

Operating instructions for safety control unit mod. NC20 / NC21



These operating instructions are only valid in conjunction with the operating instructions for the related sensors and magnets 1SMA_Nxxxcodedsensor_ITA_ENG.

Correct Use

The coded Magnetic Safety switches are a series of technical safety devices for monitoring moveable separating safety guards. They ensure that dangerous work on machines can only be carried out if the safety guards are closed. A stop command is triggered if a safety guard is opened while the machine is running. Before safety switches are used, a risk assessment must be performed on the machine in accordance with:

- EN ISO 13849-1:2015 Safety of machinery - Safety-related parts of control systems: Part 1: General principles for design;
- EN ISO 14119:2013 Interlocking devices associated with guards;
- EN 60204-1:2018 Electrical equipment of machines;
- EN 60947-5-1:2017 Electromechanical control circuit devices
- EN 60947-5-3:2013 Requirements for proximity devices with defined behaviour under fault conditions (PDDb)

Protective Separation

This safety module implements Protective Separation between the relay's contacts and the controller's circuits. This purpose is reached using materials resistant to ageing and appropriate constructive measures according to IEC 60664-1/Corr.1:2020. All the relays have a double and reinforced insulation according to IEC 60664-1/Corr.1:2020 with: Rated insulation voltage: 250 V AC Rated impulse withstand voltage: 6 kV Contamination level: 2 Overvoltage category: III

	SAFETY PRECAUTIONS	
<p>The safety switch fulfills a personal protection function. Incorrect installation or manipulation, use of spare magnets to activate sensors with safety guards open can lead to severe injuries to personnel.</p> <p>Safety switches must not be bypassed (bridging of contacts), turned away, removed or otherwise rendered ineffective.</p> <p>The switching operation may only be triggered by coded magnets specially provided for this purpose which are permanently connected to the safety guard.</p> <p>A complete safety-oriented system generally consists of several signalling devices, sensors, control units and concepts for safe shut-off operations. The manufacturer of a machine or installation is responsible for correct and safe overall function.</p> <p>Auxiliary output 24/25/26 for this control unit must not be used as a safety output.</p>		

Functioning

The safety system consists of a control unit, sensors and activation magnets and is only functional in particular combinations (see combination options)!

- The sensors connected to the control unit contains reed contacts which are activated by the coded magnets. The safety control unit converts this information and transfers the safety guard state to the control system via a safety output.
- When the protective door is being opened or closed, the control unit is checked to ensure that it is functional. In this way internal errors from the sensors to the control unit output can be detected.
- If an error is detected, the control unit goes into a blocked state. The safety outputs remain in the open state. The control unit status is displayed visually by means of LED displays.
- In the case of a monitored feedback loop, safety output 1/2 is only switched through if feedback loop 22/23 was closed before the magnet was moved to the sensor's response area.
- A start button must not be incorporated into the feedback loop.

- In the case of unmonitored feedback loops, the 2-pole bridge supplied with the control unit must be connected to terminals 22/23.
- When the magnet is moved out of the response area, it is only if the Reset spacing is exceeded (see configuration options table) that the system ensures that safety output 1/2 and auxiliary output 24/25/26 switch on if the magnet is again moved to switch on distance Son.
- If the magnet is moved slowly toward the sensor in lateral direction of approach Z, the control unit switches over to the blocked state. To cancel the blocked state, the magnet must again be moved beyond the Reset spacing.

Assembly

Installation must be performed by authorized personnel only. The control unit must be assembled in a suitable operating area (switch cabinet, protective housing, at least IP 54). The control unit is installed by clipping it to a standard 35 mm top-hat rail in accordance with EN 50022.

Electrical Connection

Electrical connection must be performed by authorized personnel only. All the electrical inputs must either be isolated from the mains supply by a movable safety transformer in accordance with EN IEC 61558-2-6 with limited output voltage in the event of a defect or by another equivalent movable mechanism. The supply have to be connected in a permanently way and using a cable with a maximum length of 10 m; the sensors have to be connected to the unit using a cable with a maximum length of 30 m. Terminals 4 and 5 are reverse polarity protected for connection of the power supply for all outputs (safety and door signal output). External contact fuses (4 A quick-action fuse) for relay outputs must be fitted. All the output contacts must have an adequate protective circuit for capacitive and inductive loads. If a common power supply is used, all the inductive and capacitive loads (e.g. relay contactors) connected to the power supply must be connected to appropriate interference suppressors. If sensors are not connected to the plug-in terminals provided in the control units, the bridges supplied must be inserted in accordance with the connection plan.

