

CATALOG 2021

# Arc Guard System™ – TVOC-2

Adapted for the Swedish market including E-numbers





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# Arc Guard System™ – TVOC-2

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# Arc Guard System™

## Monitor your installation, anytime and anywhere

ABB is a leader in electrical safety with the TVOC-2 Arc Guard System™ providing an unrivaled optical arc mitigation device with the fastest reaction time on the market. Connect to cloud based ABB Ability™ platform provides possibilities for remote monitoring.



### Safety and protection

#### Saving lives and minimizing damage to equipment

With a market-leading reaction time of under 1 ms, TVOC-2 is already the fastest, most reliable arc guard solution available on the market. By adding the communication module, information regarding any trip travels faster, reaching the right people sooner.



### Continuous operation

#### Keeping the business running

The TVOC-2 detects the light from an arc flash and, together with the installed breaker, cuts the current feeding the arc extremely quickly, minimizing disruption of the system. In addition, the current sensing unit CSU-2 ensures the Arc Guard System™ only trips when necessary, eliminating the risk of nuisance tripping.



### Easy to install

#### Factory calibrated sensors

Configuration of the TVOC-2 is done in minutes and with the HMI verifying every setting done, it is extremely unlikely that mistakes will happen during the configuration. With the possibility to accommodate up to 30 sensors, the system is highly flexible and can grow with any system.

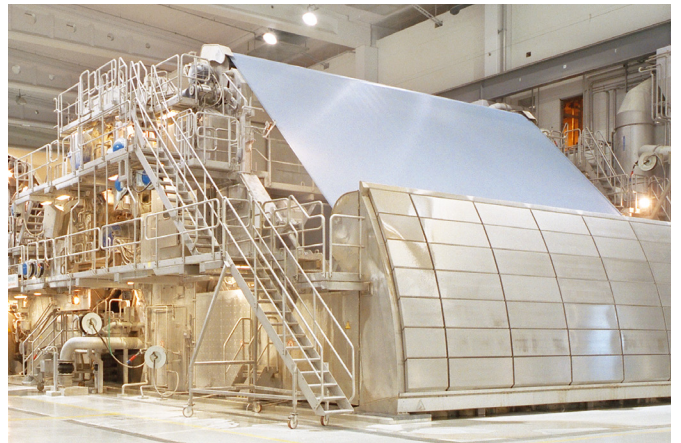
Marine and ships



Data center



Paper machine



Steel industry





# Introduction

**TVOC-2, ABB's Arc Guard System™, builds on the well known TVOC design. Its functions and features improve an already great product, putting even more focus on reliability, flexibility and simplicity.**

Arc Guard System™ increases the protection of people and equipment, and minimizes unnecessary production stops. TVOC-2 is ABB's state-of-the-art solution for arc fault protection in all applications.

With over 40 years of experience, Arc Guard System™ has become an industry standard in several key markets, helping to protect personnel and businesses around the world.

Typical applications include all low- and medium-voltage switchgear where a high level of protection is needed.

## Reliability

- Certified according to functional safety (SIL-2) standard
- Over 40 years experience in Arc Guard Systems™
- Pre-calibrated optical sensors
- Factory tested current sensors with Rogowski technology for both LV and MV applications

## Flexibility

- With IP54 high protection degree, HMI (Human Machine Interface) can be mounted on the panel door
- COM module adds ability to communicate with a remote station using Modbus RTU. Also the current sensing unit is able to communicate through Modbus RTU.
- Expandable with up to 30 optical sensors
- Configure the system to isolate separate breaker zones of the switchgear
- Add current sensing unit only if dual conditioning is needed

## Simplicity

- User-friendly start-up menu
- DIN-rail or wall-mounted
- Easy to expand as the switchgear functions are added



# System description

Short-circuit faults in LV and MV switchgears are often accompanied by an electric arc. An arc fault can lead to considerable damage to equipment and injury to personnel unless it is detected very quickly. To avoid severe damage to equipment and to personnel that are in proximity of the switchgear during the arc flash, it is crucial to de-energize the system before the energy level has increased to dangerous levels. With the Arc Guard System™ the time to de-energize the system can be reduced to 30-50 ms.

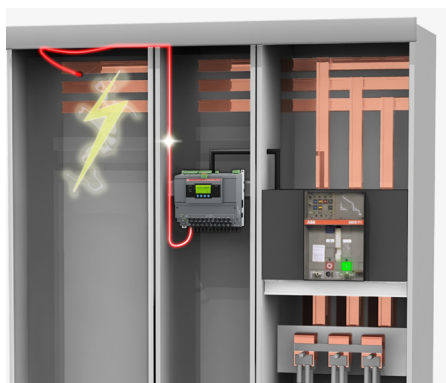
The Arc Guard System™ quickly detects an arc fault and trips the incoming circuit breaker. Using light as the main activation criteria, it trips almost instantaneously. Thanks to this key functional advantage, it overrides all other protections and delays, which is crucial when reaction times need to be measured in milliseconds.

## How it works

The system acts in three phases:

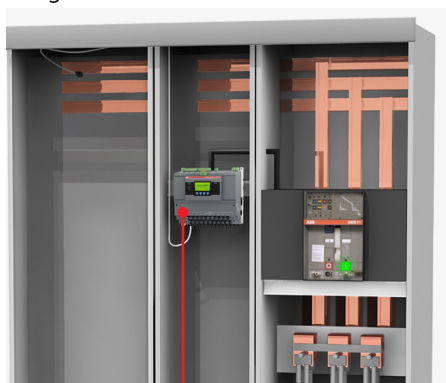
### 1 Detection

The TVOC-2 detects the light from an arc flash

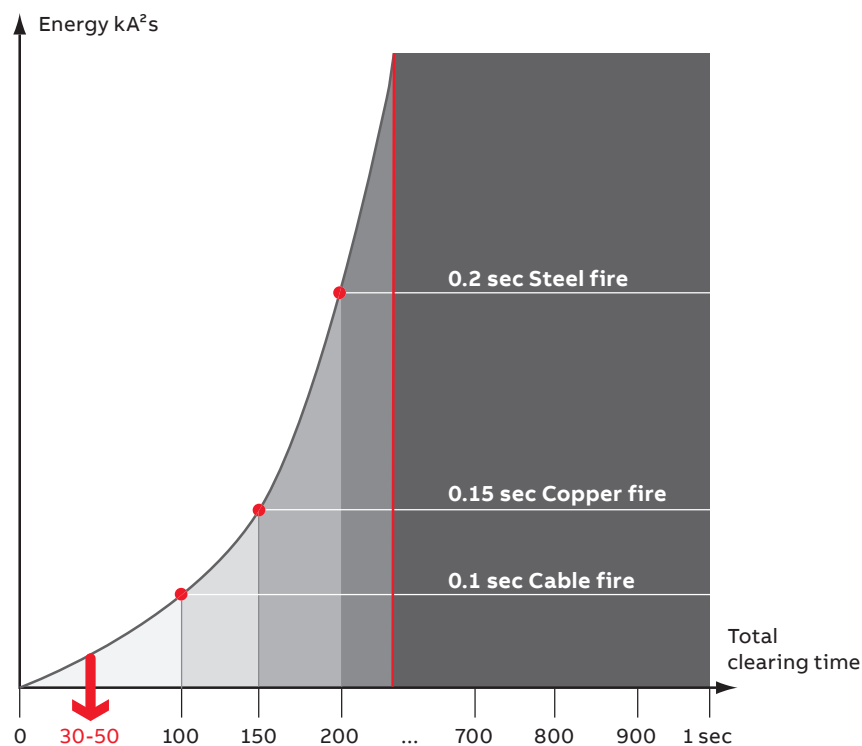


### 2 Recognition

The system determines the intensity of light



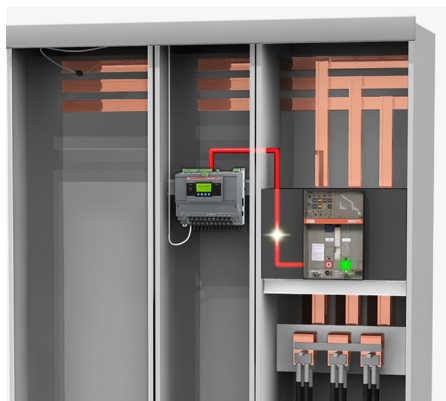
The diagram below shows how the exponential increase in energy over time affects different switchgear materials.



