Operating instructions for safety control unit mod. NC98 01 - Original instructions -

Description

The NC98 01 safety relay is created for use in safety circuit intended by EN 60204-1, EN ISO 13849-1, EN ISO 13850, EN ISO 14119.
This module is based upon the use of guided-contact safety relays.

⚠ Safety Precautions ⚠

Safety switches 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 **NC98 01** 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 **NC98 01** Module can control the state of two contacts NO + NC (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 NO contact is closed and the NC contact is open. The switching 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 a new switching of the contact and the pressure of the START button.
If the **NC98 01** 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 **NC98 01** 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).
Short-circuiting terminals Y1-Y2-X1, the restart of the device it's 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 have to be bridged and S21-S22 have to stay open.

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 maximunum 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 NC98 01 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

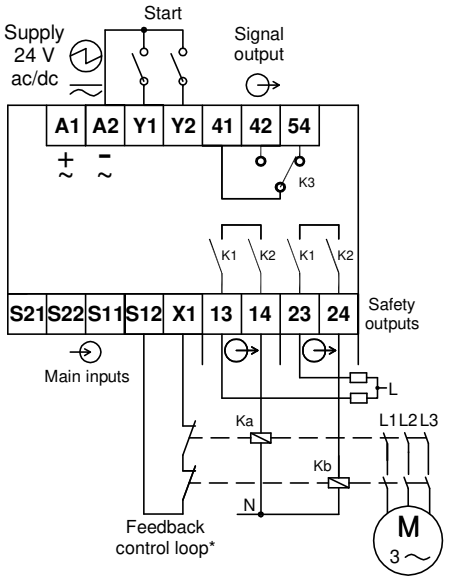
The correct functioning of the NC98 01 safety unit must be controlled by the operator and/or by the control circuit of the machine in which it is used periodically (at the beginning of every shift), by checking:
- correct switching function of each sensor by checking:
  a) that the opening of the single 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.

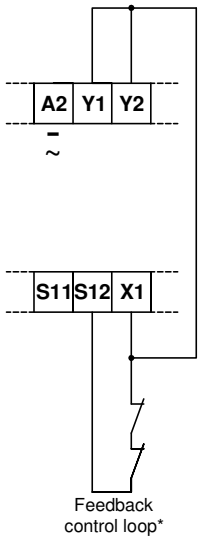
Liability coverage is void under the following circumstances:
- if instructions are not followed
- non-compliance with safety regulations
- installation and electrical connection not performed by authorized personnel
- non-implementation of functional checks
- tampering with the product

