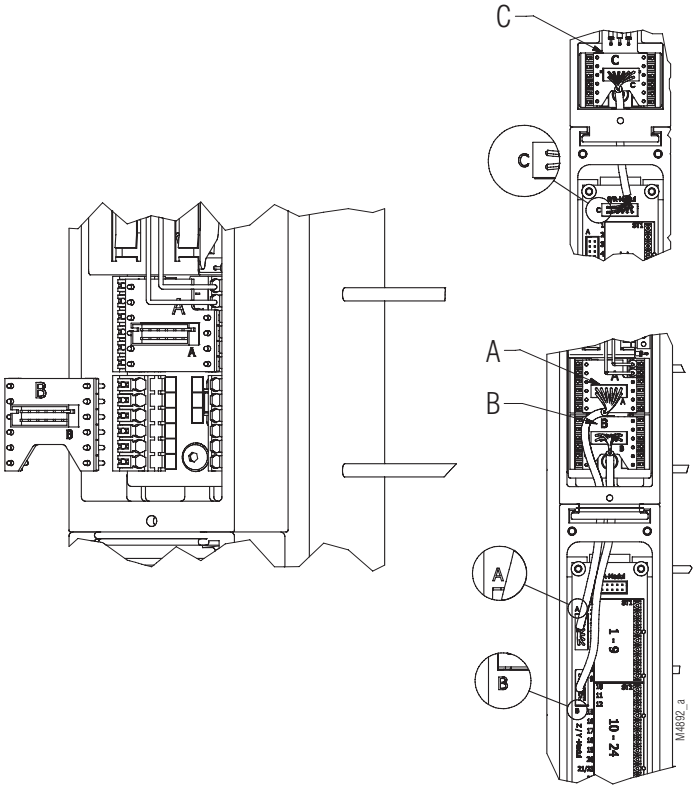


A: Mounting



1. mount option module on fence frame
2. place seal (O-ring 24 x 1.5)
3. mount swicth or solenoid lock (here e.g. ZRH01A)

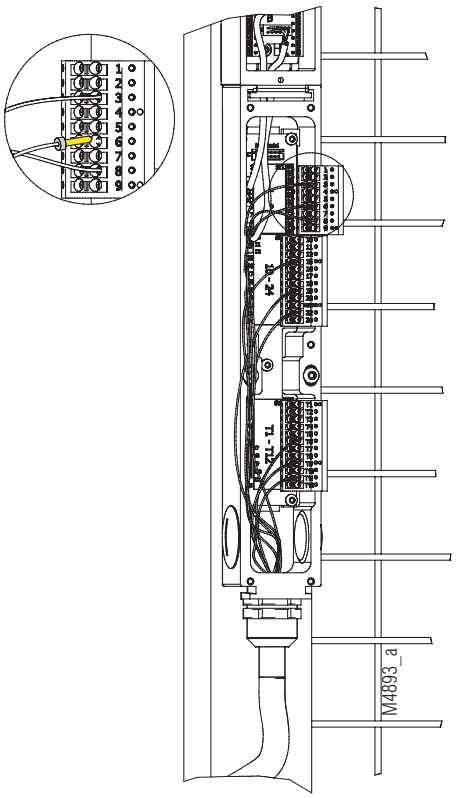
B: Connecting connection set



1. plug pcb adapter into the terminals of the switch (C) or solenoid lock (A) and (B)
2. run connection cable through the opening and plug it in PCB adapter and PCB.

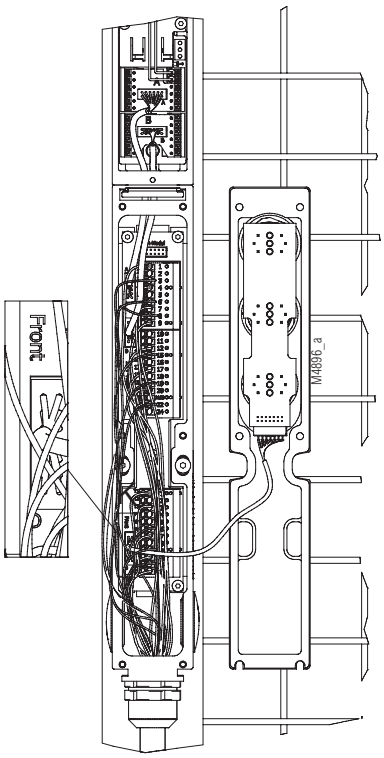
A - A; B - B; C - C

C: Connecting control signals



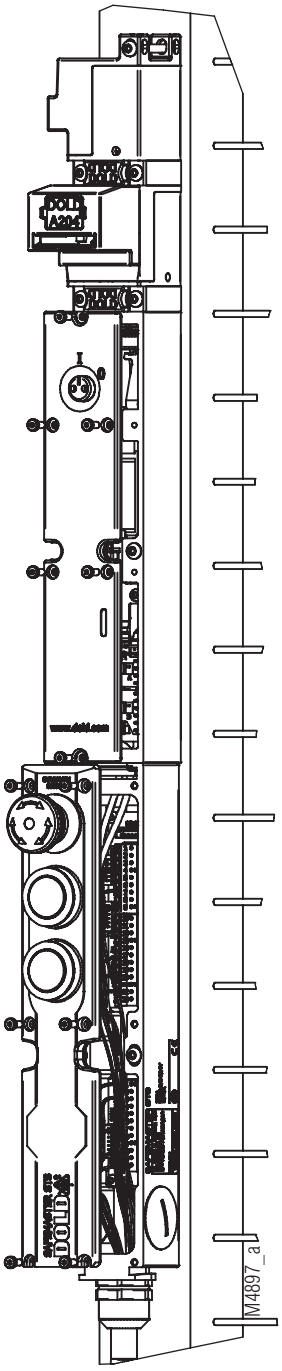
1. connect shortened wires to the terminals
2. mount coded terminal blocks to the connection pins in the option module

D: Connect front plate



plug the 14-pole connectioncable from the front cover to the pin connector in the option module

E: Mount front plate



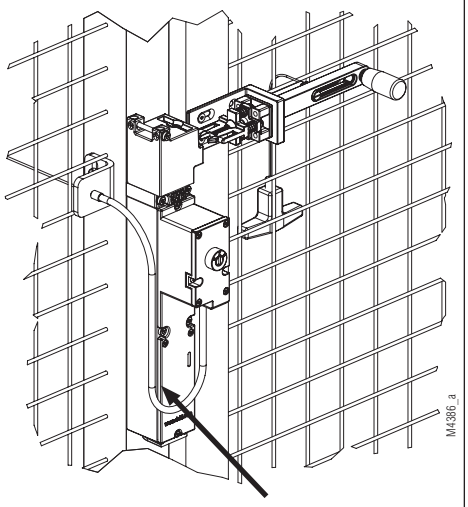
1. place and srew the front cover of the switch / solenoid lock.
2. place and screw the front cover to the option module

Attention!
No wire between front plate and enclosure

2.5 Escape release

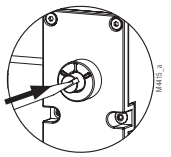
Example STS-ZRFA

A: Mounting of the steel rope

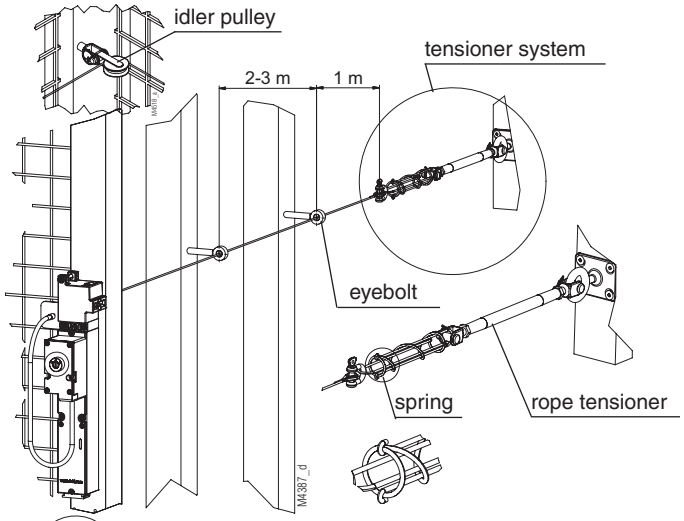


radii ≥ 60 mm

B: Press activation bolt



C: Tensioning of steel rope

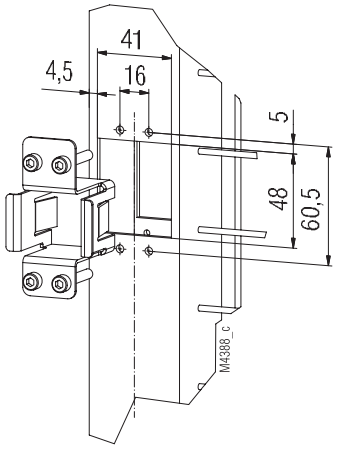


Adjust rope with rope tensioner until active position is reached. Please make sure that the hooks of the spring are correctly fixed when installing the tensioning system.

active position

Example STS-F-Kit (escape release kit)

