

1SFC170011M0201 EN, REV. H

Arc Guard System™ – TVOC-2

Installation and maintenance guide



Read this first

Warning and safety

Thank you for selecting this ABB TVOC-2 Arc Guard System™. Carefully read and make sure that you understand all instructions before you mount, connect, configure the Arc Guard System.

This manual is intended for installation and maintenance of the TVOC-2 Arc Guard System.

The manual is available on:

<http://new.abb.com/low-voltage/products/arc-guard>

- Only authorized and appropriately trained personnel are allowed to install and make the electrical connection of the Arc Guard System™ in accordance with existing laws and regulations.
- Only authorized personnel are allowed to do service and repair on the Arc Guard System.
- Unauthorized repair will effect the warranty.
- This manual is a part of the TVOC-2 Arc Guard System. Always keep this manual available when working with the TVOC-2 Arc Guard System.
- Examine the Arc Guard System™ and the package when you unpack your new product. If there are damages, please contact the transportation company or the ABB reseller/office immediately.

Safety notes

In this user manual, these symbols are used:



WARNING

General warning symbol indicates the presence of a hazard which could result in personal injury and damage to equipment or property.



WARNING

Warning symbol indicates the presence of hazardous voltage which could result in personal injury.



INFORMATION

Information sign alerts the reader to relevant facts and conditions.

Modifications to data in this manual can be applied without notice.

General safety information



WARNING

Only authorized and appropriately trained personnel are allowed to install and make the electrical connection of the Arc Guard System™ in accordance with existing laws and regulations.



WARNING

Examine the Arc Guard System™ and the package when you unpack your new product. If there are damages, please contact the transportation company or the ABB reseller/office immediately.



WARNING

Only authorized and appropriately trained service personnel are allowed to do service and repair on the Arc Guard System. Note: unauthorized repair will effect the warranty.

Personal



Service and repair should be performed by authorized personnel only. Note that unauthorized repair affects safety and warranty.

Arc Guard System™ – TVOC-2

Installation and maintenance guide

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1 About Arc Guard System™

Arc Guard System™ TVOC-2 quickly detects an arc and trips the incoming circuit-breaker. Using light as the main condition, Arc Guard System™ trips 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. The Arc Guard System™ consists of the Arc Monitor and optical detector used for detection of the arc. For some special applications, an additional current sensing unit can be added. This a measure to prevent unintentional tripping from strong light, for example, the sun.

The basic function acts in three phases:

- **Detection** is light passing through an optical detector.
- **Recognition** is the Arc Monitor determining the intensity of light.
- **Action** is the trip contact closing.

2 Safety

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2.1 Introduction

This chapter describes the safety principles and procedures to be used when working with the Arc Guard System™ or the Arc Monitor. It does not cover how to design for safety nor how to install safety related equipment. The chapter first presents applicable safety standards. Finally the chapter finishes with information about how to work in safety manner.

2.2 Applicable safety standards

2.2.1 Safety standards

This product was developed, designed and certified with regard to improved reliability and integrity by using safety principles and structures according to IEC 61508, SIL2.

The Arc Monitor has improved safety to fulfill the safety standards specified in the following directives:

Table 1 Safety standards

Directive	Description
2006/95/EC	Low voltage equipment
2004/108/EC	Electromagnetic compatibility

2.2.2 Personal safety

INFORMATION

This product has been designed for environment A. Use of this product in environment B may cause unwanted electromagnetic disturbances in which case the user may be required to take adequate mitigation measures.

- Environment A relates to low-voltage non public or industrial networks, locations and installations including highly disturbing sources.
- Environment B relates to low-voltage public networks such as domestic, commercial and light industrial locations, installations. Highly disturbing sources such as arc welders are not covered by this environment.

To ensure safety and quality the Arc Monitor has been tested according to the following standards:

Table 2 Safety standards

Directive	Description
IEC/61508 SIL 2	Functional safety of electrical programmable electronic safety-related systems
IEC/EN 60947-1	Low voltage switchgear and contractor - General
IEC/EN 60947-5-1	Low voltage switchgear and contractor - Control circuit devices and switching elements
IEC/EN 61010-1	Safety requirements for electrical equipment
IEC 61000-6-2 (2005)	Electromagnetic compatibility (EMC)- Immunity for industrial environments
IEC 61000-6-4 (2006)	Electromagnetic compatibility (EMC) - Emission standard for industrial environments
IEC 61326-1 (2005) IEC 61326-3-1	Electrical equipment for measurement and control Electrical equipment, control and laboratory use (EMC)
IEC TS 61000-6-5	Electromagnetic compatibility - immunity power stations and substation environments

2.3 Safety signs

This section specifies all dangers that may arise from performing the work detailed in the manual.



WARNING

Caution symbol indicates the presence of a hazard which could result in personal injury.



WARNING

Warning symbol indicates the presence of a hazard which could result in damage to equipment or property.

Make sure that the supply voltage has been switched off before connecting!

Working with high voltage is potentially lethal. Persons subjected to high voltage may suffer cardiac arrest, burn injuries, or other severe injuries. To avoid these hazards, do not proceed working before removing the power to the Arc Guard System.

Arc Guard System™ and Arc Monitor are designed to protect people and installation equipment. Install your system components and Arc Monitor before supplying power.

DIP switches are used to activate Current Sensing Unit (CSU-2), auto reset and assigning trip contacts. Changing DIP switch can cause consequences with the Arc Guard System.

Make sure you understand the consequences of changing DIP switches.

More information regarding DIP switches,

See: “DIP switches” on page 29.



INFORMATION

Information sign alerts the reader to relevant facts and conditions.

