SAFEMASTER STS
Safety Switch- and key interlock system locking module ZRN, ZRF and ZAN, ZAF

Translation of the original instructions

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Content

Before installing, operating or maintaining this device, these instructions must be carefully read and understood.

The installation must only be done by a qualified electrican!

The installation must only be done by a qualified mechanic!

Do not dispose of household garbage!
The device must be disposed of in compliance with nationally applicable rules and requirements.

Storage for future reference.

To help you understand and find specific text passages and notes in the operating instructions, we have important information and information marked with symbols.

Symbol and Notes Statement

DANGER:
Indicates that death or severe personal injury will result if proper precautions are not taken.

WARNING:
Indicates that death or severe personal injury can result if proper precautions are not taken.

CAUTION:
Indicates that a minor personal injury can result if proper precautions are not taken.

INFO:
Referred information to help you make best use of the product.

ATTENTION:
Warns against actions that can cause damage or malfunction of the device, the device environment or the hardware / software result.

General Notes

The product hereby described was developed to perform safety functions as a part of a whole installation or machine. A complete safety system normally includes sensors (SAFEMASTER STS System), evaluation units, signals and logical modules for safe disconnections. The manufacturer of the installation or machine is responsible for ensuring proper functioning of the whole system. DOLD cannot guarantee all the specifications of an installation or machine that was not designed by DOLD. The total concept of the control system into which the device is integrated must be validated by the user. DOLD also takes over no liability for recommendations which are given or implied in the following description. The following description implies no modification of the general DOLD terms of delivery, warranty or liability claims.

Notes

Risk!
Danger to life or risk of serious injuries.

- Hazards must be ruled out before a key can be entered and the movable part of the guard can then be opened!

INFO

- For information regarding use in the system and validation according to EN ISO 13849-2, see SAFEMASTER STS application guide.
- Take advantage of the advice of the **E. DOLD & SÖHNE KG** specialists regarding the choice of units and combination of a system.

ATTENTION !

- To avoid wrong usage (e.g. by overload, mounting position or usage in acid, alkaline or other hostile ambient conditions) the limitations of the product have to be observed. Please check in advance if your application requires the usage of the more robust stainless steel model of SAFEMASTER STS. The requirements of the mounting and operating instruction must be fulfilled.

SAFEMASTER STS
Safety switch- and key interlock system
Locking module ZRN, ZRF and ZAN, ZAF

0278792

Locking module ZRN, ZAN
with emergency unlocking

Locking module ZRF, ZAF
with escape unlocking

STS-System Benefits
- EU-Test certificate according to the directive 2006/42/EG, annex IX
- For safety applications up to PLe/Cat. 4 according to DIN EN/ISO 13849-1
- Modular and expandable system
- Rugged stainless steel design
- Wireless mechanical safeguarding
- Combines the benefits of safety switch, locking module and key transfer in a single system
- Easy installation through comprehensive accessories
- Protection against lock-in
- Coding level low, medium, high according to DIN EN ISO 14119:2014-03

Features
- Locking module for monitoring doors and entries
- Optionally with emergency or escape unlocking
- De-energized on trip (ZRN) or energized on trip (ZAN)
- Status indication by integrated LEDs
- Separate monitoring of actuator / key position and locking module position
- Escape unlocking including 10 m pull cable, shroud tensioner, chain and spring

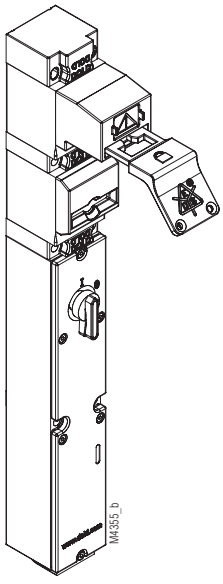
Product Description

Locking modules ZRN, ZAN, ZRF und ZAF are assembled with other modules to an STS unit. They serve as a solenoid lock of separating guards on machines with cycle or overrun times or other hazards, which may still be present even after the access query. It must therefore be ensured that there is no hazard remaining when removing the actuator or key and access can be unlocked.