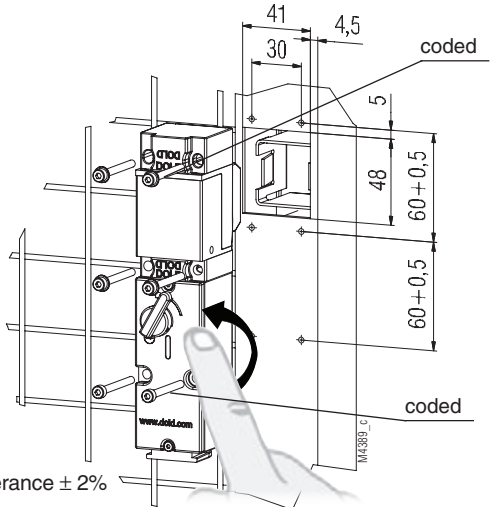
A: Mounting of frame profile insert



Dimension tolerance ± 1%

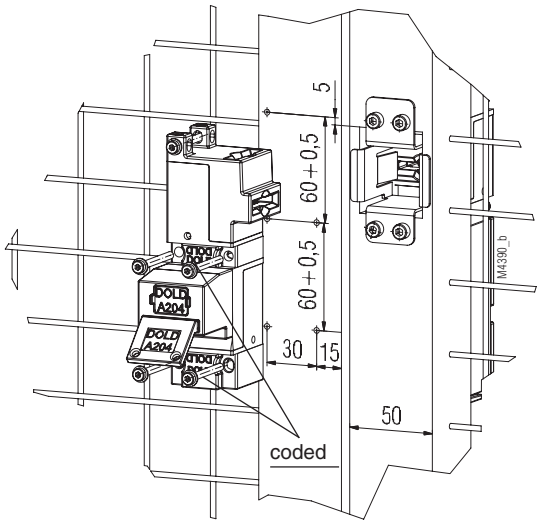
Frame profile 50 mm x 50 mm

B: Mounting of the SVBM-unit

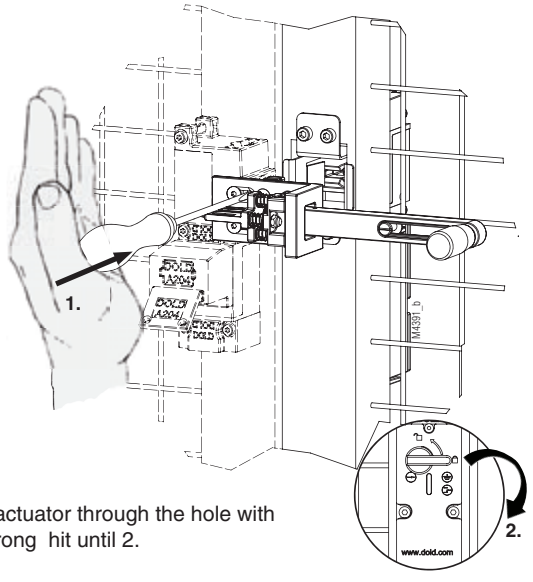


Dimension tolerance ± 2%

C: Mounting of the mechanical unit on the door



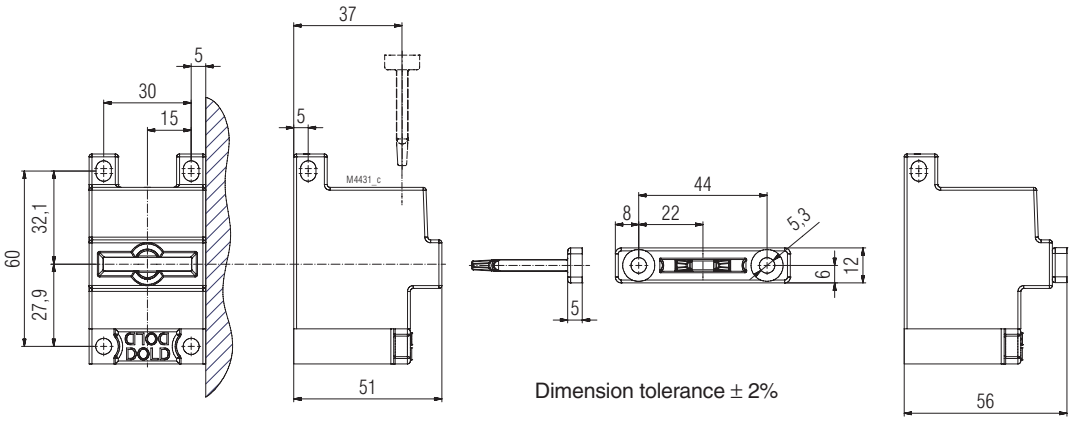
D: Fixing the actuator



Fix actuator through the hole with a strong hit until 2.

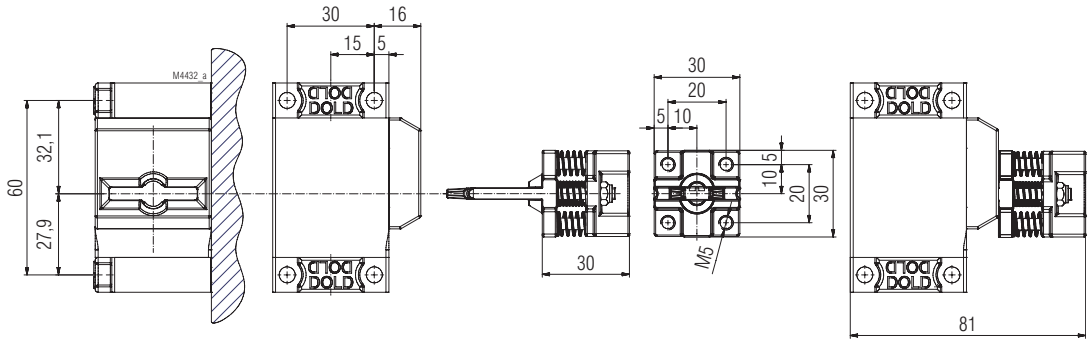
Units based on solenoid modules with emergency release (e.g. ZRN-), escape release (e.g.ZRF-) and the escape release kit (STS-F-Kit) have to be installed/protected in a way that unintended opening of the lock is avoided