Total clearing time = ABB Arc Guard System™ + breaker

### 3 Action

The system sends signal to trip breaker(s)





# Functionality

## Arc monitor

With its modular concept, the Arc monitor is designed to fit all types and sizes of low- and medium-voltage switchgears.

It is designed according to functional safety, and is SIL 2-certified according to IEC 61508 and IEC 62061 which highlights the full focus on reliability. This corresponds to performance level d according to EN ISO 13849-1. Safety functions are exclusively handled by hardware. In addition, the system, trip logs and user-interface are all microprocessor-monitored.

The system can be configured to trip selected breakers, depending on which sensor that detects the light. The DIP-switches that take care of this function also handle settings like auto-reset and current sensing units (see pages 12-13 for more details).

Energy is stored in the unit for operation up to 0.2 s if the supply voltage fails. This is sufficient to close the tripping circuit even if voltage disappears at a short-circuit fault.

Note: The circuit breaker still needs a back-up energy source for its tripping circuit.

## Connections

All connections can be accessed from the front of the Arc Guard System™. Pluggable terminal blocks allow electrical wiring before mounting TVOC-2 into the cabinet.

The solid state tripping contacts are type IGBT, which guarantees fast and reliable tripping.

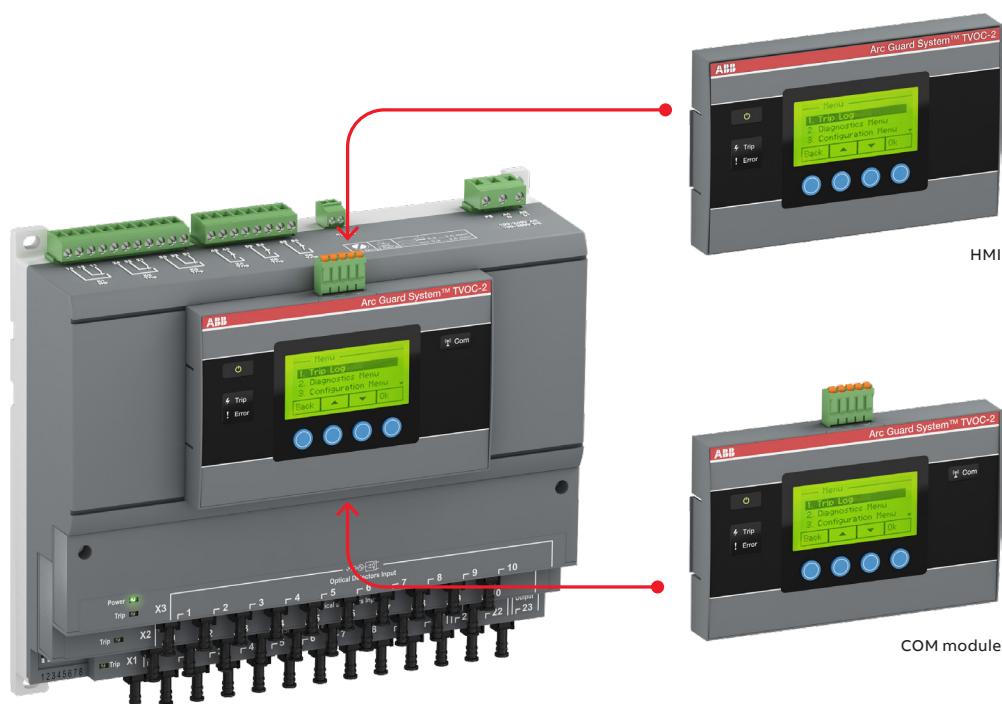
More details can be found on page 11, technical data.

## HMI (Human Machine Interface)

- Handles settings with key-pad and full text display
- Holds error log and trip information after power loss
- Error log and trip log include time/date stamp from a real-time clock
- TVOC-2 can handle two separate HMIs (cabinet door and on product)
- Three-meter cable included
- COM Module available using Modbus RTU

## Sensor & sensor modules

- Fiber-optic sensors not affected by electrical noise
- Pre-calibrated sensors remove need for manual configuration
- Up to 30 detectors can be connected



# Functionality

## Current Sensing Unit (optional)

The Current Sensing Unit (CSU-2) is an accessory needed in those applications where strong light is expected on a regular basis. The CSU-2 continuously measures the current in up to 3 phases and neutral to ensure that the light is created by an arc flash.

- The CSU-2 detects if the cable to the current sensor is cut or if the connection is not done properly. The unit informs the TVOC-2 of the loss of current signal.
- Rogowski coil current sensors are used with the CSU-2
- RJ45 connection between CSU-2 and current sensors
- A green light signal on top of the CSU-2 confirms correct connection
- High accuracy measurement  $\pm 3\%$  of a wide range of nominal current
- Open loop variants
- Wall or DIN-rail mounting.

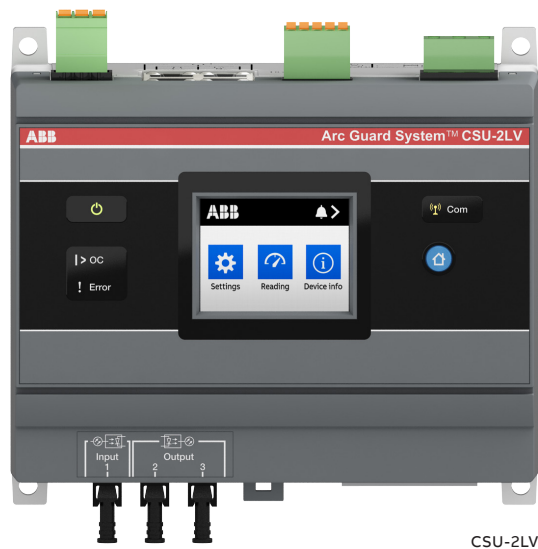
## HMI

- Touchscreen panel
- Communication with Modbus RTU to configure and monitor the CSU-2 remotely.

## TVOC-2 connection

- CSU-2 and TVOC-2 are connected via a fiber optic cable that sends a continuous light signal if no errors or over current is present

TVOC-2 together with CSU-2 will have a tripping time of approximately 2 ms depending on the amplitude of the over current and the number of phases measured.



