

TCS-A5 (and TCS-R6 module)

DEVICE FOR PERMANENT CONTROL OF SAFETY CIRCUITS WITH ACTUATOR FOR OPENING EMERGENCY SWITCH WITH SHUNT TRIP OPENING COIL AND BUTTONS OR NORMALLY CLOSED CONTACTS

GENERALITY

The creation of these devices for the control of safety circuits meets the need to have a safe and reliable emergency stop system.

In particular, we tried to develop a safe emergency stop system that did not have the "defects" of other types (such as the use of under voltage coils or systems that use batteries, etc.).

The TCS-A5 (Trip Circuit Supervision Active 5) is a command and control system for emergency stop through buttons and contacts normally closed.

Unlike TCS products, the TCS-A5 is used to open the switches associated with a opening coil or in any case systems that can be activated with normally open contacts.

The TCS-A5 actuator produces a controlled input line for normally closed pushbuttons or contacts and the output with normally open contact with circuit continuity and efficiency control.



FEATURES

The device provides:

- Normally closed buttons and contacts at low power supply to guarantee more safety and to avoid functional problems with long lines
- active check with interruption or short-circuit signalling of the buttons line
- possibility to use many push-buttons (5 with total check) or buttons that command more TCS-A5
- switch command output, alarm signalling output and safety output
- check of the output line on the opening coil with continuity check
- insensitive to network interruption without using batteries
- selection of the number of push-buttons or contacts
- selection function of opening or alarm in case of fault on buttons line and/or coil line
- isolated and stabilized power supply insensitive to micro-interruptions
- check the presence of auxiliary power supply

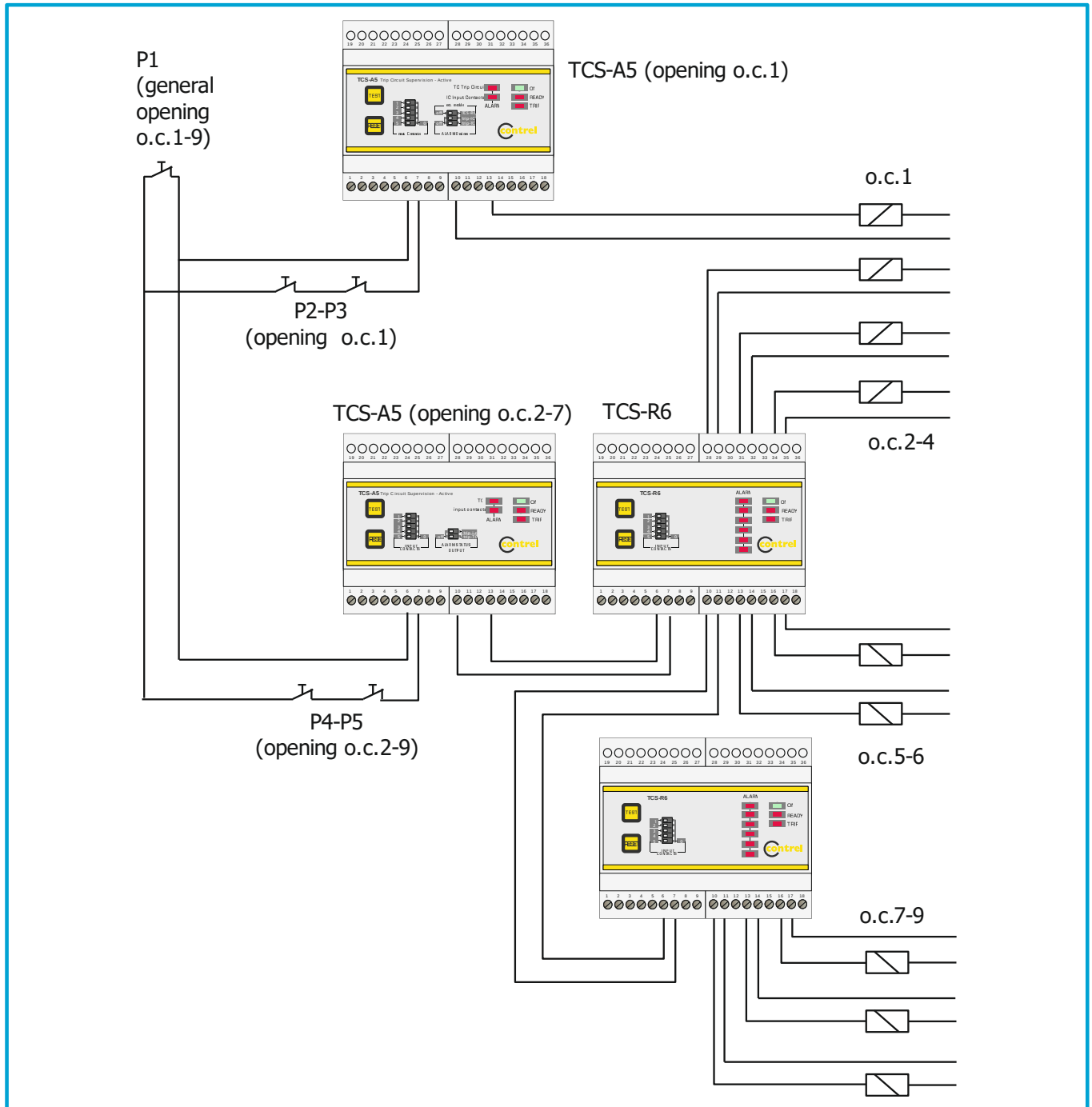
As indicated by CEI 64/8 standard, the emergency command must be installed when it's necessary to act on the power supply to eliminate unexpected hazards. With TCS-A5 is possible to interrupt the power supply and to check permanently the functionality of the command line of the normally closed push-buttons or contacts and to check the control output circuit with continuity and efficiency circuit check. If it's necessary to command more than one coil, it's possible to use more TCS-A5 or one **TCS-R6** module.

TCS-R6

The TCS-R6 module allows continuity and efficiency control up to 5 circuits with fault circuit alarm signalling. With the sixth output (TC1, always at 24/48 V) of the TCS-R6, it is possible to control a subsequent TCS-R6 in order to extend the number of individually controlled circuits indefinitely. Obviously the TC1 output can also be used to control a 24/48V coil.