Liability coverage is void under the following circumstances:

- if instructions are not followed
- non-compliance with safety regulations
- installation and electrical connection not performed by authorized personnel
- non-implementation of functional checks.

Setup

If the control unit does not appear to function when operating voltage is applied (green LED does not light up), the unit must be returned unopened to the manufacturer. Check whether the safety outputs are being switched (see LED display) by opening and closing the protective door.

Sensors and Magnets installation

- Install Sensor and Magnets so that:
- They are accessible for inspection work and the installation of spare parts.
 - When the safety guard is closed, the active read head and actuator area are exactly aligned (see "Sensors and Magnets alignment, of the sensor manual 1SMA_Nxxxcodedsensor_ITA_ENG)
 - The magnet is located in the sensor's response area when the safety guard is closed.
 - A guide and an extra stop must be fitted to the moveable part of the safety guard.
 - A stopping mechanism must be fitted to the protective doors for closed position.
 - If the Sensor and Magnets are fitted flush, the switching distance is reduced depending on the installation depth and the safety guard material.
 - If the Sensors and Magnets are fitted on ferromagnetic material, the activation distance is reduced.
 - The approach speed between the Sensor and magnet must not be too low if the unit is working in automatic start configuration.
 - Round magnets are torque-resistant. In order to ensure that the magnet cannot be rotated when secured to the protective doors, a 2 mm hole should be drilled for the safety lug during installation.

LED display

Function	LED	Colour	State
Operating voltage	PWR	green	on
Outputs 1/2 and 24/25/26: OPEN	OUT	red	on
	OUT	green	off
Outputs 1/2 and 24/25/26: CLOSED	OUT	red	off
	OUT	green	on
Sensors n° x (x= 1...4)			
Magnet in activation area			
-NC contact in the sensor is OPEN	Sx	red	off
-NO contact in the sensor is CLOSED	Sx	green	on
Magnet not in activation area			
-NC contact in the sensor is CLOSED	Sx	green	off
-NO contact in the sensor is OPEN	Sx	red	on

If the green and red LEDs of the sensor light up simultaneously, the relative magnet is not completely in the response area. If the magnets are in the response area (or 2-pole bridges have been installed in the control unit) for all connected sensors, the safety output 1/2 and the auxiliary output 24/25/26 are switch (the green OUT LED lights up). Green LEDs are connected in the control unit in series in the following sequence: S1-S2-S3-S4. This means that the green LED (eg S4) can only light up if the S1 / S2 / S3 LEDs, which have been connected in series, also light up. If the actuation speed falls below the minimum speed, outputs 1/2 and 25/26 remain open.

Service and Inspection

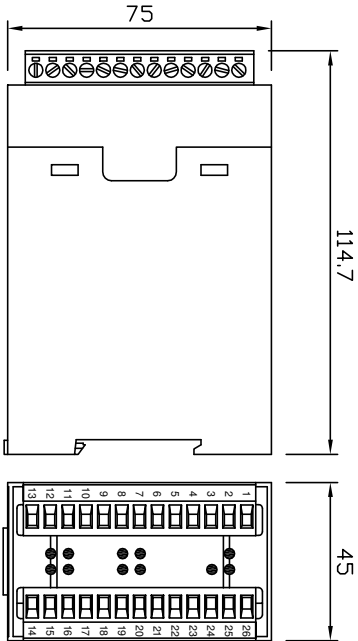
The correct functioning of the unit must be controlled by the operator and/or by the control circuit of the machine in which it is used periodically (at the beginning of every shift), by checking:

- Correct switching function of each sensor by checking:
 - a) that the opening of the single sensor/safety guard will cause the opening of the safety output (1-2)
 - b) that the closure of the same sensor/safety guard will cause the closing of the safety output (1-2)
- secure mounting of components
- correct connection fixing.