## Arc monitor

- 3 IGBT solid state tripping contacts
- 2 change-over trip signal relays
- 1 change-over self supervision alarm relay (IRF)
- 2 current sensing unit inputs
- 1 current sensing unit output

## Mounting alternatives

- DIN-rail
- Wall mounting

## Optical detector inputs

- 1-10 Main unit X1
- 1-10 Extension module X2
- 1-10 Extension module X3

## HMI

- Can be mounted on door
- IP54
- Additional HMI possible
- User-friendly start up menu
- COM Module version available

## Current Sensing Unit

- 4 current sensor inputs (RJ45 connector)
- 1 change over trip signal relay for over current
- 1 optical input from other CSU
- 2 optical outputs
- Modbus RTU

# Ordering details



Arc Monitor with COM Module

1SFCI70011V0001



Arc Monitor with HMI

1SFCI70014V0001



Extension unit

1SFCI70012F0001



COM Module

1SFCI70009V0001



HMI

1SFCI70012V0001



Detector cable

1SFCI70011F0001

## Main unit

Description	Rated supply voltage		Type	Order code	E-number	Weight (1 pce)
	Uc	V DC				
	V 50/60 Hz	V DC				kg

## Arc monitor

including one COM Module	–	24...48	TVOC-2-48-C	1SFA664001R1004	2800000	0.95
	100...240	100...250	TVOC-2-240-C	1SFA664001R1003	2800004	
including one HMI and door mounting accessories	–	24...48	TVOC-2-48	1SFA664001R1002		0.95
	100...240	100...250	TVOC-2-240	1SFA664001R1001	2801705	

## Accessories

Description	Type	Order code	E-number	Weight (1 pce)
				kg

## Extension

10 optical inputs	TVOC-2-E1	1SFA664002R1001	2801707	0.15
10 optical inputs for cable TVOC-2-DP60 only	TVOC-2-E3	1SFA664002R3001	2801708	0.15

## COM Module

with communication interface (Modbus RTU)	TVOC-2-COM	1SFA664002R4001	2800005	0.15
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## HMI

additional including door mounting accessories	TVOC-2-H1	1SFA664002R1005	2801706	0.15
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## Detectors

Cable length	1 m	TVOC-2-DP1	1SFA664003R1010	2801709	0.02
	2 m	TVOC-2-DP2	1SFA664003R1020	2801711	0.02
	4 m	TVOC-2-DP4	1SFA664003R1040	2801713	0.04
	6 m	TVOC-2-DP6	1SFA664003R1060	2801715	0.60
	8 m	TVOC-2-DP8	1SFA664003R1080	2801717	0.80
	10 m	TVOC-2-DP10	1SFA664003R1100	2801719	0.10
	15 m	TVOC-2-DP15	1SFA664003R1150	2801721	0.15
	20 m	TVOC-2-DP20	1SFA664003R1200	2801723	0.20
	25 m	TVOC-2-DP25	1SFA664003R1250	2801725	0.25
	30 m	TVOC-2-DP30	1SFA664003R1300	2801727	0.30
	60 m (1)	TVOC-2-DP60	1SFA664003R3600	2801728	0.60

(1) Only to be used with TVOC-2-E3

# Ordering details



CSU-2LV

1SFC170008V0001



RC120-05

1SFC170024F001



RC200-10

1SFC170024F001



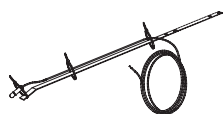
Optical cable TVOC-2 – TVOC-2

1SFC170028F0001



Cable strap

1SFC170010F0001



Mounting kit

1SFC170018F0001



Label

1SFC170014F0001



Mounting bracket

1SFC170015F0001



Mounting kit for HMI

1SFC170017V001

## Current sensing unit

Description	Type	Order code	E-number	Weight (1 pce) kg
Low voltage current sensing unit	CSU-2LV	1SFA664002R5001		0.420
Medium voltage current sensing unit	CSU-2MV	1SFA664002R8001		0.420

Diameter mm	Cable length	Type	Order code	E-number	Weight (1 pce) kg
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## Rogowski coil current sensors for low voltage applications

120	5	RC120-05	1SFA664005R1205		0.180
	10	RC120-10	1SFA664005R1210		0.180
	15	RC120-15	1SFA664005R1215		0.570
	30	RC120-30	1SFA664005R1230		1.030
200	5	RC200-05	1SFA664005R2005		0.210
	10	RC200-10	1SFA664005R2010		0.210
	15	RC200-15	1SFA664005R2015		0.600
	30	RC200-30	1SFA664005R2030		1.050

Note: For medium voltage application, use KECA and KEVCD current sensors types.

Please consult <https://new.abb.com/medium-voltage/apparatus/instrument-transformers-and-sensors-id/products/sensors-new>

## Optical cable between:

- TVOC-2 and TVOC-2 (transferring CSU signal)

- CSU-2 and TVOC-2

- CSU-2 and CSU-2

	0.5 m	TVOC-2_OP05	1SFA664004R1005	2801729	0.01
	1 m	TVOC-2-OP1	1SFA664004R1010	2801731	0.01
	2 m	TVOC-2-OP2	1SFA664004R1020	2801733	0.02
	4 m	TVOC-2-OP4	1SFA664004R1040	2801735	0.04
	6 m	TVOC-2-OP6	1SFA664004R1060	2801737	0.06
	8 m	TVOC-2-OP8	1SFA664004R1080	2801739	0.08
	10 m	TVOC-2-OP10	1SFA664004R1100	2801741	0.10
	15 m	TVOC-2-OP15	1SFA664004R1150	2801743	0.15
	20 m	TVOC-2-OP20	1SFA664004R1200	2801745	0.20
	25 m	TVOC-2-OP25	1SFA664004R1250	2801746	0.25
	30 m	TVOC-2-OP30	1SFA664004R1300	2801747	0.30

## Other accessories

Description	Type	Order code	E-number	Weight (1 pce) kg
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### Cable straps

1 set incl. 50 pcs	TVOC-2-MK1	1SFA664006R1001		0.10
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### Mounting kit

600 mm	TVOC-2-MK600	1SFA663006R1001		0.35
800/1000 mm	TVOC-2-MK800/1000	1SFA663006R1002		0.60

### Label

1 set incl. 10 pcs	TVOC-2-LABEL SET	1SFA663005R1001		0.02
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### Mounting bracket

1 set incl. 5 bracket pcs and 10 cable strap pcs	TVOC-2 MB1	1SFA663006R1010		0.25
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### Mounting kit for HMI

Including a nut, gasket, HMI cable and blank front label	TVOC-2-MK2	1SFA664006R1002		0,125
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# Technical data

## Main unit

### Optical inputs and output

Optical detectors	10 inputs on Arc monitor
	10 inputs on Extension unit X2 (optional)
	10 inputs on Extension unit X3 (optional)
Current signal from CSU	2 inputs: X1.21, X1.22 (optical)
Forward current signal to another Arc monitor	1 output: X1.23 (optical)

### Breaker trip contacts (K4, K5, K6)

Solid state tripping contacts	3 NO solid state type IGBT
Rated voltage	250 V AC / DC
Make and carry for 0.2 s	30 A
Make and carry for 1 s 0.15% duty ration	10 A
Breaking capacity	250 V      1.5 A      AC-15
	250 V      1 A      DC-13
	110 V      3 A      DC-13
	48 V      3 A      DC13
	Reinforced insulation between separate contacts
	Voltage drop 5 V 30 A, 3 V 3 A, 2 V 10 mA
	Off state current < 1 mA at 250 V 60 Hz
	Min. recommended load current 10 mA

### Signal relay outputs (K2, K3)

Manual or auto resetable	2 CO gold-plated contacts
Rated voltage	250 V AC / DC
Continuous carry I <sub>th</sub>	5 A
Make and carry for 0.2 s	30 A
Make and carry for 3 s 10% duty ratio	15 A
Breaking capacity	250 V      3 A      AC-15
	250 V      0.3 A      DC-13
	110 V      0.6 A      DC-13
	48 V      2 A      DC-13
	Reinforced insulation between separate contacts
	I <sub>th</sub> = 5 A
	Min switching load:
	1 mA at 5 V DC with contacts not used for switching current
	> 0.5 A if inductive/capacitive load before.