The TCS-R6 is a device that contains a command input to connect to the output of the TCS-A5 (or in any case a normally open contact) and five relay outputs to use for opening the switches, including a continuity check for each output keeping the outputs isolated from each other, so that you can also use different power sources.

EXAMPLE OF OPENING SWITCH SYSTEM WITH TCS-A5 AND TCS-R6 MODULES



MODELS

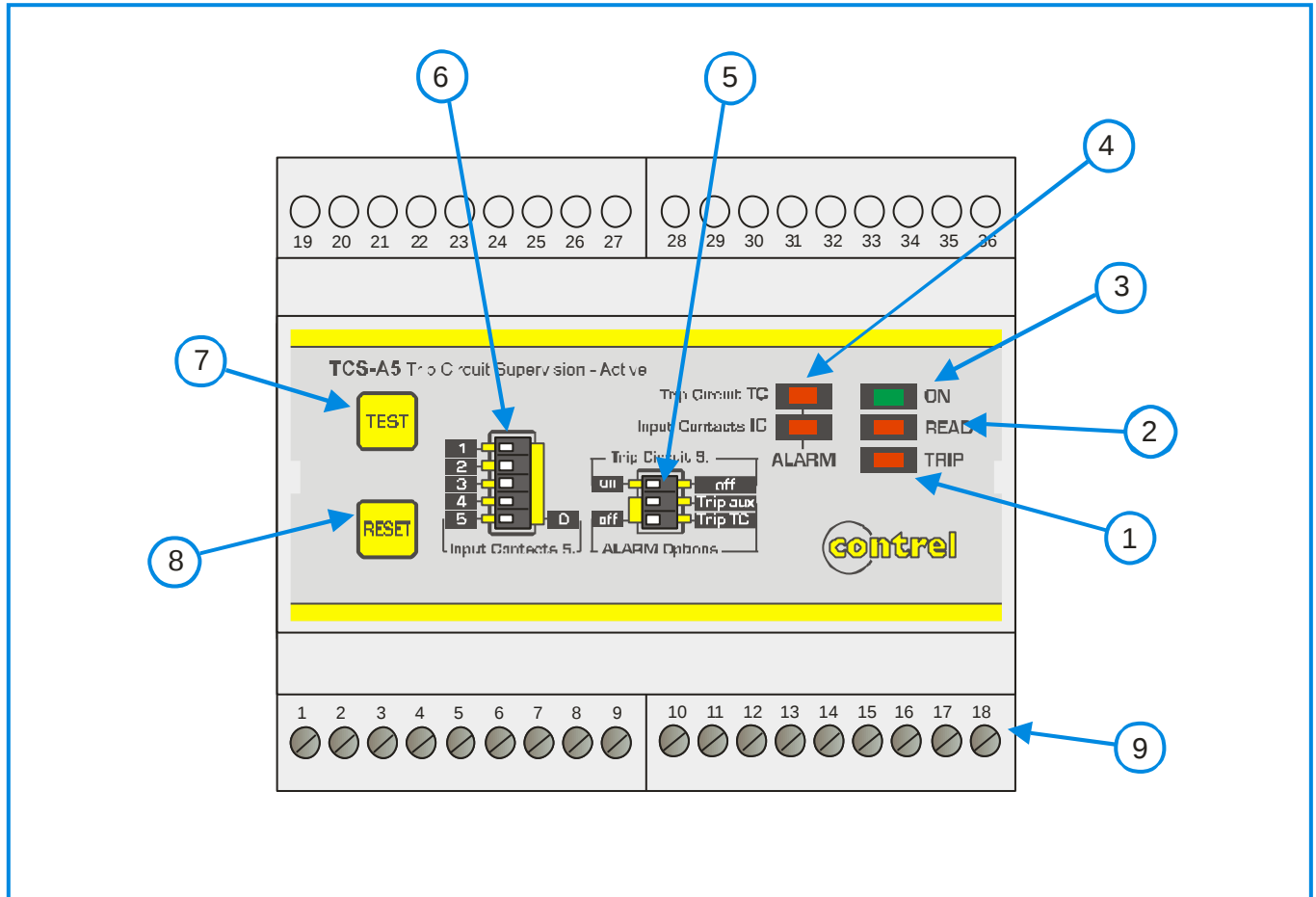
The available models differ according to the auxiliary supply voltage and the circuit under control:

A) TCS-A5	Vaux:115-230Vac	Trip Circuit Vc: 100÷240Vac/dc
B) TCS-A5	Vaux:24-48Vac/dc	Trip Circuit Vc: 20÷60Vac/dc
C) TCS-A5	Vaux:115-230Vac	Trip Circuit Vc: 20÷60Vac/dc
D) TCS-A5	Vaux:24-48Vac/dc	Trip Circuit Vc: 100÷240Vac/dc
E) TCS-A5	Vaux:110Vdc	Trip Circuit Vc: 100÷240Vac/dc
F) TCS-A5	Vaux:110Vdc	Trip Circuit Vc: 20÷60Vac/dc
G) TCS-R6	Vaux: 115-230Vac	Trip Circuit Vc: 65÷150Vac/dc
H) TCS-R6	Vaux: 115-230Vac	Trip Circuit Vc: 150÷260Vac/dc
I) TCS-R6	Vaux: 24-48Vac/dc	Trip Circuit Vc: 20÷60Vac/dc
L) TCS-R6	Vaux: 115-230Vac	Trip Circuit Vc: 20÷60Vac/dc
M) TCS-R6	Vaux: 24-48Vac/dc	Trip Circuit Vc: 65÷150Vac/dc
N) TCS-R6	Vaux: 24-48Vac/dc	Trip Circuit Vc: 150÷260Vac/dc
O) TCS-R6	Vaux: 110Vdc	Trip Circuit Vc: 65÷150Vac/dc
P) TCS-R6	Vaux: 110Vdc	Trip Circuit Vc: 150÷260Vac/dc
Q) TCS-R6	Vaux: 110Vdc	Trip Circuit Vc: 20÷60Vac/dc

INSTALLATION

The installation must be carried out by qualified and authorized technical personnel and only if there is no voltage. When the instrument is received, before beginning installation, check that it's O.K. And it has not suffered any damage during transport. When starting installation make sure that the voltages are compatible with the device instructions. The mounting is at snap on DIN rail 35mm. The device is a 6 modules by 17.5 mm with sealable transparent cover.