The monitoring function of the unit is done at every switching cycle. If with all safety guards closed and the safety device does not activate its safety output, do not turn off and turn on the device, then proceed to the checking of the possible safety guard open and perform the above tests in point a) and b).

In the event of damage or wear and tear, the damaged system component must be replaced. If the protective doors are not frequently used, the system should be subjected to a function test as part of the inspection schedule.

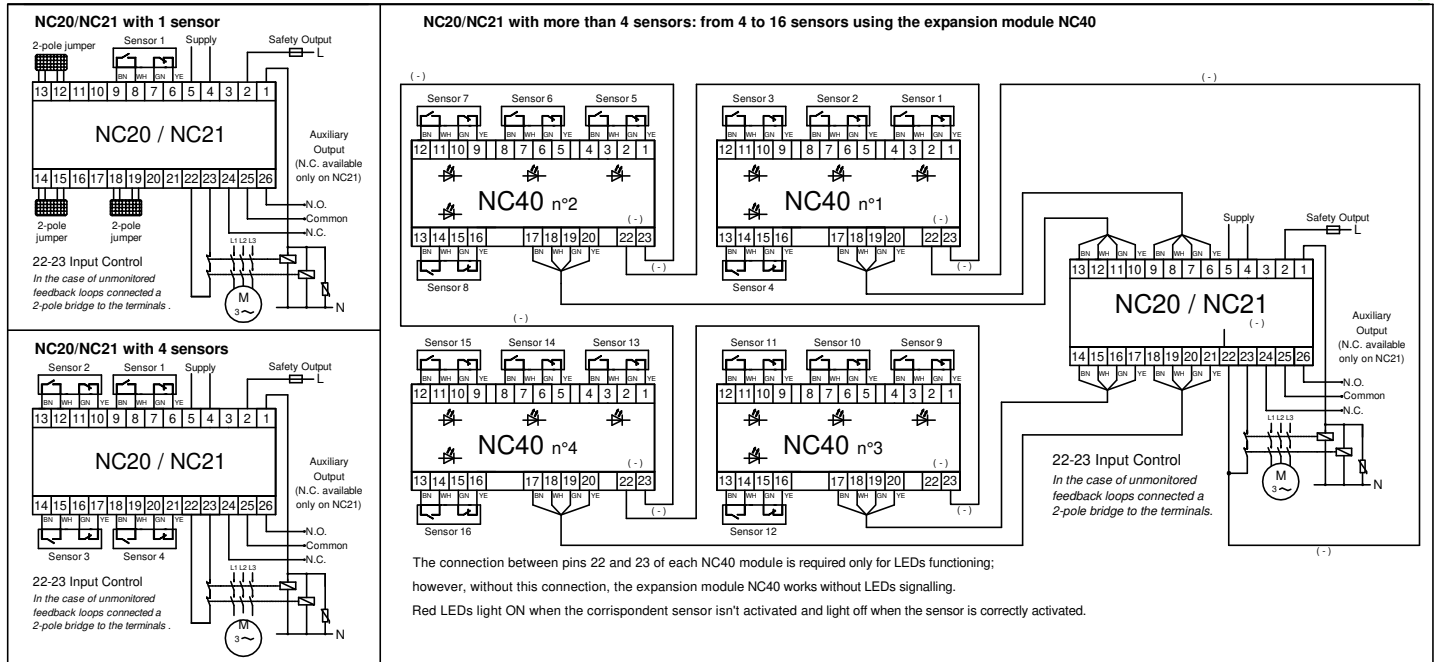
Dimensions



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Sensors Connections



NC20 / NC21 Combination Options Table

Shape	Sensor	Safety Category	Circuit Diagram	Activation Magnet	Activation Distance Son [mm]*	Deactivation Distance Soff [mm]*	Reset Distance [mm]*
	N514 GC	4		M144	< 6	> 13	>30
	N514 LC						
	N520 GD			M120			
	N520 GL						
	N185 GB	4		M110 M11A	< 7	> 17	>24
	N255 GA			M110 M11A	< 6	> 12	>14
	N255 LA						
	N305 GA		4		M113 M11A	< 6	> 12
	N305 LA						

* Activation, deactivation and reset distances are influenced by ferromagnetic materials. all the data applies to the frontal direction of approach and a center offset of 0,0 mm. All the distances have a tolerance of ±1 mm.