2.4 Work in safety manner

Safe working methods must be used to prevent injuries. The safety equipment must not be disengaged, bypassed or in any other way modified so that the safety effect ceases.

2.4.1 Handling the Arc Monitor

The Arc Monitor may only be used for the purposes mentioned in this manual. The Arc Monitor was developed, manufactured, tested and documented in accordance with applicable safety standards. If you follow the instructions regarding safety and use as described in this manual, the product will, in the normal case, neither cause personal injury nor damage to machinery and equipment.

To avoid malfunctions or damage through improper handling, follow these instructions during transportation, installation and maintenance:

- Transport with care. Do not drop, throw, or give the Arc Monitor a strong shock. It can cause breakage or failure.
- Handle with care. Do not drop, throw, or give the Arc Monitor a strong shock. It can cause breakage or failure.
- The Arc Monitor is installed by authorized personnel only.
- This manual is a part of the Arc Monitor and should always be accessible to personnel working with this product.
- Read and understand the manual thoroughly before performing any installation or commissioning.
- Excessive amounts of dust on the optical detectors can lead to a degradation of detection. When regular inspections are made, it is recommended also to inspect the detectors. Clean with dry cloth if needed.
- CSU-2 is constantly sending light to the CSU-2 input at the Arc Monitor during normal conditions (for safety and reliability reasons). The light might decrease over time and should be checked every year by a manual diagnostic test. See more information in chapter Maintenance and in HMI functions.
- A log is kept that indicates if the light level had decreased below a certain level. If so, the Current sensing unit should be replaced within the next 6 months.
- The safety of the system will not be affected if the Current sensing unit is not replaced. However, when the light level becomes too low then the Arc Monitor will recognize this as a high current situation. And then the system functions as if there was a no current condition, that is, trip on light at optical detectors only.

Configuration is done with DIP switches, settings of parameters and controlling of configuration is done in the HMI.

2.4.2 Storage

Storage in original package requires a temperature range of between, -25C° to +70C° (-13F to + 158F) and a humidity maximum 95%.

2.4.3 Limitation of liability

The safety information in this manual must not be considered as a guarantee from ABB that the equipment cannot cause accidents or injury, even if all the safety instructions have been observed.

2.5 Security guidelines

2.5.1 Security disclaimer

This product is designed to be connected to and to communicate information and data via a network interface. It is your sole responsibility to establish and maintain any appropriate measures (such as but not limited to the installation of firewalls, application of authentication measures, encryption of data, installation of anti-virus programs, etc.) to protect the product, the network, its system and the interface against any kind of security breaches, unauthorized access, interference, intrusion, leakage and/or theft of data or information.

ABB Ltd and its affiliates are not liable for damages and/or losses related to such security breaches, any unauthorized access, interference, intrusion, leakage and/or theft of data or information.

2.5.2 Risk Mitigation and Secure Deployment

To prevent equipment to operate in an unsafe or undesirable manner due to malicious activities the TVOC-2 unit must be positioned in a trusted network, strictly limited and in a hosted portion of a network or control system.

When a Serial to Ethernet Converter is used, the user is responsible for creating a defence-in-depth protection for each network by allocating firewall solutions to the front of internal trusted networks of each network by manage firewalls, their configurations and access rules.

For secure remote access, use a VPN connection with an encryption layer to create a secure channel over an insecure network. Separate the management systems and connections to separate network segments with all necessary cybersecurity features on and deny all other connectivity mechanisms from automation systems to restrict unauthorized access.

The user of the product should be aware that the unsecure nature of the serial Modbus protocol exposes the communication between the product and the control system. Authentication and integrity of transmitted information is not provided by the protocol.

The main security is provided through monitoring the cybersecurity, topology (asset management) and correct operation of the data networks using the cybersecurity monitoring modules and features of the firewalls and managed switches.

3 Arc Monitor

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3.1 Introduction

This chapter describes the functions available in the Arc Monitor. The chapter is divided in two parts:

- Overview of the Arc Monitor.
- Functions of the Arc Monitor.

3.2 Overview of Arc Monitor

The Arc Monitor consists of:

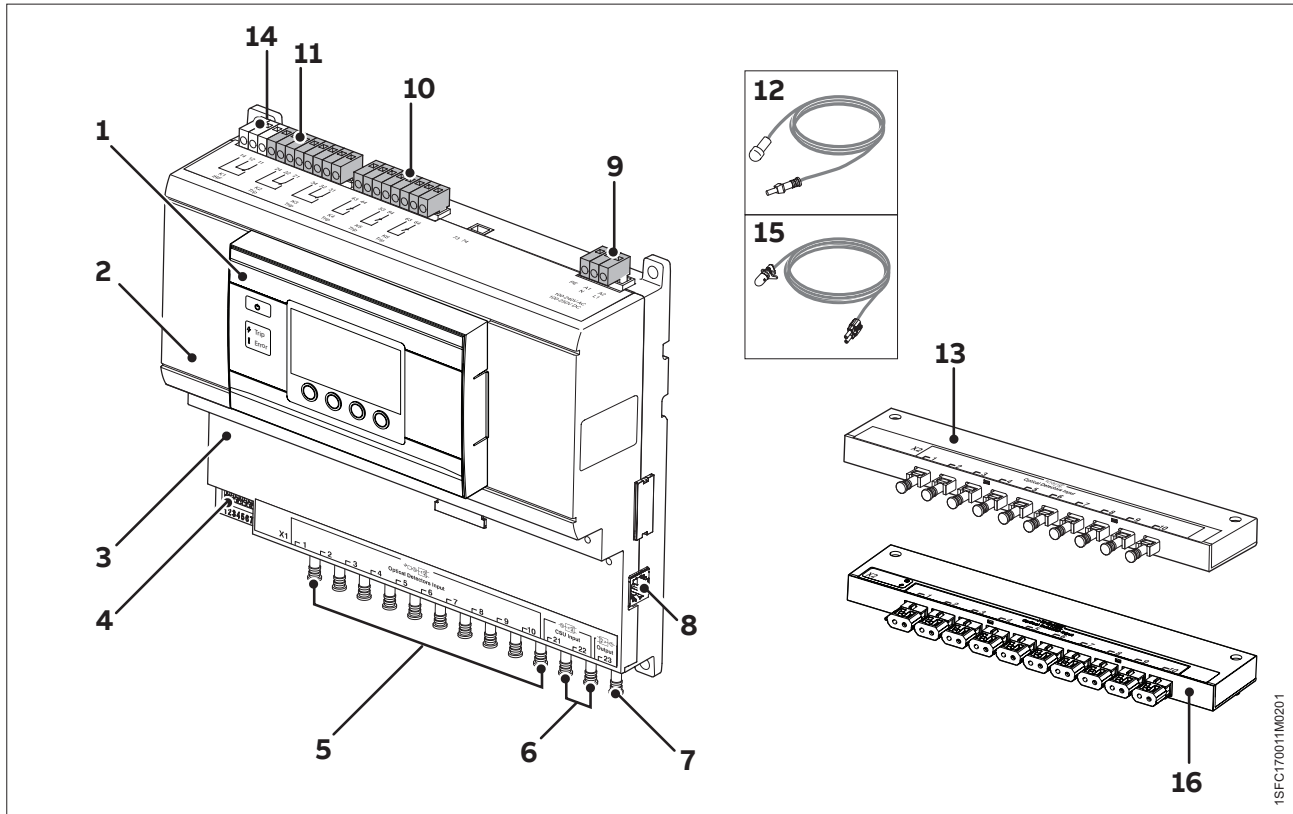


Figure 1
Arc Monitor overview

Table 1 Overview of Arc Monitor

Number	Part	Number	Part
1	Human Machine Interface, HMI and HMI-COM	9	Power supply
2	Arc Monitor	10	Solid state tripping contacts
3	Extension module plug in area	11	Signal relays
4	DIP switch	12	Detector (not included with the Arc Monitor)
5	Detector inputs	13	Extension (option)
6	Current Sensing Unit, CSU-2, inputs	14	Internal Relay Fault
7	Current Sensing Unit, CSU-2, output	15	Detector (not included with the Arc Monitor)
8	HMI external connection	16	Extension E6-S (option)

3.2.1 Arc Monitor

The Arc Monitor is the heart in the system and handles signalling and detection. The HMI handles conditions, errors, and more. The system can be configured to trip selected breakers, depending on which detector detects light. The DIP-switches that take care of this function also handle settings like auto-reset and Current Sensing Units. Energy is stored in the Arc Monitor for operation up to 20ms for TVOC-2-48. This is sufficient to close the tripping contacts even during a short time of power loss.

3.2.2 Human Machine Interface, HMI and HMI-COM

The Human Machine Interface is used for all communication with the user and also to confirm any changes. It can be mounted both on the product and on the cabinet door (not HMI-COM). This is preferred to be able to get information about trips without opening the cabinet after a trip. The HMI has a non-erasable memory which holds trip logs and error logs even after power loss including a time stamp. HMI-COM is a connected version of HMI available using Modbus RTU. HMI-COM shall not be mounted on the door.

The Arc Monitor can handle a second HMI module.

3.2.3 DIP switch

The DIP switch is a physical switch on the Arc Monitors front. DIP switches are used to activate the CSU-2, auto reset and assigning trip contacts. DIP switch configuration is only possible in power off mode.

3.2.4 Detector Inputs

Detector inputs are used to connect the detectors to the Arc Monitor. There are two types of detectors. One type that is used for the base unit and E1/E3 extension module. A second type of detectors with a duplex fiber is used solely for the E6-S extension module.

3.2.5 Current Sensing Unit input

The Current Sensing Unit (CSU-2) is an accessory needed only in those few specific applications where strong light is expected on a regular basis. Current Sensing Units are connected with an optical fiber using light as signal for normal current. If the connection to CSU-2 is lost an error message will appear on the HMI display after 10 seconds. The safety function of the Arc Guard System™ will not be affected.



INFORMATION

DIP Switch 1 or/and 2 must be configured if the CSU-2 is in use.

To read more about the CSU-2 configuration;

See: “One (1) CSU-2 connected” on page 31.

3.2.6 Current Sensing Unit output

This output is used to pass the CSU-2 signal forward to another Arc Monitor.

3.2.7 External HMI connection

HMI can be mounted separately or a second module can be connected (option).



INFORMATION

Only use the included 3 meter (118 inch) cable for communication.

To learn more about the HMI functions;

See: “5 Human Machine Interface (HMI)” on page 37.

3.2.8 Solid state tripping contacts (IGBT)

The three solid state trip contacts, K4, K5 and K6 are used to trip the circuit breakers. This will stop the energy from feeding the arc.

At normal condition:

- K4 Open, no arc detected
- K5 Open, no arc detected
- K6 Open, no arc detected

3.2.9 Signal Relays

The Internal Relay Fault (IRF), K1 indicates the system status. At normal condition the K1 is energized and signals that no diagnostics error is detected on the Arc Guard System.

The two trip signal relays, K2 and K3 are used to signal when a trip occurs. The relays can be used to activate an alarm or to pass the trip information to a supervised system.

The signal relays are called K2 and K3.

- K2 de-energized, no arc detected
- K3 de-energized, no arc detected

If the system is configured for manual reset, K2 and K3 are energized until the user is resets them on the HMI in the trip notification window. If the system is configured for auto reset, K2 and K3 are de-energized 250 ms after the arc is extinguished.