DESCRIPTION FUNCTIONS AND TCS-A5 OPERATORS

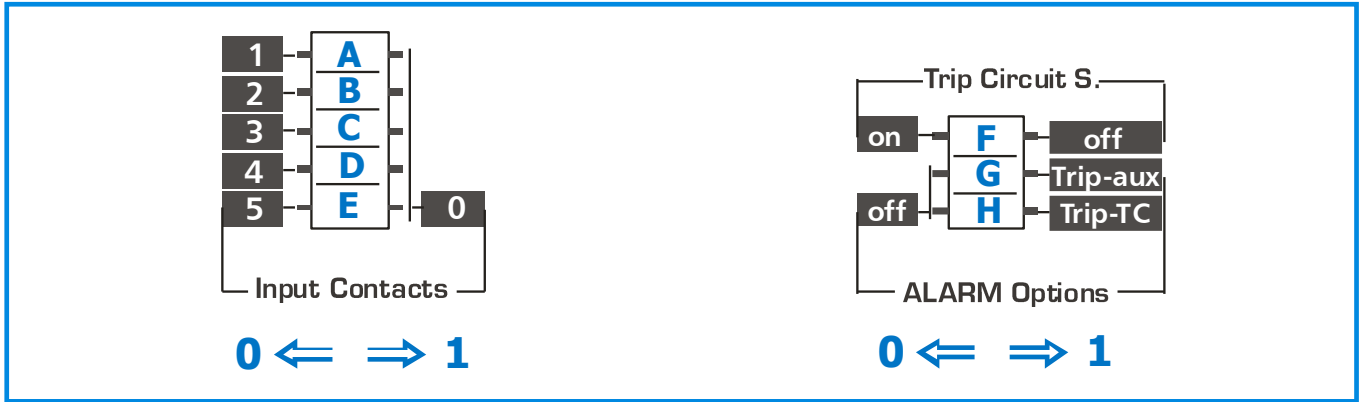


LEGEND

1. LED TRIP to signal the activation of the TRIP relay output when the circuit on the input contacts is opened
2. LED READY to signal that there are not alarm or fault and the instrument is ready to operate
3. LED ON to signal that the device is on, it indicates the presence of the auxiliary power supply.
4. LED ALARM to signal output circuit fault (TC Trip Circuit) and input contact circuit fault (IC Input Contacts).
5. Micro-switches to set the operating mode in alarm condition and enable/disable "trip circuit".
6. Micro-switches to set the number of controlled input contacts.
7. TEST push-button. When it is pressed, it causes the tripping and the commutation of the ALARM and TRIP relays.
8. RESET push-button. It works only with if it's set manual RESET. It allows the reset of the TRIP output after tripping.
9. Screw terminal blocks, cable max 2,5 mm²

TCS-A5 MICRO-SWITCHES SETTING

The frontal micro-switches allow to set the number of controlled contacts (INPUT CONTACTS) and the operating mode in alarm condition (ALARM OPTION).



A, B, C, D, +E micro-switches to set the number of contact checked

5 contacts: A=0, B=0, C=0, D=0, E=0
4 contacts: A=1, B=0, C=0, D=0, E=0
3 contacts: A=1, B=1, C=0, D=0, E=0
2 contacts: A=1, B=1, C=1, D=0, E=0
1 contact: A=1, B=1, C=1, D=1, E=0
0 contacts: A=1, B=1, C=1, D=1, E=1

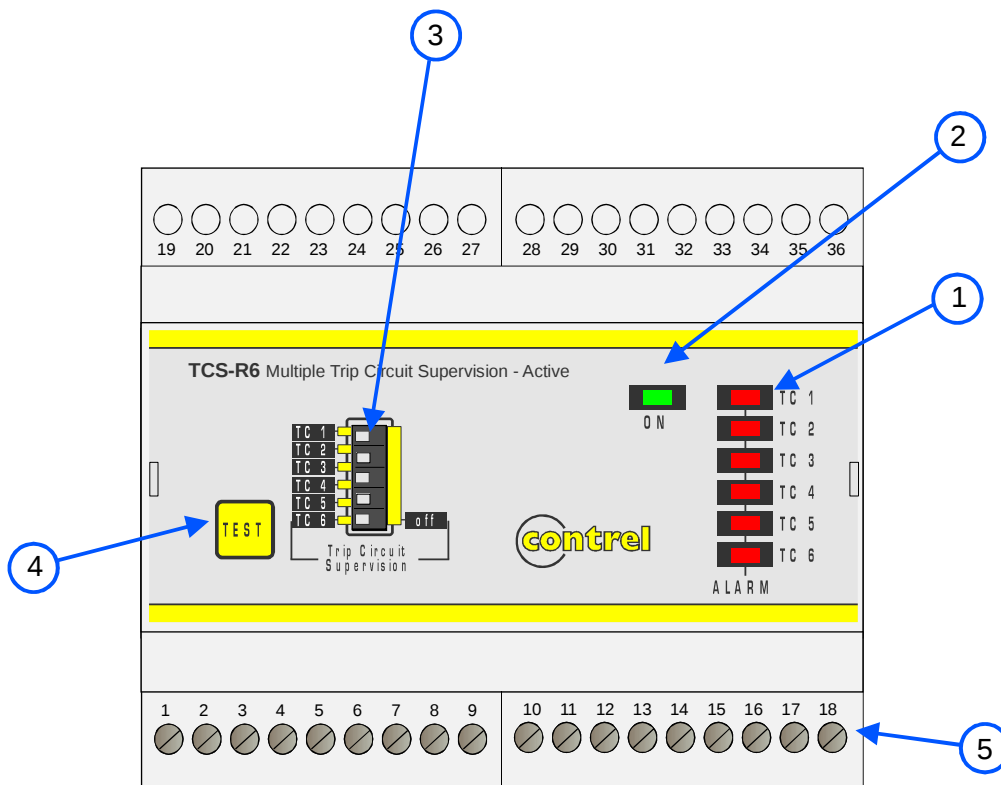
F micro-switch to enable / disable "trip circuit"