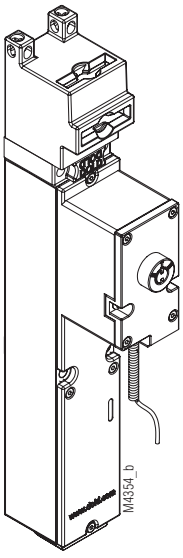
Approvals and Markings

CE · TÜVRheinland CERTIFIED · Functional Safety Type Approved · www.tuv.com ID 0600000000 · TÜVRheinland C US

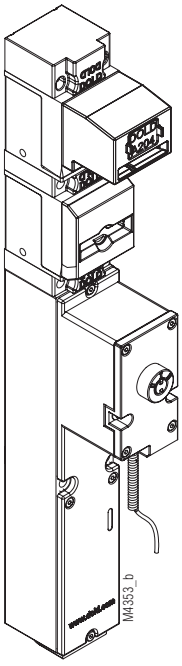
Installation Examples



ZRNDVM



ZRFA



ZRFB01M

Design and Function

Extremely rugged and flexible solenoid lock monitoring the safe position of an access in the system. For this purpose the modules are used in combination with other mechanical modules, for instance, actuator, key and/or padlock modules.

Access can only be released after the safety of the equipment has been ensured for the operating personnel.

With ZRN and ZRF an access can only be opened when a signal is applied to the magnet. In addition, both modules offer protection against lock-in. In emergency situations a door can be opened through manual operation of the emergency release (ZRN) or escape release (ZRF) without a signal being applied to the magnet.

ATTENTION!

Locking modules ZRF and ZAF may not be used without actuator module only to release keys in a key interlock system.

Only the actuator modules A, B and D may be installed above a locking module ZRF and ZAF. Actuator modules K and E as well as key or padlock modules may never be installed since they would prevent the function of the escape release.

However, key modules 01, 01S as well as padlock module V can be installed above an actuator module B or D.

With the Locking modules ZAN and ZAF an entry can be opened when no signal is applied to the magnet. In addition, this module offers possible protection against lock-in. A door can be released in emergency situations by manually operating the emergency or escape release.

ATTENTION!

The modules ZAN and ZAF may be used only in connection with the mechanical modules e.g. key modules 01, 01S, padlock modul V or an actuator module A, B, D. Combination with other mechanical STS modules is not permitted and may cause the unit to be blocked.

Indication

LED red:	Magnet energized
LED yellow/green:	Separately controllable

Circuit Diagrams (Example ZRFA, ZRNA)

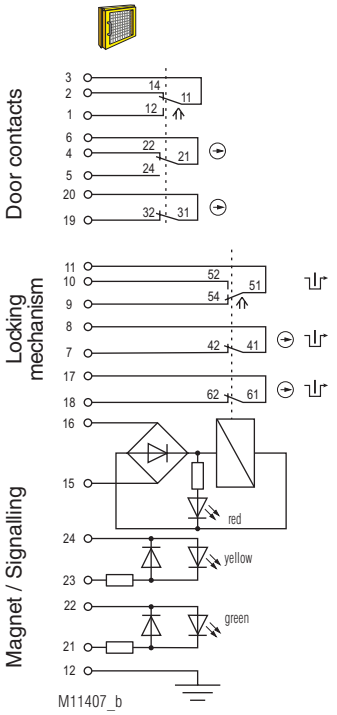


Fig. 1:
Locking module activated:
Magnet locked,
Actuator inserted,
Door closed

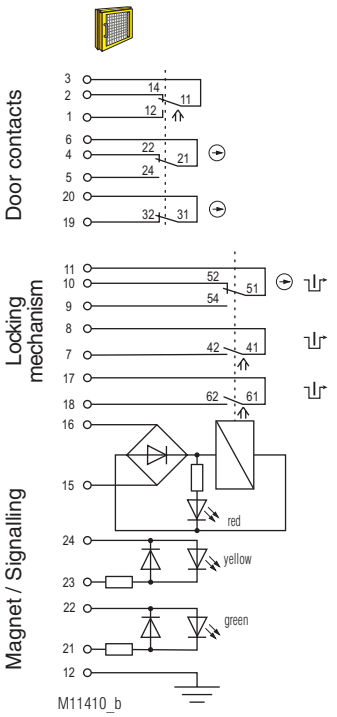


Fig. 2:
Locking module deactivated:
Magnet released,
Actuator inserted,
Door closed

