NS series safety switches with solenoid and RFID technology

Description

These switches are used mainly on machines where the hazardous conditions persist even after the machine has been switched off. Mechanical parts such as pulleys, saw blades, etc., could continue to move after the machine is switched off or could still be hot or under pressure. Thus, the switches can also be used if individual guards are only to be opened under certain conditions. Versions with mode 1 (safety outputs active when guard closed and locked) are interlocks with guard locking acc. to ISO 14119; the product is labelled with the symbol shown.

Maximum safety with a single device

PL e + SIL 3

The NS series switches are constructed with redundant electronics. As a result, the maximum PL e and SIL 3 safety levels can still be achieved through the use of a single device on a guard. This avoids expensive wiring in the field and allows faster installation. Inside the control cabinet, the two electronic safety outputs must be connected to a safety module with OSSD inputs or to a safety PLC.

Series connection of several switches

PL e + SIL 3

One of the most important features of the NS series is the possibility of connecting up to 32 sensors in series, while still maintaining the maximum safety levels PL e 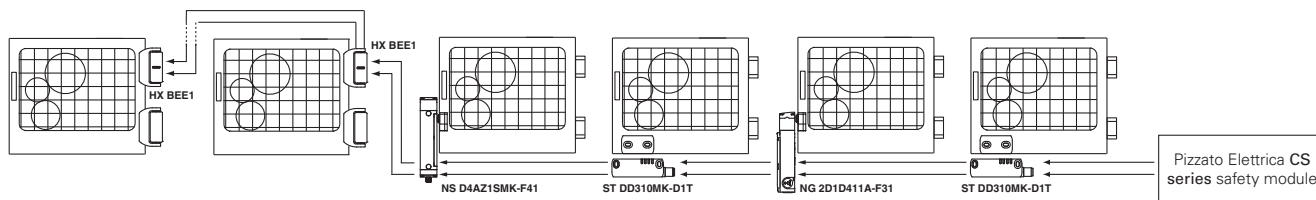laid down in EN 13849-1 and SIL 3 acc. to EN 62061. This connection type is permissible in safety systems which have a safety module at the end of the chain that monitors the outputs of the last NS switch.

The fact that the PL e safety level can be maintained even with 32 sensors connected in series demonstrates the extremely secure structure of each single device.

NS D4AZ1SMK-F41   NS D4AZ1SMK-F41   NS D4AZ1SMK-F41

Pizzato Elettrica **CS series** safety module
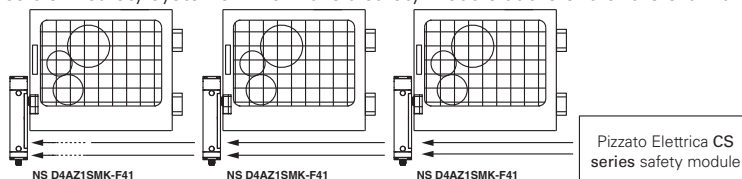
Series connection with other devices

PL e + SIL 3

The NS series features two safety inputs and two safety outputs, which can be connected in series with other Pizzato Elettrica safety devices. This option allows the creation of safety chains containing various devices. For example, stainless steel safety hinges (HX BEE1 series), RFID sensors (ST series) and door lock sensors (NG series) can be connected in series while still maintaining the maximum PL e and SIL 3 safety levels.

HX BEE1   HX BEE1

NS D4AZ1SMK-F41   ST DD310MK-D1T   NG 2D1D411A-F31   ST DD310MK-D1T

Pizzato Elettrica **CS series** safety module

## RFID actuators with high coding level

The NS series is provided with an electronic system based on RFID technology to detect the actuator. This allows to provide each actuator with different coding and makes it impossible to tamper with a device by using another actuator of the same series. Millions of different coding combinations are possible for the actuators. They are therefore classified as high level coded actuators, according to EN ISO 14119.

Holding force of the locked actuator
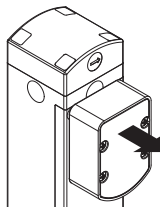
2100 N

The strong interlocking system guarantees a maximum actuator holding force of $F_{1max} = 2100$ N.

Dustproof
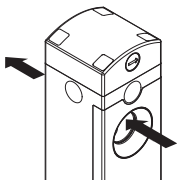
The switch is provided with a through hole for inserting the actuator. Thanks to this unique feature, any dust that enters the actuator hole can always come out on the opposite side instead of remaining inside. Moreover, the lock pin is provided with a diaphragm seal, making the system suitable for critical environments with a high level of dust.

Modularity

The innovative design of the auxiliary releases makes possible a wide range of combinations of auxiliary releases with lock, escape release buttons or screwdriver releases with front and rear mounting.

The electrical connection is also highly flexible: outputs are available with cables as well as with connectors, which can be oriented axially or laterally.

Head and release devices with variable orientation, not detachable
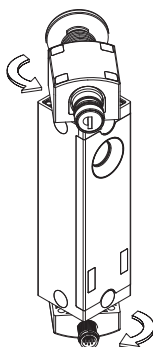
The upper part of the switch, which contains the release devices, can be rotated and is permanently connected to the lower part, which contains the outputs for the electrical connection. After loosening the fastening screws, the individual modules can be rotated in 90° steps. As a result, a single device can be used to realise various configurations without the installation technician needing to concern himself with the correct assembly of various parts.

The fastening screws are provided with protective caps to prevent dirt build-up and thereby simplify cleaning.

Centring
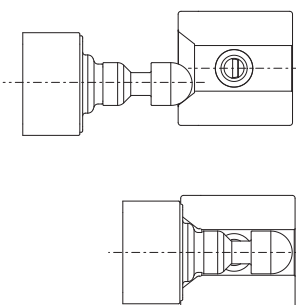
The switch is provided with a wide centring inlet for the actuator pin. This solution makes it easier to align the actuator and the opening hole on the head during installation. Moreover, this solution drastically reduces the probability of a collision between the switch and the actuator, making it possible to install the device even on inaccurately closing doors.

Six LEDs for immediate diagnosis
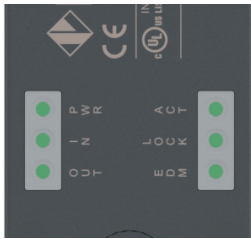
As the LEDs have been designed for quick immediate diagnosis, the status of each input and output is highlighted by one specific LED. This makes it possible to quickly identify the interruption points in the safety chain, which device is released, which door is opened and any errors inside the device. All of this at a glance, without needing to decode complex flashing sequences.

Holding force of the unlocked actuator
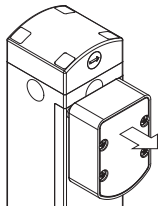
The inside of each switch features a device which holds the actuator in its closed position. Ideal for all those applications where several doors are unlocked simultaneously, but only one is actually opened. The device keeps all the unlocked doors in their position with a retaining force of 20 N~, stopping any vibrations or gusts of wind from opening them.