3.2.10 Detectors

The detectors are used to detect the intensive light from an arc and transfer it to the Arc Guard System.

The detectors are using fiber-optics and are guaranteed that they will react on the correct light intensity.

For this reason, the cables are not to be modified in any way.

3.2.11 Extension E1 and E3

The extension module is used to expand the system from the original 10 detectors with additional detectors. One extension can hold up to 10 detectors. The Arc Monitor can hold up to 2 extensions making it possible to mount up to 30 detectors. The standard extension is used for detector up to 30 meter length.

i INFORMATION

A separate version of the extension module is available which is intended only for 60 meter detectors.

i INFORMATION

Do not connect single fiber TVOC-2-DP* detectors to E6-S module.

3.2.12 Extension for supervised detectors

The extension module E6-S is used to expand the system from the original 10 sensors with additional supervised detectors. One extension can hold up to 10 detectors. The Arc Monitor can hold up to 2 extension modules making it possible to mount up to 20 supervised detectors. The E6-S extension module can only be installed with detectors enabled for supervision DPxx-S up to 30 m.

i INFORMATION

An additional variant of extension unit is available called E6-S. This unit is adapted to detectors of type DPxx-S. The unit sends a heartbeat signal through the cable to monitor the integrity of the detector cable. A warning is displayed on the HMI if there is any damaged or disconnected detector cables.

4 Installation

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4.1 Introduction

This chapter describes how to install the Arc Monitor and set up the system. Also in this chapter are examples in placing detectors and general information concerning the products.

Installation of Arc Monitor is performed in steps. After finishing one step you proceed to the next one. The sequence is mandatory.



INFORMATION

The Arc Monitor has 10 detector inputs. If your system needs more inputs then you will need to use additional extension modules.

4.2 Installation procedure



WARNING

The reader should have knowledge and follow the applicable safety laws and standards as well as local safety instructions.

Installation procedure consists of the following five steps:

- Getting started
- Mounting
- Connecting electrical connections
- Configuration
- Testing and verification

Tools required

To mount the Arc Monitor the following tools are required:

- Screwdriver, 2.5 x 0.6 mm (0.98 x 0.23 inch)
- Phillips screwdriver 4.3/2
- Drill 5 mm (0.196 inch), in case of wall mounting.

4.2.1 Getting started

This section describes instructions how to receive and check the Arc Monitor.

Do the following steps:

Receiving and checking

1. Turn the package with the correct side up.
2. Remove the transport casing.
3. Visually inspect the Arc Monitor.
4. Check that all items are included, according to the delivery document.

List of contents

Check the contents in this package as follow:

- Arc Monitor
- Connection cable 3 meter (118 inch) for external Human Machine Interface, HMI
- Plastic nut for mounting external HMI
- Sealing for mounting external HMI
- Label for covering HMI contact on Arc Monitor, (only if external HMI is used)
- Quick installation guide



INFORMATION

This package is a basic start kit. If you need more according for your system needs then contact your local supplier.

Intermediate storage

Until the Arc Monitor is mounted it should be stored in its original package.

4.2.2 Mounting TVOC-2

This section describes the procedure to mount and connect the Arc Monitor.

The procedure is divided into following components:

- Arc Monitor
- Human Machine Interface, HMI
- Detectors
- Extension
- Current Sensing Unit, CSU-2

Placing Arc Monitor

The Arc Monitor can be mounted anywhere in the switchgear, for example in the breaker cubicle or in a separate control cabinet.

Mounting Arc Monitor

This section describes how to mount the Arc Monitor at its location.

The Arc Monitor can be mounted on:

- A wall
- DIN Rail

Mounting on wall

Follow the steps below to mount the Arc Monitor on the wall:

1. Predrill holes in wall to fit screws M5. See **figure 1** for dimensions.
2. Place the Arc Monitor on the wall.
3. Screw in each corner of the monitor.
4. Use a torque wrench and torque the screws to 2.4 Nm.

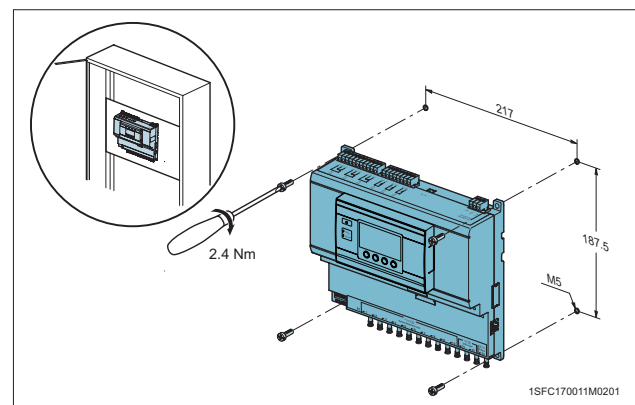


Figure 1
Mounting on wall

Mounting on a DIN rail

Follow this procedure to mount the Arc Monitor on a DIN rail:

1. **1** Hook the Arc Monitor to the DIN rail.
2. **2** Pull the barrier down, between detector 5 and 6.
3. **3** Snap the Arc Monitor on to the rail then release the barrier.

