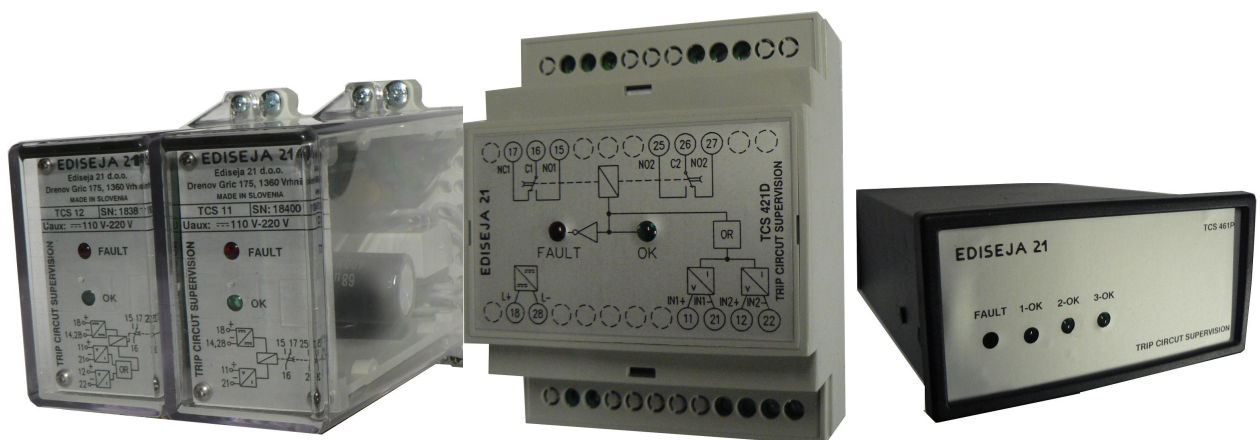


## TCS Trip Circuit Supervision Relay User manual



Device:  
TCS

Document: User manual  
Code: TCSMUALE

Date:  
07.10.2020

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# 1 PREFACE

## Liability statement

We have checked the contents of this manual to ensure that the descriptions of both hardware and software are as accurate as possible. However, deviations may occur so that no liability can be accepted for any errors or omissions contained in the information given.

The contents of this manual will be checked in periodical intervals, corrections will be made in the following editions.

We reserve the right to make technical improvements without notice.

## Contact

If you have any questions or comments related to this product please contact us on:

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## Explanation of the symbols



Read the instructions!



Device was tested with 2,5 kV AC voltage to check the device insulation.



Waste Electrical and Electronic Equipment (WEEE) Directive 2015/863/EU; the affixed product label indicates that you must not discard this electrical/electronic product in domestic household waste.

## Warnings

In this paper the following terms are used:

### Danger

indicates that death, severe personal injury or substantial property damage will result if proper precautions are not taken.

**Warning**

indicates that death, severe personal injury or substantial property damage can result if proper precautions are not taken.

**Caution**

indicates that minor personal injury or property damage can result if proper precautions are not taken. This particularly applies to damage on or in the device itself.

**General information**

These paper contain the information that is necessary for the proper and safe operation of the described devices. This paper is intended for technically qualified personnel.

**Warning!**

**Hazardous voltage is present inside the device during operation. Disregarding of safety rules can result in severe personal injury or property damage.**

**Only qualified personnel may work with described devices after being familiar with warnings and safety notices in this paper and other safety regulations.**

**Warning!**

**Device must operate completely assembled! Device must be used as described. No modifications of the device should be made.**

**Warning!**

**Do not open device while it is energized! Hazardous voltage is present inside the device. Disconnect all connectors before opening!**

**Warning!**

**If device is damaged disconnect it from power supply! Send it to the manufacturer for inspection.**

**Warning!**

**Connect to earth before attaching power supply!**

\* Combiflex® is ABB Registered Trademark.

<i>Device:</i>	<i>Document:</i>	<i>Code:</i>	<i>Date:</i>	<i>Page:</i>
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## 2 GENERAL DESCRIPTION

TCS is family of circuit breaker trip circuit supervision relays. There are two types of relays; with active power supply (TCS 1xxx, 2xxx, 4xxx) or passively supplied through supervision circuit (TCS Axxx, Bxxx, Cxxx, Dxxx). Devices with active power supply draws very low supervision current which is crucial in autonomous protection systems with trip capacitor power bank.

### 2.1 TCS 1xxx, 2xxx, 4xxx

TCS 111x, 211x, 411x has one supervision channel. With additional external resistor those devices can supervise circuit breaker trip circuit in both circuit breaker positions.

TCS 121x, 221x, 421x has two supervision channels. Second channel replaces external resistor and enables use of latched trip contact or permanent trip (e.g. undervoltage protection). TCS device has one output which is controlled with supervision input(s). If the supervision current is below threshold, digital output drops after time delay.

Power supply and supervision inputs are made for standard substation voltages; 24 V DC, 48 V-60 V DC and 110 V-250 V DC .

For device operation visual inspection device is equipped with green LED and one red lamp for digital output state.

TCS xxxC is in HX1 housing and is intended for installing into ABB Combiflex® system, TCS xxxD is intended for DIN35 rail mounting.

### 2.2 TCS Axxx, Bxxx, Cxxx, Dxxx

TCS A11x, B11x, C11x, D11x has one supervision channel. With additional external resistor those devices can supervise circuit breaker trip circuit in both circuit breaker positions.

TCS A22x, B22x, C22x, D22x has two supervision channels. With two additional external resistors those devices can supervise two circuit breakers trip circuit in both circuit breaker positions.

TCS A11x, B11x, C11x, D11x device has one digital output which is controlled with supervision input. TCS A22x, B22x, C22x, D22x device has two outputs. Digital output is controlled with supervision input. If the supervision current is below threshold, digital output drops after time delay.