Actuator module A + standard actuator T



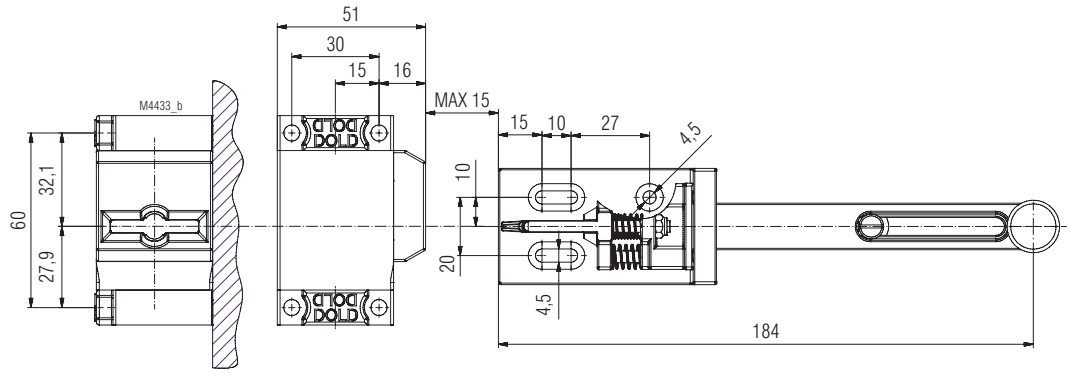
Dimension tolerance ± 2%

Actuator module B + actuator C



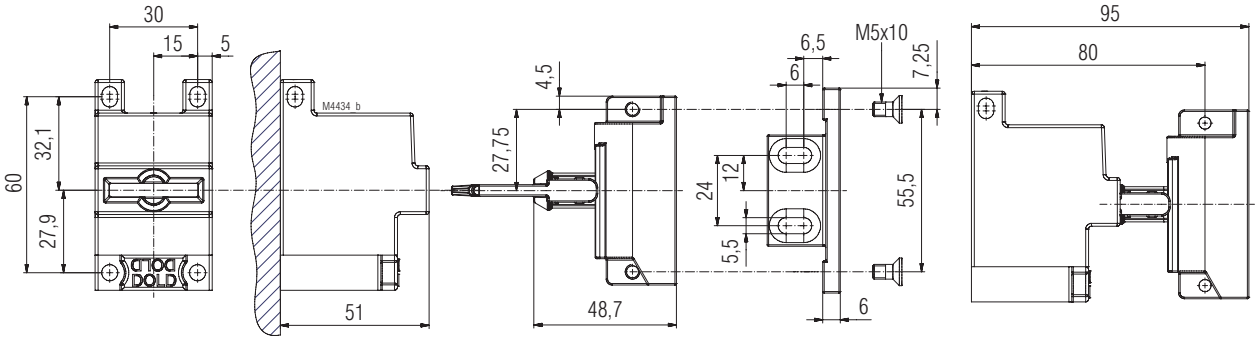
Dimension tolerance ± 2%

Actuator module B + actuator CS

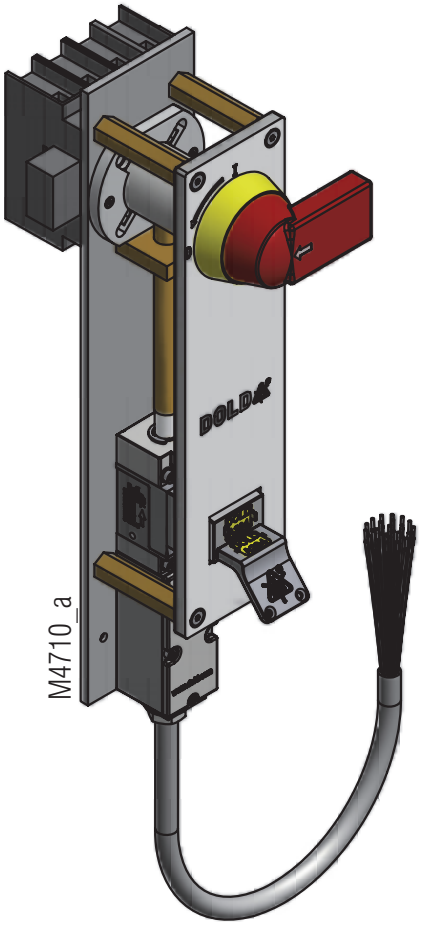


Dimension tolerance ± 2%

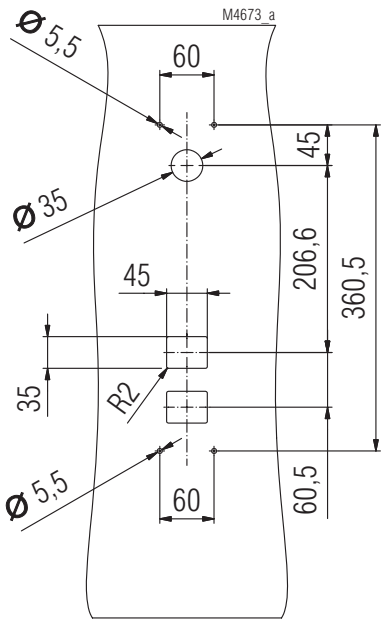
Actuator module A + actuator J

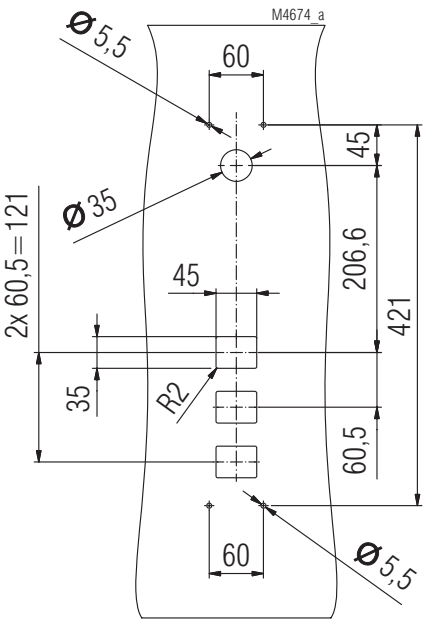


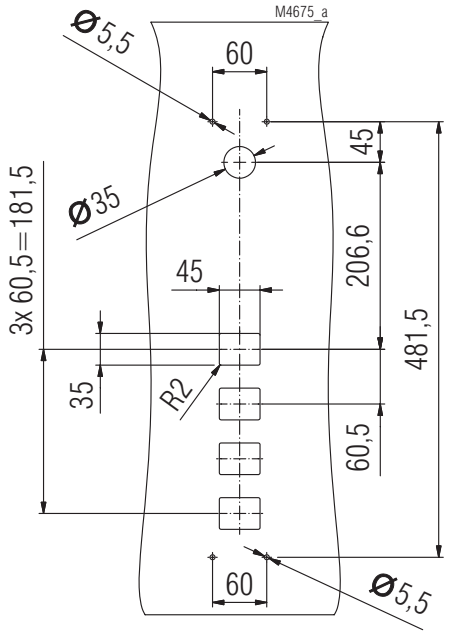
Dimension tolerance ± 2%



Dimensions / Drilling plan control cabinet



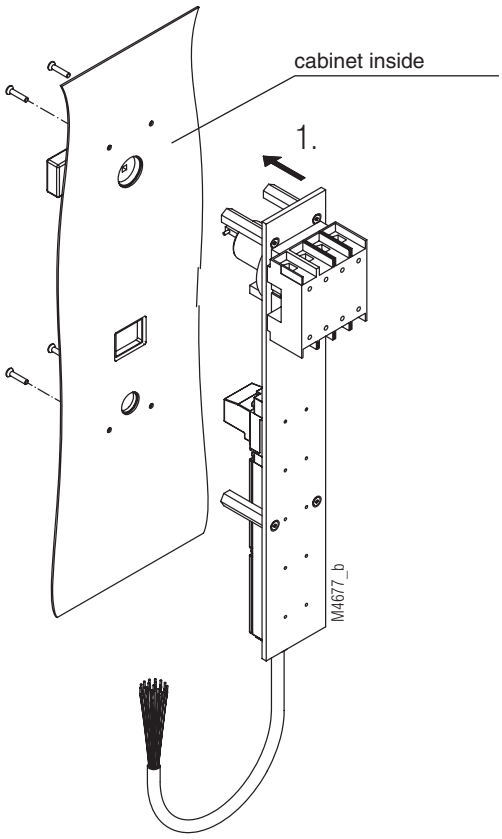


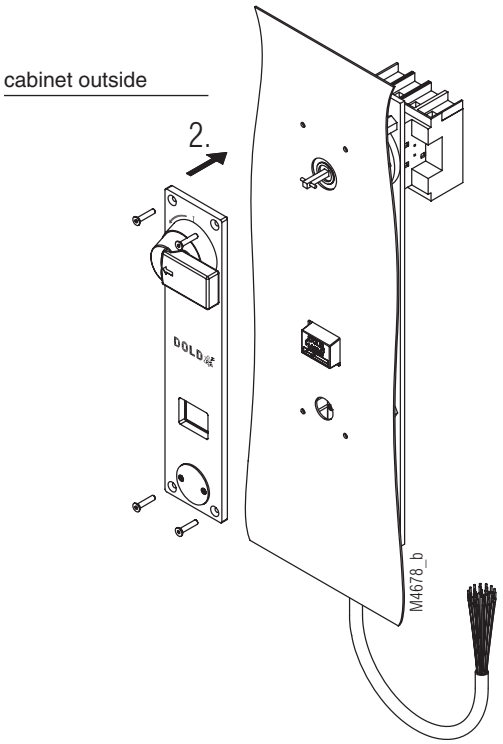


Mounting remarks

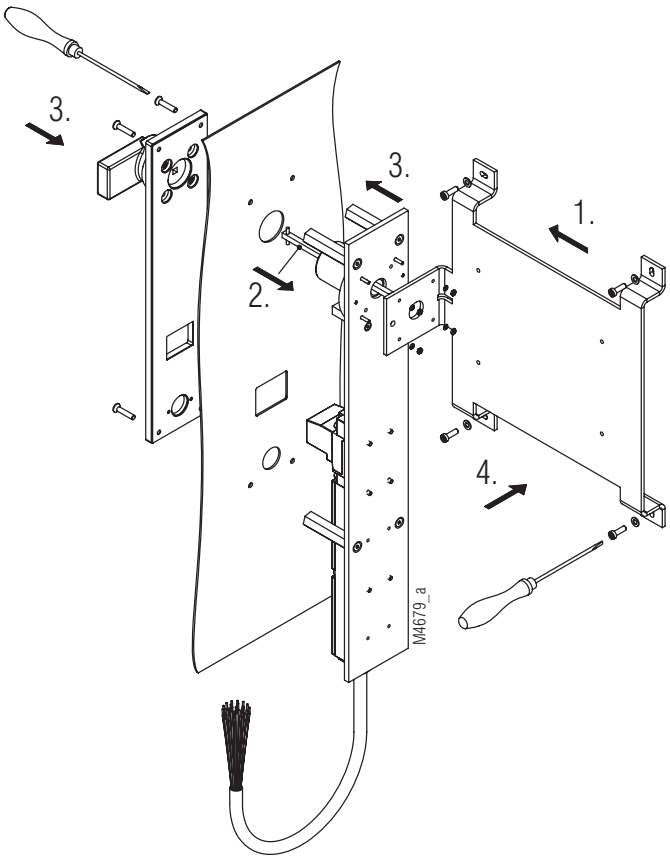
Before mounting, the key must be removed. To this purpose the disconnector switch must be in the “off” position and the locking switch is to be unlocked via the auxiliary release. For devices without locking function it is sufficient switching the disconnector switch in the “off” position.

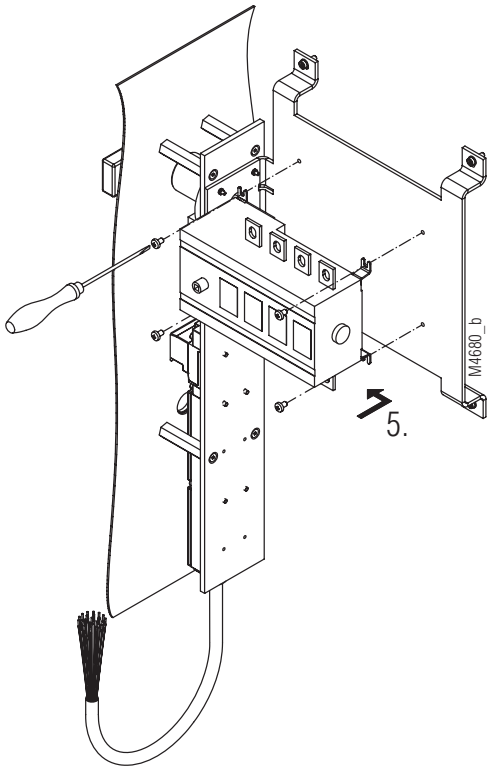
Versions 25 ... 125 A





Versions 160 ... 800 A



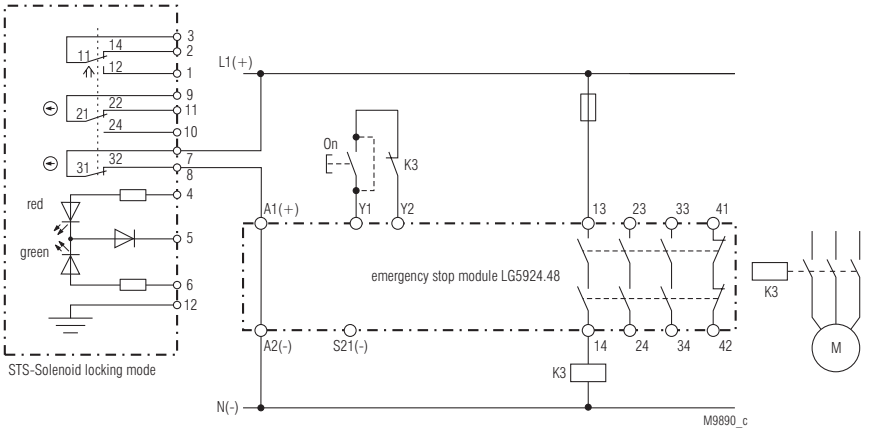


3. Circuit diagrams and connection examples

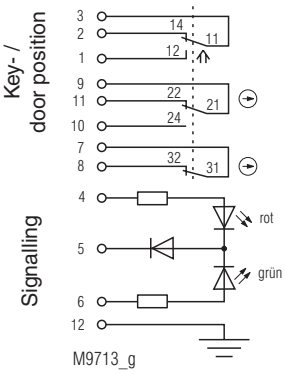
3.1 Circuit diagrams for switching modules (SX-, SV-, RX-, RV-modules)

All examples shown in active state

1.) STS-switching module (SX-Module) + 1-channel E-stop-module (LG 5924.48)

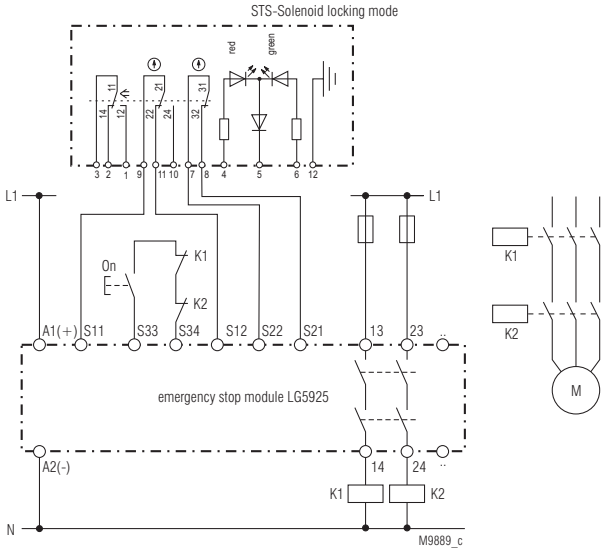


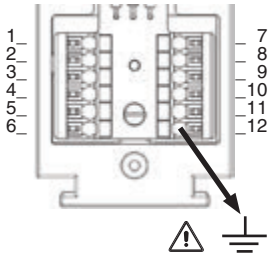
Active state SX-Module
Non-active state RX-Module



When monitoring of the key or door position is required, **terminals 7 and 8 must** be used!!!

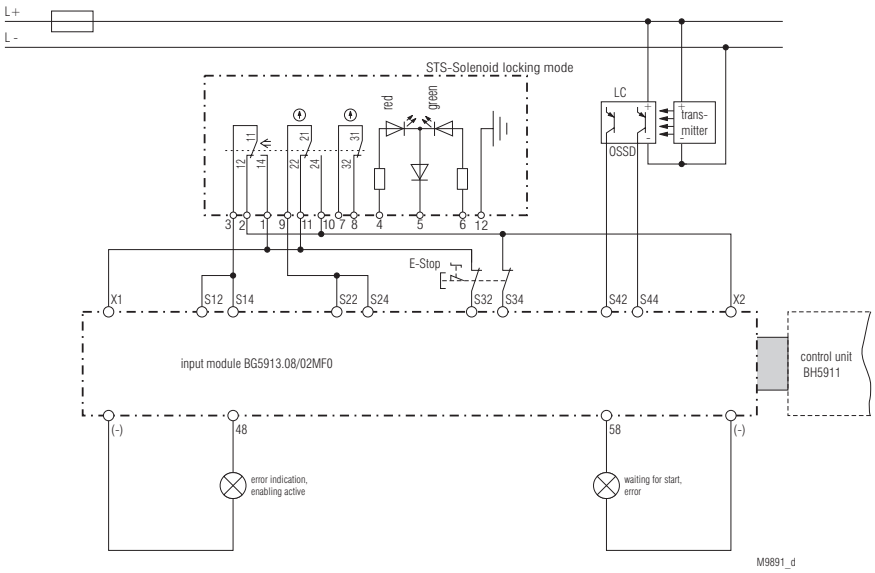
2.) STS-switching module (SX-Module) + 2-channel E-stop-modulel (LG 5925)





At 2-channel redundant monitoring of the key or door position
d o n o t connect to terminal 10!!!