Function for protecting against recoil forces
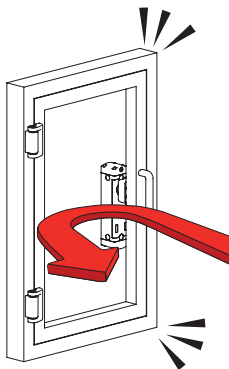
If a door is closed too quickly or with so much force that the recoil would cause it to open again, a special function in the NS switch prevents locking. This function prevents the immediate locking of the door if the lock signal is applied. This protects the switch against recoil forces that occur during instantaneous locking, thus avoiding possible damage to the device.

Key release device and escape release button
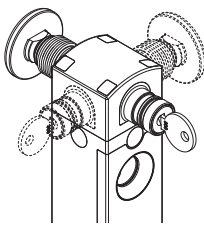
The key release device (auxiliary release) is used to permit unlocking of the actuator only by personnel in possession of the key. The device also functions with no power supply and, once actuated, prevents the guard from being locked.

The escape release button allows actuator release and immediate opening of the door. Generally used in machines within which an operator could inadvertently become trapped, it faces towards the machine interior, to allow the operator to exit even in the event of a power failure. The button has two stable states and can be freely extended in length with suitable extensions (see accessories).

Both devices can be positioned on the four sides of the switch. As a result, it can be installed both towards the interior and towards the exterior of the machine.

## Three safety output actuation modes

MODE 1
MODE 2
MODE 3

For the device, it is possible to choose among 3 different actuation modes of the safety outputs: safety outputs active with actuator inserted and locked (mode 1) for machines with inertia; safety outputs active with actuator inserted (mode 2) for machines without inertia; a first safety output active with actuator inserted and locked and a second safety output active with actuator inserted (mode 3) for special applications.

Protection against tampering
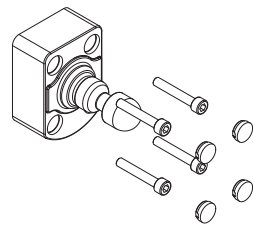
Each actuator of the NS series is supplied with four protective caps. Not only do the caps prevent dirt from accumulating and simplify cleaning, they also block access to the fastening screws of the actuator. As a result, standard screws can be used instead of tamper-proof screws.

## Actuator with flexible bolt for inaccurately closing doors
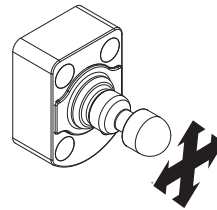
All NS series actuators are articulated, thereby allowing the actuator pin to be safely guided into the switch through the centring hole. As a result, the actuator and switch do not need to be precisely aligned during installation. In addition, the device can thereby be used on doors with a minimum actuation radius of 150 mm without the actuation pin needing to be angled.

Front and side mounting

Integrated in the housing of the NS series is a hole for inserting the actuator pin. Fixing holes are also provided in the robust body for front and side mounting.

This makes it easier to mount the switch during lateral installation: the switch is directly mounted without needing to rotate the module that
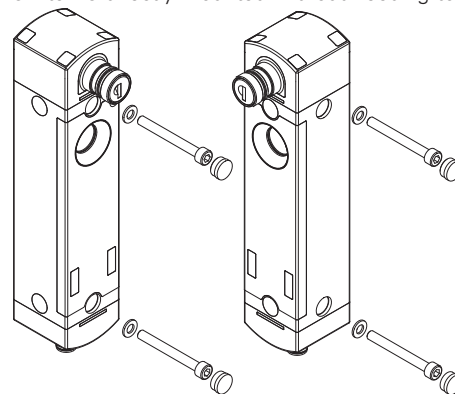
contains the hole for inserting the actuator pin. The fixing holes can be sealed with the protective caps provided for this purpose. Dirt deposits and tampering attempts are thereby prevented.

High protection degree

IP69K
IP67

These devices are designed to be used in the toughest environmental conditions and they pass the IP67 immersion test acc. to EN 60529. They can therefore be used in all environments where maximum protection degree of the housing is required. Due to their special design, these devices are suitable for use in equipment subjected to cleaning with high pressure hot water jets. These devices meet the IP69K test requirements according to ISO 20653 (water jets with 100 bar and 80°C).