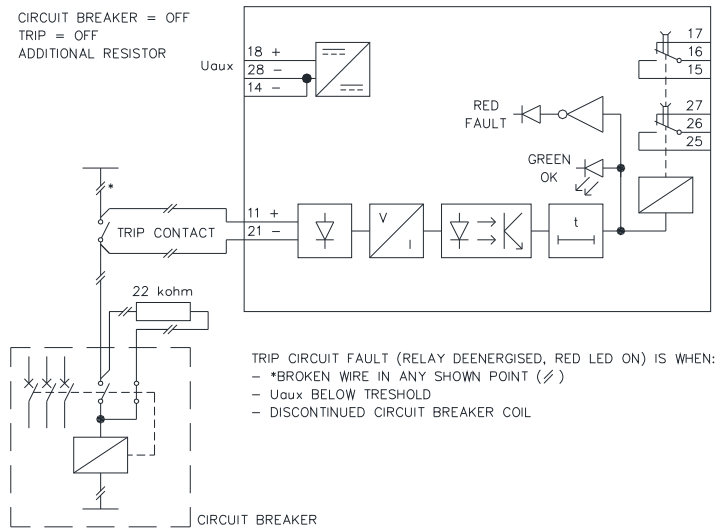
Power supply and supervision inputs are made for standard substation voltages; 24 V DC, 48 V-60 V DC and 110 V DC and 220 V DC .

For device operation visual inspection device is equipped with green LED and one red lamp for digital output state.

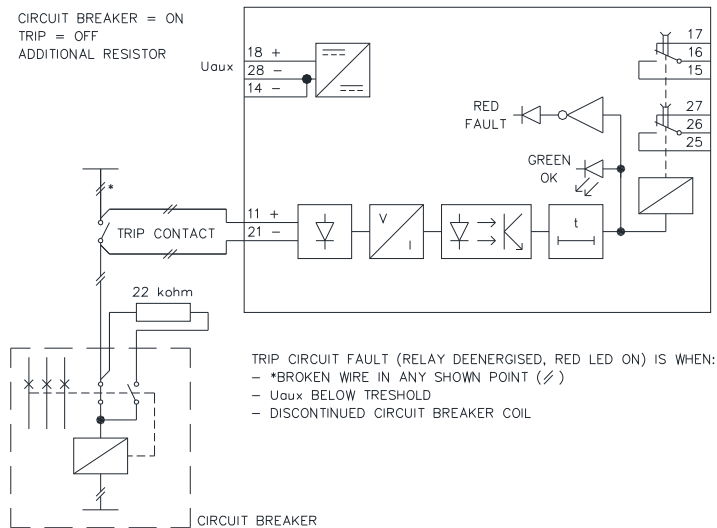
TCS xxxC is in HX1 housing and is intended for installing into ABB Combiflex® system, TCS xxxD is intended for DIN35 rail mounting.

### 3 OPERATION

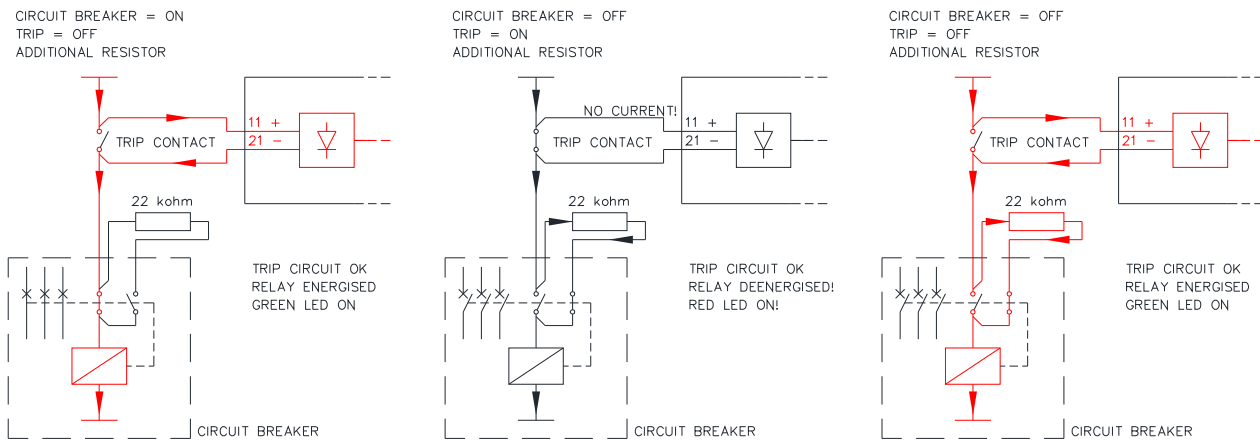
#### 3.1 TCS 111x, 211x, 411x OPERATION



Picture 1: TCS 111x, 211x, 411x trip circuit supervision path (CB OFF)



Picture 2: TCS 111x, 211x, 411x trip circuit supervision path (CB ON)



Picture 3: TCS 111x, 211x, 411x trip circuit supervision current flow

### 3.2 TCS 121x, 221x, 421x OPERATION

User has two options for connection the TCS relay to the circuit breaker (CB):

- ◆ 3 wires connection to the CB
- ◆ 2 wires connection to the CB

Operation of the TCS relay is the same for both connection type when CB is ON. There is difference in operation when CB is OFF.