F=0 "trip circuit" enabled
F=1 "trip circuit" disabled (for eventual connection to a minimum voltage coil)

G, H micro-switches to set the ALARM option

G=1 in case of the auxiliary power supply lack, the activation TRIP relay activates for 100 ms
H=0 in case it is detected an output circuit fault, the activation TRIP relay is NOT activated
H=1 in case it is detected an output circuit fault, the activation TRIP relay is activated

DESCRIPTION FUNCTIONS AND TCS-R6 OPERATORS

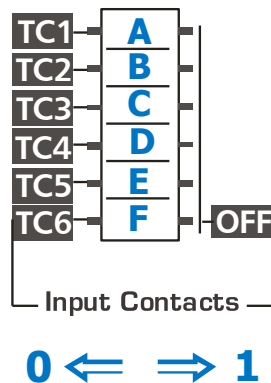


LEGEND

1. LED ALARM to signal the alarm on outputs or the outputs are activated
2. LED ON to signal that the device is on, it indicates the presence of the auxiliary power supply.
3. Micro-switches to enable the continuity check on outputs.
4. TEST push-button. When it is pressed, it caused the tripping of the output relays.
5. Screw terminal blocks, cable max 2,5 mm²

TCS-R6 MICRO-SWITCHES SETTING

The frontal micro-switches enable the continuity check and the correct functionality on outputs.



A, B, C, D, E, F micro-switches to enable the continuity check and the correct functionality of the outputs:

A=0 enable the continuity check and correct functionality of the TC1 output (always at 24 Vac/dc)

B=0 enable the continuity check and correct functionality of the TC2 output

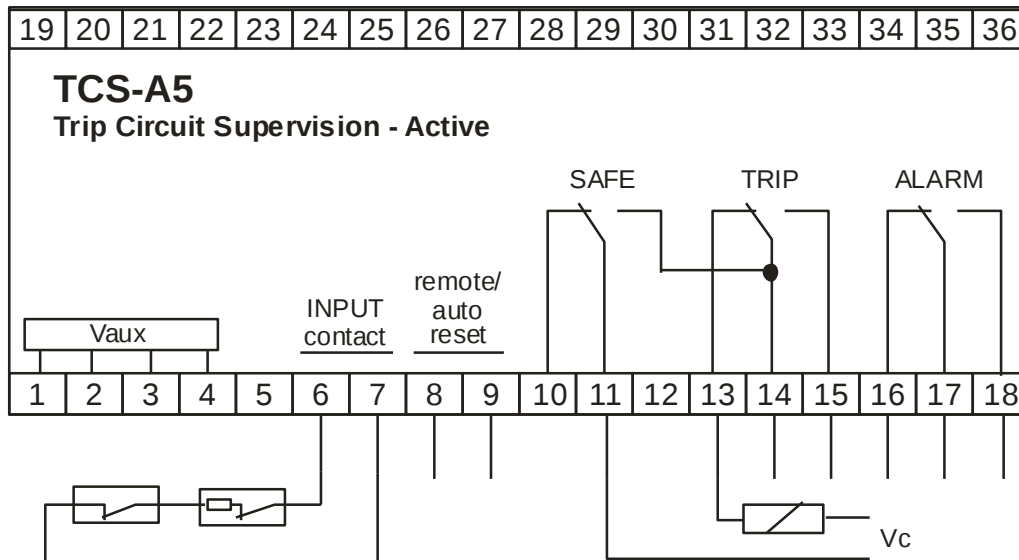
C=0 enable the continuity check and correct functionality of the TC3 output

D=0 enable the continuity check and correct functionality of the TC4 output

E=0 enable the continuity check and correct functionality of the TC5 output

F=0 enable the continuity check and correct functionality of the TC6 output

TCS-A5 CONNECTIONS



Auxiliary power supply (terminals 1-2-3-4)

The power supply section depends from the model of the device:

- 115-230V 50-60Hz model

With double 115V rated input (100÷130V 50-60Hz) between the terminals 1-2 and 3-4
Connect the two sections in series to supply the instrument at 230V (220÷240V 50-60Hz).
Connect the two section in parallel to supply the instrument at 115V.

- 24-48V 50-60Hz/cc model

Input for 24-48V between the terminals 1-3

- 110Vcc model

Input for 110V between the terminals 1-3

Input contact normally closed

terminals 6-7

The input contacts must be connected between two terminals in the way to create a closed circuit. At the opening of the circuit, there will be the activation.

The self-controlled contacts (with short circuit check) must be cabled with a resistance of 1000Ω 0.5-1W 1%.

The maximum self-controlled contacts are 5, while the not self-controlled contacts, in series, can be unlimited.

RESET or automatic RESET inputs

terminals 8-9

It's possible to have an external RESET button, connected between the two terminals with a normally open contact. To have the automatic reset, it need to short circuit the two terminals.

TRIP relay output

terminals 10-11-12-13-14-15

The activation circuit must be supplied with the correct voltages indicate by various model.