External device monitoring
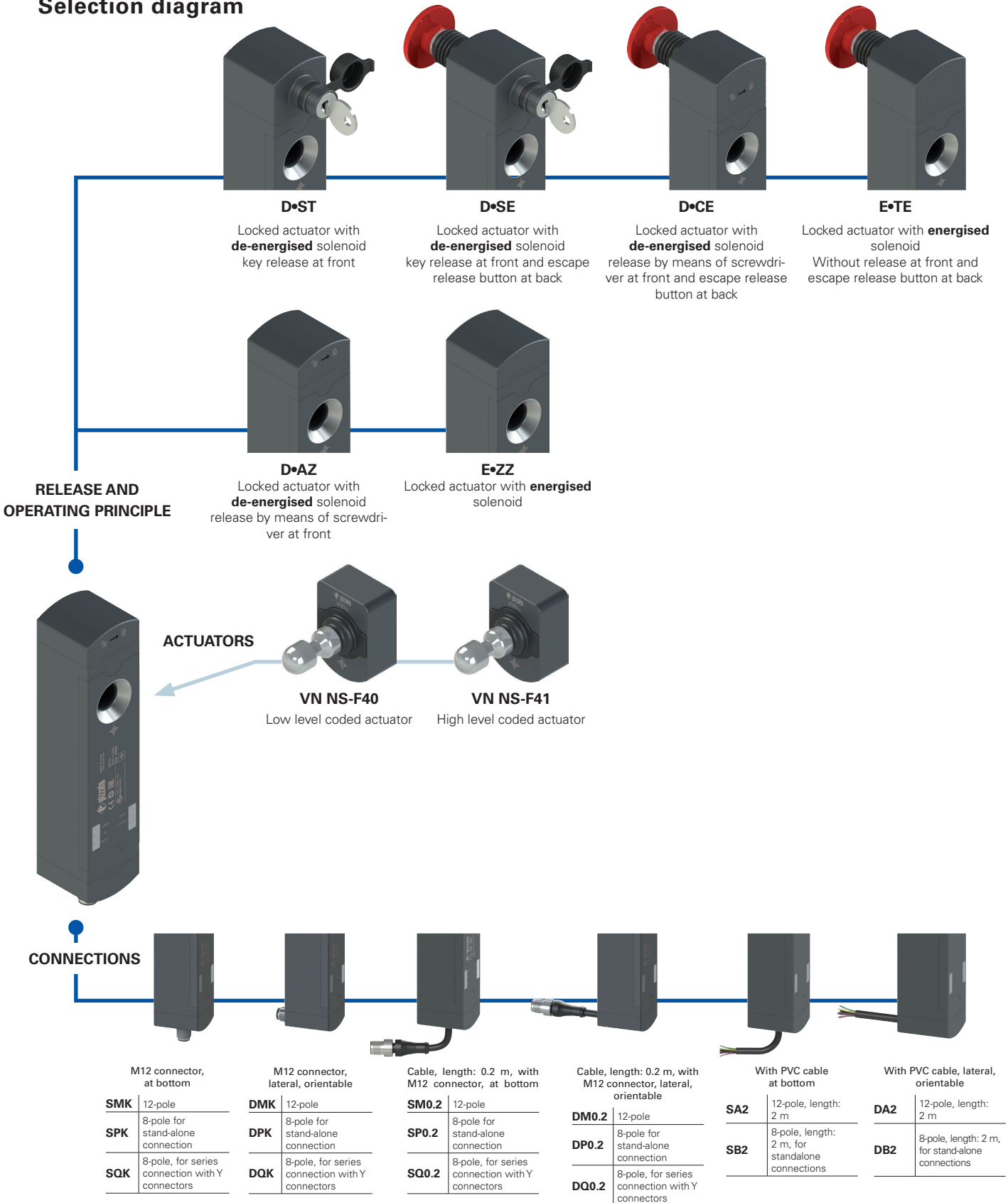
EDM

On request, the switch can be supplied with EDM function (External Device Monitoring). In this case, the switch itself checks the proper function of the devices connected to the safety outputs. These devices (usually relays or safety contactors) must send a feedback signal to the EDM input, which checks that the received signal is consistent with the state of the safety outputs.

Selection diagram

D•ST
Locked actuator with **de-energised** solenoid key release at front

D•SE
Locked actuator with **de-energised** solenoid key release at front and escape release button at back

D•CE
Locked actuator with **de-energised** solenoid release by means of screwdriver at front and escape release button at back

E•TE
Locked actuator with **energised** solenoid
Without release at front and escape release button at back

RELEASE AND OPERATING PRINCIPLE

D•AZ
Locked actuator with **de-energised** solenoid release by means of screwdriver at front

E•ZZ
Locked actuator with **energised** solenoid

ACTUATORS

VN NS-F40
Low level coded actuator

VN NS-F41
High level coded actuator

CONNECTIONS

M12 connector, at bottom

SMK	12-pole
SPK	8-pole for stand-alone connection
SQK	8-pole, for series connection with Y connectors

M12 connector, lateral, orientable

DMK	12-pole
DPK	8-pole for stand-alone connection
DQK	8-pole, for series connection with Y connectors

Cable, length: 0.2 m, with M12 connector, at bottom

SM0.2	12-pole
SP0.2	8-pole for stand-alone connection
SQ0.2	8-pole, for series connection with Y connectors

Cable, length: 0.2 m, with M12 connector, lateral, orientable

DM0.2	12-pole
DP0.2	8-pole for stand-alone connection
DQ0.2	8-pole, for series connection with Y connectors

With PVC cable at bottom

SA2	12-pole, length: 2 m
SB2	8-pole, length: 2 m, for standalone connections

With PVC cable, lateral, orientable

DA2	12-pole, length: 2 m
DB2	8-pole, length: 2 m, for stand-alone connections

——• product options

⟶ Sold separately as accessory

Code structure

Attention! The feasibility of a code number does not mean the effective availability of a product. Please contact our sales office.

article | options

NS D4AZ1SMK-F41E36LP30

Operating principle

D	locked actuator with de-energised solenoid. mode 1: OS safety outputs active with inserted and locked actuator
E	locked actuator with energised solenoid. mode 1: OS safety outputs active with inserted and locked actuator
G	locked actuator with de-energised solenoid. mode 2: OS safety outputs active with inserted actuator
H	locked actuator with energised solenoid. mode 2: OS safety outputs active with inserted actuator
L	locked actuator with de-energised solenoid. mode 3: first safety output active with inserted and locked actuator, second safety output active with inserted actuator
M	locked actuator with energised solenoid. mode 3: first safety output active with inserted and locked actuator, second safety output active with inserted actuator

Inputs and outputs

3	2 safety inputs IS1, IS2 2 safety outputs OS1, OS2 1 signalling output O3: actuator inserted 1 signalling output O4: actuator locked 2 solenoid activation inputs IE1, IE2 1 reset input I3 Note: Supplied only together with actuator
4	2 safety inputs IS1, IS2 2 safety outputs OS1, OS2 1 signalling output O3: actuator inserted 1 signalling output O4: actuator locked 2 solenoid activation inputs IE1, IE2 1 programming / reset input I3
5	2 safety inputs IS1, IS2 2 safety outputs OS1, OS2 1 signalling output O3: actuator inserted 1 signalling output O4: actuator locked 2 solenoid activation inputs IE1, IE2 1 programming / reset input I3 1 feedback input EDM I5 Note: Not available with mode 3

Auxiliary release at front and back

AZ	release by means of screwdriver at front only available for operating principle D, G and L
ST	key release at front only available for operating principle D, G and L
SE	key release at front and escape release button at back only available for operating principle D, G and L
CE	release by means of screwdriver at front and escape release button at back only available for operating principle D, G and L
ZZ	without release only available for operating principle E, H and M
TE	Without release at front and escape release button at back only available for operating principle E, H and M

Release button length

	for max. 15 mm wall thickness (standard)
LP30	for max. 30 mm wall thickness
LP40	for max. 40 mm wall thickness
LP50	for max. 50 mm wall thickness

Actuator extraction force

	actuator extraction force 20 N (standard)
E36	actuator freely removable
E37	actuator extraction force 40 N

Actuator

F40	low level coded actuator VN NS-F40 the switch recognises any type F40 actuator
F41	high level coded actuator VN NS-F41 the switch recognises one single type F41 actuator

Connection type

K	integrated M12 connector (standard)
0.2	cable, length: 0.2 m, with M12 connector
2	cable, length: 2 m (standard)
...	....
10	cable, length: 10 m

Cable or connector type

A	PVC cable 12x0.14 mm² (standard)
B	PVC cable 8x0.34 mm² for stand-alone connection Note: without inputs IS1, IS2, I5 and without output O4
E	PUR cable, halogen-free, 8x0.34 mm² for stand-alone connection Note: without inputs IS1, IS2, I5 and without output O4
M	M12 connector, 12-pole (standard)
P	M12 connector, 8-pole, for stand-alone connections Note: without inputs IS1, IS2, I5 and without output O4
Q	M12 connector, 8-pole, for series connection with Y connectors Note: without inputs IE2, I3, I5 and without output O3

Output direction, connections

D	cable or connector, lateral
S	cable or connector, at bottom

Code structure for actuator

VN NS-F40

Actuator

F40	low level coded actuator the switch recognises any type F40 actuator
F41	high level coded actuator the switch recognises one single type F41 actuator