#### 3 WIRES CONNECTION

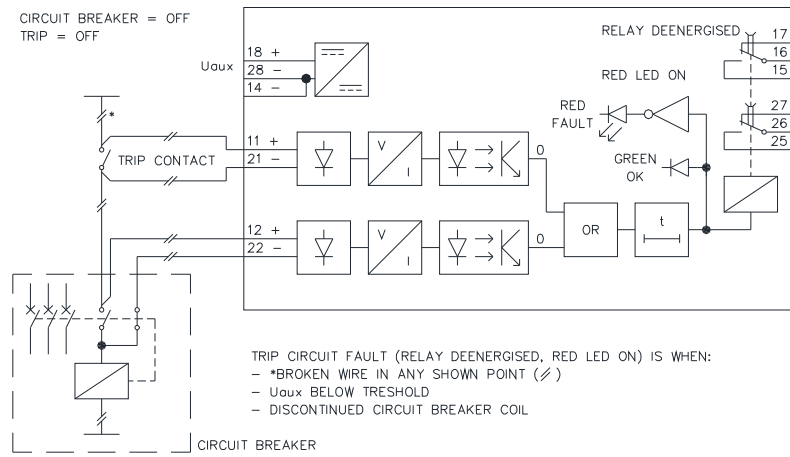
3 wires connection is recommended. In case of 3 wire connection there is more trip path that is under supervision of TCS relay when CB is OFF. Connection requires 3 wires from TCS relay to the CB.

#### 2 WIRES CONNECTION

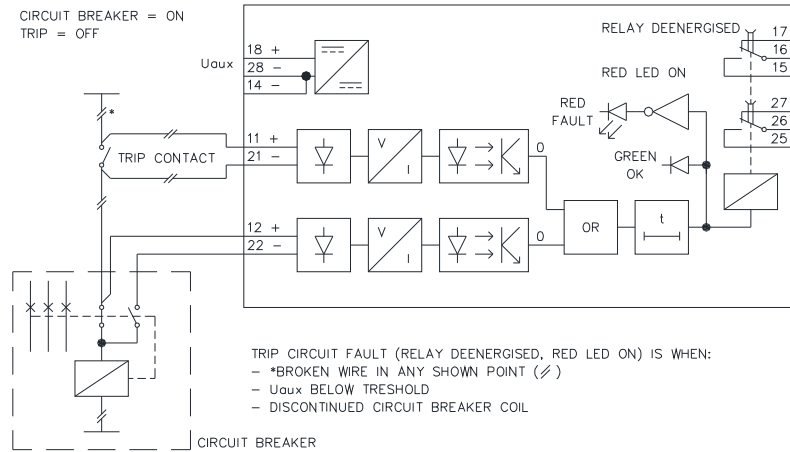
In case of 2 wires connection there is less trip path that is under supervision of TCS relay when CB is OFF. Connection requires 2 wires from TCS relay to the CB.



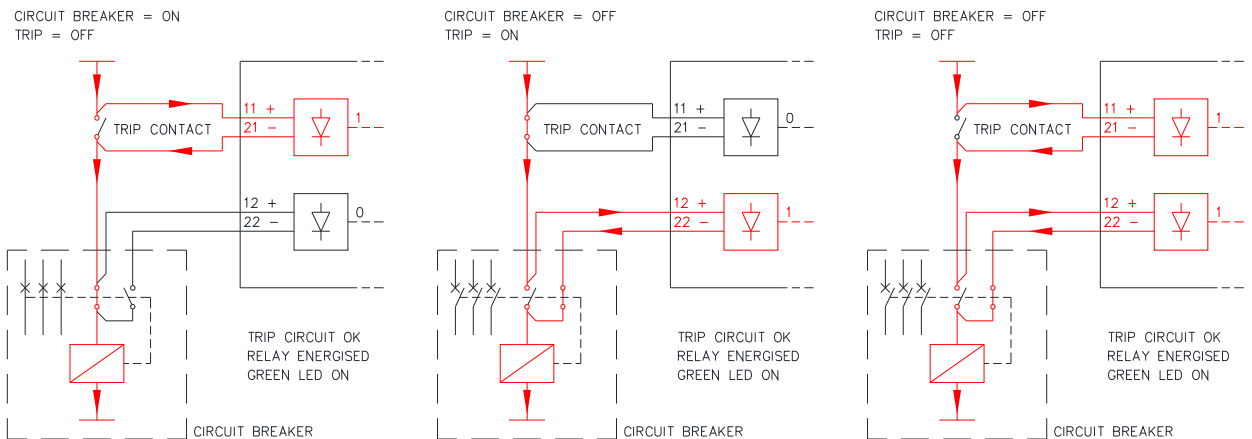
3.2.1 TCS 121x, 221x, 421x OPERATION - 3 WIRES TO CB



Picture 4: TCS 121x, 221x, 421x trip circuit supervision path - 3 wires to CB (CB OFF)

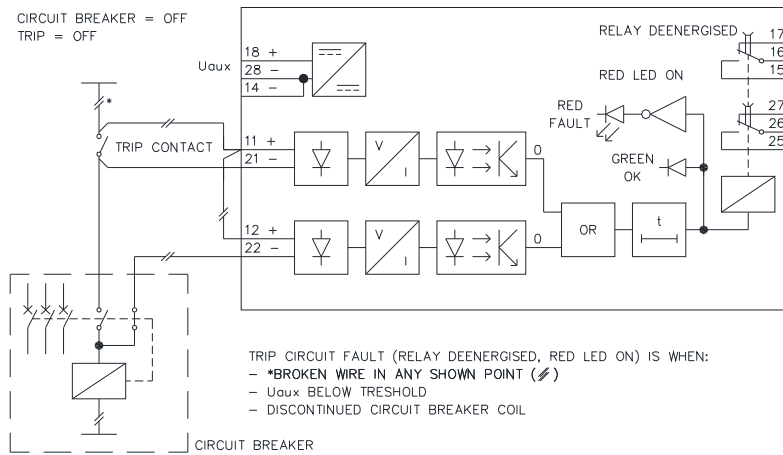


Picture 5: TCS 121x, 221x, 421x trip circuit supervision path - 3 wires to CB (CB ON)

