

# Operating instructions for safety control unit mod. NC97 - Original instructions -



## Description

The NC97 safety relay is created for use in safety circuit intended by EN 60204-1, EN ISO 13849-1, EN ISO 13850, EN ISO 14119:2013. This module is based upon the use of guided-contact safety relays.

## ⚠ Safety Precautions ⚠

Safety switches fullfills a personal protection function; they must not be bypassed (bridging the contacts), moved, removed or otherwise made ineffective. Incorrect installation or manipulation can lead to severe injuries to personnel. The manufacturer or the technician that intall the machinery is responsible for correct and safe overall function.

Auxiliary output 41/42/54 gives informations about the state of the device; it must not be used as a safety output.

The NC97 is not proper for the operation in presence of ionizing and not ionizing radiations (rays X, microwaves, laser, ultraviolet rays) (EN 60204-1, §4.4.7).

## Functioning

The NC97 Module can control the state of two contacts (safety Reed sensors, emergency stop button, mechanical safety switches, interlocks for mobile guards): the output is activated by pressing and releasing the START button only if the contacts of two sensors are closed. The opening of even only one input contact, leads to a safety situation, by putting the safety outputs in open state and by preventing the closing even after the re-closing of the contact and the pressure of the START button.

If the NC97 is used to control emergency stop button, after the intervention of the device, the reset of the command shall not restart the machinery but only permit restarting (EN 60204-1, §9.2.3.4.2, EN ISO 13850, §4.1.4).

If the NC97 is used to control interlocks for mobile guards, the reclosing or resetting of an interlock safeguard shall not initiate hazardous machine operation (EN 60204-1, §9.3.1).

Shorting terminals Y1-Y2-X1, the restart of the device is automatic (in this case A2 has not to be connected to start circuit); the behavior of the machinery to the restart of the device - or the not automatic restart of the dangerous elements of the machinery - depends on the realization of the command circuit of the machinery according to the risk evaluation effected by the user.

If the emergency stop command has only one N.C. contact, it must be connected between the positive supply contact (L+) and the A1 contact; if no safety sensors are connected to the unit, S11-S12 and S21-S22 have to be bridged .

Safety category 4 is granted only if (see connection diagram):

- to interrupt the load are used two relays, each connected to an input of the safety unit;
- the NC auxiliary contacts of the relays controlled by the control unit (Ka, Kb) are inserted in the feedback loop.

The safety is ensured by using guided contacts, by the redundance and by the interconnection schematic of the contacts.

The responsibility to choose the adequate components for safety applications, for example guided contacts safety relays, falls to the user.

## Electrical Connection

Electrical connection must be performed by authorized personnel only following the indications of EN ISO 13849-1 and EN ISO 13849-2.

All the electrical inputs must either be isolated from the mains supply by a separate coils 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 lenght of 10 m; the sonsors have to be connected to the unit using cables with a maximumum lenght of 30 m.

The outputs of the relays have a maximum current of 3 A; the supply connected to the outputs must be protected from overcurrents by devices adequate to the loads that have to be protected.

All the output contacts must have an adequate protective circuit for capacitive and inductive loads.

All the inductive and capacitive loads connected to the power supply must be connected to appropriate interference suppressors.

## Assembly

Installation must be performed by authorized personnel only.

The NC97 control unit must be assembled in a suitable operating area (switch cabinet, protective housing, at least IP 54) and installed by clipping it to a standard 35 mm top-hat rail.

## Setup

If the control unit does not appear to function when operating voltage is applied (green "Power" LED does not light up), it must be returned unopened to the manufacturer.

Check whether the safety outputs are being switched (see LED display) by activating the two inputs and START.

## Service and Inspection

The correct functioning of the NC97 safety 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 outputs (13-14 / 23-24)
  - b) that the closure of the same sensor / safety guard will cause the closing of the safety outputs (13-14 / 23-24) as a result of a startup command
- 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 following the eventual start command, the safety device does not activate its safety outputs, 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)

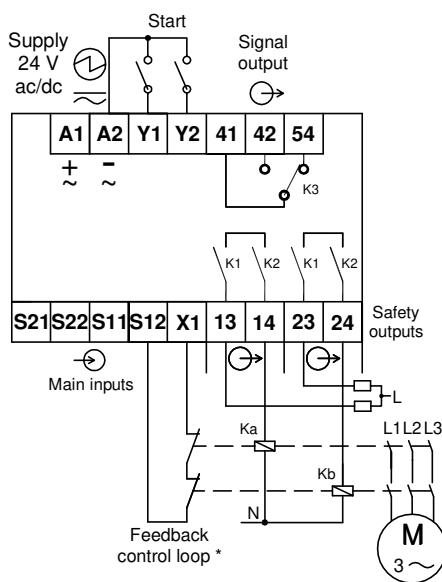
In the event of damage or wear and tear, the damaged system component must be replaced.