In this manual the voltage used are:

100-240Vac/dc or 24-48Vac/dc

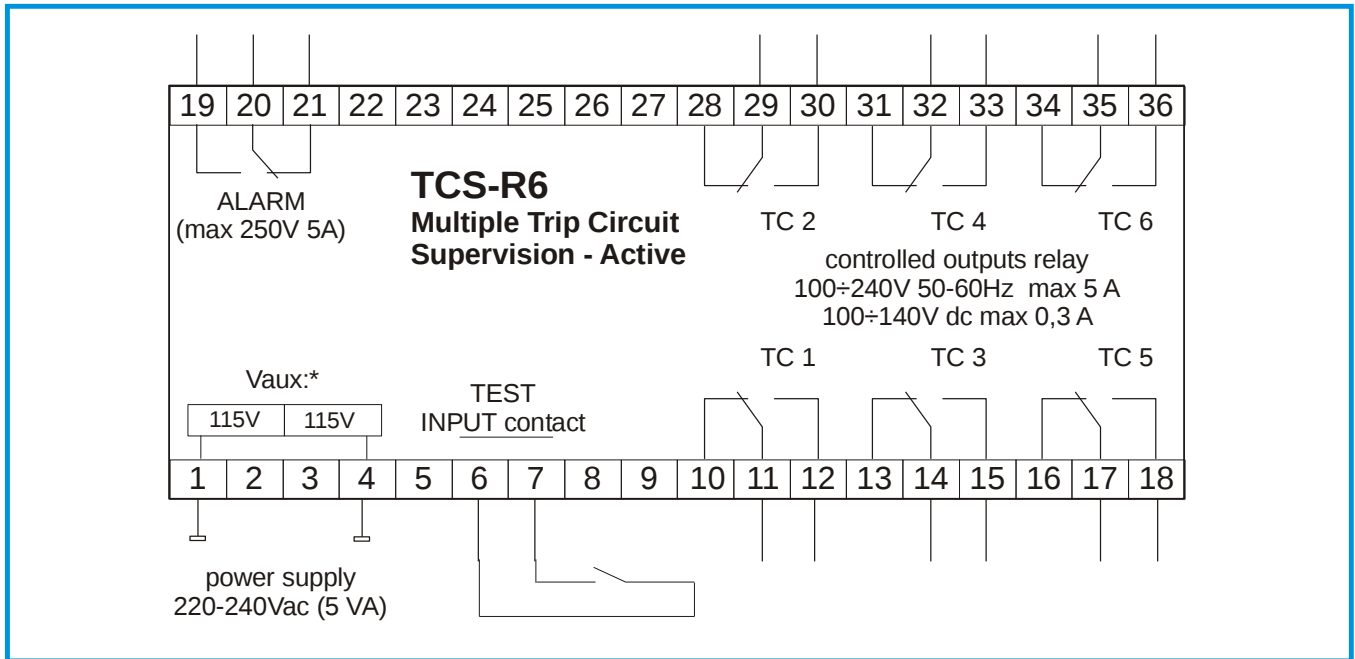
Between the 11-13 terminal boards needs to connect the coils for the switches opening command.

ALARM relay output

terminals 16-17-18

The change-over alarm contact can be used for remote signaling of the circuit fault condition. The normal condition is signaled with normally energized relay. In the diagram, the relay is shown in the condition of a device without auxiliary power supply or alarm condition.

TCS-R6 CONNECTIONS



Auxiliary power supply

Terminals 1-2-3-4

The power supply section depends from the model of the device:

- 115-230V 50-60Hz model

With double 115V rated input (100÷130V 50-60Hz) between the terminals 1-2 and 3-4
Connect the two sections in series to supply the instrument at 230V (220÷240V 50-60Hz).
Connect the two section in parallel to supply the instrument at 115V.

- 24-48V 50-60Hz/cc model

Input for 24-48V between the terminals 1-3

- 110Vcc model

Input for 110V between the terminals 1-3

Command input

Terminals 6-7

Command input (normally open) can be connected to a TCS-A5.

TRIP relay output

Terminals 10-11-12, 13-14-15, 16-17-18, 28-29-30, 31-32-33, 34-35-36

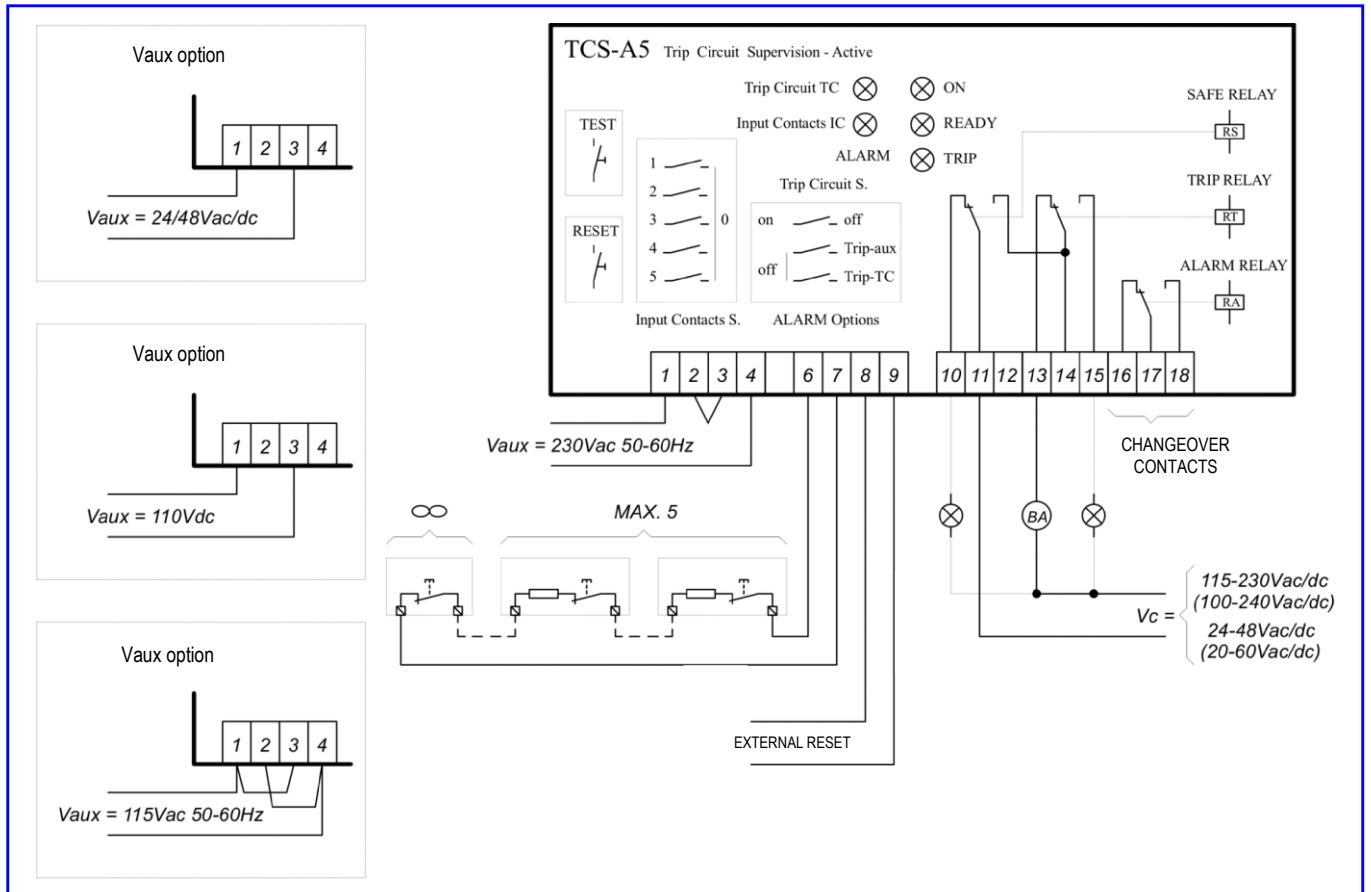
Relay outputs used for opening switches, supplied with the voltages provided by the various models.