Connection diagram

- Manual start

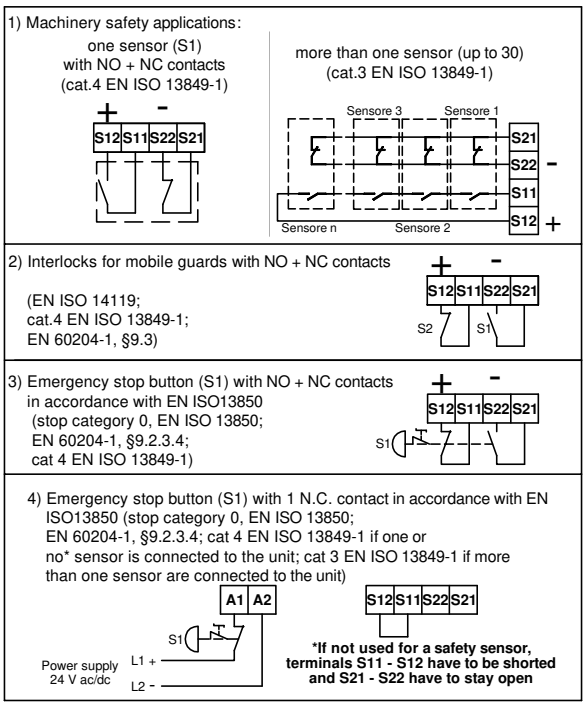


- Automatic start



* 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



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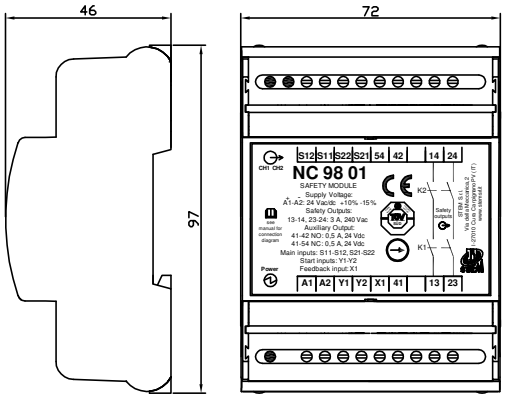
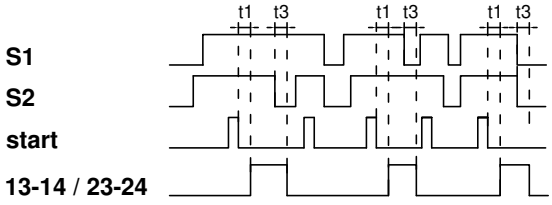
LED Table			
Function	**LED**	**Color**	**State**
Power supply	PWR	Green	on
Outputs 13-14 e 23-24 : OPEN **Output 41-42 : OPEN** **Output 41-54 : CLOSED**	CH1 CH2	Green Green	off off
Outputs 13-14 e 23-24: CLOSED **Output 41-42 : CLOSED** **Output 41-54 : OPEN**	CH1 CH2	Green Green	on on

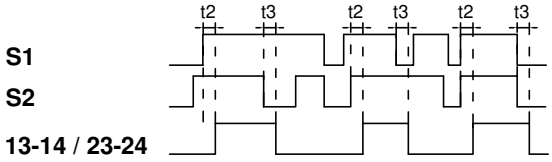
Dimensions



Timing diagram for manual start



Timing diagram for automatic start (Y1- Y2 - X1 bridged)



Technical data

Parameter	Value	Unit
Housing material	PA	
Dimensions	97 x 72 x 46	mm
Weight	160	g
Operating conditions	Temperature: -5 ... +55	°C
	Relative humidity: 4% ... 100%	
	Pressure: 86 ... 106	kPa
Housing conditions	Temperature: -25 ... +70	°C
	Relative humidity: 5% ... 95%	
	Pressure: 86 ... 106	kPa
Degree of protection (IEC 60529)	IP20	
Pollution degree	2	
Rated impulse withstand voltage (Uimp)	4	kV
Rated insulation voltage (Ui)	250	V
Overvoltage category	III	
Assembly	35 mm DIN standard rail	
Connection type	Screw terminals	
Supply voltage	24 -15% / +10% (AC 50 ÷ 60 Hz)	V ac/dc
Internal fuse on the supply	750 mA PTC	
Current consuption	@24Vdc: 25 min, 70 max; @24Vac: 110 min, 220 max	mA
Safety Outputs switching voltage	240 (max)	V AC
Switching current AC-1 / Electrical life	3 A (safety outputs) / $>10^5$ cycles	
Minimum switching current @ 10 V	10	mA
Safety output switching power	720 (max)	VA
External fuse at the output	4 A gG (according to IEC EN 60269-1)	
Safety outputs terminals	13 -14, 23 - 24	
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) / 10^5c. DC-13: 1A / 24 V / 10^5cycles	
Auxiliary output parameters	max: 0,5A @ 24 Vdc	
Output response time - manaul start (t1)	150	ms
Output response time - automatic start (t2)	30	ms
OFF state response time (t3)	20	ms
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)	**e**	**e**	**d**	**d**	**e**	
nop (number of operations / year)	65000	19200	65000	31500	19200	N. op. / year
MTTFd	30	100	30	56	100	years
PFHd	$9{,}54 \times 10^{-8}$	$2{,}47 \times 10^{-8}$	$2{,}65 \times 10^{-7}$	$1{,}03 \times 10^{-7}$	$4{,}29 \times 10^{-8}$	