Main features

- Actuation without contact, using RFID technology
- Digitally coded actuator
- SIL 3 and PL e also with series connection of up to 32 devices
- Max. actuator holding force: 2100 N
- SIL 3 and PL e with a single device
- Protection degrees IP67 and IP69K
- Versions with key release and escape release button
- 6 signalling LEDs

Quality marks:

CE 0123 c(UL)us TÜV SÜD EAC

EC type examination certificate: M6A171075157020
UL approval: E131787
TÜV SÜD approval: Z10 17 10 75157 019
EAC approval: RU C-IT.A 35. .00454

In compliance with standards:

EN ISO 14119, EN 60947-5-3, EN 60947-1, IEC 60204-1, EN 60204-1, EN ISO 12100, IEC 60529, EN 60529, EN 61000-6-2, EN 61000-6-3, BG-GS-ET-19, IEC 61508-1, IEC 61508-2, IEC 61508-3, IEC 61508-4, SN 29500, EN ISO 13849-1, EN ISO 13849-2, EN 62061, EN 61326-1, EN 61326-3-1, EN 61326-3-2, ETSI 301 489-1, ETSI 301 489-3, ETSI 300 330-2, UL 508, CSA 22.2 No.14

Compliance with the requirements of:

Machinery Directive 2006/42/EC, EMC Directive 2014/30/EC, RED Directive 2014/53/EU, RoHS directive 2011/65/EU, FCC Part 15.

Features approved by UL

Utilization categories: 24 Vdc, 0.25 A.
Inputs supplied by 24 Vdc remote class 2 source or limited voltage and limited energy
In compliance with standard: UL 508, CSA 22.2 No.14

Features approved by TÜV SÜD

Protection degree: IP67, IP69K
Ambient temperature: -20°C…+50°C
PL, category: PL e, cat. 4.
SIL: SIL 3 / SIL CL 3
In compliance with standards: EN ISO 14119:2013, EN 60947-5-3:2013, EN 61508-1:2010 (SIL 3), EN 61508-2:2010 (SIL 3), EN 61508-3:2010 (SIL 3), EN 61508-4:2010 (SIL 3), EN 62061:2005/A2:2015 (SIL CL 3), EN ISO 13849-1:2015 (Cat. 4, PL e).
Complies with machinery directive 2006/42/EC
Please contact our technical department for the list of approved products.

Technical data

Housing made of glass fibre reinforced technopolymer, self-extinguishing and shock-proof
Versions with integrated cable $12 \times 0.14 m^2$ or $8 \times 0.34 m^2$, standard length 2 m, other lengths from 0.5 … 10 m on request
Versions with integrated M12 stainless steel connector
Versions with 0.2 m cable and M12 connector, other lengths from 0.1 … 3 m on request
Protection degree: IP67 acc. to EN 60529
IP69K acc. to ISO 20653 (Protect the cables from direct high-pressure and high-temperature jets)

General data

SIL level (SIL CL): up to SIL 3 acc. to EN 62061
Performance Level (PL): up to PL e acc. to EN ISO 13849-1
Safety category: up to cat. 4 acc. to EN ISO 13849-1
Interlock, no contact, coded, with guard locking: type 4 acc. to EN ISO 14119
Level of coding acc. to EN ISO 14119: low with F40 actuator
High with F41 actuator

		SIL	PL	Cat.	PFH_D	$MTTF_D$
Mode 1 / 2	Interlock monitoring function (guard closed)	3	e	4	1.22E-09	1840
	Guard locking function (guard locked) Not available in mode 2	3	e	4	1.23E-09	2657
	Monitoring of the guard locking function	3	e	4	2.29E-10	2243
	System (general)	3	e	4	1.24E-09	1671
Mode 3	Interlock monitoring function (guard closed)	2	d	2	1.49E-09	3987
	Guard locking function (guard locked)	2	d	2	1.50E-09	2627
	Monitoring of the guard locking function	3	e	4	2.04E-10	2254
	System (general)	2	d	2	1.82E-09	1677

DC: High
Service life: 20 years
Ambient temperature: -20°C … +50°C
Max. actuation frequency with actuator lock and release: 600 operating cycles/hour
Mechanical endurance: 1 million operating cycles
Max. actuation speed: 0.5 m/s
Min. actuation speed: 1 mm/s
Maximum force before breakage F_{1max}: 2100 N acc. to EN ISO 14119
Max. holding force F_{Zh}: 1615 N acc. to EN ISO 14119
Maximum clearance of locked actuator: 4 mm
Released actuator extraction force: ~ 20 N

Power supply electrical data

Rated operating voltage U_e SELV: 24 Vdc ±10%
Operating current at U_e voltage: 40 mA min.; 0.4 A max. with activated solenoid; 1.2 A with activated solenoid and all outputs at maximum power
Rated insulation voltage U_i: 32 Vdc
Rated impulse withstand voltage U_{imp}: 1.5 kV
External protection fuse: type gG fuse 2 A or equivalent device
Overvoltage category: III
Electrical endurance: 1 million operating cycles
Solenoid duty cycle: 100% ED (continuous operation)
Solenoid consumption: 9 W max.
Pollution degree: 3 acc. to EN 60947-1

Electrical data of inputs IS1/IS2/I3/IE1/IE2/I5/EDM

Rated operating voltage U_{e1}: 24 Vdc
Rated current consumption I_{e1}: 5 mA

Electrical data of OS1/OS2 safety outputs

Rated operating voltage U_{e2}: 24 Vdc
Output type: PNP type OSSD
Maximum current per output I_{e2}: 0.25 A
Minimum current per output I_{m2}: 0.5 mA
Thermal current I_{th2}: 0.25 A
Utilization category: DC13; U_{e2}=24 Vdc, I_{e2}=0.25 A
Short circuit detection: Yes
Overcurrent protection: Yes
Internal self-resettable protection fuse: 1.1 A
Duration of the deactivation impulses at the safety outputs: < 300 µs
Permissible maximum capacitance between outputs: < 200 nF
Permissible maximum capacitance between output and ground: < 200 nF
Activation time of safety outputs OS1 and OS2 after deactivation of safety inputs IS1, IS2: typically 7 ms, max. 15 ms
Activation time upon unlocking the actuator: typically 7 ms, max. 12 ms
Activation time upon removal of the actuator: typically 120 ms, max. 200 ms
Maximum delay for EDM status change: 500 ms