ALARM relay output

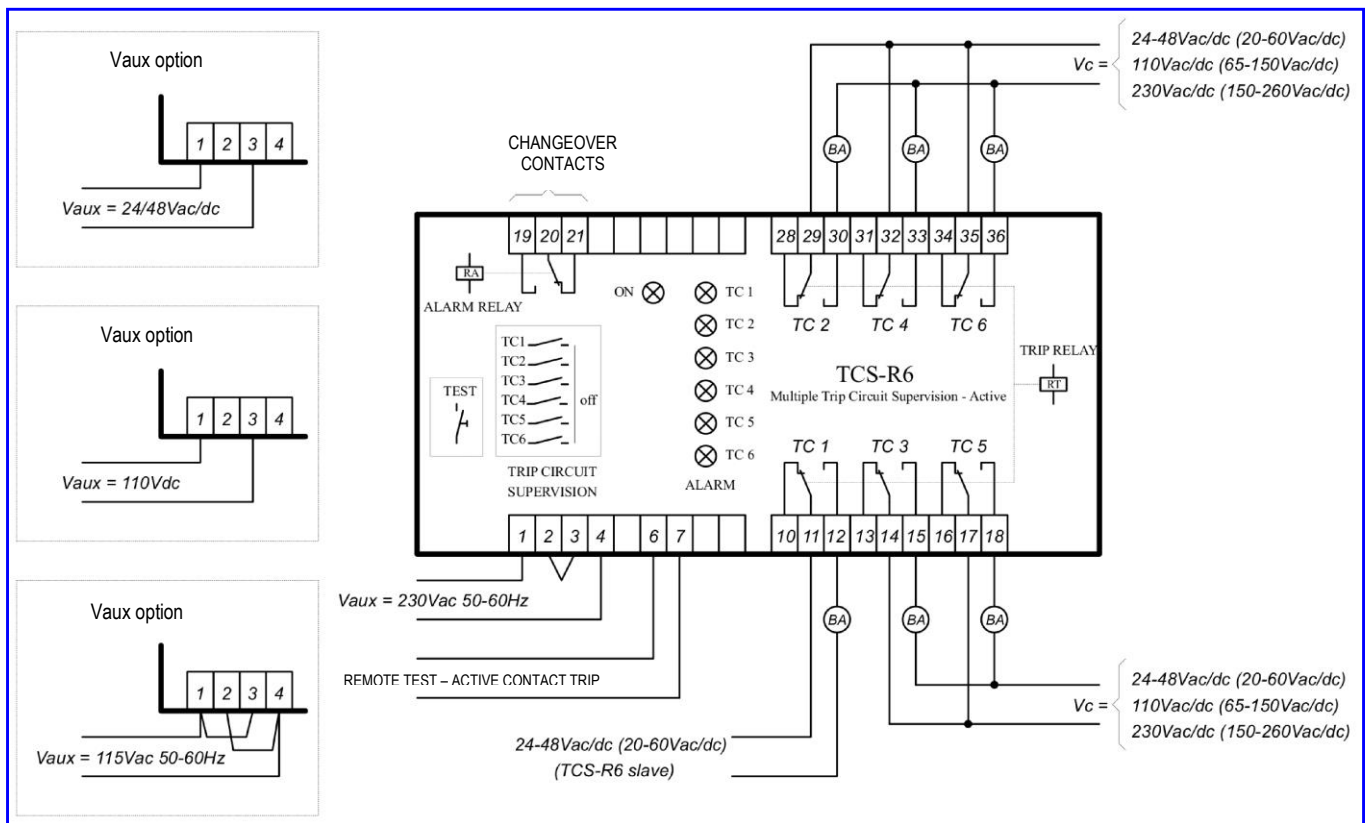
Terminals 19-20-21

The change-over alarm contact can be used for remote signaling of the circuit fault condition. The normal condition is signaled with normally energized relay. In the diagram, the relay is shown in the condition of a device without auxiliary power supply or alarm condition.