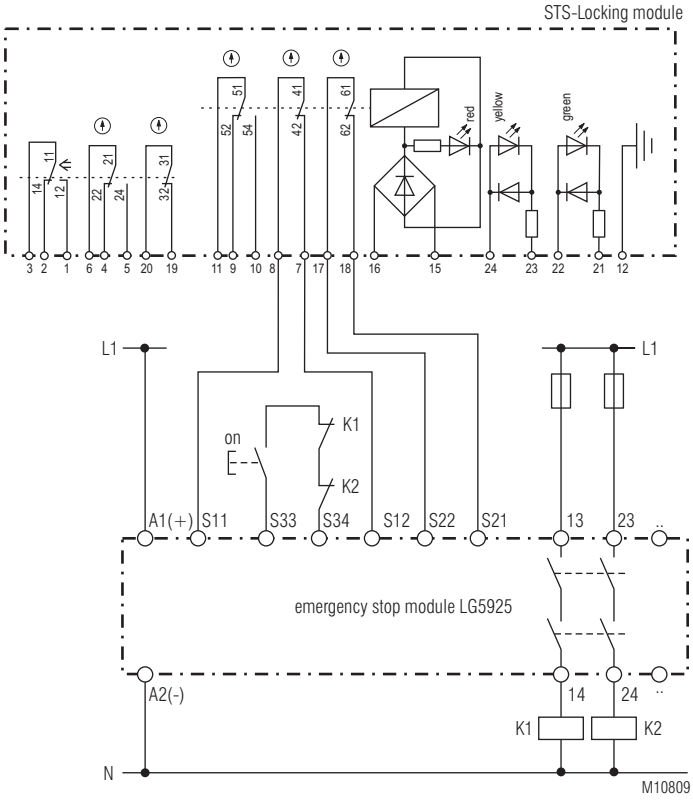
3.) STS-switching module (SX-Module) + input module (BG5913); exclusive OR circuit with C/O contact

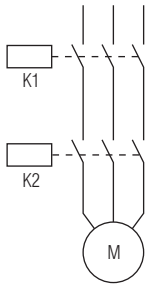


All examples shown in active state

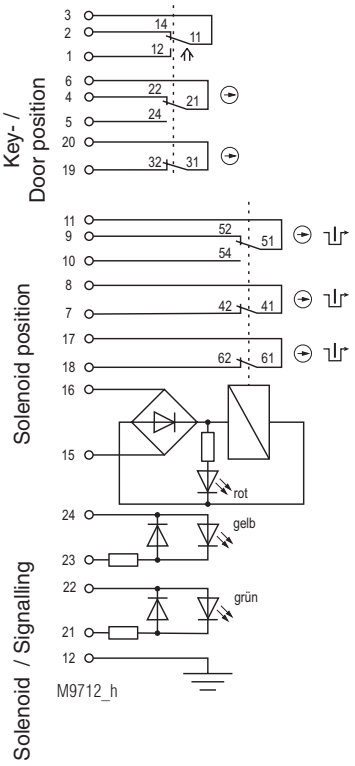
1.) STS-solenoid locking module (ZRX-module) + 2-channel E-stop module (LG 5925)

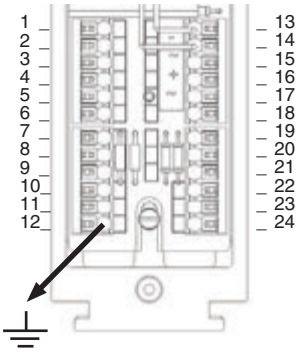
Minimum wiring for 2-channel monitoring





Active state ZR_-module
Non-active state YR_-Module





For single channel monitoring
terminals 7 and 8 or 17 and 18 must a l w a y s be used!!!.

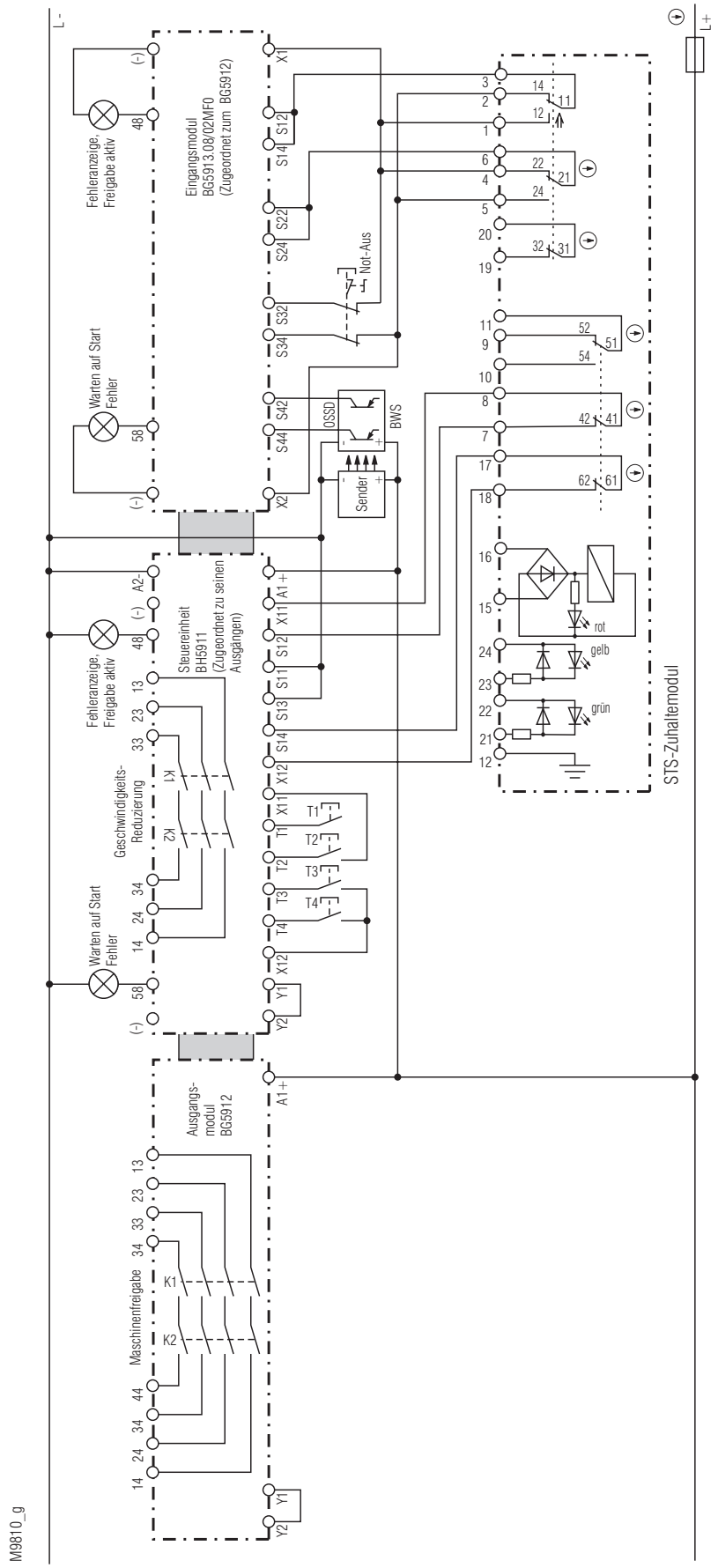
The contacts of the door or keyposition must only be used for additional purposes. They are intended to be used for extended feedback e.g. set-up mode (see example on page 16).

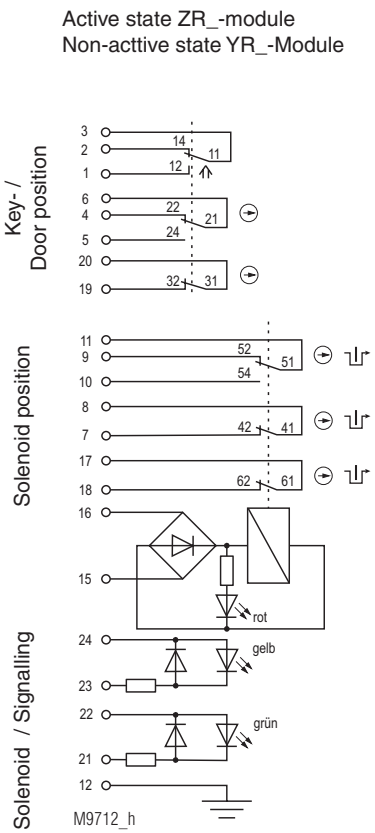
On dual channel redundant monitoring of the lock position and using the changeover contact 9, 10 and 11, the **terminal 10 must not be used**.
At antivalent monitoring terminal 9 must not be connected.

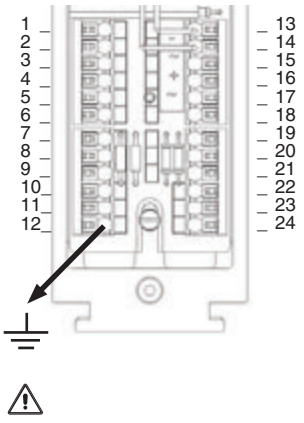
In applications where the key or door position is monitored dual channel, **terminal 5 must not be connected** (see wiring example page 16)

All examples shown in active state

***2.)* STS-solenoid locking module (ZRX-Modul) + SAFEMASTER M (input module BH 5913, control Unit BH 5911, output module BG 5912)**
State: Door closed and locked. Suitable for applications with set-up operation (door closed but not locked) and full operation (door closed and locked).