Electrical data of O3/O4 signalling outputs

Rated operating voltage U_{e3}: 24 Vdc
Output type: PNP
Maximum current per output I_{e3}: 0.1 A
Utilization category: DC13; U_{e3}=24 Vdc, I_{e3}=0.1 A
Short circuit detection: No
Overcurrent protection: Yes
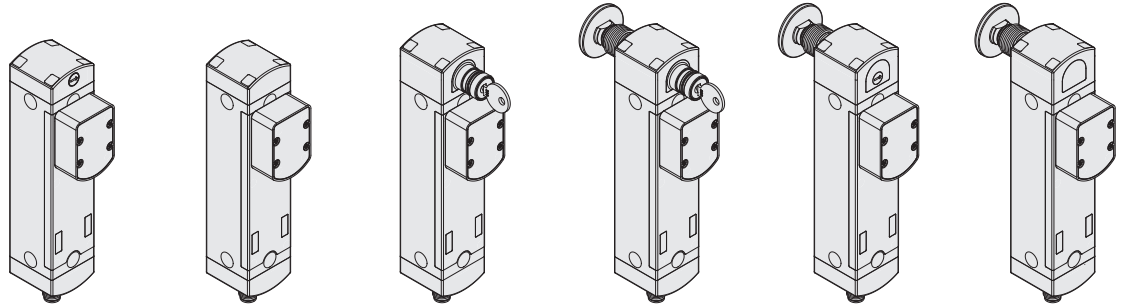Internal self-resettable protection fuse: 1.1 A

RFID sensor data

Assured operating distance S_{ao}: 2 mm
Assured release distance S_{ar}: 6 mm (actuator not locked)
10 mm (actuator locked)
Rated operating distance S_n: 3 mm
Repeat accuracy: ≤ 10 % s_n
Differential travel: ≤ 20 % s_n
Max. switching frequency: 1 Hz

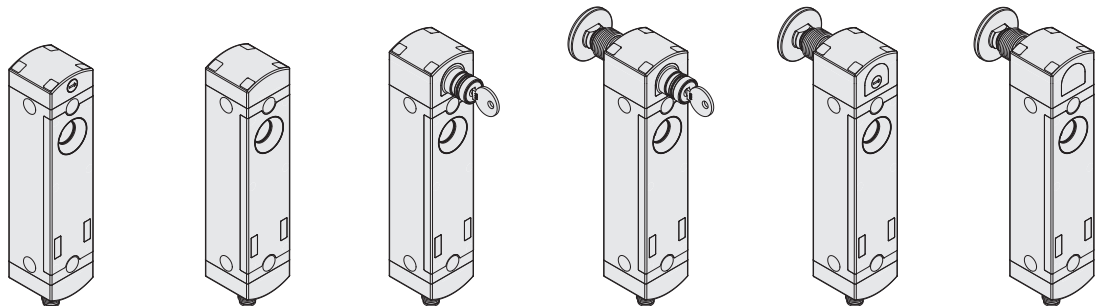## Activation mode of the OS1 and OS2 safety outputs

Mode 1
Safety outputs OS1 and OS2 are active when the actuator is inserted and locked.

IS1
IS2
AND
OS1
OS2
Locking function

In case of machines with or without inertia of the dangerous elements.
Safety category of the safety outputs: PL e, SIL 3.

Mode 2
Safety outputs OS1 and OS2 are active when the actuator is inserted.

IS1
IS2
AND
OS1
OS2
Interlocking function

In case of machines without inertia of the dangerous elements.
Safety category of the safety outputs: PL e, SIL 3.

Mode 3
Safety output OS1 is active when the actuator is inserted and locked and IS1 is active. Safety output OS2 is active when the actuator is inserted and IS2 is active.

Interlocking function
Locking function
IS1
IS2
AND
OS1
AND
OS2

In case of machines with or without inertia of the dangerous elements.
Safety category of the safety outputs: PL d, SIL 2.

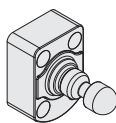## Selection table for switches with high level coded actuators

Operating principle	Locked actuator with de-energised solenoid. With screwdriver release	Locked actuator with energised solenoid	Locked actuator with de-energised solenoid. With key release	Locked actuator with de-energised solenoid. With key release and escape release button	Locked actuator with de-energised solenoid. With screwdriver release and escape release button	Locked actuator with energised solenoid. With escape release button
Mode 1	NS D4AZ1SMK-F41	NS E4ZZ1SMK-F41	NS D4ST1SMK-F41	NS D4SE1SMK-F41	NS D4CE1SMK-F41	NS E4TE1SMK-F41
Mode 2	NS G4AZ1SMK-F41	NS H4ZZ1SMK-F41	NS G4ST1SMK-F41	NS G4SE1SMK-F41	NS G4CE1SMK-F41	NS H4TE1SMK-F41
Mode 3	NS L4AZ1SMK-F41	NS M4ZZ1SMK-F41	NS L4ST1SMK-F41	NS L4SE1SMK-F41	NS L4CE1SMK-F41	NS M4TE1SMK-F41

Selection table for switches

Operating principle	Locked actuator with de-energised solenoid. With screwdriver release	Locked actuator with energised solenoid	Locked actuator with de-energised solenoid. With key release	Locked actuator with de-energised solenoid. With key release and escape release button	Locked actuator with de-energised solenoid. With screwdriver release and escape release button	Locked actuator with energised solenoid. With escape release button
Mode 1	NS D4AZ1SMK	NS E4ZZ1SMK	NS D4ST1SMK	NS D4SE1SMK	NS D4CE1SMK	NS E4TE1SMK
Mode 2	NS G4AZ1SMK	NS H4ZZ1SMK	NS G4ST1SMK	NS G4SE1SMK	NS G4CE1SMK	NS H4TE1SMK
Mode 3	NS L4AZ1SMK	NS M4ZZ1SMK	NS L4ST1SMK	NS L4SE1SMK	NS L4CE1SMK	NS M4TE1SMK

To order a product with lateral connection replace character **S** with character **D** in the order codes shown above. Example: NS D4AZ1**S**MK → NS D4AZ1**D**MK
To order a product with EDM input replace number **4** with number **5** in the codes shown above. Example: NS D**4**AZ1SMK → NS D**5**AZ1SMK
Legend: interlock with lock monitoring acc. to EN ISO 14119

Selection table for actuators

The use of RFID technology in NS series devices makes them suitable for several applications. Pizzato Elettrica offers two different versions of actuators, in order to best suit customers' specific needs.
Type F40 actuators are all encoded with the same code. This implies that a device associated with an actuator type F40 can be activated by other actuators type F40.
Type F41 actuators are always encoded with different codes. This implies that a device associated with an actuator type F41 can be activated only by a specific actuator. Another F41 type actuator will not be recognised by the device until a new association procedure is carried out (reprogramming). After reprogramming, the old actuator F41 will no longer be recognized.

| Level of coding acc. to EN ISO 14119	Article
low	VN NS-F40
high	VN NS-F41

Complete safety system

The use of complete and tested solutions guarantees the electrical compatibility between the NS series switches and the safety modules from Pizzato Elettrica, as well as high reliability. The switches have been tested with the modules listed in the adjacent table.
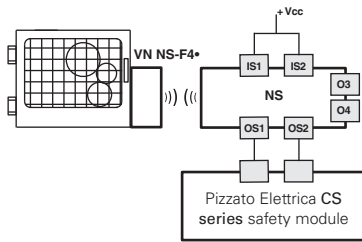
Switches	Compatible safety modules	Safety module output contacts		
		Instantaneous safety contacts	Delayed safety contacts	Signalling contacts
NS ●●●●1●●●	CS AR-05●●●●	3NO	/	1NC
	CS AR-06●●●●	3NO	/	1NC
	CS AR-08●●●●	2NO	/	/
	CS AT-0●●●●●	2NO	2NO	1NC
	CS AT-1●●●●●	3NO	2NO	/
	CS MP●●●●●●	page 255 - SAFETY CATALOGUE 2017/18		
	CS MF●●●●●●	page 283 - SAFETY CATALOGUE 2017/18		

All NS series switches can be connected, provided that compatibility is checked, to safety modules or safety PLCs with OSSD inputs.