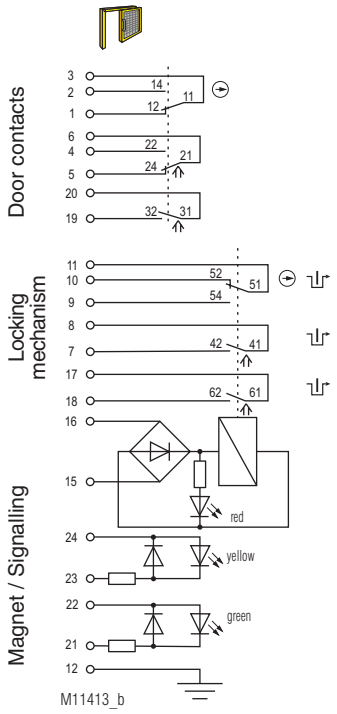


Fig. 3:
Locking module deactivated:
Magnet released,
Actuator removed,
Door open

Mechanical switch positions					
Circuit diagram			Fig. 1	Fig. 2	Fig. 3
Door contacts	3	2	■	■	
	3	1			■
	6	4	■	■	
	6	5			■
	19	20	■	■	
Locking mechanism	11	9	■		
	11	10		■	■
	7	8	■		
	17	18	■		
Magnet Signalling	De-energized on trip				
	15	16			
	Open circuit operation				
	15	16			

■ closed

□ open

The state shown in **Figure 3** does not depend on the control signal of the magnet. If the control signal is applied and the key removed the lock changes to the state of **Figure 2**.
If no signal is applied and the key is removed the lock changes to the state of **Figure 1.**

Technical Data

Mechanical Data

Mechanical principle:	Rotating axis with redundant actuation and mechanical interlock
Enclosure:	Stainless steel V4A / AISI 316L
Internal parts:	Stainless steel V4A / AISI 316 / AISI 630 (acc. to EN 10027-2; 1.4401; 1.4404; 1.4542; 1.4301; 1.4310)
Degree of protection:	IP 65
Locking force:	F_{zh} 4000 N
Locking module principle:	Failure locking-proof
Magnetic principle:	Standby current or load current
Operating speed	
min. / max.:	100 / 500 mm/s

Input

Nominal voltage U_N	
(Measured nominal voltage):	AC/DC 24 V
Nominal voltage range:	0,85 ... 1,1 U_N (see solenoid derating graph)
Power consumption:	5,5 W

Output

Contacts	
Door position:	1 NC contact, 2 antivalent changeover contacts
Locking mechanism:	2 NC contacts + 1 C/O contact
Switching element:	IEC EN 60947-5-1 Appendix K
Switching principle:	Change-over contact with forced opening spring contact
Contact material:	Ag / $AgSnO_2$
Max. switching frequency:	360/h
Max. operating current	
De-energized on trip:	2 A
Energized on trip:	1 A
Utilization category of switching elements	
to AC 15:	1 A
to DC 13:	0,5 A
Electrical service life:	5 x 10^6 switching cycles
Short circuit strength, max. fusing:	2 A gG
Conditional rated short-circuit current:	
(rated conditional short circuit current):	1000 A
Mechanical life:	1 x 10^6 switching cycles

General Data

Operating mode	
Mechanical life:	100% ED
Temperature range	
Standby current principle:	- 25°C to + 60°C
Load current principle:	- 25°C to + 60°C
Storage**:**	- 40°C to + 80°C
Rated impulse voltage:	0,8 kV
Rated insulation voltage:	≤ 50 V
Overvoltage category:	III
Pollution degree:	2
Connection method:	Cage tension spring clamping
Cross-section	
min. / max.:	0,25 / 0,75 mm² (with ferrules and sleeve according to DIN 46228-4)
Cable entry with thread:	1 x M20x1,5
Intended use:	Up to max. cat. 4, PL e according to EN ISO 13849-1
Mounting:	To DIN EN 50041
Test principles:	DIN EN ISO 13849-1:2008 DIN EN ISO 14119:2014-03 DIN EN 60947-5-1:2005 GS-ET-15:2011-02 GS-ET-19:2011-02 GS-ET-31:2010-02

Safety Related Data

Data suitable for the PFH_D summation method according to EN ISO13849-1:2016				
Data according to EN ISO13849-1:2016	Locking module ZRN, ZRF and ZAN, ZAF			
Category	2	3	3	4
PL	d	d	e	e
PFH_D	1,061E-09	6,84592E-09	5,4469E-09	1,00122E-10
T_{10D}	20	20	20	20
CCF required	65 ...100	85 ...100	85 ...100	85 ...100
B_{10d}	2.000.000	2.000.000	2.000.000	2.000.000
d_{op} (d/a)	365	365	365	365
h_{op} (h/d)	24	24	24	24
t_{cycle} (h)	1	1	1	1
n_{op}	8760	8760	8760	8760
Diagnostic coverage DC	60 %	60 %	90 %	99 %
Test interval according to ISO14119	1 / year	1 / year	1 / month	1 / month