TM	20 (for MTTFd = 100 years)	years
Stop category (EN ISO 13850)	0	
Vibration resistance	EN 60068-2-6, EN 60947-5-3	
Mechanical life	10^7	cycles
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	TÜV IT 0948 16 MAC 0076 B	

UL CERTIFICATION REQUIREMENTS

Power Source (input)

Input Terminals	Voltage	Max. Current
A1-A2	24Vac/dc	220mA / 70mA

Auxiliary Outputs (SAFETY)

Output Terminals	Contacts Type	General Use Or Resistive	Pilot Duty	
13-14 23-24	NO	3A/240Vac Res	1.4A/240Vac	1A/24Vdc

Signaling Outputs (SIGNAL)

Output Terminals	Contacts Type	Nom. Ratings
41-42	NO	0.5A/24Vdc
41-54	NC	

Environmental Ratings
Max. Surrounding Air Temperature: 55°C
Pollution Degree: 2
Environmental designation
Open type equipment

Installation Notes
Use with min. 60°C copper (CU) conductor only
Terminal tightening torque: 5-7 Lbln
(0,56-0,79 Nm)

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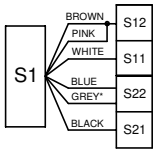
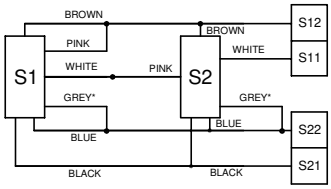
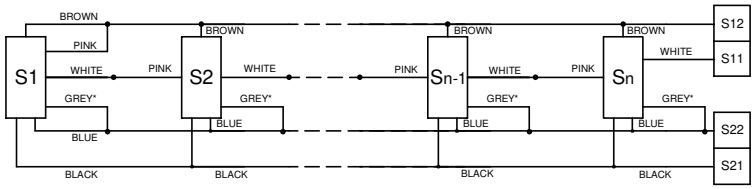
NC98 01 connection diagram for Hall safety sensors

N. of sensors	Connection options
1	GREY*: ONLY G2 versions 
2	GREY*: ONLY G2 versions 
n sensors conncted in series on the same channel (n_{max} = 10)	GREY*: ONLY G2 versions 

Shape	Sensor	Activation Magnet	Activation Distance Son [mm] [1]	Deactivation Distance Soff [mm] [1]	Reset Distance [mm] [1]
	N51H G1 N51H G2	M140 H1	< 13	> 18	> 20
	N52H G1 N52H G2	M120 H1	< 6	> 12	> 15
M25 	N25H G1 N25H G2	M110	< 5	> 11	> 13
M30 	N30H G1 N30H G2	M113	< 5	> 10	> 13

[1] 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.

Technical data (*also for activation magnets)		
Parameter	**Value**	**Unit**
Housing Material [2]	glass-fiber reinforced PPS	
Operating conditions [2]	Temperatura: -20 ÷ +80	°C
	Relative humidity: 4% ÷ 100%	
	Pressure: 86 ÷ 106	kPa
Storage conditions [2]	Temperature: -25 ÷ +70	°C
	Relative humidity: 5% ÷ 95%	
	Pressure: 86 ÷ 106	kPa
Degree of protection (IEC 60529) [2]	IP67	
Supply voltage (Vs)	20 ÷ 35	V dc
Internal fuse	Not present; the protection against possible over-currents has to be guarenteed by the power supplier of the sensors (ex. safety control unit)	
Current consuption [3]	35 max	mA
Output switching voltage	20 ÷ 35 (=power supply voltage)	V dc
Max output current	15	mA
Connections	cable with terminals	
B10d (EN ISO 13849-1)	$20x10^6$	cycles
Classification (EN ISO 14119)	TYPE 4	
Vibration and shock resistance [2]	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 [2]	EN 60204-1, EN ISO 13849-1, EN ISO 14119 (Type 4)	
Approval	TÜV IT 0948 16 MAC 0076 B	

[2] Data also for coded magnets

[3] Current consuption of each sensor connecte to the safety unit.
The current consuption of the unit depends on number of connected sensors.
($I_{max\ tot} = I_{max\ NC9801} + n \times I_{max\ sensor}$; $n_{max} = 10$).