TCS-A5 CONNECTION

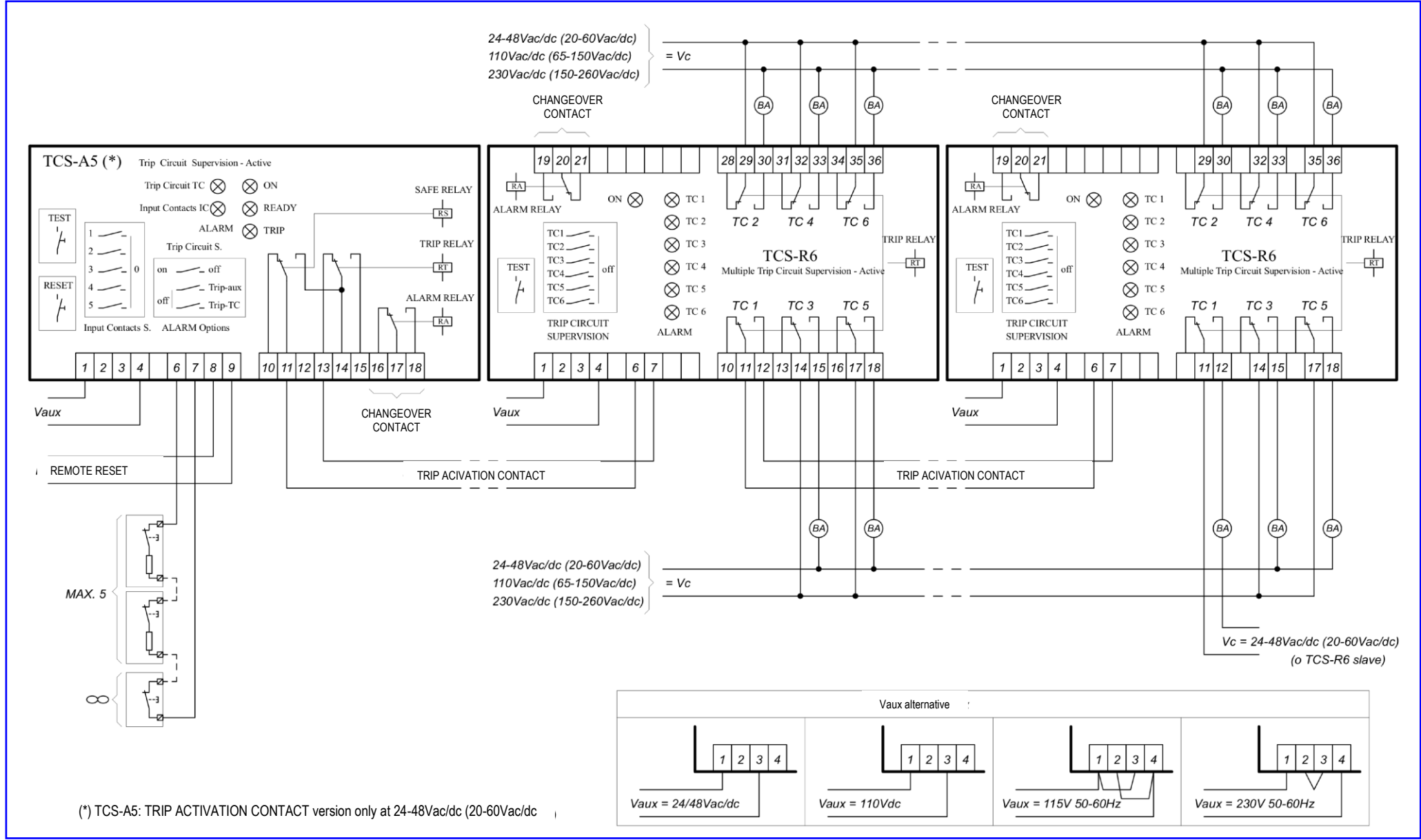


TCS-R6 MODULE CONNECTION



The TC1 ÷ TC6 switches in the OFF position disable the control of the corresponding opening circuit. The ALARM LEDs indicate the fault (or opening) of the corresponding circuit. In the case of connection of several TCS-R6 modules, the TC1 LED lighting up, with consequent switching of the ALARM relay, indicates the fault in the connection itself.

TCS-A5 WITH TCS-R6 MODULE WIRING CONNECTION



TCS-A5 FUNCTIONING

The classic application of the device is to command the opening of a switch equipped with an opening coil (BA) using safety pushbuttons connected in series.

When the device is normally connected as in the diagram, with Vc present but without Vaux, all relays are de-energized, the BA actuator doesn't receive energy from RT relay (TRIP) and the RA relay (ALARM) is in alarm state.

When the Vaux is powered up, the ON led lights up, the Alarm Relay (RA) is energized, in the normal operating position, after about 80ms the Trip Relay (RT) and after others 80ms the RS relay (SAFE) are energized, and the Led Ready lights up. From this moment the device is ready to receive command from the normally closed safety buttons (NC).

After 150 ms from the trip request (NC button pressed) the TR relay is de-energized while the BA actuator is energized, opening the associated switch. The trip status is signaled on the device with the TRIP led that turned on while the READY led turned off, and in remote using a lamp in parallel to the BA coil.

This condition can be stored. In this way it's possible to use safety buttons with instantaneous opening (without mechanical retain). The memory can be reset using the button on the device or using the remote button (free of voltages).

Short-circuiting the 8 and 9 terminals the device will be reset after the trip request.

With the TEST button of the device is possible perform a test without to use the safety buttons.

The 5 safety buttons are checked in the perfect condition of functioning (without short-circuit on terminals or on connection). These buttons should contain a resistance of 1000Ω, ½W or 1W, 1% after the connection terminals (see wiring connection). This it allows at the device to detect when there are short-circuit on the terminals or on the connection.

In application with more of 5 buttons, the buttons that exceed the limit of 5, it should not be of the self-control type. The number of the self-control buttons should be exactly balanced setting the number on the dip-switches on the device. It's important to set the correct number because an error could create some problem to the device that don't recognize the number and the condition of the connected buttons.

When on one or more of the self-control buttons there is an abnormal connection, on the device the Alarm Led turn on and the Alarm relay is de-energized, the exchange 16-17-18 commute for the remote signaling; this condition is only of alarm and don't cause the system trip (if the micro-switch Trip is not selected).

In addition to the fail safe on the power supply, the device also contains TCS function (control open circuit). The device can also control the efficiency of the source of control voltage (Vc) and the circuit connection to the BA (trip circuit).