### Internal Relay Fault (IRF) signal (K1)

Self supervision alarm relay	1 CO gold-plated contact
Rated voltage	250 V AC/DC
Continuous carry, I <sub>th</sub>	5 A
Make and carry for 3 s	8 A
Breaking capacity	250 V      1.5 A      AC-15
	250 V      0.15 A      DC-13
	110 V      0.3 A      DC-13
	48 V      0.5 A      DC-13
	Reinforced insulation between separate contacts
	I <sub>th</sub> = 5 A
	Min switching load:
	1 mA at 5 V DC with contacts not used for switching current
	> 0.5 A if inductive/capacitive load before

# Technical data

## Main unit

### Settings and indications

Connections for HMI on base module	1 output RJ45 male at front side 1 output RJ14 female at right side
Display on HMI	52 x 26 mm graphic LCD with LED backlight
Keyboard on HMI	Membrane buttons, 4 soft keys
LED signal on HMI	Power, Trip, Error
LED signal on Arc monitor and extension units	Power, Trip
Configuration switches	8-pole DIP-switch on Arc monitor front
Settings (HMI)	Time and display language
COM Module version	Modbus RTU protocol
Configuration (DIP switches)	Manual or auto reset of K2 and K3 Use of CSU or not Trip configuration
Display information	Trip log, connected modules, actual configuration self diagnostic test result and error log

Power supply	TVOC-2-240	TVOC-2-48
Rated supply voltage, Us	100-240 V AC, 50-60 Hz 100-250 V DC	24 - 48 V DC Possibility to connect two power supplies for redundancy. (Common minus)
Us variation	AC -20% – +10% DC -25% – +30%	DC -25% - +30%
Rated insulation voltage, Ui	250 V with reinforced insulation	250 V with reinforced insulation
Rated impulse withstand Voltage Uimp	4 kV	4 kV
Main MCB/fuse	Max. 10 A char. C/fuse 10 A gG	Max 6A, MCB ABB Type S202 Z6A
Power consumption	5 W	5W

### Start-up time

Trip possible	< 15 ms from power on	< 100 ms from power on
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### Reaction time

From light detection to trip (contacts K4, K5, K6)	Approx. 1 ms (depends on light intensity)
From light detection to indication signal (relay K2, K3)	< 10 ms
Current condition from input to output	< 0.4 ms

### Environmental conditions

Altitude	Less than 2000 m above sea level.
Permissible ambient temperature	-25 to +55°C
Degree of protection	IP20 Arc monitor IP54 HMI front side









### Detector cable

Maximum length	30 m with Arc monitor and extension – E1 60 m with extension – E3
Service temperature range	-25 to +70°C continuous -25 to +85°C short-time
Smallest permissible bending radius	45 mm after installation 10 mm on handling
Acceptable backlight intensity light without tripping	3000 Lux

### Optical cable

Maximum length	30 m
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### Standards

       		
UL508		Industrial control equipment
CSA C22.2 No.14		Industrial control equipment
IEC 61508		Functional safety of electrical/electronic/programmable electronic safety-related systems
IEC EN60947-1		Low voltage switchgear and controlgear – Part 1: General rules
IEC EN60947-5-1		Low voltage switchgear and controlgear – Part 5-1: Control circuit devices and switching elements - Electromechanical control
IEC 61010-1		Safety requirements for electrical equipment for measurement, control and laboratory use

# Technical data

## Current sensing unit

Type		CSU-2LV	CSU-2MV
Mounting		Wall or DIN-rail	
Inputs	Current sensor inputs (phases L1-L3)	3	
	Current sensor inputs (neutral)	1	
	Current signal input optical (daisy chain)	1	
Outputs	Current signal output optical	2	
	Signal relay (for over current signal)	1	
Settings L1-L3, Neutral	Nominal current range	250 ... 4000 A	100 ... 4000 A
	Over current setting	250 ... 12000 A	100 ... 12000 A
	Current warning range	250 ... 12000 A	100 ... 12000 A
Current sensor input	Current input sensitivity	0,361 V / kA	1,852 V / kA
	Connector	RJ45	
Reaction time	Current condition from input to output	< 1 ms	
	From light detection with current condition to trip (contacts K4, K5, K6)	< 2 ms	
Supply	Rated supply voltage, Us	24 ... 240 V AC 50 / 60 Hz	
	Us variation	AC -10 % ... +15 %	
	Rated supply voltage, Us	24 ... 250 V DC	
	Us variation	DC -25 % ... + 30 %	
	Rated insulation voltage, Ui	250 V with reinforced insulation	
	Rated impulse withstand voltage Uimp	4 kV	
	Main MCB/fuse	Max. 10 A char. C/fuse 10 A gG	
	Power consumption	<2 W	
Interface	Communication protocol	Modbus RTU	
	HMI	Touchscreen	
Contacts	Signal relay (for over current signal)	1 C.O gold-plated contact (K1)	
Current measurement accuracy		+- 3 %	
Fits with	Current sensors	RC120-05, RC120-10, RC200-05, RC200-10, RC120-15, RC120-30, RC200-15, RC200-30	KECA 80 C85, KECA 80 D85, KECA 80 C104, KECA 80 C165, KECA 80 C184, KECA 80 C216, KECA 250 B1, KEVCD 12 AG3, KEVCD 17.5 AG3, KEVCD 24 AG3, KECA 80 C260

## Environmental conditions

Altitude	Less than 2000 m above sea level.
Permissible ambient temperature	-25 to +55 °C
Degree of protection	IP20

## Standards



## Settings and indications

LED signal on HMI	Power, over current, error, communication
LED signal in sensor connector	Green: Connected ; Red: Not connected
Keyboard on HMI	Membrane button, home
Display input	Language, date & time, inputs, correction factors, warning level, over current level, automatic reset, daisy chain

Current sensors		RC120 and RC200
Current sensing technology		Rogowski coil
Cable		Shielded
Transducer	Material	Thermoplastic UL94-V0
	Transducer diameter	12.4 ±0.2 mm
	Fastening of transducer	Bayonet holder
Environmental conditions	Protection degree	IP67
	Usage	Outdoor and Indoor
	Operating temperature	-30 °C to +80 °C
	Storage temperature	-40 °C to +80 °C
Standards		UL61010-1 EN61010-1 EN61010-031 EN61010-2-031 EN61010-2-032

# Applications

## Basic installation tips

### Arc monitor (TVOC-2)

The Arc monitor can be mounted anywhere in the switchgear, e.g. in the breaker cubicle or in a separate control or metering cabinet. Tripping is handled by a separate tripping circuit. The task of the Arc monitor is to, in combination with the breaker, disconnect the circuit very quickly. You can connect up to 3 breakers in this way and, if required, trip different breakers depending on where the arc occurs.

### Current sensing unit (CSU-2)

The CSU-2 is an accessory used if you cannot prevent direct sunlight or other highly intensive light reaching the sensors. CSUs can be mounted in series if more than two are needed. The CSU-2 is connected to the main unit with fiber optic cables. The unit sends a continuous light to the main unit until either an error or over current turns off the signal.

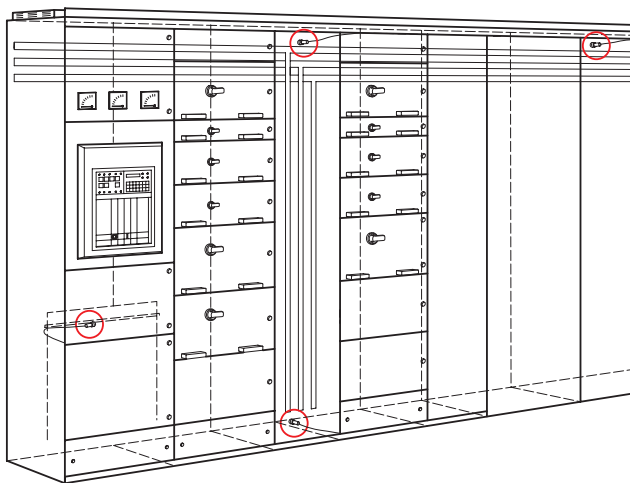
### Connection of current sensors (for CSU-2)

The CSU-2 measures 1 to 3 phases and neutral if needed. Current sensors for LV is offered together with the CSU-2LV and sensors for CSU-2MV are sold separately (see below link). The current sensors are connected to the CSU-2 with RJ45 connectors. A green LED light indicates correct connection. Red LED light indicates if the connection is not done properly according to settings in device.