Category 2: The prerequisites for installation and integration into a category 2 architecture must be met

Category 3: The prerequisites for installation and integration into a category 3 architecture must be met

Category 4: The prerequisites for installation and integration into a category 4 architecture must be met, in particular 2 actuators must be used

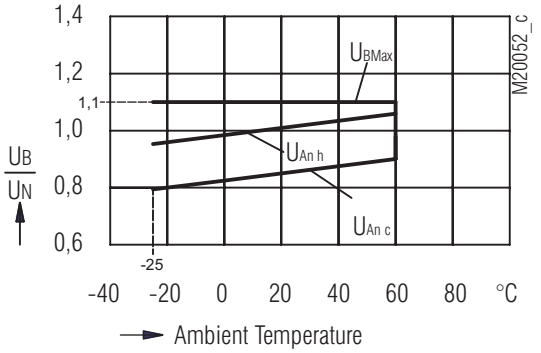
PFH_D: A single module has no function. As a result, an individual module cannot have any safety-related characteristic values. The safety-related characteristic data in the table only serve to determine the values of a unit into which it is integrated.

When used as part of a **key transfer system**:

- PFH_D total STS system = SUM PFH_{D1} + … PFH_{Dn}
- Lowest category of a module = category of whole STS/X system
- Lowest DC of a module = DC entire STS/X unit

If the design of a unit is changed, the safety-related data may also change.

Solenoid Derating Graph



U_{BMax} maximum power supply dependent upon temperature
$U_{An\ c}$ response voltage at coil temperature = ambient temperature
$U_{An\ h}$ response voltage at preceding agitation at 1.1 x Un

Function Selection / Versions

	Selectable functions			
Locking module	Standby current	Load current	Escape unlocking	Emergency release
STS-ZRN	X			X
STS-ZRF	X		X	
STS-ZAN		X		X
STS-ZAF		X	X	

Variants

Locking module ZAN
Locking module, energized on trip, emergency unlocking.
In emergency situations, for instance, in the event of confinement, the emergency release allows for the mechanical release of an access from outside the hazard area without the help of a tool.
With the actuation of the emergency release, the circuits on terminals 7 and 8; 9 and 11 as well as 17 and 18 will be cut off at the same time and contact between 10 and 11 will be closed. This opening of the circuits must generate an emergency-stop.

Locking module ZRN
Locking module, de-energized on trip, emergency release.
Emergency unlocking in the Locking module ZRN is equipped with a lever similar to the ZAN. After operating the lever the locking module magnet is pressed down mechanically and the locking module function of the STS unit is unlocked. Especially for machines with overrun time this means that with the emergency release activated the access is open while the machine or plant still represents hazards. When using a locking module with emergency release we recommend combining it with acoustic and also visual warning signals and to provide additional locking on the control level.
When using the ZRN module within a dangerous area, it can also be used as an emergency release.

Locking module ZRF
Locking module, de-energized on trip, escape release.
In emergency situations, for instance, in the event of confinement, the escape release allows for the mechanical unlocking of an access from inside the dangerous area without the help of a tool.
With the actuation of the escape release, the circuits on terminals 7 and 8; 9 and 11 as well as 17 and 18 will be cut off at the same time and contact between 10 and 11 will be closed. This opening of the circuits must generate an emergency-stop.

The unit based on the locking module tuator is fastened to the movable part of the door. Escape unlocking functions via a mechanism integrated in the locking module and connected to a stainless steel cable. If the tension of the stainless steel cable is increased or reduced the magnet of the locking module is pressed down. The locking module unlocks and generates an emergency-stop. Through the tensioning and the independent operating direction of the cable the ZRF constantly monitors its own function.

The advantage of this version is that locked in persons can activate the escape function even from a larger distance, e.g. injured persons no longer able to reach the escape door. The stainless steel cable can also be routed through a machine enclosure without having to create major openings.