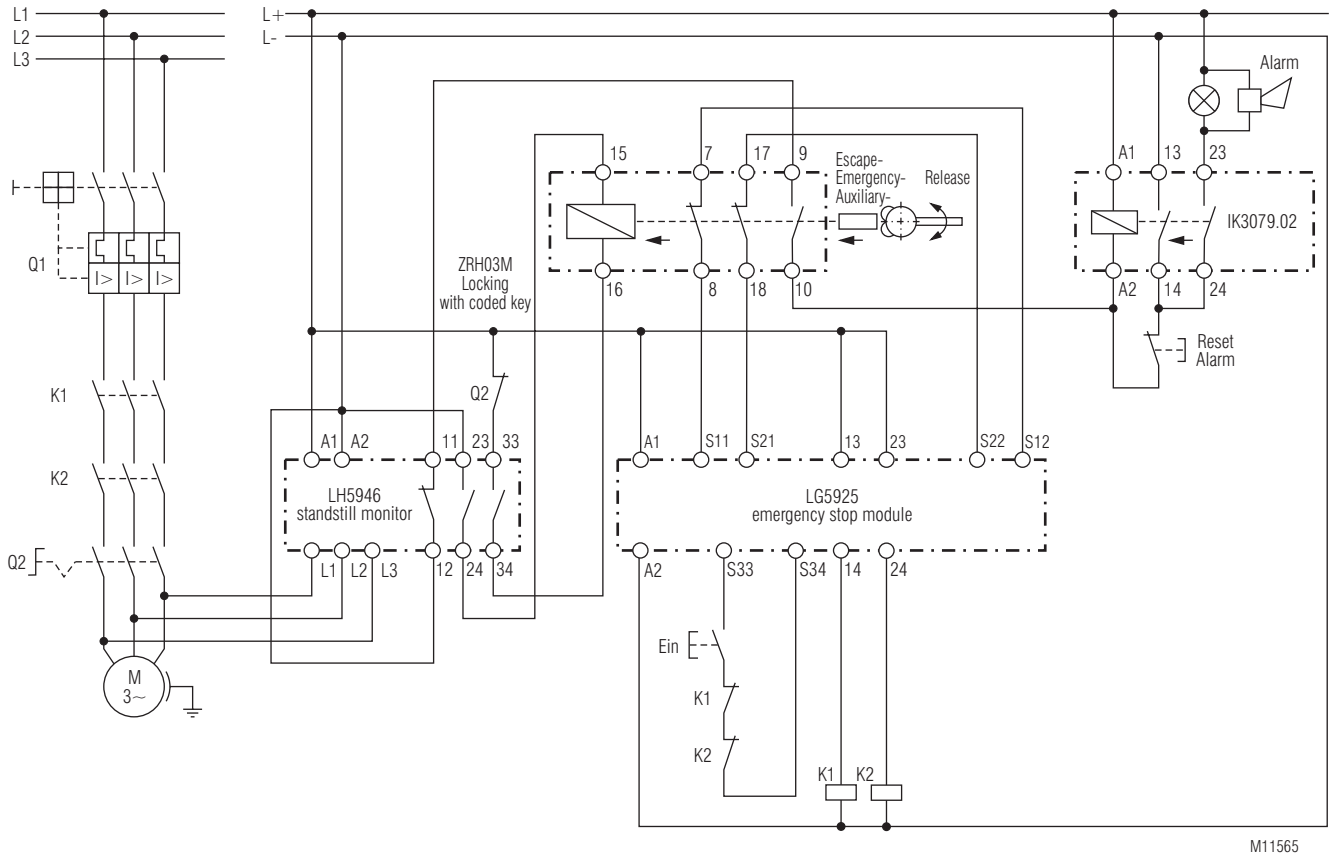




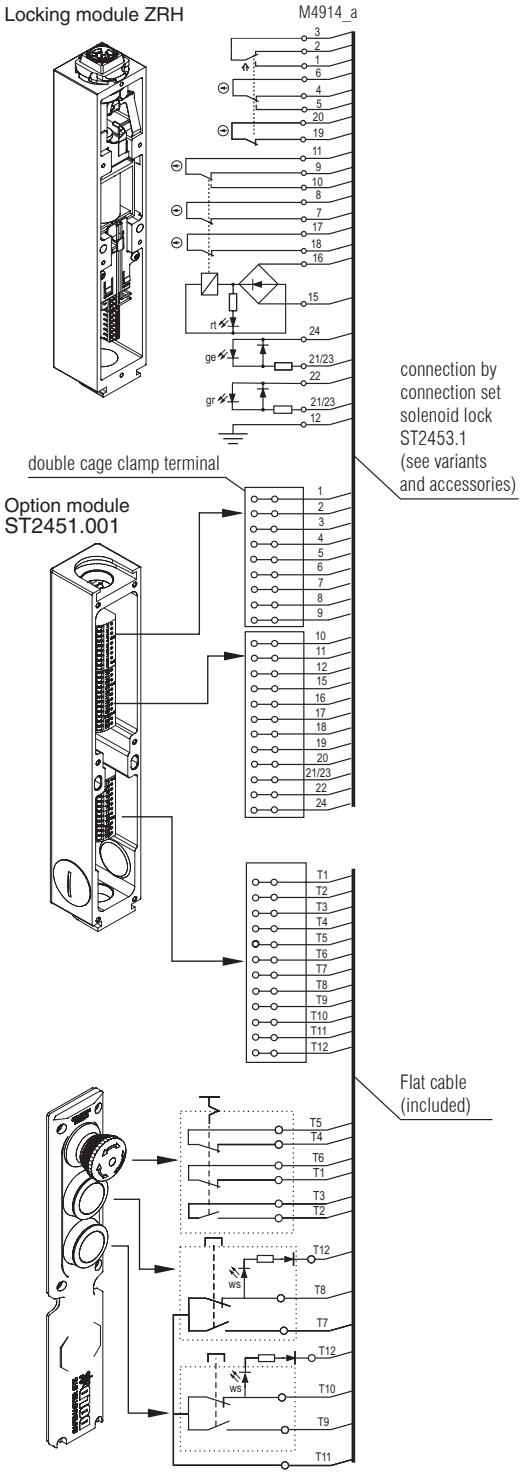
When monitoring of the key or door position is required, **terminals 19 and 20 must** be used.

All examples shown in active state

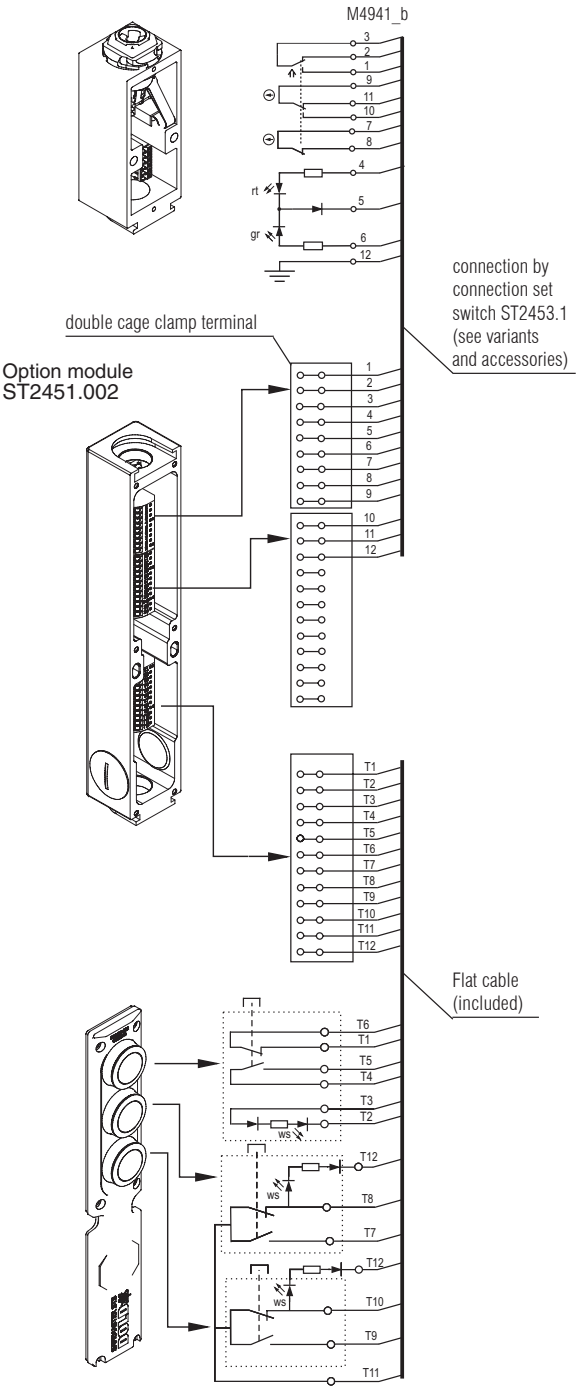
3.) STS-Zuhaltungen mit Hilfs- oder Notenriegelung oder Fluchtentsperrung zusammen mit einer akkustischen und visuellen Alarmierung.



Locking module ZRH



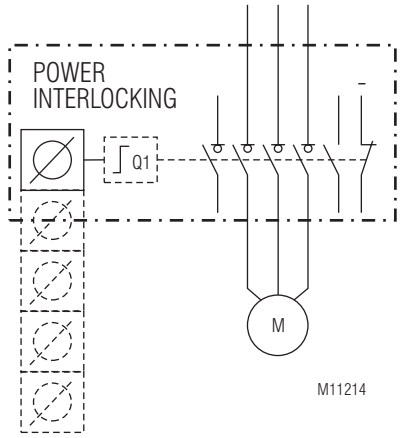
Switch module SX



3.4 Connection examples Power Interlocking

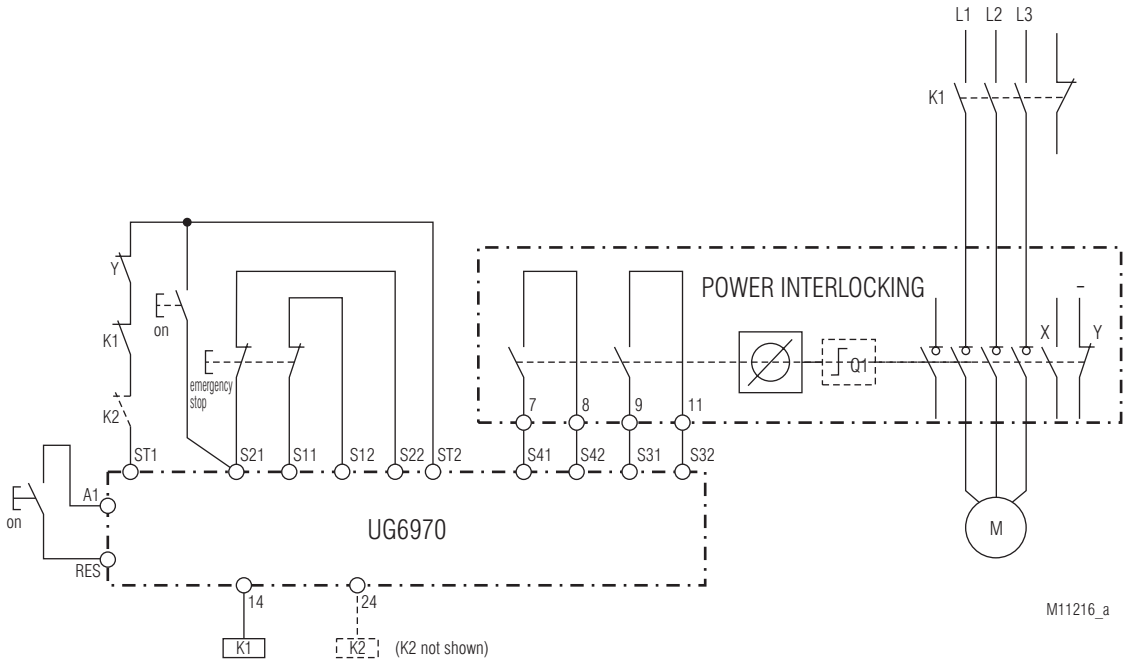
All application examples are in zero voltage state

1.) Application example with mechanical design



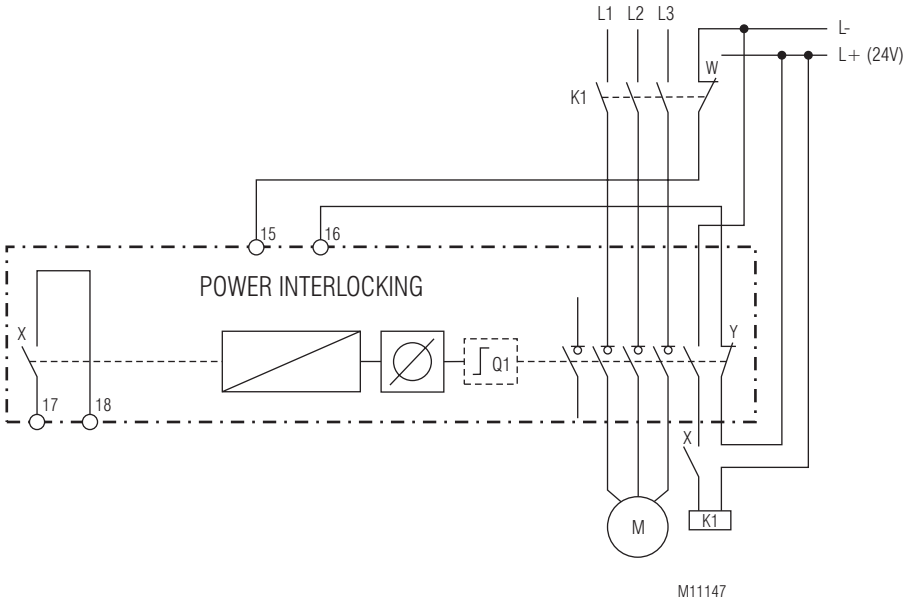
Power Interlocking without monitoring function and without redundancy (Stop 0).
After disconnecting the load isolator 1 to 5 keys can be removed.