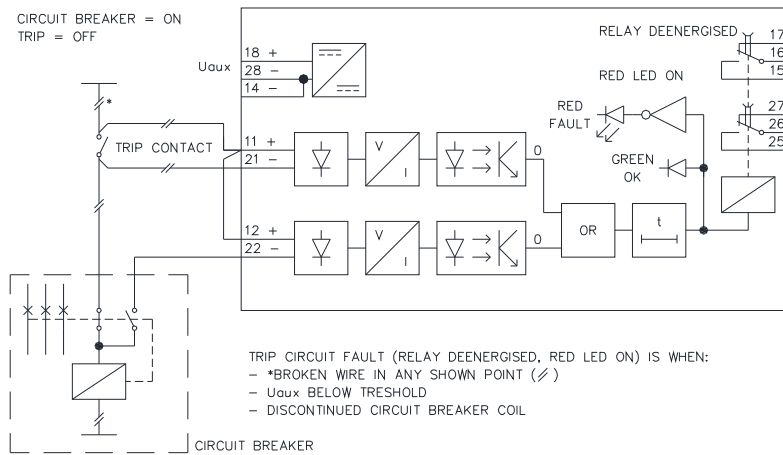


Picture 6: TCS 121x, 221x, 421x trip circuit supervision current flow - 3 wires to CB

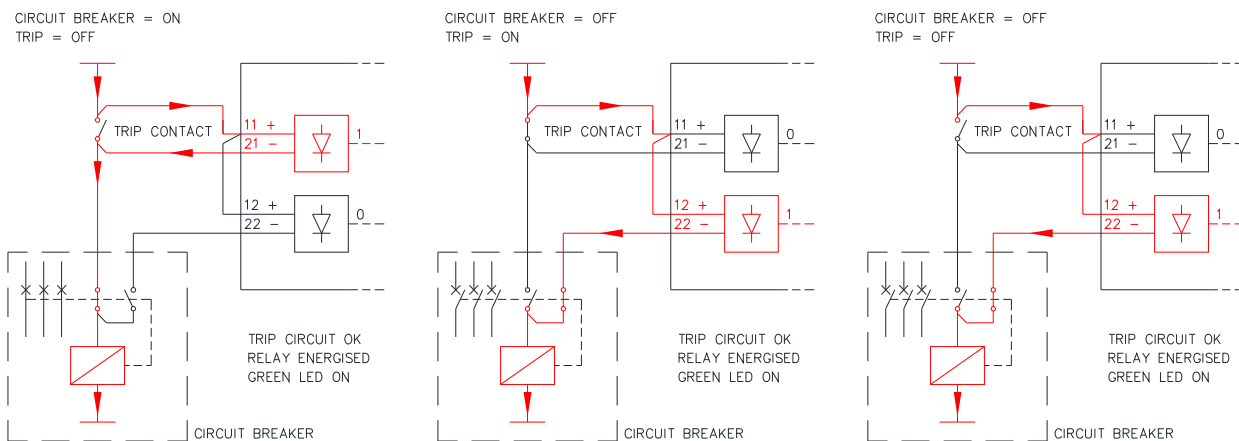
3.2.2 TCS 121x, 221x, 421x OPERATION - 2 WIRES TO CB



Picture 7: TCS 121x, 221x, 421x trip circuit supervision path - 2 wires to CB (CB OFF)



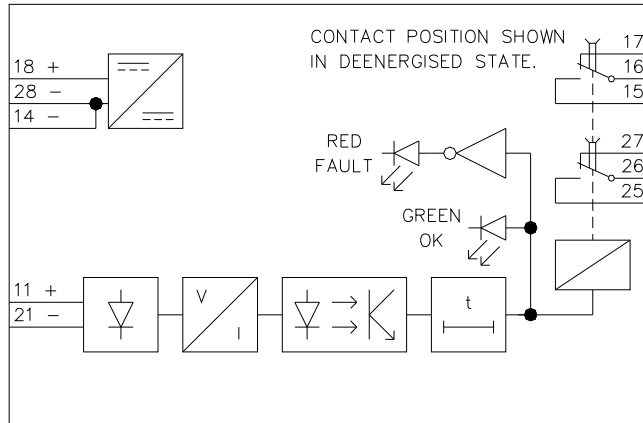
Picture 8: TCS 121x, 221x, 421x trip circuit supervision path - 2 wires to CB (CB ON)



Picture 9: TCS 121x, 221x, 421x trip circuit supervision current flow - 2 wires to CB

## 4 SCHEMATICS & DESCRIPTION

### 4.1 TCS 111x, 211x, 411x



Picture 10: TCS 111x, 211x, 411x schematic

**TCS 111x** (DC 24 V)

**TCS 211x** (DC 48 V-60 V)

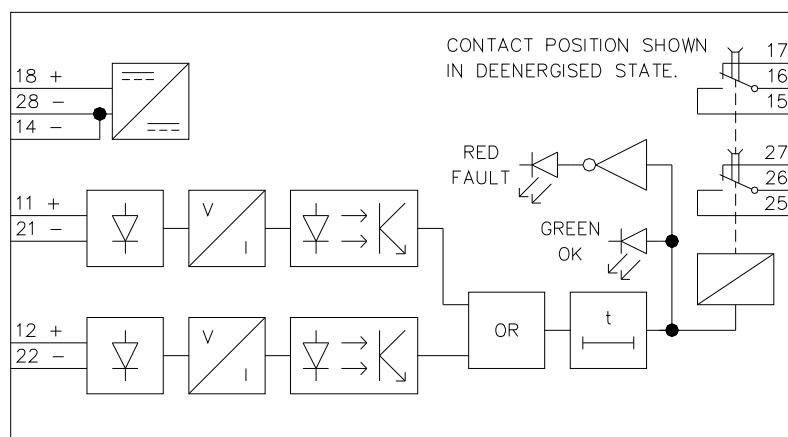
**TCS 411x** (DC 110 V-250 V, AC 230 V)

**TCS xxxC** (ABB SPER 1C1 pin compatible, Combiflex® HX1 housing)

**TCS xxxD** (housing intended for DIN35 rail mounting)

One channel trip circuit supervision relay. With the use of external resistor can supervise one circuit breaker trip in both circuit breaker positions. It has active power supply and 2xCO potential free relay contacts. Deenergised input deenergise output relay after time delay.