The locking module is unlocked by activating the escape release and a trapped person can escape from the hazard area. Especially for machines with overrun time this means that with the escape release activated the access is open while the machine or plant still represents hazards.
This is also important in regard to self-monitoring of the locking module ZRF. Since the stainless steel cable is constantly under tension when installed correctly, a cable break or detachment of the mounting elements can be detected and trigger the safety function (see installation instructions). When using a locking module with escape release we recommend combining it with acoustic and also visual warning signals and to provide additional locking on the control level.

Variants

The scope of delivery includes a stainless steel cable (10 m), shroud tensioner and a return spring in addition to the unit/module. Additional accessories such as eyelets, return pulleys or mounting material are separately available.

Attention! Only the actuator modules A, B and D may be installed above a locking module ZRF and ZAF. Possible key or padlock modules may be installed only above the actuator modules B or D.

Actuator modules K and E as well as key or padlock modules may never be installed directly above these locking modules since they would prevent the function of the escape release.

Important Notes

Function differences of locking modules with load current principle and locking modules with standby current principle.

Locking modules based on the standby current principle are in de-energized condition when in the locked position. This must be remembered especially when examining faults such as power failure or wire break.

Only when the safety evaluation shows, that a solenoid lock with closed circuit operation is not suitable or is not required, a solenoid lock with open circuit operation can be used.

Contrary to the locking modules based on the standby current principle locking modules based on the load current principle lock only when the circuit is closed. The locking modules unlock if the circuit opens with the load current principle.

Ordering Designation

Locking module ZRN
Article number: 0063841

Locking module ZRN cover
Article number: 0063868

Locking module ZRF
Article number: 0063272

Locking module ZRF cover
Article number: 0063273

Locking module ZAN
Article number: 0065621

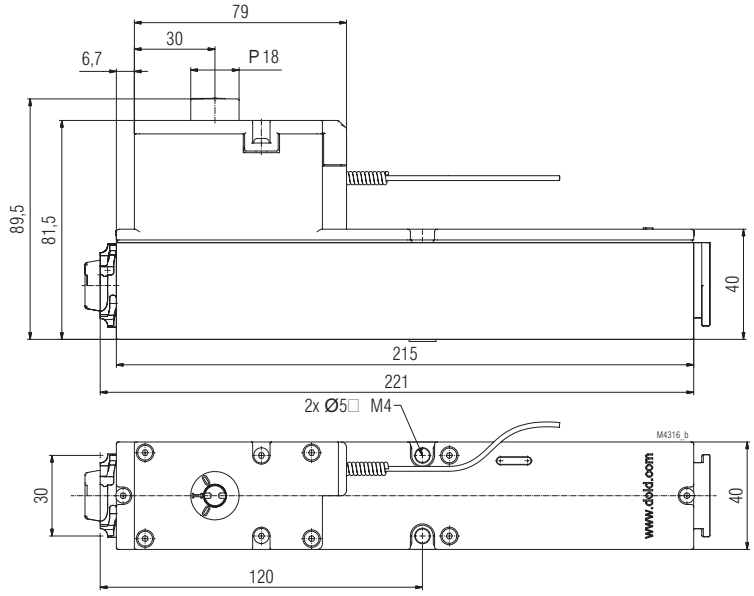
Locking module ZAF
Article number: 0065985

Accessories

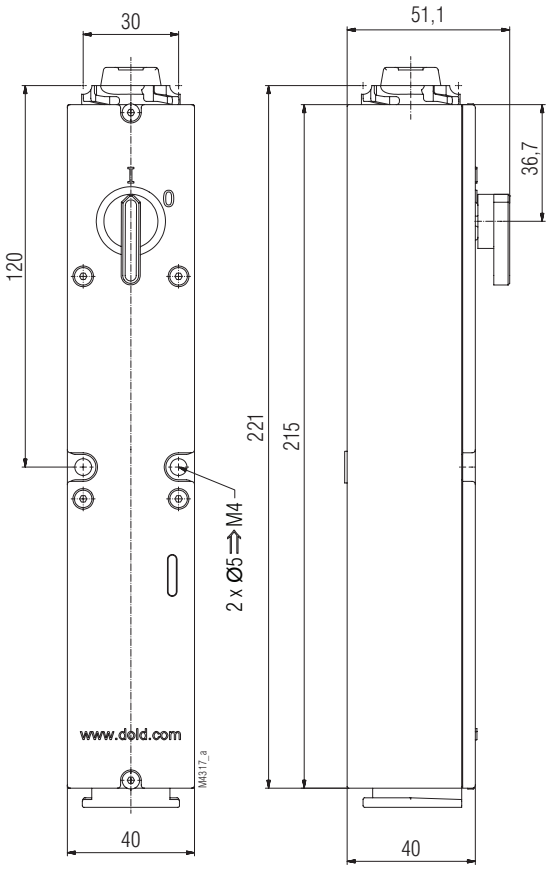
Eyebolt set
for locking module ZRF (4 pcs.): 0065198