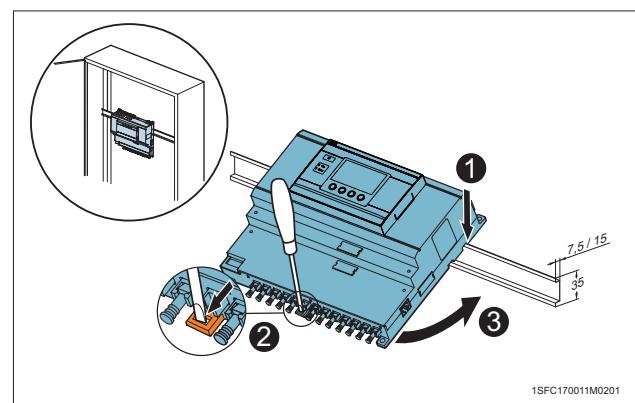


Figure 2
Mounting on DIN rail

Mounting and connecting the Arc Monitor to the system

This is a summarize of the complete procedure in mounting and connecting the Arc Monitor.



WARNING

Make sure that supply voltage is switched off before mounting and connecting the Arc Monitor!

To mount and connect the Arc Monitor do the following steps:

1. Mount and connect external HMI (option).
See: “Mounting the HMI” on page 20.
2. Connect extensions X2, X3 (option).
See: “Connecting extension module (option)” on page 24.
3. Place and mount the optical detectors. This installation guide contains examples for placing the detectors and information how to mount.
See page 21, 22, 23.
4. Connect optical detectors to the Arc Monitor and extensions (option).
5. Connect optical cables (option) from current sensing units, CSU-2 to lower right hand side of base unit (X1:21-22). **See: “Connecting CSU-2 cable” on page 24.**
6. Connect optical cable (option) to output for additional Arc Monitor (X1:23)
7. Connect electrical connections. **See: “Connecting electrical connections” on page 18.**
8. Configure the system by setting the DIP switches.
See: “4.2.5 Configurations” on page 29.
9. Supply the system with power.
10. Go through Start-Up sequence in Human Machine Interface, HMI. **See: “4.3.1 Start-Up Sequence” on page 33.**
11. Controlling the detectors and the system.
See: “4.3.2 Check” on page 35.

Installation



WARNING

Make sure that supply voltage is switched off!

Mounting the HMI

There are three options to mount the HMI; On the the panel separately from the Arc Monitor, inside of the panel or both using a extended cable to an extra HMI.

Mounting the HMI on door

Follow this procedure to mount the HMI module, separately on the door.

i INFORMATION

It is important to use the cable which is included in the package! To mount the HMI on a door do the following steps:

1. Before mounting: Drill a 25 mm (1 inch) hole through the door.
2. **1** Remove the HMI module from the Arc Monitor by pressing on both sides on HMI and at the same time,
3. **2** Pull straight out from the Arc Monitor.
4. **3** Add the sealing on the HMI.
 - Mount the HMI on front door. **4**
 - Insert the back side of module into the door hole.
 - Tighten the plastic nut by hand. Make sure the HMI is fixed to the door.
5. **5** Connect the communication cable between the HMI module back side and Arc Monitor right hand side.
6. **6** Attach the label to cover HMI module hole on the Arc Monitor front if needed.

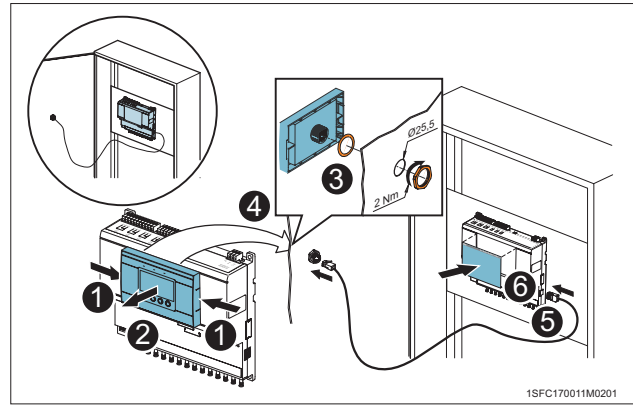


Figure 3
Mounting the HMI on door

Mounting the Optical detector



WARNING

Make sure that supply voltage is switched off!

This section is about optical detectors and the mounting is described using examples:

- Where to positioning the detectors.
 - How the detectors are mounted on busbars system.
- This section also describes how to connect the detectors to the Arc Monitor.

Decide where to position the detectors on the basis of knowledge of your own system. The main issue is to cover all components that might suffer from an arc.

i INFORMATION

Excess plastic fiber cable should be wound up and kept as a ring with a diameter of at least 100 mm (4 inches). The plastic fiber cables are not to be bent in a loop with a radius of less than 20 mm (1 inch) occasionally and 35 mm (1.4 inches) for a long period of time.

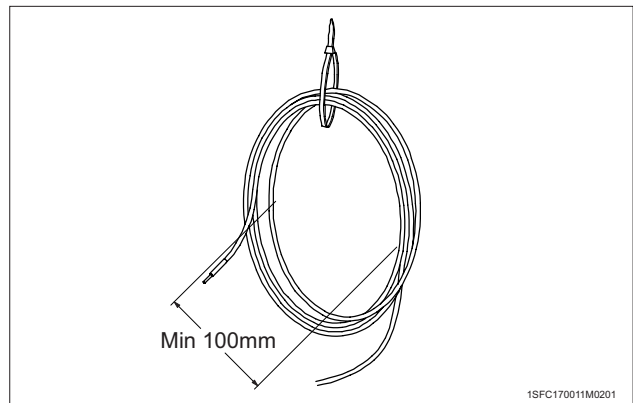


Figure 4
Mounting the optical detector

Example 1, positioning optical detector in a switch gear

The most common positioning of the detector involves the horizontal and vertical bus bar system and the breaker cubicle. If possible, supervise each cubicle. Avoid placing the detector so that it sees normal light from the breaker. See the example below about where to positioning the detectors.

The detector can detect arcs within a three meter (118 inch) distance.