### 4.2 TCS 121x, 221x, 421x

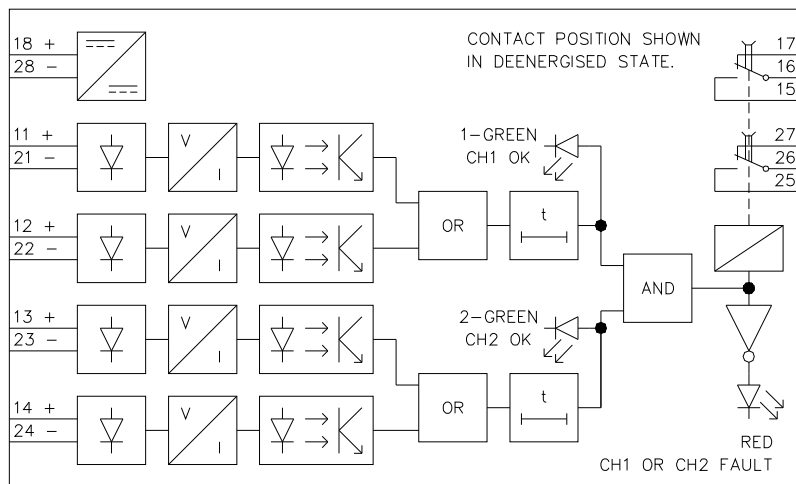


Picture 11: TCS 121x, TCS 221x, TCS 421x schematic

- TCS 121x (DC 24 V)
- TCS 221x (DC 48 V-60 V)
- TCS 421x (DC 110 V-250 V, AC 230 V)
- TCS xxxC (Combiflex® HX1 housing)
- TCS xxxD (DIN35 rail mounting housing)
- TCS xxxP (panel mounting 96 x 48 mm housing)

Two channel trip circuit supervision relay. It can supervise one circuit breaker trip circuit in both circuit breaker positions without external resistor. It has active power supply and 2xCO potential free relay contacts. Both deenergised inputs deenergise output relay after time delay.

### 4.3 TCS 141x, 241x, 441x

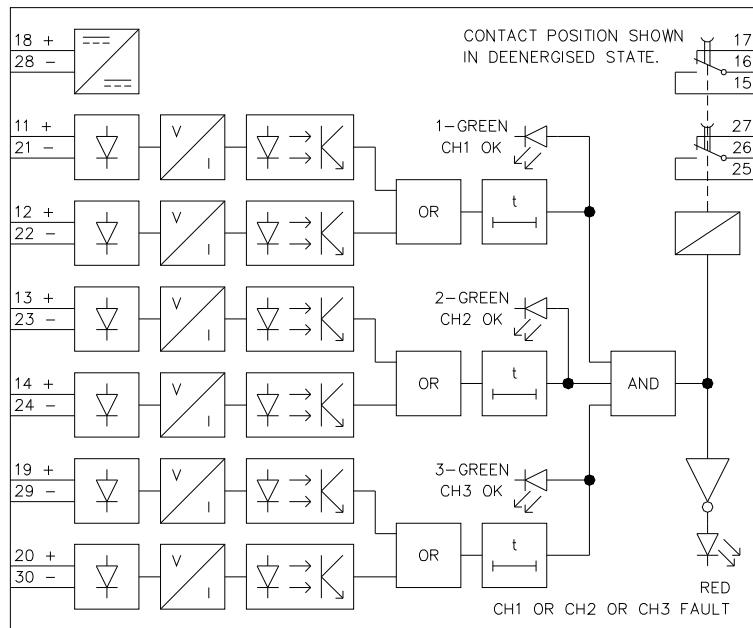


Picture 12: TCS 141x, TCS 241x, TCS 441x schematic

- TCS 141P (DC 24 V)
- TCS 241P (DC 48 V-60 V)
- TCS 441P (DC 110 V-250 V, AC 230 V)

Four channel trip circuit supervision relay. It can supervise two circuit breaker trip circuits in both circuit breaker positions without external resistor (e.g. medium voltage circuit breaker with two coils). It has active power supply and has 2xCO relay potential free contacts. Any deenergised input pair deenergise output relay after time delay.

#### 4.4 TCS 161x, 261x, 461x

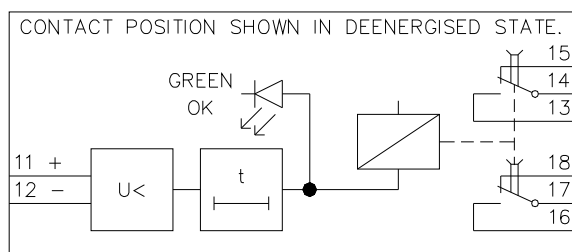


Picture 13: TCS 161x, TCS 261x, TCS 461x schematic

- TCS 161P (DC 24 V)
- TCS 261P (DC 48 V-60 V)
- TCS 461P (DC 110 V-250 V, AC 230 V)

Six channel trip circuit supervision relay. It can supervise three circuit breaker trip circuits in both circuit breaker positions without external resistor (e.g. high voltage three single pole circuit breaker). It has active power supply and has 2xCO relay potential free contacts. Any deenergised input pair deenergise output relay after time delay.