Return pulley set
for locking module ZRF (2 pcs.): 0065199

Dimensional Drawings [mm]

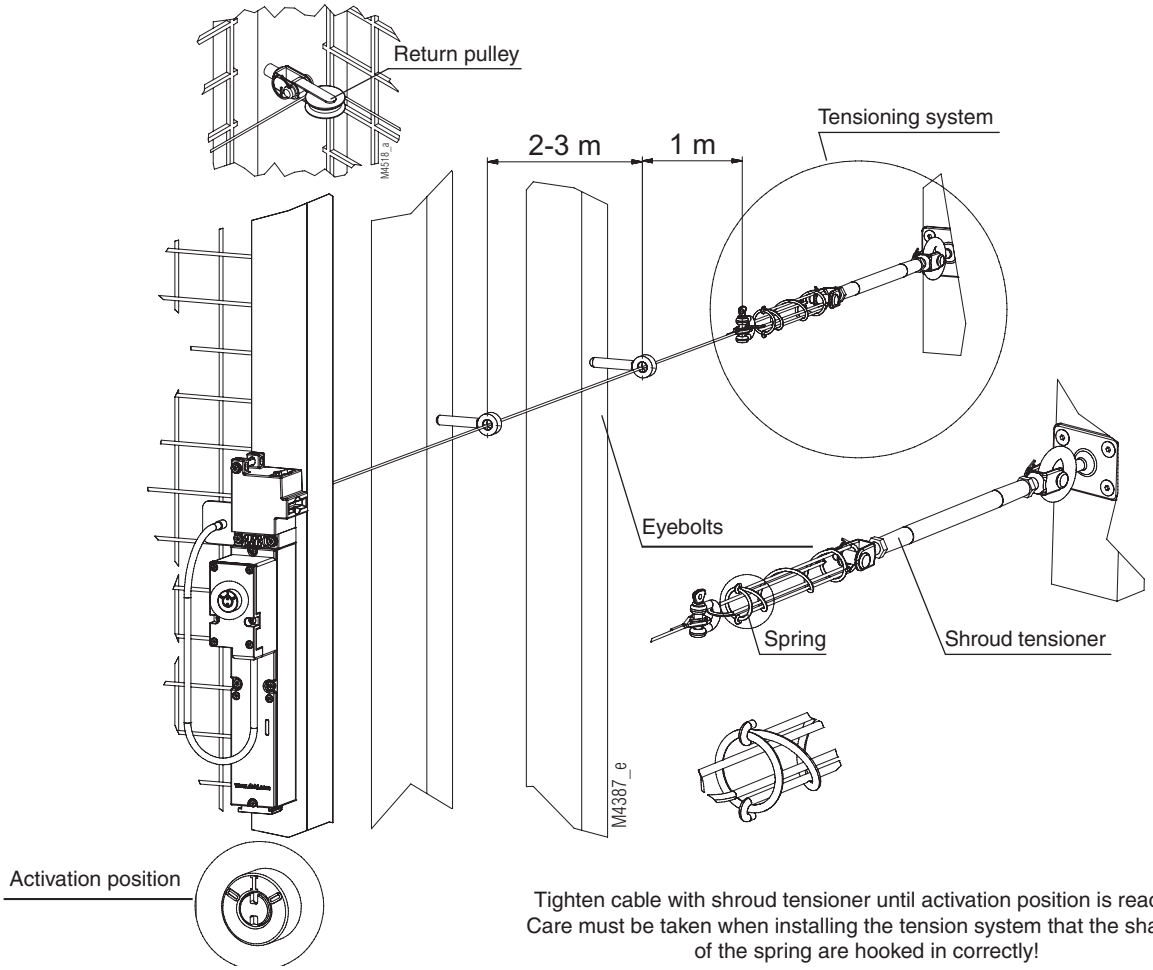


Locking module ZRF, ZAF with escape unlocking



Locking module ZRN, ZAN with emergency release

Application Examples



Tighten cable with shroud tensioner until activation position is reached.
Care must be taken when installing the tension system that the shackles of the spring are hooked in correctly!