NS series switches can be used as individual devices provided that the safety outputs be evaluated by a Pizzato Elettrica safety module (see table for combinable safety modules).
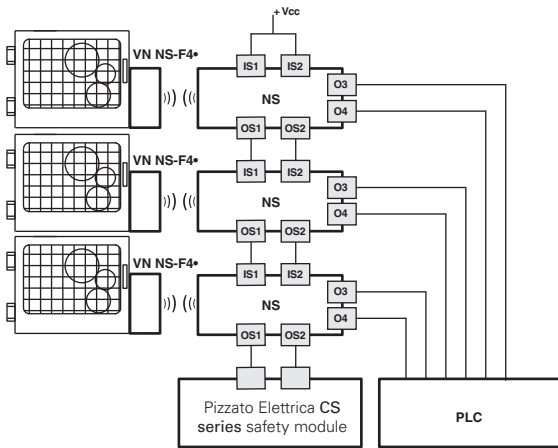
Possibility of series connection of multiple switches for simplifying the wiring of the safety system, whereby only the outputs of the last switch are evaluated by a Pizzato Elettrica safety module (see table with compatible safety modules). Each NS series switch is provided with two signalling outputs which are activated when the guard is closed (O3) or locked (O4). Depending on the specific requirements of the system that has been realised, the signals of the signalling outputs can be evaluated by a PLC.
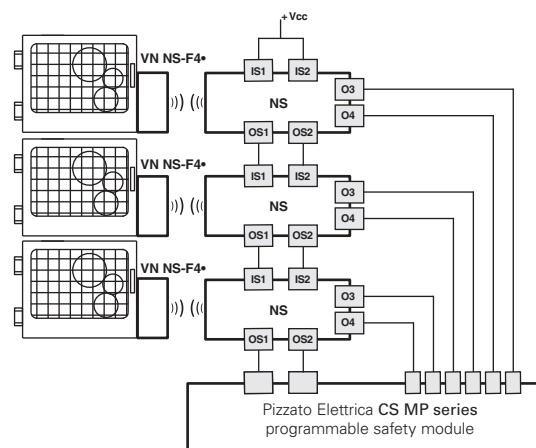
Possibility of series connection of multiple switches for simplifying the wiring of the safety system, whereby only the outputs of the last switch are evaluated by a Pizzato Elettrica safety module of the CS MP series. Both the safety-relevant evaluation and the evaluation of the signalling outputs are performed by the CS MP series.
The examples listed above refer to applications with NS ●●●●1●●●

Internal block diagram
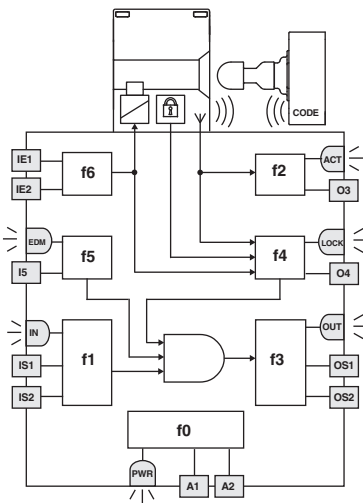
The diagram on the side represents the 7 logic functions which interact inside the device.
Function f0 is a basic function and includes the monitoring of the power supply as well as internal, cyclical tests. Function f1 monitors the status of the device inputs, whereas function f2 monitors the presence of the actuator within the detection areas of the switch.
Function f4 checks the actuator lock condition.
Function f3 is intended to activate or deactivate the safety outputs and check for any faults or short circuits in the outputs.
In the EDM versions, the f5 function verifies the consistency of the EDM signal during safety output state changes.
The safety-related function, which combines the sub-functions mentioned above, activates the safety outputs according to the chosen operating mode:
- Both safety outputs OS1/OS2 for switches in mode 1 are activated only if both IS1/IS2 safety inputs are active and the actuator is inserted and locked;
- Both safety outputs OS1/OS2 for switches in mode 2 are activated only if both IS1/IS2 safety inputs are active and the actuator is inserted;
- The safety output OS1 for switches in mode 3 is activated only if the IS1 safety input is active and the actuator is inserted and locked, whereas the safety output OS2 is activated only if the IS2 safety input is active and the actuator is inserted.
The f6 function verifies the coherence of the enable/disable signals of the actuator lock command.
The status of each function is displayed by the corresponding LED (PWR, IN, OUT, ACT, LOCK, EDM), in such a way that the general device status becomes immediately obvious to the operator.

LED	Function
PWR	Power supply/self-diagnosis
IN	status of safety inputs
OUT	status of safety outputs
ACT	actuator state
LOCK	actuator locked
EDM	state of EDM inputs (NS ●5●●1●●●)

Actuation sequence in mode 1

PWR ● ACT ○	PWR ● ACT ●	PWR ● ACT ●	PWR ● ACT ●	PWR ● ACT ○
IN ● LOCK ○	IN ● LOCK ○	IN ● LOCK ●	IN ● LOCK ○	IN ● LOCK ○
OUT ○	OUT ●	OUT ●	OUT ○	OUT ○

The switch is supplied with power (PWR LED on, green), the IS1 and IS2 inputs are enabled (IN LED on, green), the OS1 and OS2 safety outputs are disabled (OUT LED off). The actuator is outside of the actuation zone (LED ACT off).

When the actuator is brought inside the safe actuation area (dark grey area), the switch turns on the ACT LED (green). In this position, the O3 signalling output (door-closed) is activated. The actuator is not locked (LOCK LED off).

The IE1, IE2 inputs can be used to lock the actuator (LOCK LED on, green). The OS1 and OS2 safety outputs are enabled (OUT LED on, green). The O4 signalling output is activated at the same time. The safe actuation area is extended in order to allow greater play for the actuator.

The IE1, IE2 inputs can be used to unlock the actuator (LOCK LED off). The switch disables the OS1 and OS2 safety outputs and turns off the OUT LED. The O4 signalling output is deactivated at the same time. The safe actuation area returns to the initial values.

When the actuator leaves the actuation limit area, the device turns off the ACT LED and the O3 signalling output.