UL CERTIFICATION REQUIREMENTS

This Device is intended for Din Rail mounting in an overall Industrial Control Panel Enclosure and have been evaluated according to the requirements of UL508 and C22.2 no. 14 and have not been investigated with respect to EMC, FMEA or for use in safety related circuits.

This device is intended to be used with a Class 2 power source or Class 2 transformer in accordance with UL1310 or UL1585.

As an alternative a LV/C (Limited Voltage / Current) power source with one of the following properties can be used:

- This device shall be used with a suitable isolating source such that the maximum open circuit voltage potential available to the product is not more than 24 Vac/dc and the current is limited to a value not exceeding 8 amperes measured after 1 minute of operation.
- This device shall be used with a suitable isolating source in conjunction with a fuse in accordance with UL248. The fuse shall be rated max. 4 A and be installed in the 24 Vac/dc power supply to the device in order to limit the available current.
- Terminal tightening torque of 4.5 Lb per In.

A device that is intended to be supplied from a Limited voltage /current circuit shall be provided with installation instructions that specify the use of a suitable isolating transformer or power supply and rating of the secondary overcurrent protective device (max. 4 A) to be installed in the field. The open peak voltage is limited to max. 30 V with a max. power of 100 VA according table 32.1 (UL508).

RATINGS

- Read Heads: Input: 24 V ac/dc, Class 2 Output: Max 30 V ac/dc, Class 2
- Accessories: 24 V ac/dc, Class 2
- Actuators: Non-electric

Technical data

Parameter	Value	Units
Housing Material	PC	
Dimensions	114.7 x 75 x 45	mm
Weight	240	g
Working Climatic Conditions	Temperature: 0 ... +55	°C
	Relative Humidity: 4% ... 100%	
	Air Pressure: 86 ... 106	kPa
Storage Climatic Conditions	Temperature: -25 ... +70	°C
	Relative Humidity: 5% ... 95%	
	Air Pressure: 86 ... 106	kPa
Degree of protection (IEC 60529)	Terminals: IP20 / Housing: IP40	
Degree of contamination	2	
Max number of sensors	4 (directly connected)	
Connection type	Plug-in screw terminals	
Cable insulation removal for correct insertion into the terminal	6	mm
Supply Voltage	24 ±10%	V AC/DC
Internal fuse on the supply	500 mA, PTC	
Typ. current consumption	200 min 300 max	mA
Switching voltage SAFETY output	250 (max)	V AC
Switching current (Imax @ 24 V)	4	A
Switching current (Imin @ 12 V)	25	mA
Switching power to the output (max)	750	VA
External fuse on the output	4 A quick-action	
Safety outputs (Auxiliary outputs)	1 (1)	
Usage category (safety output)	AC-1: 4A, 250V / AC-15: 1A, 250V AC-1: 4A, 24V / AC-15: 1A, 24V DC-13: 4A, 24V	
Switching voltage AUXILIARY output	max 250 for NC20; max 48 for NC21	V AC
Safety category and PL EN ISO 13849-1:2015	4 with one sensor	3 with more than one sensor
	PL e	PL d PL e
nop (n. of operation / year)	42048 11860	42048 20000 11860
MTTFd (AC-1: I load = 4A)	30	30 62 100
PFFhd	9,54x10 ⁻⁸ 2,47x10 ⁻⁷ 2,65x10 ⁻⁷ 8,84x10 ⁻⁸ 4,29x10 ⁻⁸	
B10d	AC-1 (4A) = 4x10 ⁵ ; AC-15 (1A) = 1,4x10 ⁵	N. cycles
TM	20	years
Output open response time	20	ms
Rated insulation voltage	250	V
Rated impulse withstand voltage	6	kV
Mechanical switching cycle relays	30x10 ⁵	N. cycles
Vibration and shock resistance	EN 60947-5-1:2017	
EMC compliance	EN 60947-5-1:2017, EN 60947-5-2:2020, EN 60947-5-3:2013, EN 61326-3-1:2017	
Sensors coding level according to EN ISO 14119:2013	Type 4, low level	
Approval	TÜV n° Z10 17 01 48304 012	