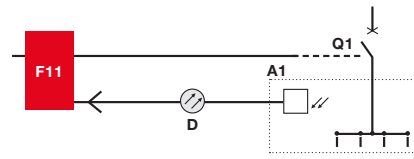


<https://new.abb.com/medium-voltage/apparatus/instrument-transformers-and-sensors-id/products/sensors-new>

Current measurement is based on precise input from calibrated current sensors. Only dedicated current sensors RC120 and RC200 for CSU-2LV and KECA and KEVCD type for CSU-2MV can be used.

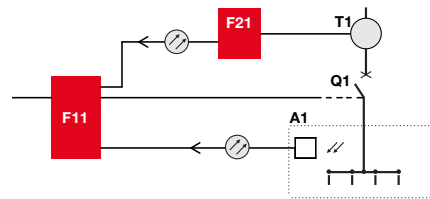


Example showing the position of detectors in:  
1. Horizontal and vertical bus bar system  
2. Circuit-breaker cubicle



Arc Guard System™ with Arc monitor

A1	Switchgear
F11	Arc monitor
F21	Current Sensing Unit
CS	Current sensor
Q1	Circuit-breaker
T1	Current sensor



Arc Guard System™ with Arc monitor and Current Sensing Unit

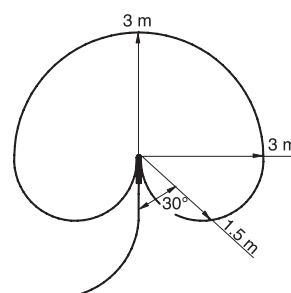
### Detectors

Detector cables are available in standard lengths (see ordering details). They cannot be cut or joined. Avoid sharp bends or pinching when installing the cables.

The plastic fiber is made of polymethylene acrylate (PMMA) with a polyethylene jacket. Each detector consists of an optical cable and a lens that are calibrated together to give the same sensitivity independent of cable length. The detector has a plug-in connector that fits the Arc monitor. The lens collects light from all directions, with the exception of a small shaded area behind the detector (see the polar diagram). Practical experiments have shown that arc light reflected between metallic surfaces is normally sufficient to cause tripping.

### Detector positioning

The basic strategy for positioning the sensors is to make sure to cover all parts that may suffer from an arc. Typically this involves the horizontal and vertical bus bar system and the breaker cubicle. If possible, it's also normally preferable to supervise each cubicle. Avoid placing the detector so that it sees the normal light from a breaker. The sensor can detect arcs within a 3-meter distance (see illustration). To raise the safety level even higher, you can separate them at a 1.5-meter distance, thereby creating redundancy between them.



Polar diagram of detector

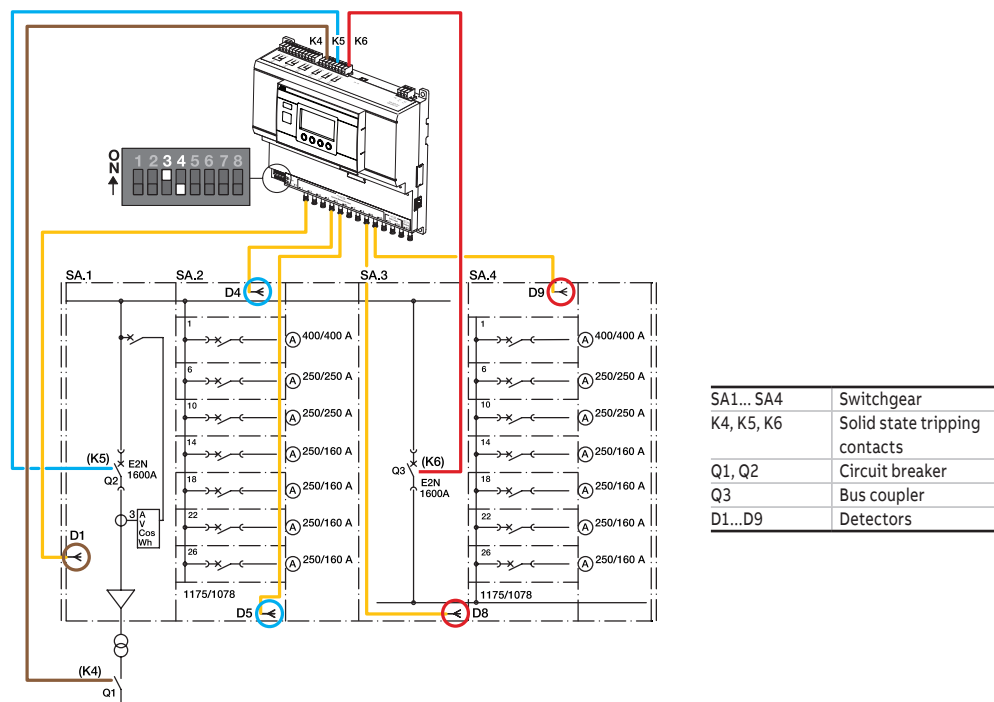


# Applications

## Diagrams

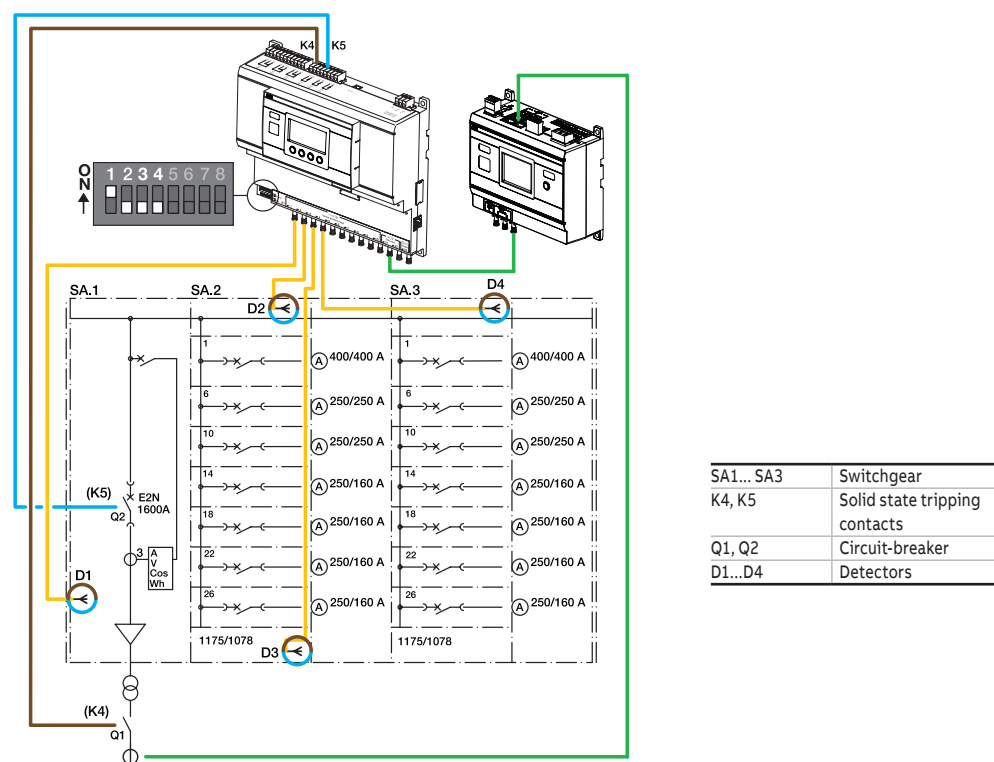
### Example 1:

Arc Guard System™ installed to trip all breakers in case of an arc.