Actuation sequence in mode 2 and mode 3

In contrast to the above mode 2 description, the safety outputs OS1 and OS2 are activated when the actuator is detected, and deactivated when the actuator is no longer detectable, in mode 3, the OS1 safety output is active with inserted and locked actuator and IS1 active, the OS2 safety output is active with inserted actuator and IS2 active.

Operating states

| PWR LED	IN LED	OUT LED	ACT LED	LOCK LED	EDM LED (a)	Device state	Description
○	○	○	○	○	○	OFF	Device switched off.
◑	◑	◑	◑	◑	◑	POWER ON	Internal tests upon activation.
●	○	○	✳	✳	●	RUN	Safety inputs of the device not active.
●	●	✳	✳	✳	✳	RUN	Activation of safety inputs.
●	◑≋	○	✳	✳	✳	RUN	Safety inputs incoherence. Recommended action: check for presence and/or wiring of inputs.
●	✳	✳	✳	🔴≋	✳	RUN	Incoherence of solenoid activation inputs IE1, IE2. Recommended action: check for presence and/or wiring of inputs.
●	✳	✳	✳	🟠≋	✳	RUN	Auxiliary release activated. Deactivate the auxiliary release to lock the actuator
●	✳	✳	●	✳	✳	RUN	Actuator in safe area. O3 signalling output active.
●	✳	✳	●	●	○	RUN	Actuator in safe area and locked; O3 and O4 outputs active.
●	●	●	●	●	○	RUN	**Mode 1** Activation of safety inputs IS1, IS2. Actuator in safe area and locked. O3, O4, OS1 and OS2 outputs active.
●	●	●	●	✳	○	RUN	**Mode 2** Activation of safety inputs IS1, IS2. Actuator in safe area. O3, OS1 and OS2 outputs active.
●	🟠	🟠	●	●	○	RUN	**Mode 3** Actuator present, guard closed and locked, IS1 enabled, IS2 disabled, OS1 enabled, OS2 disabled
●	●	🟠	●	○	○	RUN	**Mode 3** Actuator present, guard closed and not locked, IS1 and IS2 enabled, OS1 disabled, OS2 enabled
◑≋	✳	✳	✳	✳	✳	RUN	Rapid flashing: supply voltage too high. Slow flashing: temperature outside admissible range
●	✳	🔴≋	✳	✳	✳	ERROR	Error on safety outputs. Recommended action: check for any short circuits between the outputs, outputs and ground or outputs and power supply, then restart the device.
●	○	○	🔴≋	○	○	ERROR	Actuator detection error. Check the physical integrity of the device and, in case of failure, please replace the entire device. If undamaged, realign the actuator with the switch and restart the device.
🔴	○	○	○	○	○	ERROR	Internal error. Recommended action: restart the device. If the failure persists, replace the device.
●	✳	○	✳	✳	●	RUN	EDM signal active (external relay off)a
●	●	●	●	●	○	RUN	EDM signal not active (external relay on)a
●	○	○	○	○	🔴≋	ERROR	Error in the EDMa function

Legend: ○ = off ● = on ●≋ = flashing ◑ = alternating colours ✳ = indifferent   (a) Available only in versions NS •5••1•••

External device monitoring (EDM)
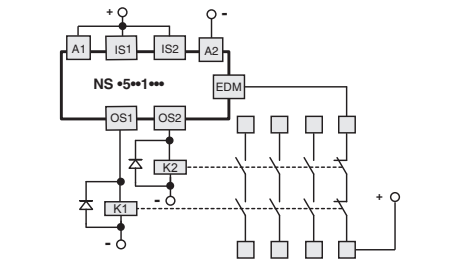
The NS •5••1••• version, in addition to maintaining the operating and safety characteristics of the NS series, allows control of **forcibly guided NC contacts of contactors or relays** controlled by the safety outputs of the switch itself. As an alternative to the relays or contactors you can use Pizzato Elettrica expansion modules CS ME-03.
See page 245 - SAFETY CATALOGUE 2017/18.
This check is carried out via the EDM input (External Device Monitoring as defined in EN 61496-1) of the switch.
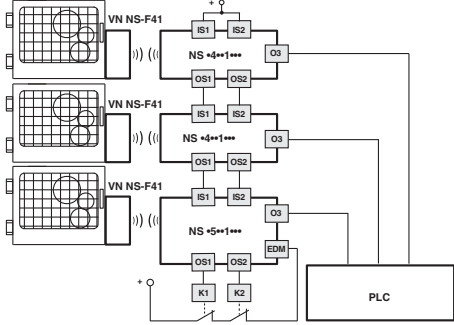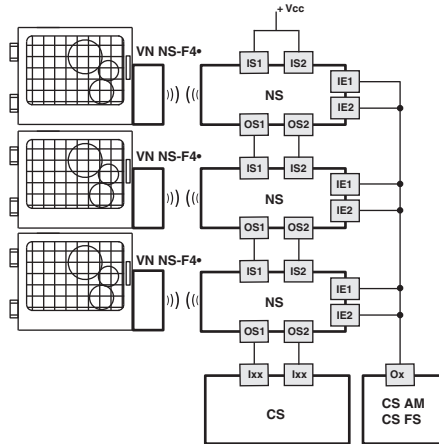

This version, with the IS safety inputs, **can be used at the end of a series** of NS switches, **up to a maximum number of 32 devices**, while maintaining the maximum PL e safety level and acc. to EN ISO 13849-1 and SIL 3 safety level acc. to EN 62061.
This solution allows you to dispense with the safety module connected to the last device in the chain. If present, the EDM function must be used.

Series connection of several switches

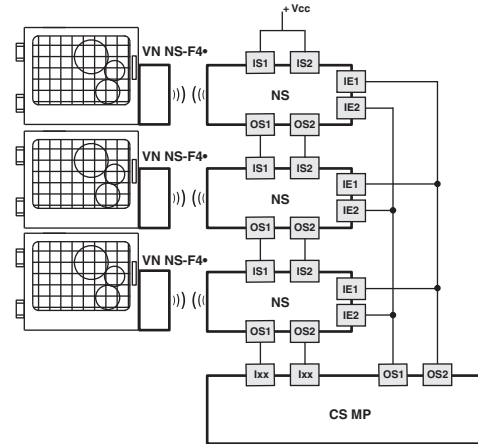| Lock detection function (guard locked) 2 channels / Category 4 / up to SIL 3 / PL e	Lock detection function (guard locked) 2 channels / Category 4 / up to SIL 3 / PL e
Locking control function 1 channel / Category 2 / up to SIL 2 / PL d	Locking control function 2 channels / Category 4 / up to SIL 3 / PL e