2.) Application example with a switching version



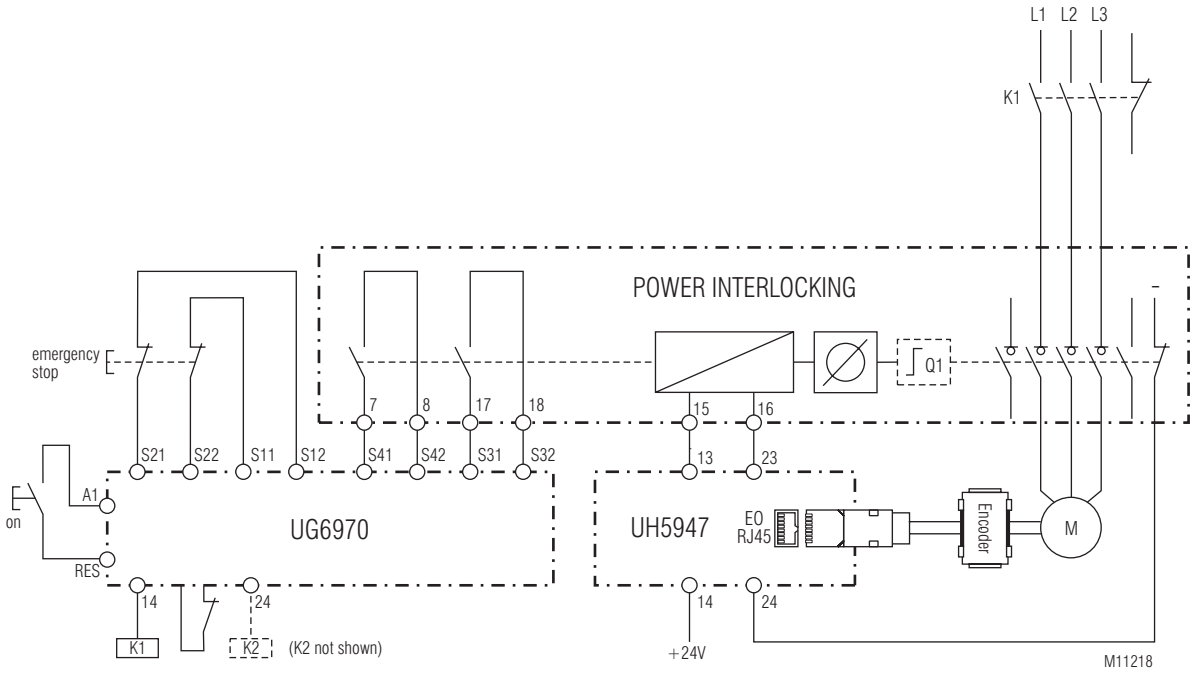
Power Interlocking with monitoring function.
After disconnecting the load isolator 1 key can be removed immediately. This key is equipped, in addition, with monitoring contacts. If necessary, they can be included in a safety circuit together with an auxiliary contact of the switch disconnector.

3.) Application example with a solenoid locking version



Disconnected state, magnet energized (24 V), key inserted and removable.
Power Interlocking where standstill monitoring, time delay or other monitoring functions can be added.
The key can be removed only after disconnecting the load isolator and release by the magnet.

4.) Application example with a solenoid locking version



Disconnected state, solenoid energized (24 V), key inserted and removable.
Power Interlocking with monitoring function and mechanical redundancy;
- Stop 0 over Q1;
- Stop 1 over circuit logic

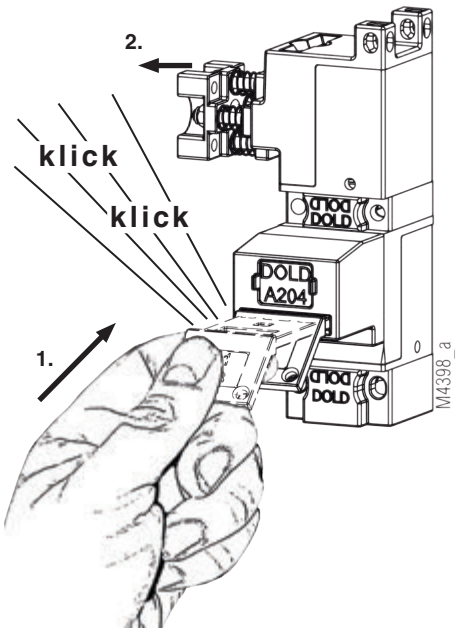
4. Operation

SAFEMASTER STS-units are parts of the DOLD safety switch and key interlock system. When supplied by DOLD it comes always with a key exchange plan (see page 4). The specifications stated in the key exchange plan have to be observed implicitly. The operation of the SAFEMASTER STS-units has to be done according to the data sheets.

Before using the system the operator has to make him selve acquainted with the operating sequence state in the key exchange plan. The coding of the keys and locks make sure that the system can only be operated in the defined sequence. Keys, actuators and padlock modules must only be operated manually. Tools must not be used for operation!

4. 1. Mechanical Units

Example: M10A

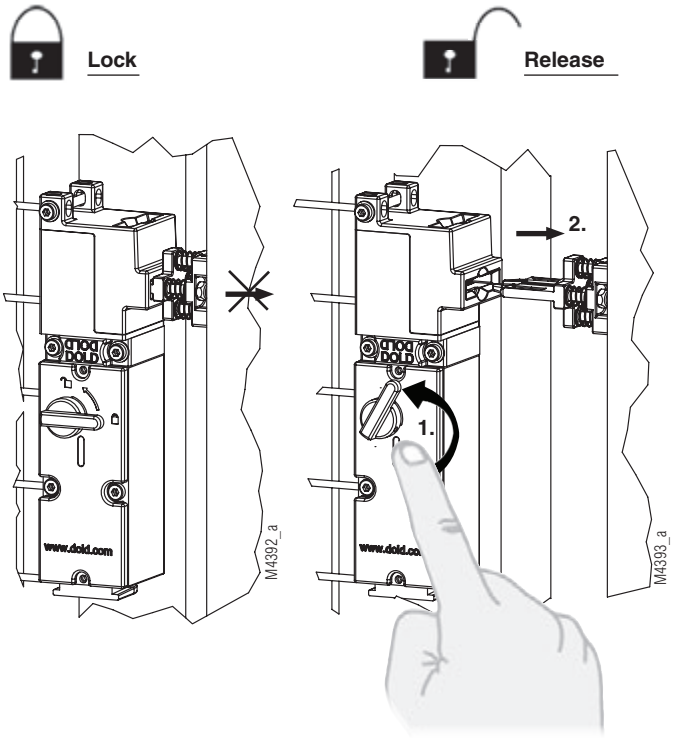


1. Push the key in fully, until it latches.

The latching is only to keep keys and actuators in position and prevents ejection.

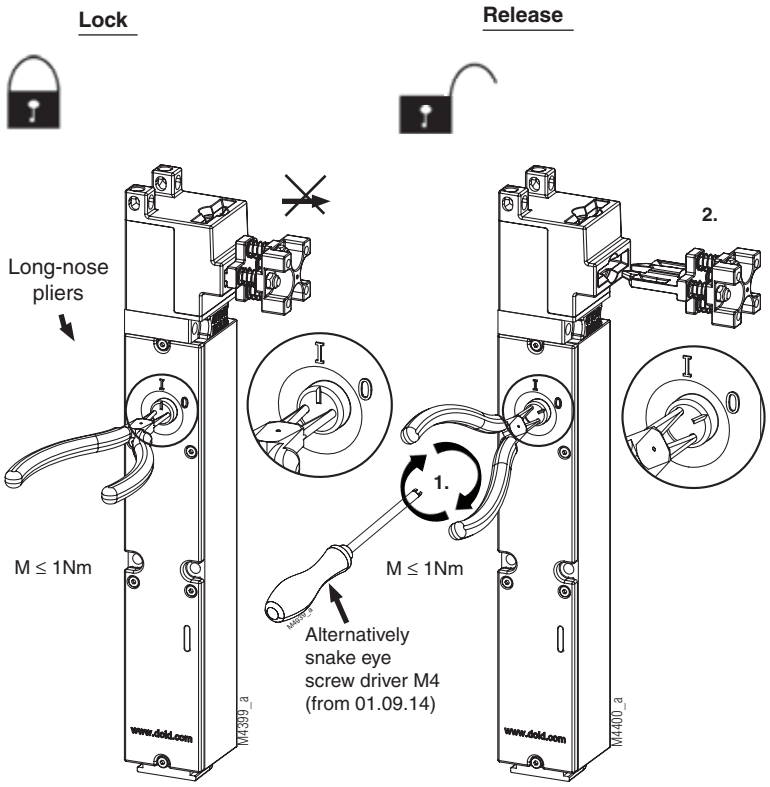
4. 2. Switch units with locking mechanism

Example: SVA



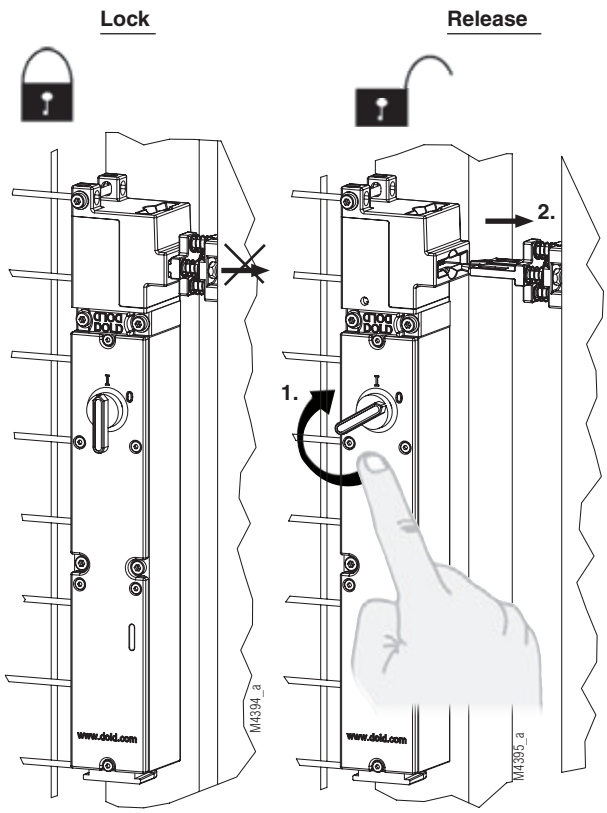
4. 3. Solenoid locking module with auxiliary release