## Liability coverage is void under the following circumstances:

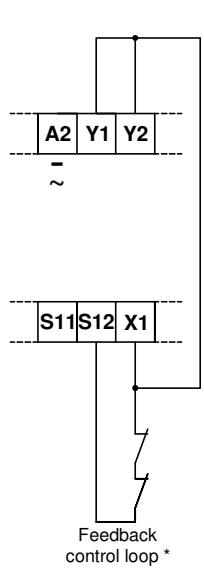
- if instructions are not followed
- non-compliance with safety regulations
- installation and electrical connection not performed by authorized personnel
- non-implementation of functional checks
- tampering with the product

## Connection diagram

### - Manual start

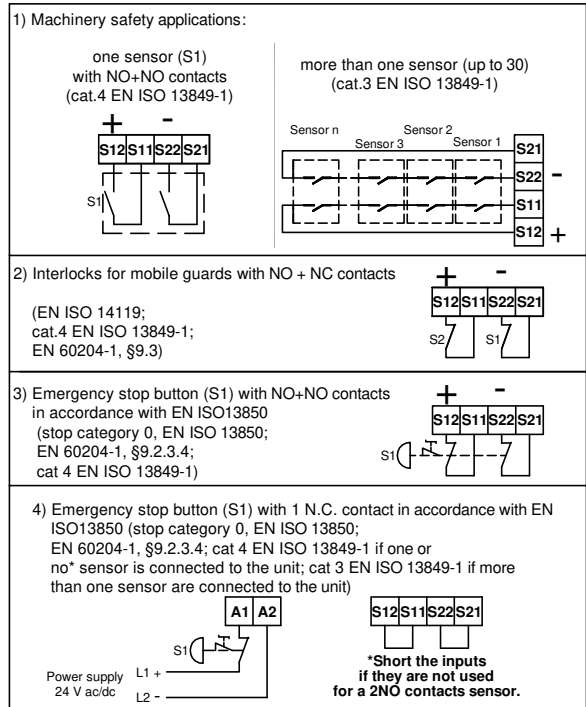


### - Automatic start



\* If it is not necessary to control the NC auxiliary contacts of the relays via a feedback loop, short-circuit terminals S12 and X1.