### Example 2:

Arc Guard System and Current Sensing Unit CSU-2 installed to trip breakers depending on where the arc occur.



# Configuration

## Trip condition configuration – Manual/auto reset configuration

### System configuration using DIP switch

DIP switches are used to configure the system regarding use of current condition (activated CSU inputs) and assigning detectors to breaker trip outputs (so-called selectivity). They are located on the front (low, left) of the Arc monitor.

#### DIP switches

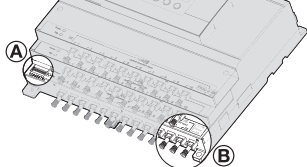




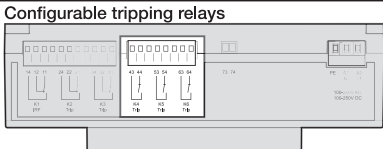

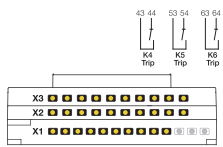

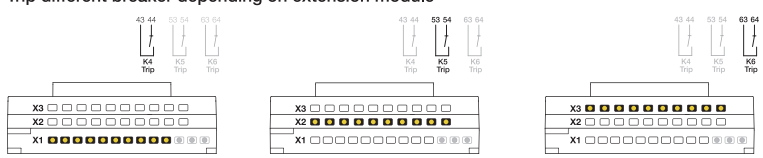

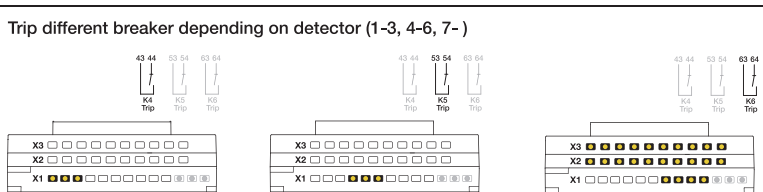
<b>Sw1</b>	Current condition inputs Terminals X1:21-22	<b>Sw5</b>	Not used
<b>Sw2</b>	Current condition output Terminal X1:23	<b>Sw6</b>	Autoreset K2, K3 (signal relays)
<b>Sw3</b>	Trip output assign	<b>Sw7</b>	Not used
<b>Sw4</b>	Trip output assign	<b>Sw8</b>	Not used

#### Breaker trip output

Breaker trip output	Detector inputs
Output relay K4	Terminals X1:1-10
Output relay K5	Terminals X2:1-10
Output relay K6	Terminals X3:1-10

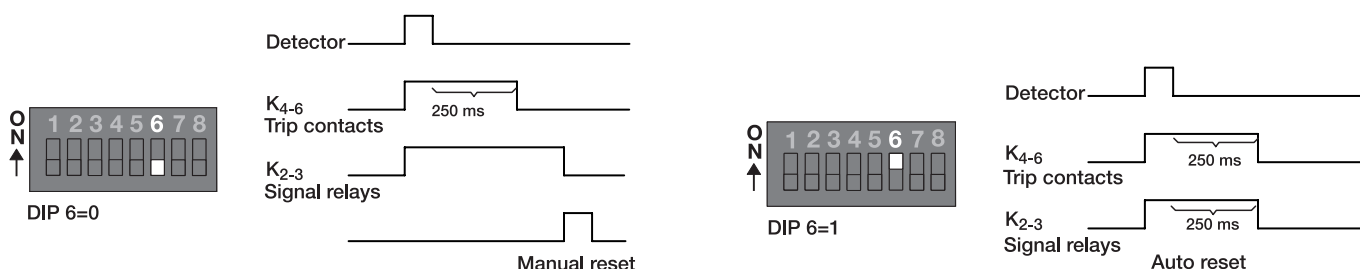
### Trip condition configuration

TVOC-2 can be configured to trip selected breakers depending on which detector is signalling for an arc. This can be used to trip sections of a switchgear or use one monitor for several small switchgears. It also has an option to add a current condition, see page 13.

Configurable tripping relays					
<p><b>Symbol description</b></p> <p> =  Arc detected</p> <p> =  Arc not detected</p> 					
<p><b>A</b></p> <p><b>Configuration 1</b></p> <p>ON ↑</p> 	<p><b>Standard configuration, trip all breakers</b></p> 	Sw3	Sw4	<p><b>Function detectors</b></p> <p>Any detection trips all breakers K4, K5, K6</p>	
<p><b>Configuration 2</b></p> <p>ON ↑</p> 	<p><b>Trip different breaker depending on extension module</b></p> 	0	1	<p>Detectors X1 operate K4 Detectors X2 operate K5 Detectors X3 operate K6</p>	
<p><b>Configuration 3</b></p> <p>ON ↑</p> 	<p><b>Trip different breaker depending on detector (1-3, 4-6, 7- )</b></p> 	1	0	<p>Detectors X1:1-3 operate K4 Detectors X1:4-6 operate K5 Detectors X1:7-10, X2 and X3 operate K6</p>	

### Manual/auto reset configuration

The signal relays K2, K3 can be configured to react as the trip contacts (auto reset) or to be de-energized by manual reset on the HMI. See below for explanation.




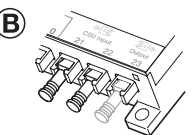
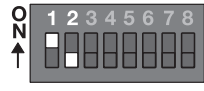
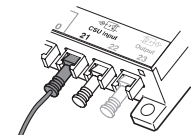
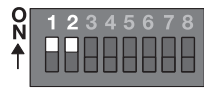
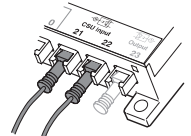
# Configuration

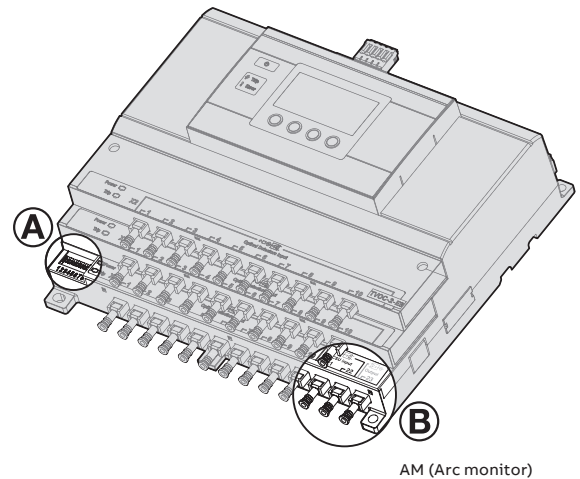
## Current condition configuration

### Normal trip configuration with additional current condition

A current condition is an option that could be used to avoid the risk of nuisance tripping due to strong light from other sources than arcs. The main risks are light from arc chutes and direct sunlight, which in normal cases can be avoided.



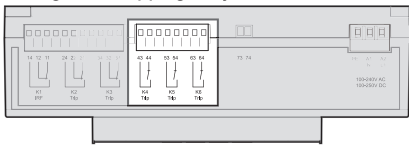

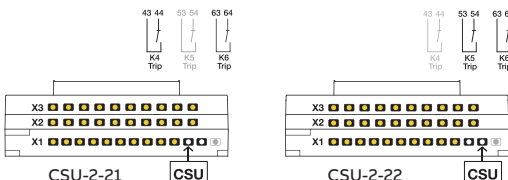
All trip configurations on page 12 can be combined with an additional current condition. It is possible to connect up to two current sensing units directly to the arc monitor (AM) (input 21 and 22). To connect additional current sensing units in series is also possible if required. To share the current condition between different arc monitors can be done by connecting output 23 on the first arc monitor to the standard current sensing units input on the other. The arc monitor will then block the trip condition until it detects an over current.