Example: ZRHA



4. 4. Solenoid locking module with emergency release

Example: ZRNA

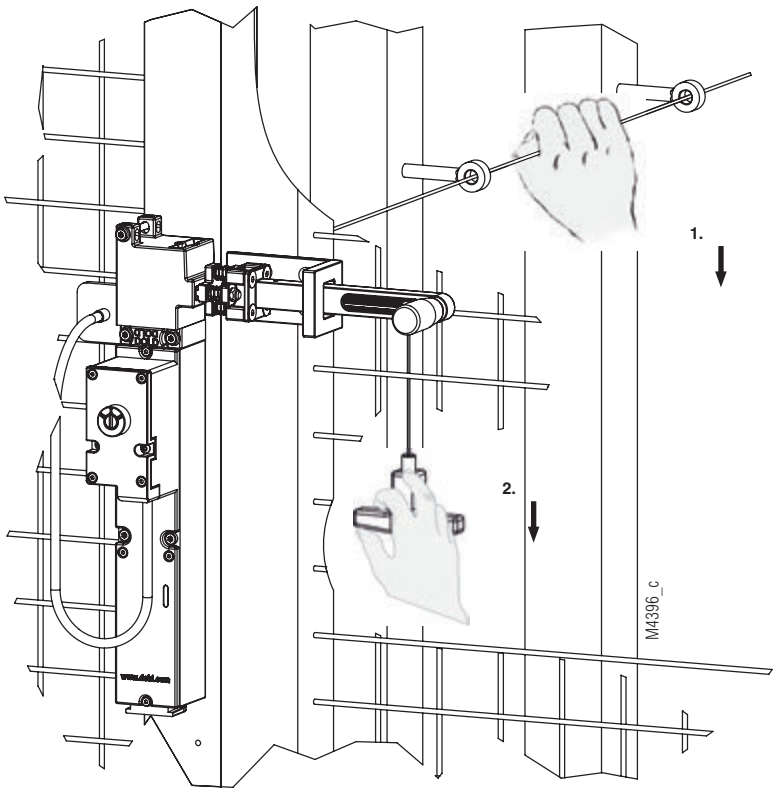


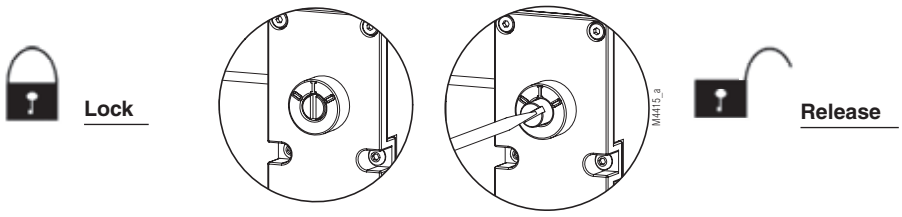
Before returning to normal operation, the protective function must have been reactivated.

4. 5. Solenoid locking module with escape release

Example: ZRFA

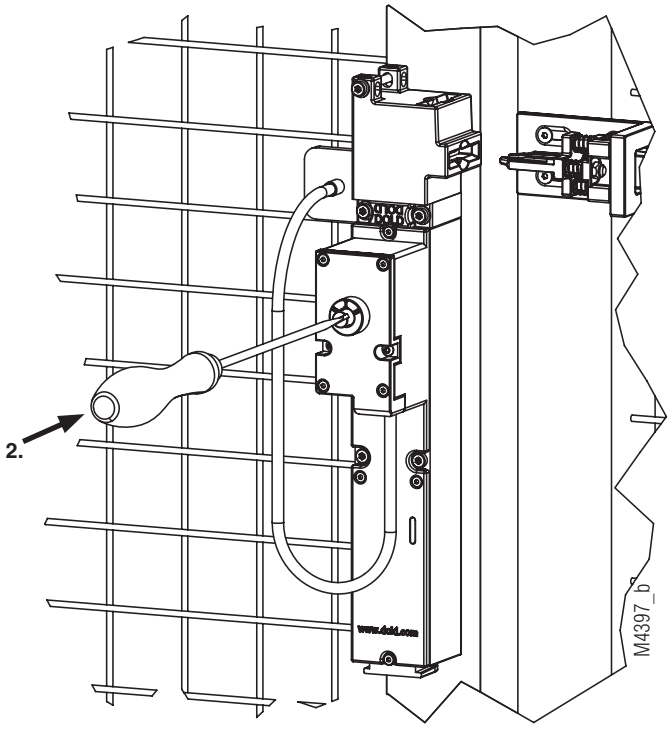
Activation





Reset

1. The STS-ZRFA has to be reseted before it is ready for use.



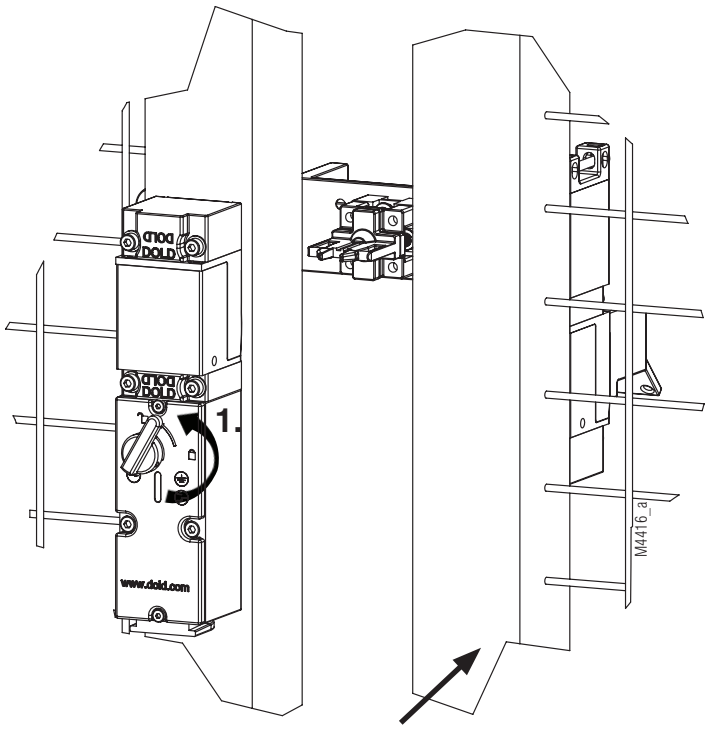
3. Active postion is reached automatically.
If not please check the rope and rope tension, see page 10; C: Tensioning of steel rope.

4.6 F-Kit

Example: STS-F-Kit

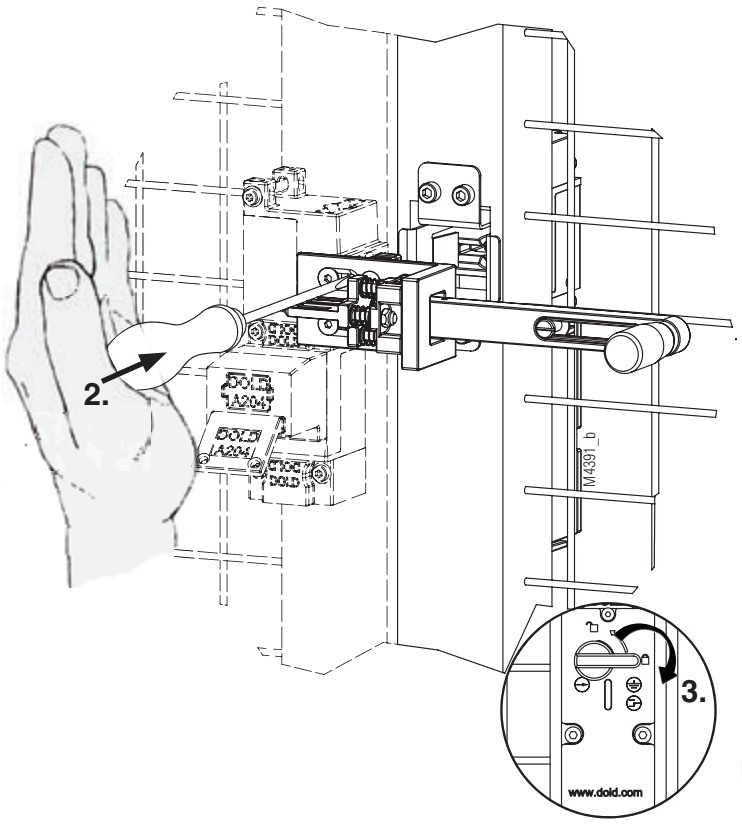
Activation

1. To reset the system, the actuator has to be removed according to the procedure.
See also page 10; D: Fixing the actuator.



2. Door can be opened and allows escape.

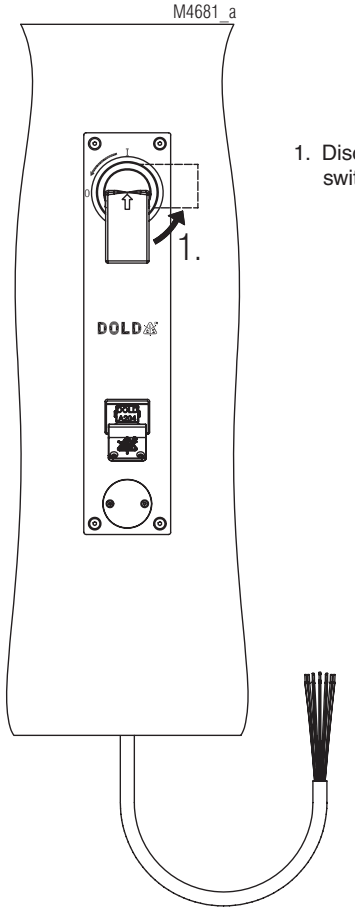
Reset



Handle should reach active position automatically

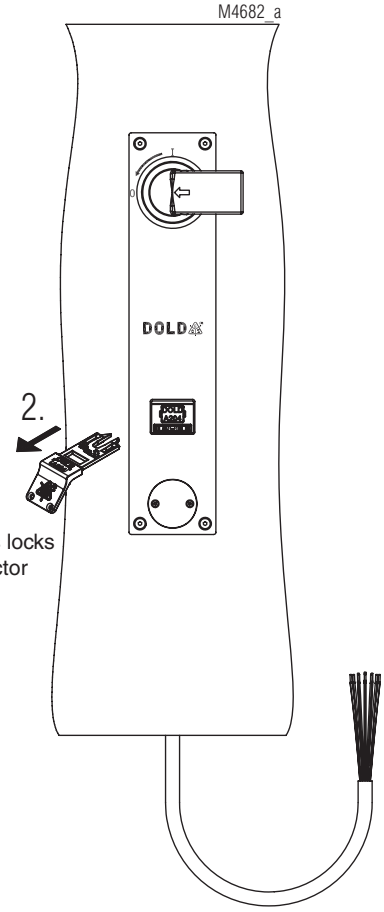
Switching off (all models)