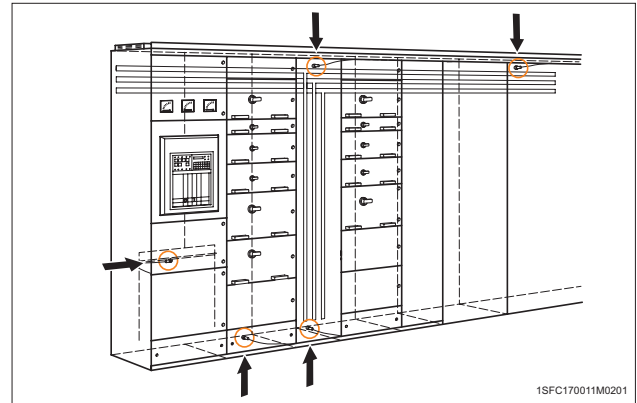


Figure 5
Positioning optical detector in a switch gear

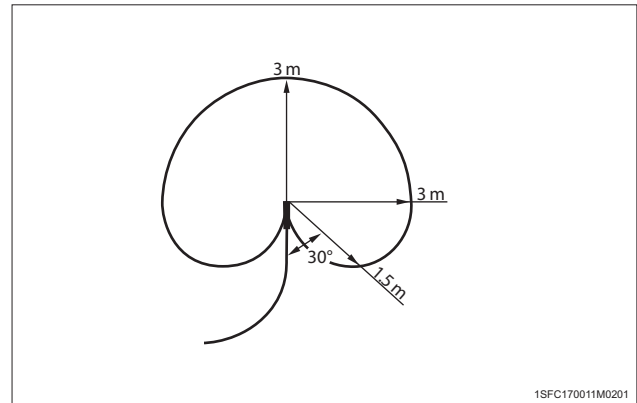


Figure 6
Detector detect arcs distance

Example 2, Mounting Optical detector in an apparatus cubicle

A single detector is able to monitor the busbars in both the apparatus cubicle and the respective cable.

This is an example of how to mount optical detectors with the mounting kit.

Do the following steps to mount the detector on a busbar.

1. Attach the detector to the mounting bracket (1SFA663006R1001 or 1SFA663006R1002) before it is attached to the cubicle.
2. The bend of mounting bracket should point downwards.
3. Attach the detector to the upper side of the bracket. See **Figure 7**.
4. Use a 2.5 mm (0.1 inch) wide cable strap.
5. Place the strap on the rear groove of the detector head and around the notches in the mounting bracket.
6. Attach the detector bracket onto the cubicle frame. See **Figure 8**.

The hole in the mounting bracket is for M5 thread rolling screws or 5.5 self tapping screws.

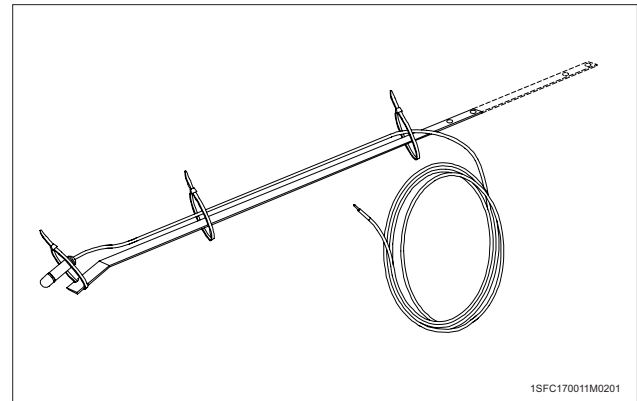


Figure 7
Place the strap

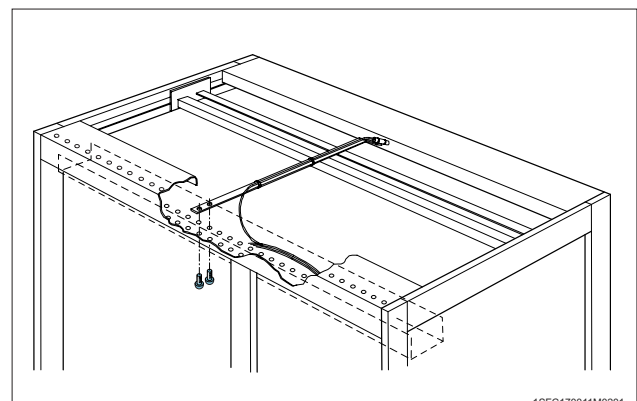


Figure 8
Attach the detector bracket

Example 3, Mounting in a circuit breaker cubicle

In a circuit breaker cubicle there is a risk of detecting breaking arcs unintentionally, if the detector is placed above the busbars. In such a cubicle it is better to place the detector at the bottom. See **Figure 9**.

- Use the same mounting bracket as for top mounting but the bend is turned upwards and the detector placed on the upper side.
- Drill a hole 20 mm (0.79 inches) in front of the busbars, where the detector can be located.

If many cables are connected to the terminals on the lower side of the circuit breaker, the arc monitoring should have an additional detector located just behind the front protective sheet. See **Figure 10**.

Attach the detector directly to the bottom side of the bracket of the protective cover with a cable strap.

Example 4, Mounting on a wall

Attach the lens from the front and pull the cable from the back of the panel and fasten from the front of the panel or Install the lens through the panel and fasten on the back of the panel The minimum diameter of the hole should be 9.85 mm. See **Figure 11**.

Connecting optical detectors

⚠ WARNING
Make sure that supply voltage is switched off!

Follow this steps below to connect the optical detectors to the Arc Monitor.

1. **1** Remove the protection plug or the dummy plug.

⚠ WARNING
Only remove protection plug from connection to use. Protection plugs are needed to protect the detector inputs from dust and light.