No current sensing unit		Sw1	Sw2	Function current condition
<b>A</b> 	<b>B</b> 	0	0	Not used
One current sensing unit 		1	0	Input CSU21 used
Two current sensing units 		1	1	Both inputs used



### Special trip configuration depending on over current

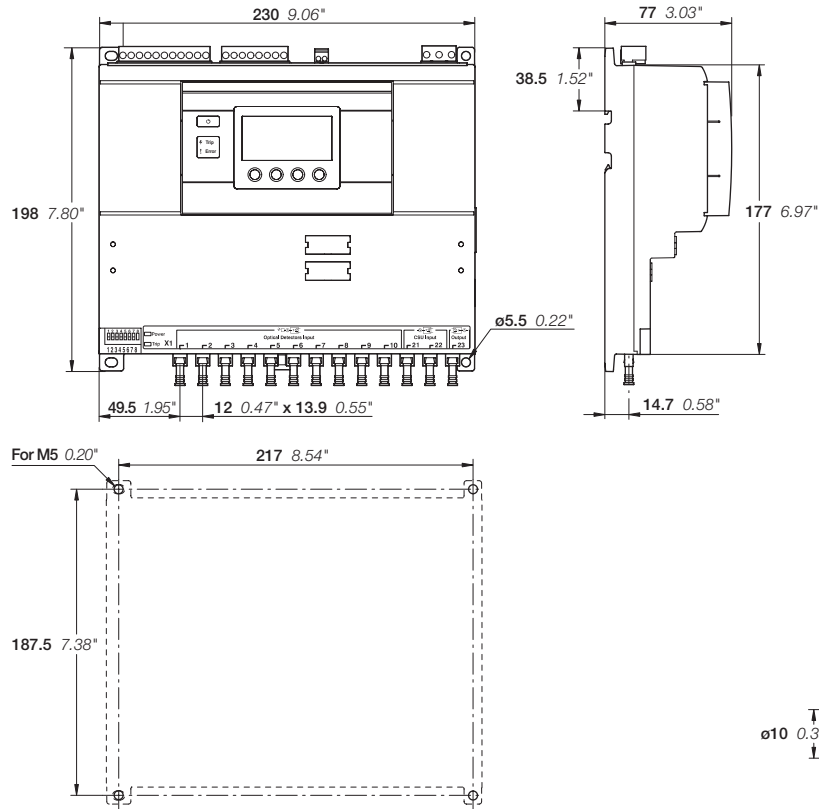
The arc monitor has a special trip configuration that determines trips depending on where it detects the over current. This configuration will then trip different breakers depending on which supply is showing an over current.

Symbol description		Configurable tripping relays	
 = Arc detected  = Arc not detected			
<b>A</b> <b>Configuration 4</b> 			Any detector + current condition CSU-2-21 operate K4 + K6  Any detector + current condition CSU-2-22 operate K5 + K6

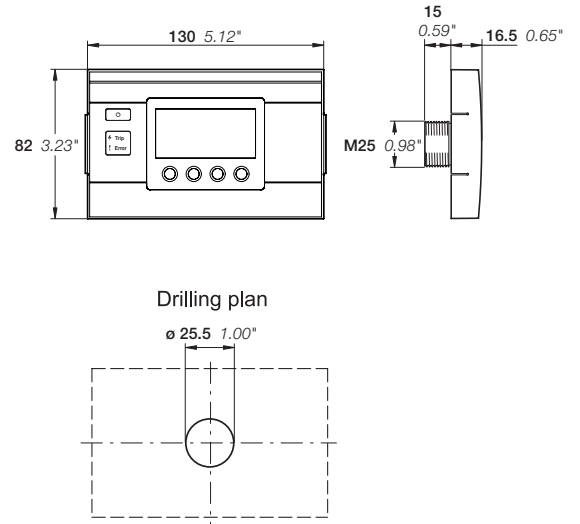
DIP switches 1, 2, 3 and 4 to position ON  
 See manual for more details