#### 4.5 TCS A11x, B11x, C11x, D11x



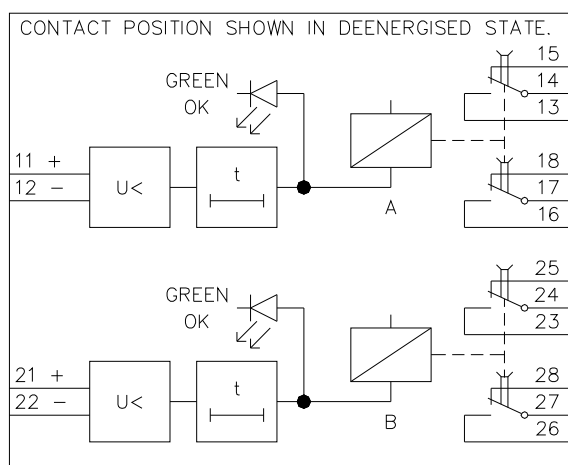
Picture 14: TCS A11x, B11x, C11x, D11x schematic

- TCS A11x (DC 24 V)
- TCS B11x (DC 48 V-60 V)
- TCS C11x (DC 110 V-125 V)
- TCS D11x (DC 220 V)
- TCS xxxC (Combiflex® HX1 housing)

**TCS xxxD** (housing intended for DIN35 rail mounting)

One channel trip circuit supervision relay. It can supervise one circuit breaker trip circuit in both circuit breaker positions with the use of external resistor. Output has 2xCO potential free relay contacts. Deenergised input deenergise output relay after time delay.

#### 4.6 TCS A22x, B22x, C22x, D22x



Picture 15: TCS A22x, B22x, C22x, D22x schematic

**TCS A22x** (DC 24 V)

**TCS B22x** (DC 48 V-60 V)

**TCS C22x** (DC 110 V-125 V)

**TCS D22x** (DC 220 V)

**TCS xxxC** (ABB RXEM 1 pin compatible, Combiflex® HX1 housing)

**TCS xxxD** (housing intended for DIN35 rail mounting)

Two channel trip circuit supervision relay. It can supervise two circuit breaker trip circuits in both circuit breaker positions with the use of external resistor in each channel. Each output has 2xCO potential free relay contacts. Deenergised input deenergise dependent output relay after time delay.

## 5 INSTALLATION



### Warning!

Hazardous voltage is present inside the device during operation. Disregarding of safety rules can result in severe personal injury or property damage.

Only qualified personnel may work with described devices after being familiar with warnings and safety notices in this paper and other safety regulations.

#### Following instruction must be taken into consideration:

- ◆ The device must be accessible to qualified personnel only.
- ◆ The device is permitted to operate in enclosed housing or cabinet only.
- ◆ The device location must be vibration-free.
- ◆ The admissible operating temperature must be observed.
- ◆ Check the device for damage at unpacking. If device is damaged it must not be installed, but it should be send to the manufacturer for repair.
- ◆ The device should not be opened.
- ◆ For connection:
  - ◆ TCS xxxC - stranded wire 0,25 mm<sup>2</sup>–1,5 mm<sup>2</sup> must be used, recommended stripping length is 10 mm. Connection requires 10 A ABB Combiflex<sup>®</sup> sockets. Follow ABB instructions for installing Combiflex<sup>®</sup> devices.
  - ◆ TCS xxxD & TCS xxxP - single core or stranded wire 0,25 mm<sup>2</sup>–2,5 mm<sup>2</sup> must be used. Recommended stripping length is 8 mm.

**Safety of any system incorporating the TCS device is the responsibility of the assembler of the system.**

<i>Device:</i>	<i>Document:</i>	<i>Code:</i>	<i>Date:</i>	<i>Page:</i>
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## 6 COMMISSIONING AND MAINTENANCE

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### 6.1 COMMISSIONING

---

**Warning!**

Hazardous voltage is present inside the device during operation. Disregarding of safety rules can result in severe personal injury or property damage.

Only qualified personnel may work with described devices after being familiar with warnings and safety notices in this paper and other safety regulations.

---

**Following instruction must be taken into consideration:**

- ◆ Device must operate completely assembled! Device must be used as described. No modifications of the device should be made.
- ◆ Check if the power supply voltage complies with device operation voltage.
- ◆ Do not open device while it is energized! Hazardous voltage is present inside the device.
- ◆ If the TCS device is used in a manner not specified in this manual, the protection provided by the device may be impaired.

### 6.2 MAINTENANCE

Device is maintenance-free. Do not use liquids for cleaning the unit. Use water moisturised mop. Disconnect all connectors before cleaning.



## 7 TECHNICAL DATA

### 7.1 TCS 1xxx, 2xxx, 4xxx DATA

Power supply		
Rated input voltage	TCS 1xxx	24 V DC
	TCS 2xxx	48 V-60 V DC
	TCS 4xxx	110 V-250 V DC, 230 V AC
Permissible voltage range	TCS 1xxx	19,2 V–29 V DC
	TCS 2xxx	38 V–72 V DC
	TCS 4xxx	88 V–300 V DC
Power consumption	< 1 W	

Supervision input(s)		
Rated input voltage	TCS 1xxx	24 V DC
	TCS 2xxx	48 V-60 V DC
	TCS 4xxx	110 V-250 V DC
Permissible voltage range	TCS 1xxx	≤ 29 V DC
	TCS 2xxx	≤ 72 V DC
	TCS 4xxx	≤ 300 V DC
Turn on voltage (max)	TCS 1xxx	≥ 10 V DC (typical 8 V)
	TCS 2xxx	≥ 20 V DC (typical 16 V)
	TCS 4xxx	≥ 40 V DC (typical 35 V)
Drop out voltage (min)	TCS 1xxx	≤ 5 V DC
	TCS 2xxx	≤ 13 V DC
	TCS 4xxx	≤ 25 V DC
Input current	< 1 mA	

Digital output		
Max breaking voltage	400 V	
Max current	AC	8 A at 250 V, 50 Hz (UL 10 A)
	DC	8 A at 32 V (resistive bourden)
		2 A at 48 V (resistive bourden)
		0,37 A at 110 V (resistive bourden)
		0,27 A at 220 V (resistive bourden)

Operation	
Drop out time	approximately 2,8 s (max 3 s)
Turn on time	approximately 1 s

## 7.2 TCS Axxx, Bxxx, Cxxx, Dxxx DATA

Supervision input(s)		
Rated input voltage	TCS Axxx	24 V DC
	TCS Bxxx	48 V-60 V DC
	TCS Cxxx	110 V-125 V DC
	TCS Dxxx	220 V-250 V DC
Permissible voltage range	TCS Axxx	19,2 V-29 V DC
	TCS Bxxx	38 V-72 V DC
	TCS Cxxx	88 V-138 V DC
	TCS Dxxx	176 V-264 V DC
Input current	TCS Axxx	max 17 mA
	TCS Bxxx	max 13 mA
	TCS Cxxx	max 6 mA
	TCS Dxxx	max 5 mA