## Inputs



LED Table				Technical data		
Function	LED	Color	State	Parameter	Value	Unit
<b>Power supply</b>	PWR	Green	on	Housing material	PA	
	<b>Outputs 13-14 e 23-24 : OPEN</b>			Dimensions	114,5 x 99 x 22,5	mm
<b>Output 41-42 : OPEN</b>			CH1	Green	off	
<b>Output 41-54 : CLOSED</b>			CH2	Green	off	
<b>Outputs 13-14 e 23-24: CLOSED</b>			CH1	Green	on	
<b>Output 41-42 : CLOSED</b>			CH2	Green	on	
<b>Output 41-54 : OPEN</b>						
				Degree of protection (IEC 60529)	IP20	
				Pollution degree	2	
<b>Timing diagram for manual start</b> 				Rated impulse withstand voltage (Uimp)	4	kV
				Rated insulation voltage (Ui)	250	V
<b>Timing diagram for automatic start (Y1- Y2 - X1 bridged)</b> 				Overvoltage category	III	
				Assembly	35 mm DIN standard rail	
<b>UL CERTIFICATION REQUIREMENTS</b>				Connection type	Screw terminals	
				Supply voltage	24 -15% / +10% (AC 50 ÷ 60 Hz)	V ac/dc
<b>Environmental Ratings</b> Max. Surrounding Air Temperature: 55°C Pollution Degree: 2 <b>Environmental designation</b> Open type equipment				Internal fuse on the supply	750 mA PTC	
				Current consumption	@24Vdc: 25 min, 70 max; @24Vac: 110 min, 220 max	mA
<b>Installation Notes</b> Use with min. 60°C copper (CU) conductor only Terminal tightening torque: 5-7 Lbin (0,56-0,79 Nm)				Safety Outputs switching voltage	240 (max)	V AC
				Switching current AC-1 / Electrical life	3 A (safety outputs) / >10 <sup>5</sup> cycles	
Minimum switching current @ 10 V				Minimum switching current @ 10 V	10	mA
				Safety output switching power	720 (max)	VA
External fuse at the output				External fuse at the output	4 A gG (according to IEC EN 60269-1)	
				Safety outputs terminals	13 -14, 23 - 24	
Auxiliary output terminals				Auxiliary output terminals	41 - 42 NO; 41 - 54 NC	
				Usage category / Electrical Life (SAFETY outputs)	AC-15: 1,4 A / 240 V (inductive load, cos Φ=0,3) / 10 <sup>5</sup> c. DC-13: 1A / 24 V / 10 <sup>5</sup> cycles	
Auxiliary output parameters				Auxiliary output parameters	max: 0,5A @ 24 Vdc	
				Output response time - manual start (t1)	150	ms
Output response time - automatic start (t2)				Output response time - automatic start (t2)	30	ms
				OFF state response time (t3)	20	ms
Max input sensor resistance				Max input sensor resistance	200	ohm
				Safety category (EN ISO 13849-1)	Cat. 4 (1 safety sensor)   Cat. 3 (more than 1 sensor)	
PL (EN ISO 13849-1)				PL (EN ISO 13849-1)	e   e   d   d   e	
				nop (number of operations / year)	65000   19200   65000   31500   19200	N. op. / year
MTTFd				MTTFd	30   100   30   56   100	years
				PFHd	9,54 x 10 <sup>-8</sup>   2,47 x 10 <sup>-8</sup>   2,65 x 10 <sup>-7</sup>   1,03 x 10 <sup>-7</sup>   4,29 x 10 <sup>-8</sup>	
TM				TM	20 (for MTTFd = 100 years)	years
				Stop category (EN ISO 13850)	0	
Vibration resistance				Vibration resistance	EN 60068-2-6, EN 60947-5-3	
				Mechanical life	10 <sup>7</sup>	cycles
EMC compliance				EMC compliance	EN 61000-6-2, EN 61000-6-3, IEC 61326-3-1, EN 60947-5-3	
				In accordance with	EN 60204-1, IEC 60664-1, EN ISO 13849-1, EN ISO 13849-2, EN ISO 14119, EN ISO 13850	
Approvals				Approvals	TÜV IT 0948 16 MAC 0077 B	

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NC97 connection diagram for Hall safety sensors

N. of sensors		Connection options						
<b>1</b>								
<b>2</b>								
<b>n</b> sensori connessi in serie sullo stesso canale (n <sub>max</sub> = 10)								
Shape	Sensor	Activation Magnet	Activation Distance Son [mm] <sup>1</sup>	Deactivation Distance Soff [mm] <sup>1</sup>	Reset Distance [mm] <sup>1</sup>	Technical data (*also for activation magnets)		
						Parameter	Value	Unit
	N51H G3	M140 H1	< 13	> 18	> 20	Housing Material <sup>2</sup>	glass-fiber reinforced PPS	
						Operating conditions <sup>2</sup>	Temperature: -20 ÷ +80	°C
							Relative humidity: 4% ÷ 100%	
						Storage conditions <sup>2</sup>	Temperature: -25 ÷ +70	°C
Relative humidity: 5% ÷ 95%								
	N52H G3	M120 H1	< 6	> 12	> 15	Degree of protection (IEC 60529) <sup>2</sup>	IP67	
						Supply voltage (Vs)	20 ÷ 35	V dc
						Internal fuse	Not present; the protection against possible over-currents has to be guaranteed by the power supplier of the sensors (ex. safety control unit)	
						Current consumption <sup>3</sup>	35 max	mA
	N25H G3	M110	< 5	> 11	> 13	Output switching voltage	20 ÷ 35 (=power supply voltage)	V dc
						Max output current	15	mA
						Connections	cable with terminals	
						B10d (EN ISO 13849-1)	20x10 <sup>5</sup>	cicli
	N30H G3	M113	< 5	> 10	> 13	Vibration and shock resistance <sup>2</sup>	EN 60068-2-6, EN 60947-5-3	
						EMC compliance	EN 61000-6-2, EN 61000-6-3, IEC 61326-3-1, EN 60947-5-3	
						In accordance with <sup>2</sup>	EN 60204-1, EN ISO 13849-1, EN ISO 14119 (Type 4)	
						Approval	TÜV IT 0948 16 MAC 0077 B	
<sup>1</sup> 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.						<sup>2</sup> Data also for coded magnets <sup>3</sup> Current consumption of each sensor connects to the safety unit. The current consumption of the unit depends on number of connected sensors. (I <sub>max tot</sub> = I <sub>max NC97</sub> + n x I <sub>max sensor</sub> ; n <sub>max</sub> = 10).		