⚠ WARNING
For the E6-S extension unit, the dummy plugs (TVOC-2-PP2) connected at delivery, are also used to maintain functionality of the unit. Removing the dummy plugs will not only allow for dirt and dust to enter but will trigger warnings on the HMI for damaged detectors.

2. Connect optical detectors to lower side of Arc Monitor. Detector inputs are X1:1-10 (for Extension 1, X2:1-10 and Extension 2, X3:1-10)

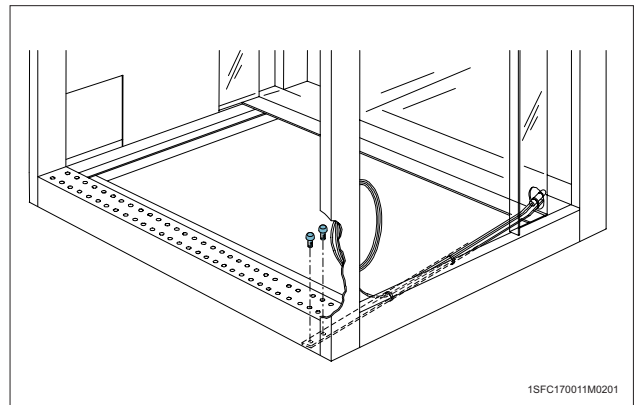


Figure 9
Place the detector at the bottom

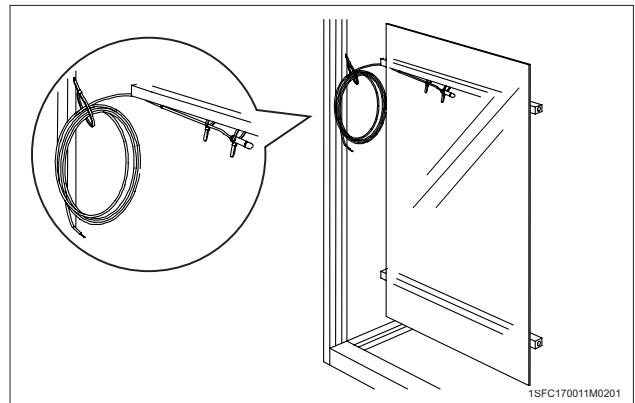


Figure 10
Additional detector located just behind the protective sheet

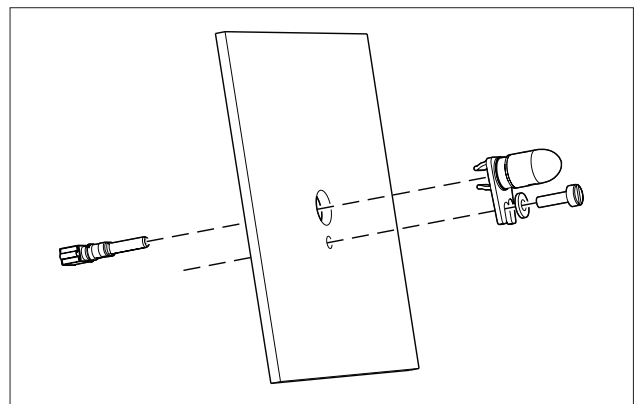


Figure 11
Place the detector at the bottom

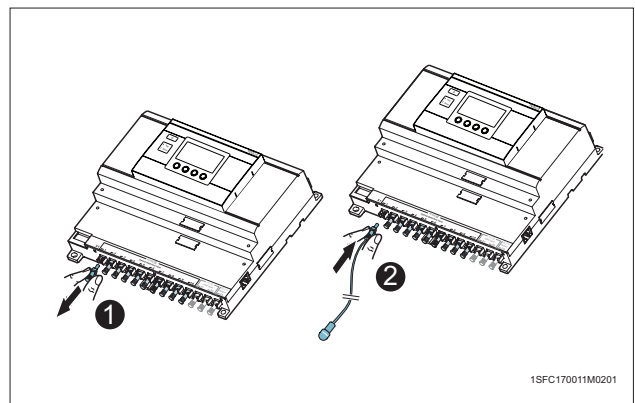


Figure 12
Connect the detector cable

Connecting extension module (option)



WARNING

Make sure that supply voltage is switched off!

Follow these steps to connect extension module to the Arc Monitor:

1. **1** Remove the protection part.
2. **2** Mount the extension module into the contact of the Arc Monitor.
3. **3** Secure the extension module using screwdriver torque 0.6 Nm.

To connect second extension module:

1. **1** Remove the protection part from the second extension module.
2. **2** Mount the extension module into the contact of the Arc Monitor.
3. **3** Secure the extension module using screwdriver torque 0.6 Nm.
4. Cover the X2 text with label X3 which comes with the additional extension module.

Connecting CSU-2 cable



WARNING

Make sure that supply voltage is switched off!

Follow this steps to connect CSU-2 cable to the Arc Monitor:

1. **1** Remove the protection plug.
2. **2** Connect current sensing cable to lower side right side of Arc Monitor by pressing.

Current sensing units (CSU-2) inputs are X1: 21, 22.
Current sensing units (CSU-2) outputs are X1: 23.



INFORMATION

Before the system is ready to use, a DIP switch configurations are needed.

For more information, See: **“4.2.5 Configurations”** on page 29.