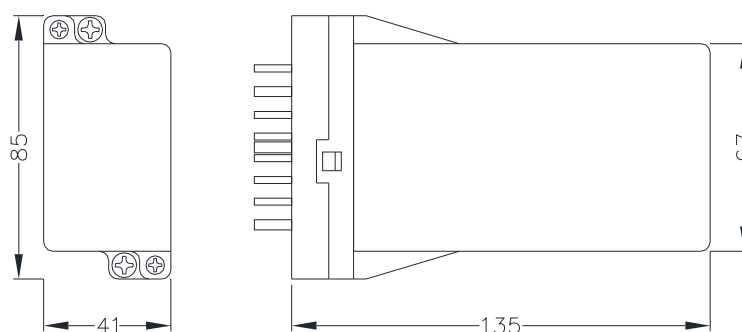
Digital output(s)		
Max breaking voltage	400 V	
Max current	AC	8 A at 250 V, 50 Hz
	DC	8 A at 32 V (resistive bourden)
		2 A at 48 V (resistive bourden)
		0,37 A at 110 V (resistive bourden)
		0,27 A at 220 V (resistive bourden)

Operation	
Drop out time	approximately 2,5 s (max 3 s)
Turn on time	approximately 10 ms

### 7.3 TCS xxxC DATA

Device		
<b>Mounting type</b>		Combiflex®
<b>Connector type</b>		Combiflex®
<b>Wire</b>	crosssection	0,25 mm <sup>2</sup> – 1,5 mm <sup>2</sup>
	type	stranded wire
	voltage rating	500 V
	colour	follow appropriate standard
<b>Weight</b>		0,21 kg
<b>Temperature range</b>	-10 °C to + 55 °C	
<b>Humidity operating</b>	up to 95 % (noncondensing)	
<b>Enclosure</b>	Material	UL 94 V-0
<b>Overvoltage category</b>	III	
<b>Altitude</b>	up to 2000 m	

#### 7.3.1 TCS xxxC DIMENSIONS

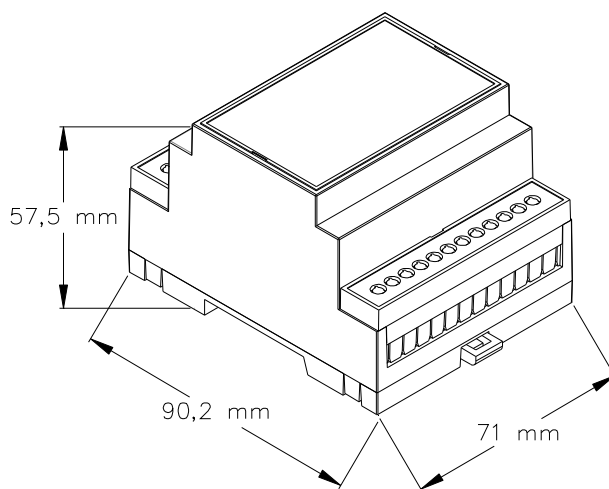


Picture 16: TCS xxxC dimensions (ABB Combiflex® HX1)

## 7.4 TCS xxxD DATA

Device		
<b>Mounting type</b>		DIN35 rail
<b>Connector type</b>		Screw type, moving cage
<b>Wire</b>	crosssection	0,25 mm <sup>2</sup> – 2,5 mm <sup>2</sup>
	type	single core or stranded wire
	voltage rating	500 V
	colour	follow appropriate standard
<b>Weight</b>		0,17 kg
<b>Temperature range</b>	-10 °C to + 55 °C	
<b>Humidity operating</b>	up to 95 % (noncondensing)	
<b>Enclosure</b>	Material	ABS, UL 94 V-0
<b>Overvoltage category</b>	III	
<b>Altitude</b>	up to 2000 m	

### 7.4.1 TCS xxxD DIMENSIONS

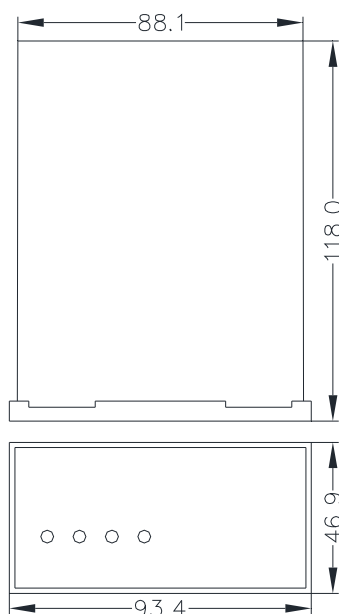


Picture 17: TCS xxxD dimensions (DIN35)

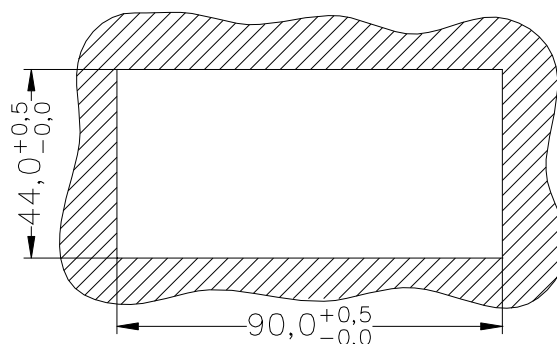
## 7.5 TCS xxxP DATA

Device		
<b>Mounting type</b>	panel mount 96 x 48 mm	
<b>Connector type</b>	Screw type, moving cage	
<b>Wire</b>	crosssection	0,25 mm <sup>2</sup> – 2,5 mm <sup>2</sup>
	type	single core or stranded wire
	voltage rating	500 V
	colour	follow appropriate standard
<b>Weight</b>	0,17 kg	
<b>Temperature range</b>	-10 °C to + 55 °C	
<b>Humidity operating</b>	up to 95 % (noncondensing)	
<b>Enclosure</b>	Material	ABS, UL 94 V-0
<b>Overvoltage category</b>	III	
<b>Altitude</b>	up to 2000 m	