M4681_a



1. Disconnect energy via switch disconnector

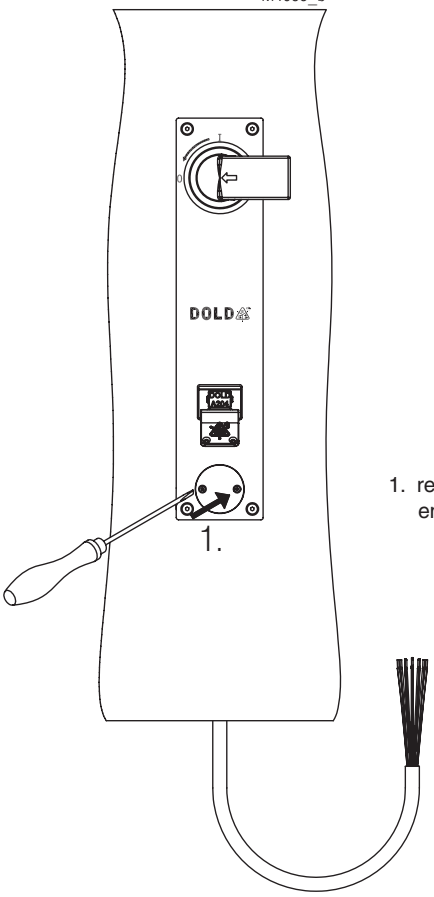
M4682_a



2. Remove key, this locks switch disconnector in off position

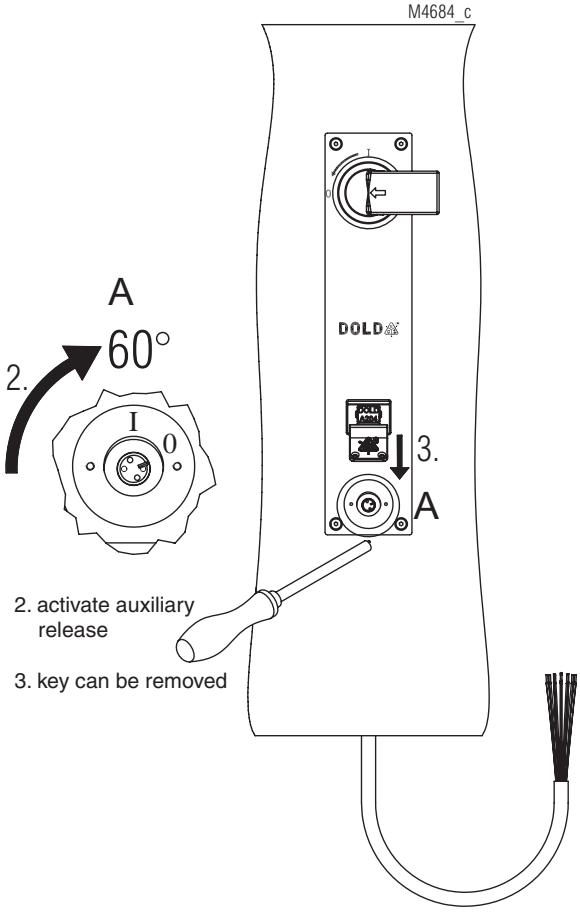
Auxiliary release (variants with electromechanical locking function)

M4683_b



1. remove cover when energy is disconnected

M4684_c

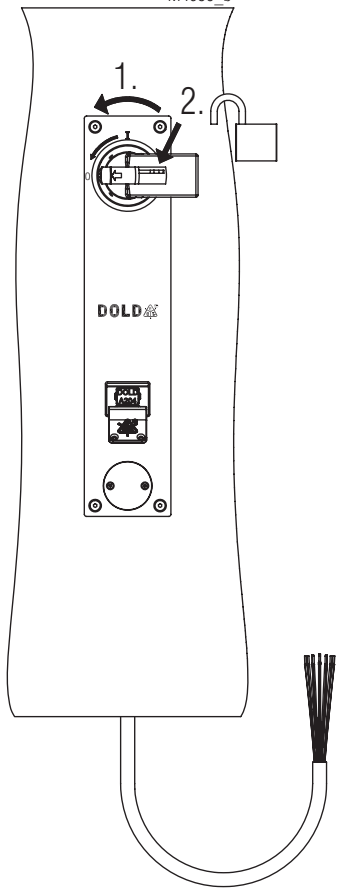


2. activate auxiliary release

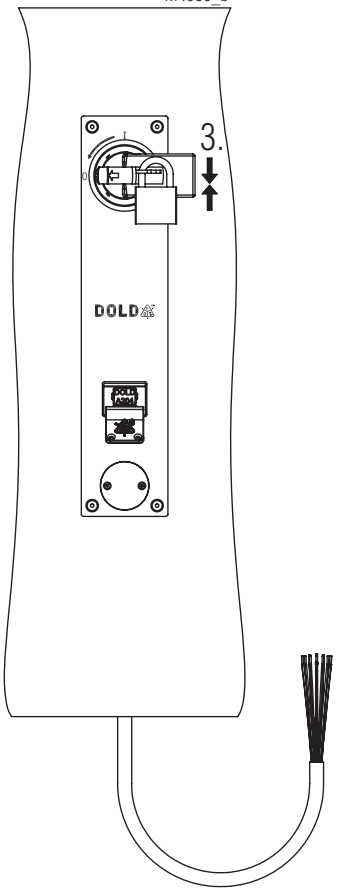
3. key can be removed

LOTO facility (all variants)

M4685_b



M4686_b



5. Cleaning

SAFEMASTER STS-units work best in clean condition. Contamination can be normally removed by compressed air or water. When using cleaning agents they have to be rinsed off afterwards, especially if aggressive chemicals like phosphoric acid are used. If this is not observed, units may be damaged.
Dogged fouling may be removed with brake cleaner. Please observe the notices by the manufacturer.
In case of coarse fouling e.g. partially hardened concrete, mechanical devices may be cleaned with a high-pressure steam cleaner

- The key and module label plates should not be damaged.
- The high pressure of the water may damage the seals of electrical devices. When using a steam cleaner extra care is required.

After such type of cleaning it may be necessary to grease the device. Aditional information may be found in the Table to select the right lubricant.

6. Lubrication

In most applications, due to the construction and the selected materials, SAFEMASTER STS does not require lubrication. Still, there are special cases in which additional lubrication would be wise. In those cases it is necessary to select the right lubricant for the application.

Table to select the right lubricant

Type of pollution	Example	Clinging dirt	Recommendation for lubricant	Remark
Dry dust	cement, flying ashes, stone, lime	no	Graphite powder; slide coating on graphite or PTFE base	**Do not use grease!**
Mud	concret, flying ashes, water with lime content	yes	Gear spray with MOS2 and graphite, Molycote spray, surface active oil	
Humid dust	Wood dust, chips	yes	Slide coating on graphite, MOS2, or PTFE base, in some cases surface active oil	**Do not use grease!**
Clinging dust	Asphalt	yes	surface active oil	**Do not use graphite!**
Acids and bases	Additives in detergents e.g. acids or brine	no, caustic	Greasing oil or grease spray	
Surface rust	Rust dust	no	Flow grease on EP base, corrosion protective spray with additive	**Use with rust film**
Icing	Sleet	yes	Silicone spray, penetrating oil	**Mount cover**

Notes

A simple way to apply the lubricant is by using spray cans. They allow to lubricate the relevant parts oft he mechanic modules through the actuator slots. Using high visconse gease or oil may cause dirt to adhere, whitch may influence the operation.

In any case we recommend performing your own test to find the most efficient lubricant for your application. Please take also into account the viscosity of the lubricant and the influence of the operating temperature. To high viscosity could result in malfunction.

Of course we are willing to assist you selecting. Please do not hesitate to adress us with your questions!

7. Test

SAFEMASTER STS-systems have to be tested regularly. This test must include the following elements:

1. Visual inspection of the units regarding cleanness: removing of all contaminations
2. Visual inspection of the fixtures: Possibly tighten the screws
3. Visual inspection regarding damage and wear: Function test
4. Function test according to the key exchange plan: Also try to insert at least 1 key into a wrong key module. This must not be possible!

In the case of faulty functions the machine has to be stopped/ secured. Remove system blockings or get it repaired.

If the operators are acquainted to the system and know the installation and operating manual, every actuation of the system can be regarded as test. The yearly test (PL a to d) or monthly test (PL e) as described in the data sheets have to be performed in any case.

7.1 System blocking as safety function

SAFEMASTER STS-units have a failure diagnostic safety function. This makes the units to go into blocked state when failures are detected and they cannot be operated after that. This function can be reseted when the fault is removed and the units are not damaged (reset function).

Procedure in case of system blocking

In the case of a system blocking we recommend the following procedure:

1. Make sure that all inserted keys, padlock modules and actuators are in the correct position and inserted correctly. (See module status page 3)
2. Start the reset procedure. Try to insert manually the blocked keys or actuators individually. Do not operate several keys or actuators at the same time; it can prevent reset function. If after the 5th try the unit is not reseted, it has a fault.
3. Try to localize the reason for the failure, e.g. bent parts, contamination, objects in the unit. If it was possible to remove the fault, repeat the reset procedure. Under certain circumstances greasing may help.

If after a few tries the SAFEMASTER STS-unit does not reset, there is an irremovable fault and the unit has to be repaired.

8. Repairs

Nearly all faults can be temporarily remediated by a replacement kit or by replacing actuator modules. Faulty units can also be sent to DOLD for repair. To accelerate the repair procedures please attach always a copy of the key exchange plan, or indicate the DOLD SAFEMASTER-STS Project number.

Do not in any case disassemble a module, as every returned module is examined by us. Also it will lose warranty, if within warranty period. In case of unprofessional assembly, the safe function of the unit can not be guaranted due to faulty assembly.

Frequently asked questions – FAQs

An electrical module cannot be joined with a mechanical module. The bayonet ring cannot be turned as described in the manual. What can be done?
When not mounted to mechanical modules, the electrical modules of SAFEMASTER STS return to a safe switched off state and will not mount to mechanical units unless actuated by hand. If a solenoid locking switch is used with closed circuit operation the locking solenoid must be pushed as described in the example for ZR_-modules.
Any objects between the modules must be removed!

Mechanical modules cannot be joined. The bayonet ring cannot be turned as described in the manual. What can be done?
Both modules must be in the correct safe state, i. e. with a key module “10” the key must be inserted, with a key module “01” the key must be extracted. You will find more information about the mounting rules on the Table Assembly / modifying - safety mounting state of the modules on page 3, 5 or 6.

How do I read the type numbers?
Please refer to the corresponding product key - table in the design guide

How can I make sure that the system works correctly?
Check the system by using the key transfer plan to detect possible false positioning or incorrect mounting of units.

One unit is blocked, why?
All SAFEMASTER STS units are able to detect internal faults. If a fault is detected the units go into a safe state which blocks the system. If the fault can be removed when the unit is in the safe state, e. g. by adjusting the mountings on a distorted surface to reduce tension. The units can then be reset by inserting and removing the key or actuator several times. (see sect. 7.1 page 26).

Key cannot be extracted or pushed in
Please check the label of the key and the key module, they must correspond. Also make sure, using the key exchange plan, that the key can be operated in the intended way. If the key cannot be extracted or pushed while operating it correctly, please make sure the key or actuator below or above is inserted fully. (see sect. 4.1).

Our experience. Your safety.

SAFEMASTER - The right solution for every application.

Innovative Safety Concepts

DOLD offers an integrated safety concept for complete solutions under one roof, which have already been successfully implemented worldwide for many decades.
From monofunctional safety control gear for simple safety applications to multifunctional, modular safety systems, DOLD develops tailor-made solutions for protecting people and plant.

We would be more than happy to tell you about our additional safety solutions.

SAFEMASTER C

The multifunctional UG 6970 safety module from the SAFEMASTER C family by DOLD monitors two independent safety functions. You can make any desired choice from the following basic functions: emergency stop, safety gate, two-hand controls, safety mat/safety edge, antivalent switch and light barrier.

SAFEMASTER S

The SAFEMASTER S series speed sensing device ensures increased productivity and safety for your service personnel thanks to a combination of safe speed and stand-still monitoring.

SAFEMASTER PRO

The modular and programable safety system SAFEMASTER PRO monitors all safety circuits in your machine and systems – easy, flexible and safe. The amount of input and outputs on the central control unit can be expanded at any time using extension modules.

SAFEMASTER W

SAFEMASTER W, the wireless companion for your safety. You can use it to shut down dangerous movements within a fraction of a second. The wireless safety system consists of a radio controlled safety switch, a handheld transmitter and an optional infrared receiver.

DOLD

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