# Dimensions

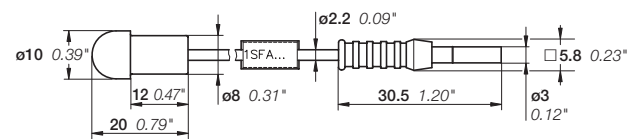
## Arc monitor



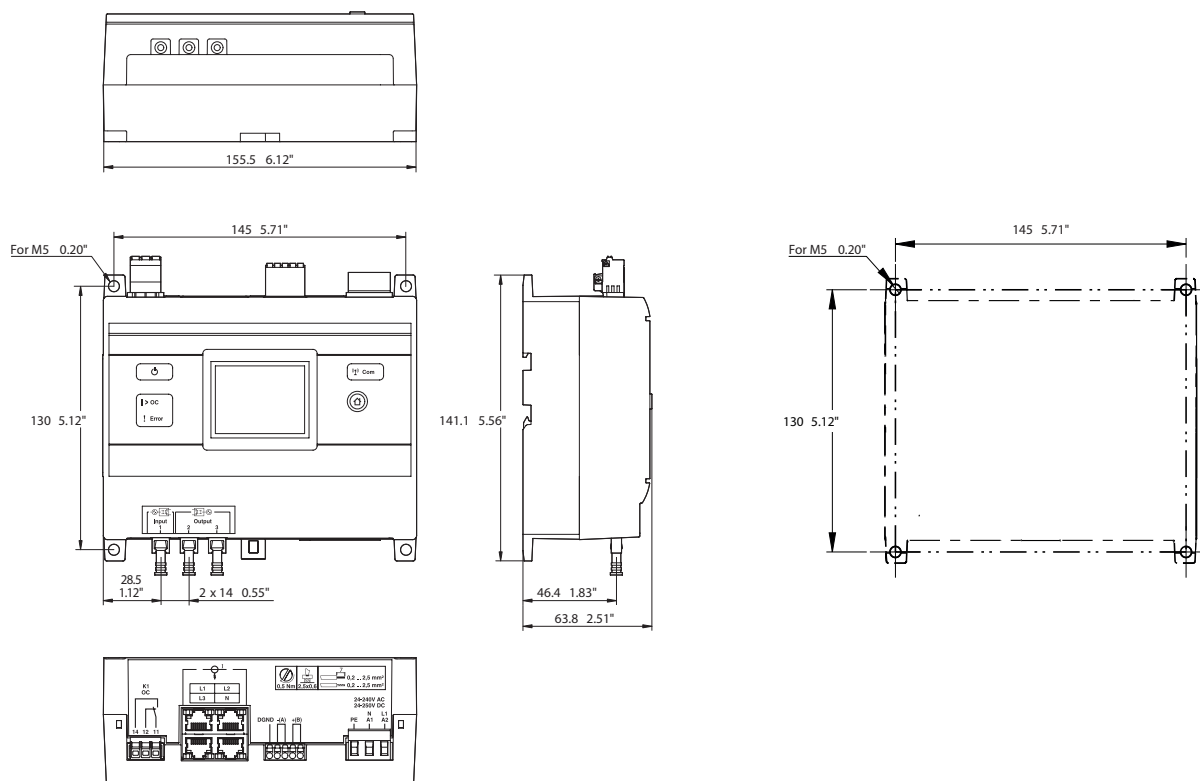
## HMI, COM Module



## Detector with optical cable



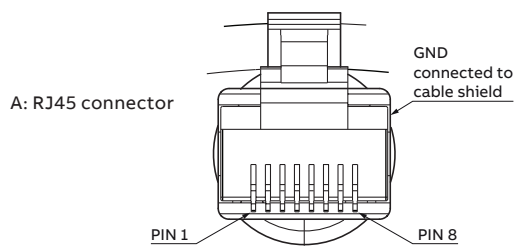
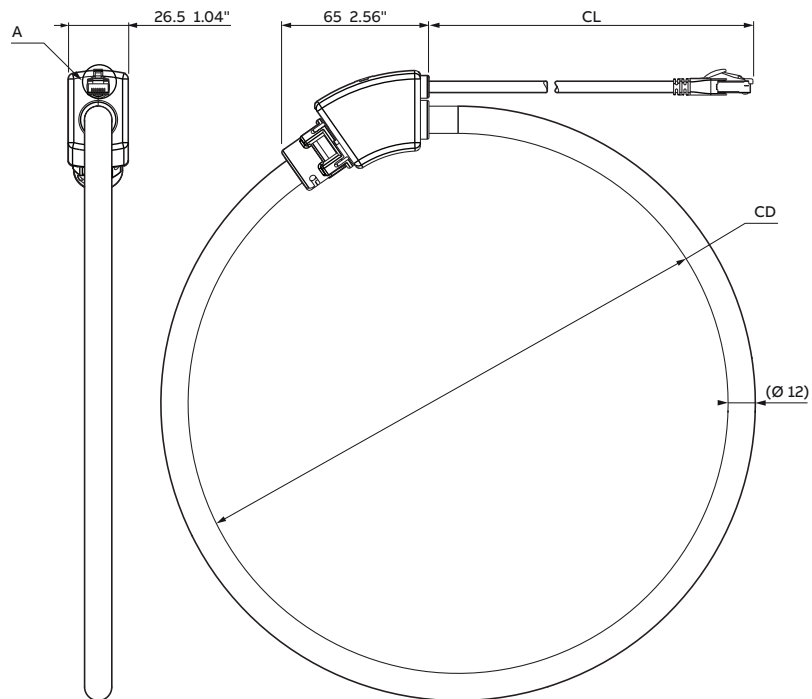
## Current Sensing Unit





# Dimensions

## Coil current sensor



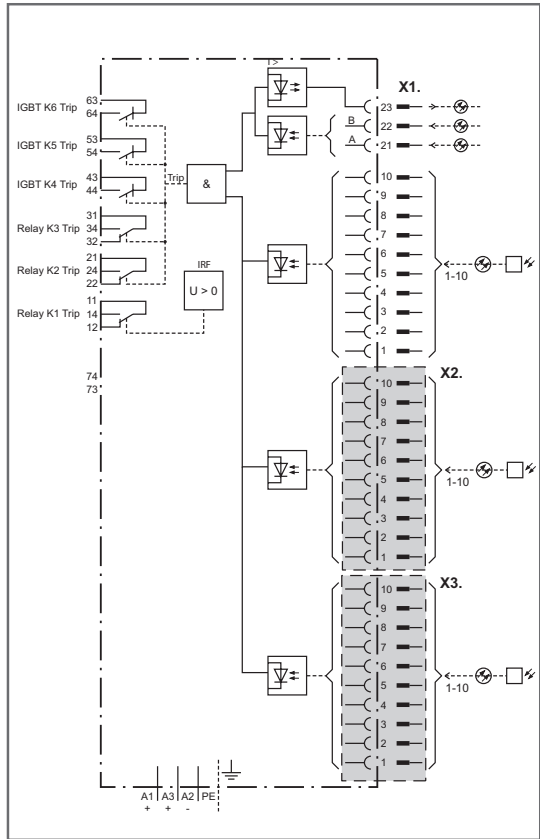
PIN 1 - Signal reference  
PIN 2 - Signal +

## Current sensor

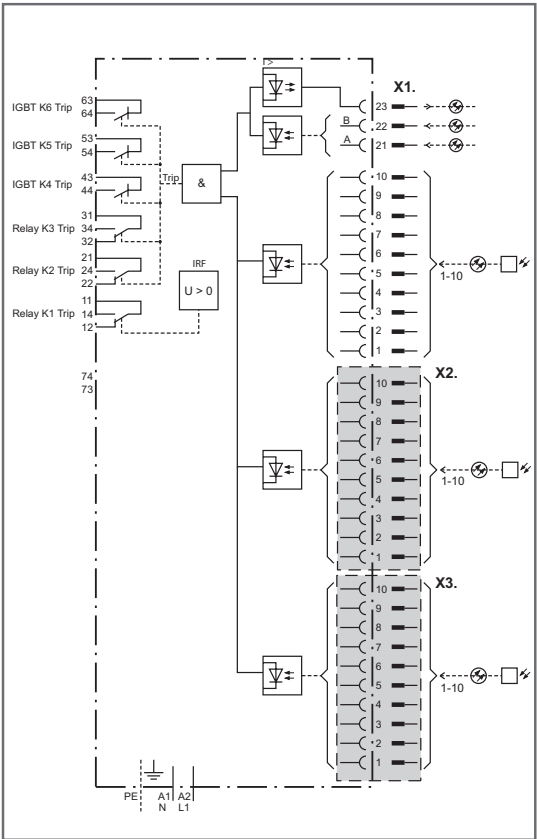
Type	CD Coil diameter		CL Cable length	
	mm	inch	m	inch
RC120-05	120	4.73	5	0.20
RC120-10	120	4.73	10	0.39
RC120-15	120	4.73	15	0.60
RC120-30	120	4.73	30	1.18
RC200-05	200	7.87	5	0.20
RC200-10	200	7.87	10	0.39
RC200-15	200	7.87	15	0.60
RC200-30	200	7.87	30	1.18

# Circuit diagrams

## Arc monitor



TVOC-2-48 1SFA6641001R1002



TVOC-2-240 1SFA664001R1001

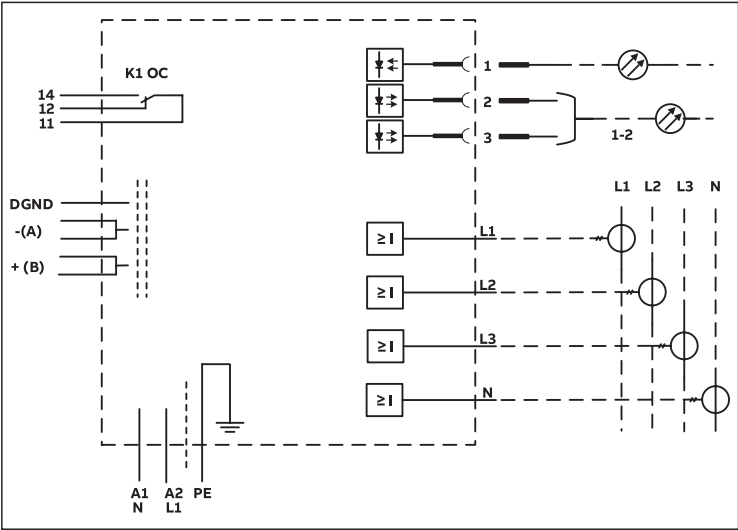
## Arc monitor

Terminals	
X1 1-10	Detector input
X2 1-10	Extra detector unit detector input (option)
X3 1-10	Extra detector unit detector input (option)
A1, A2	Power supply
TVOC-2-48: A1, A2, A3	Power supply
PE	Power supply
43, 44	Solid-state contacts
53, 54	Solid-state contacts
63, 64	Solid-state contacts
11, 12, 14	Indication contacts
21, 22, 24	Indication contacts
31, 32, 34	Indication contacts



# Circuit diagrams

## Current Sensing Unit



CSU-2

## Current Sensing Unit

L1, L2, L3, N	Current sensor input
1	Input current signal from other Current sensing unit
2... 3	Output current signal to Arc monitor and other Current sensing unit
A1	Power supply
A2	Power supply
PE	Power supply
K1	Signal relay for over current
DGND	Communication interface
-(A)	Communication interface
+(B)	Communication interface



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