### 7.5.1 TCS xxxP DIMENSIONS



Picture 18: TCS xxxP dimensions (panel mount)



Picture 19: TCS xxxP recommended cut-out (panel mount)

## 8 APPROVALS

<b>Safety</b>		
Dielectric test voltage	IEC 60255-27 IEC 61010	PS to DI, DO; DI to PS, DO; DO to PS,DI 4600 V DC or 3250 V AC, 50 Hz, 60 s DI1 to DI2; DO1 to DO2 3100 V DC or 2500 V AC, 50 Hz, 60 s
Insulation resistance test	IEC 60255-27	>100 MΩ at 500 V DC
Impulse voltage test	IEC 60255-27	5 kV, 1,2/50 μs, 0,5 J
<b>Emission</b>		
Conducted emissions	EC 60255-26 CISPR 22 EN 55022 IEC 61000-6-3	0,15 MHz - 0,5 MHz 66-56 dB(μV) quasi peak, Class B 56-46 dB(μV) average, Class B 0,5 MHz - 5 MHz 56 dB(μV) quasi peak, Class B 46 dB(μV) average, Class B 5 MHz - 30 MHz 60 dB(μV) quasi peak, Class B 50 dB(μV) average, Class B
Radiated emission	IEC 60255-26 CISPR 11 EN 55011 IEC 61000-6-3	30 MHz - 230 MHz 40 dB(μV/m) quasi peak at 3 m, Class B 230 MHz - 1000 MHz 47 dB(μV/m) quasi peak at 3 m, Class B Residential environment
<b>Immunity</b>		
Electrostatic discharge immunity	IEC 60255-26 IEC 61000-4-2	Level 4 15 kV air discharge 8 kV direct discharge
Radiated immunity	IEC 60255-26 IEC 61000-4-3 ENV 50204 (GSM)	80 MHz - 1 GHz, 1,4 GHz - 2,7 GHz, 10 V/m 10 V/m
Fast transient / burst immunity	IEC 60255-26 IEC 61000-4-4	4 kV
Surge immunity	IEC 60255-26 IEC 61000-4-5	2 kV symmetrical (line to line) 4 kV unsymmetrical (line to earth)
Conducted immunity	IEC 60255-26 IEC 61000-4-6	0,15 MHz - 80 MHz, 10 V
Power frequency magnetic field immunity	IEC 60255-26 IEC 61000-4-8	30 A/m, continuous 300 A/m, 10 s
Pulse magnetic field immunity	IEC 61000-4-9	1000 A/m
Oscillatory transient immunity - Damped	IEC 60255-26 IEC 61000-4-18	1 MHz, Level 3 (2,5 kV comm., 1 kV diff.)

oscillatory wave		
<b>Environment</b>		
Dry heat test operation	IEC 60255-27 IEC 60255-1 IEC 60068-2-2	70°C, min 16 h, energized, rated load
Cold test operation	IEC 60255-27 IEC 60255-1 IEC 60068-2-1	-25°C, min 16 h, energized, rated load
Cyclic temperature with humidity test (Damp Heat Cyclic)	IEC 60255-27 IEC 60255-1 IEC 60068-2-30	55 °C to 25 °C, 95 % Relative Humidity, 12+12 h, 6 cycles

## 9 ORDERING

### ORDERING CODE:

#### WITH ACTIVE POWER SUPPLY

TCS

#### Supervision and power supply voltage:

24 V DC .....	1			
48 V-60 V DC (in development) .....	2			
110 V-220 V DC, 230 V AC .....	4			

#### Number of supervision inputs and DOs:

1 DI, 1 DO (1 coil, ext. resistor required) .....	1	1		
2 DIs, 1 DO (1 coil, both CB positions) .....	2	1		
4 DIs, 1 DO (2 coils, both CB positions) panel mount only (x41P) .	4	1		
6 DIs, 1 DO (3 coils, both CB positions) panel mount only (x61P) .	6	1		

#### Housing:

Combiflex® HX1 housing .....				C
DIN 35 rail .....				D
Panel mount 96 x 48 mm .....				P

#### WITHOUT ACTIVE POWER SUPPLY

TCS

#### Supervision input voltage:

24 V DC .....	A			
48 V-60 V DC .....	B			
110 V-125 V DC .....	C			
220 V DC .....	D			

#### Number of supervision inputs and DOs:

1 DI, 1 DO (1 pair) .....	1	1		
1 DI, 1 DO (2 pairs) .....	2	2		

#### Housing:

Combiflex® HX1 housing .....				C
DIN 35 rail (in development) .....				D
Panel mount 96 x 48 mm (in development) .....				P

\* Combiflex® is ABB Registered Trademark.



**SELECTION TABLE:**

Power supply	Num. of sup. inputs	Num. of outputs - relays	Supply / input voltage				
			24 V DC	48-60 V DC	110 V DC	220 V DC	230 V AC
active	1	1 (2xCO)	TCS 111x	TCS 211x	TCS 411x		
active	2	1 (2xCO)	TCS 121x	TCS 221x	TCS 421x		
active	4	1 (2xCO)	TCS 141P	TCS 241P	TCS 441P		
active	6	1 (2xCO)	TCS 161P	TCS 261P	TCS 461P		
/	1	1 (2xCO)	TCS A11x	TCS B11x	TCS C11x	TCS D11x	/
/	2	2 (2xCO)	TCS A22x	TCS B22x	TCS C22x	TCS D22x	/

x means: C = Combiflex®, D = DIN35 rail mount, P = panel mount (96 x 48 mm)

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