Connector pin assignment			Internal cable wiring			
M12 connector, 12-pole	M12 connector, 8-pole stand-alone connection	M12 connector, 8-pole series connection with "Y" connectors	Cable 12x0.14 mm² external Ø 6 mm	Cable 8x0.34 mm² external Ø 7 mm		Connection
3	3	3	White	Blue	A2	Supply input 0 V
10	8	8	Purple	Red	IE1	Solenoid activation input
12	5	/	Red-Blue	Purple	IE2	Solenoid activation input
5	2	/	Pink	Black	O3	Signalling output, actuator inserted
9	/	5(b)	Red	/	O4	Signalling output, actuator inserted and locked
8	6	/	Grey	purple-white	I3	Actuator programming input / reset
1	1	1	Brown	Brown	A1	Supply input +24 Vdc
2	/	2	Blue	/	IS1	Safety input
6	/	6	Yellow	/	IS2	Safety input
11	/	/	Grey-Pink	/	I5	EDM input (a)
4	4	4	Green	Red-White	OS1	Safety output
7	7	7	Black	Black-White	OS2	Safety output
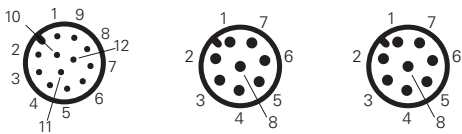
(a) Available for NS •5••1••• version only
(b) Available for 8-pole connector, not available for the end of a chain with Y connectors.

Dimensional drawings

All values in the drawings are in mm

Switch
NS ••AZ1SMK
NS ••ZZ1SMK

Switch
NS ••AZ1DMK
NS ••ZZ1DMK

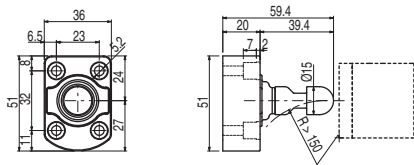**Switch**
NS ••ST1SMK
NS ••SE1SMK

NS ••CE1SMK
NS ••TE1SMK

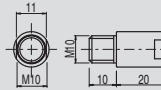**Switch**
NS ••ST1DMK
NS ••SE1DMK

NS ••CE1DMK
NS ••TE1DMK
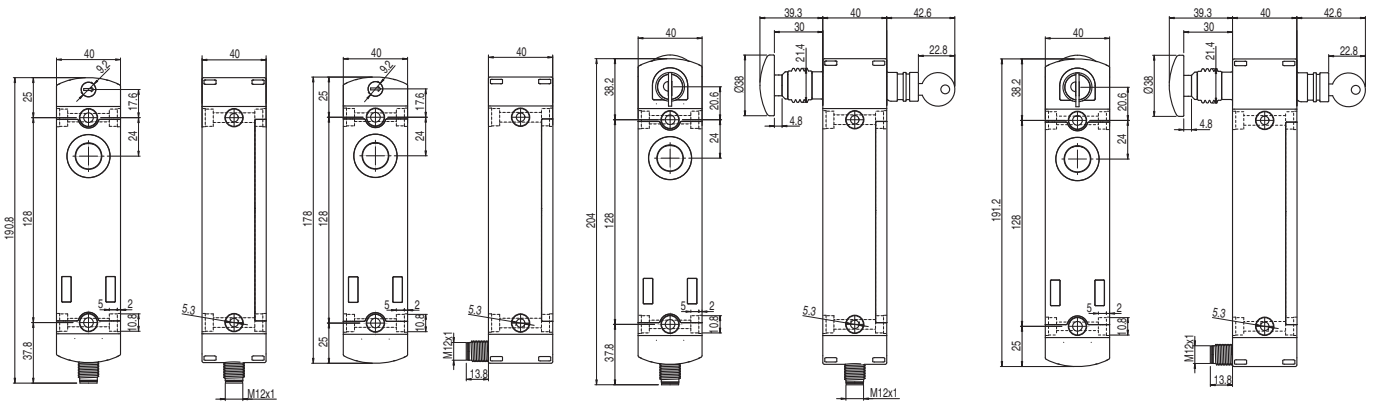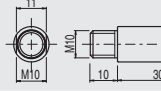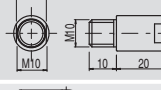

Actuator VN NS-F4•

Accessories

Article	Description
VF KLB300	Set of two locking keys

Extra copy of the locking keys to be purchased if further keys are needed (standard supply: 2 units).
The keys of all switches have the same code. Other codes on request.

Extensions for escape release button

| Article	Description	Drawing
VN NG-LP30	Metal extension for escape release button. For max. wall thickness of 30 mm	
VN NG-LP40	Metal extension for escape release button. For max. wall thickness of 40 mm	
VN NG-LP50	Metal extension for escape release button. For max. wall thickness of 50 mm	
VN NG-ERB	Red metal escape release button	
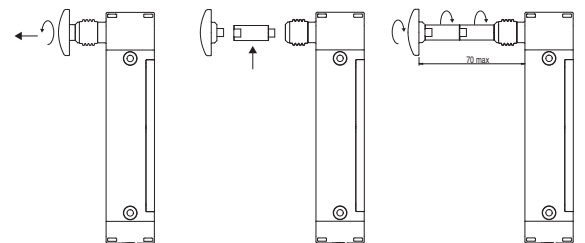
- Metal extensions can be combined with one another to achieve the desired length.
- Do not exceed an overall length of **70 mm** between the escape release button and the switch.
- Use medium-strength thread locker to secure the extensions.

Series connection

To simplify series connections of the devices, various M12 connectors are available that allow complete wiring.

This solution significantly reduces installation times while at the same time maintaining the maximum safety levels PL e and SIL 3 for the interlocking function.
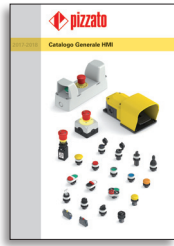
For further information see page 304 of the General Catalogue Safety 2017-2018.

IE
OS2
OS1
A2
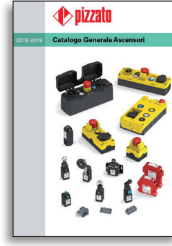A1
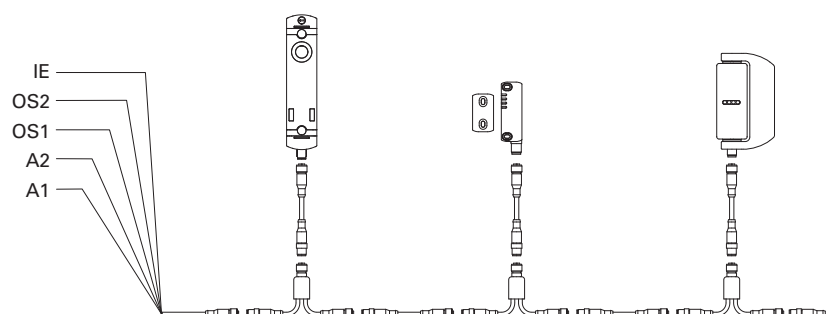
➜ The 2D and 3D files are available at **www.pizzato.com**

General Catalogue
Detection

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