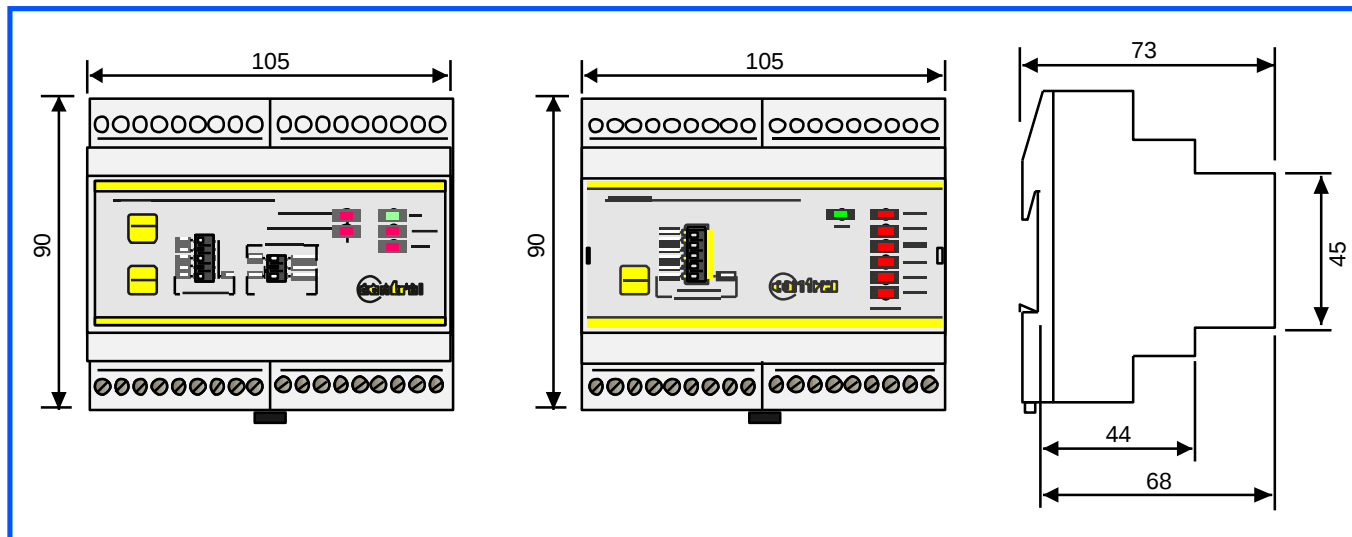
For a fault on a BA circuit, it's possible to have two following situation:

- 1) With **Trip-TC** switch set to OFF, the TC Alarm led is turning ON and RA relay is de-energized with the signalling of remote Alarm. When the fault disappears the TC Alarm led is turning off and the RA relay energized, the remote signalling disappears. The Trip relay (RT) doesn't change his status.
- 2) With **Trip-TC** switch set to ON, it's possible to have one of the following cases:
 - 2.1) With Auto-Reset (Remote Reset) not inserted the memory Trip will be activated, the Trip Led will turn on, the READY Led will turn OFF and the Trip relay (RT) will be de-energized, the same way of the BA trip. This condition is hold up to the RESET that turn off the memory. If in the meantime the fault was removed, everything come back to the normal, otherwise, even if the TCS-A5 is come back in the READY condition, the ALARM TC Led remain ON and the RA relay is still in alarm. It's obvious that this is an emergency condition and the power switch should not be closed because it would be not able to open by electricity.
 - 2.2) With Auto-Reset (Remote Reset) inserted (short-circuit between 8 and 9 terminals) the Trip Relay (RT) is de-energized for 50÷100 ms and after it come back energized. This caused the momentary closing of the contacts of the 11 and 12 terminals. With this contacts and with the RA contacts it's possible to create a specific remote signalling of fault of the BA TRIP circuit, with priority greater than the alarm signalling for button in short-circuit.

If in the condition of normal functioning the Vaux is missing, the device has a duration of about 1 second. Exceeded this time there are the following condition:

- 1) With the **Trip-aux** switch set to OFF, the Safety Relay (RS) will be de-energized before of the Trip Relay (RT), without the BA tripping.
- 2) With the **Trip-aux** switch set to ON the Trip Relay (RT) will be de-energized before of the Safety Relay (RS) causing the BA tripping.

DIMENSION



mounting on DIN rail 35mm (DIN 50022) - 6 modules by 17,5 mm

TCS A5 TECHNICAL FEATURES

auxiliary power supply	- 115÷230Vac ±10% 50-60Hz - 24-48Vdc/50-60Hz ±20% - 110Vdc ±20%
max consumption	max 5 VA
TC output circuit	- 100÷240Vac/dc - 20-60Vac/dc
operating voltage input contacts	max 30Vdc
IC current circuit contact inputs	min. 0,4mA - Max 0,7mA dc
input circuit contacts	max 5 self-controlled, for short circuit too, (resistance 1000 Ω 0,5W), unlimited not controlled
TRIP + SAFE activation output relay	contacts max 5 A 250V 50-60Hz / max 0,3 A 110Vdc / 2 A 48Vdc
ALARM output relay	change over contact NO-C-NC max 5 A 250V 50-60Hz / max 0,3 A 110Vdc / 2 A 48Vdc
signalling	led ON, led READY, led TRIP, led ALARM (TC and IC)
self-controlled contacts setting	5 micro-switches
alarm option setting	micro-switches for TC and IC alarm TRIP activation and for the connection with TCS-R6 module
push-button	TEST and RESET
TRIP output activation delay	150 ms
READY led turn on delay	150 ms
TRIP output pulse for lack of Vaux	100 ms
autonomy for lack of Vaux	about 1 second
operating temperature	-10 ÷ 60°C
storing temperature	-25 ÷ 70°C
relative humidity	≤ 95 %
insulation test	3 kV 60 sec. / 4 kV imp. 1,2/50µs
mounting position	any
connection type	Screw terminal boards, cable section max 2,5 mm ²
protection degree	IP 40 front with cover - IP 20 enclosure
mounting according DIN 50022	Snap on DIN rail 35mm / 6 modules by 17,5 mm
weight	about 0,5 kg
standards	safety CEI-EN 61010-1 / CEI-EN 61551-1 EMC compatibility CEI-EN 61326-1 CEI-EN 61326-2-4 CEI 64-8 (64-8/464.1 – 64-8/465.5 – 64-8/537.4.3)

Contact the technical assistance or refer at specific document for application didn't describe in this manual.