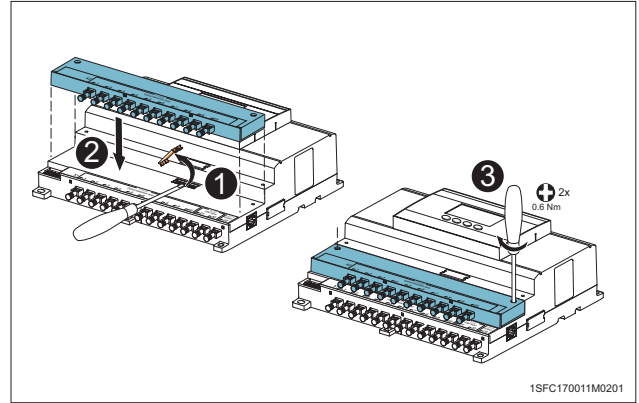


Figure 13
Connect extension module

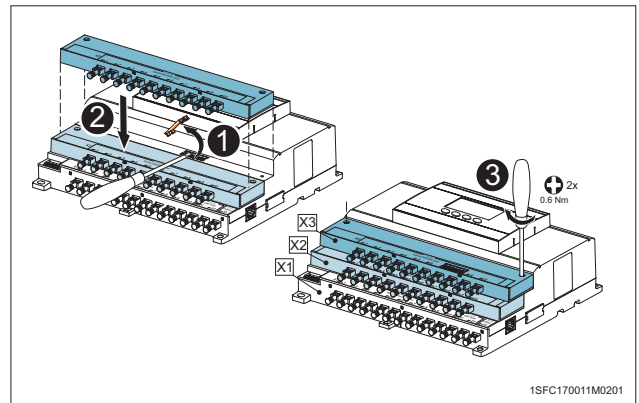


Figure 14
Connect second extension module

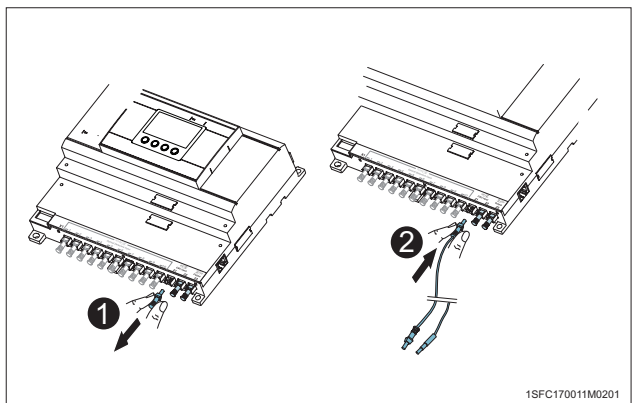


Figure 15
Connect the CSU-2 cable

Connecting electrical connections

WARNING
Make sure that supply voltage is switched off!

This section describes how to connect the electrical connections to the Arc Monitor and to the Arc Guard System.

Connecting HMI;
See: “Mounting the HMI” on page 20.

Connecting optical detector
See: “Connecting optical detectors” on page 23.

Connecting extension module (option)
See: “Connecting extension module (option)” on page 24.

Connecting Current Sensing Unit (option)
See: “Connecting CSU-2 cable” on page 24.

Electrical connections are:

1. Internal Relay Fault, (IRF, K1)
2. Trip Signal relays, (K2, K3)
3. Trip contact, (K4, K5, K6)
4. Power supply

They are situated on top of the Arc Monitor.

Connecting the Arc Monitor

WARNING
Make sure that supply voltage is switched off!

First connect the trip signal relays and trip contacts.
Follow the steps below:

1. Connect wires for Internal Relay Fault, IRF, trip signal relays (K2, K3) and trip contacts (K4, K5, K6).
2. Use a torque of 0.5 NM
3. Use a screwdriver 2.5 x 0.6 mm (0.98 x 0.23 inches)
4. Cable area 0.2 - 2.5 mm² (0.078 x 0.98 inches²).
5. Connect cable for IRF, K1 to terminal number, 14, 12, 11.
6. Connect cable for K2 to terminal number 24, 22, 21.
7. Connect cable for K3 to terminal number 34, 32, 31.
8. Connect cable for K4 to terminal number 43, 44.
9. Connect cable for K5 to terminal number 53, 54.
10. Connect cable for K6 to terminal number 63, 64.

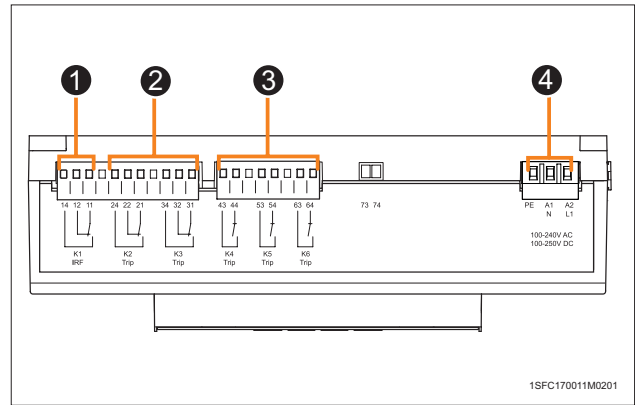


Figure 16
Electrical connections

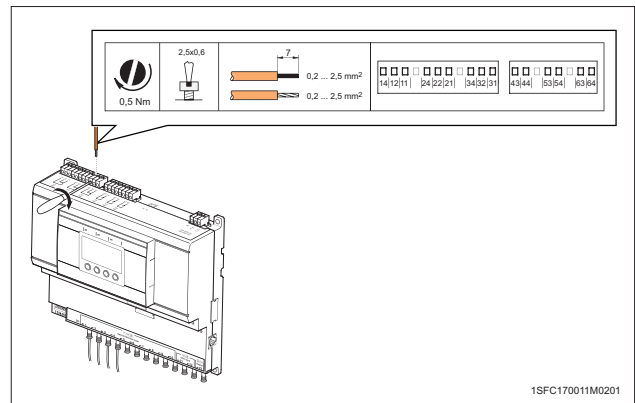


Figure 17
Connecting the trip signal relays and trip contacts

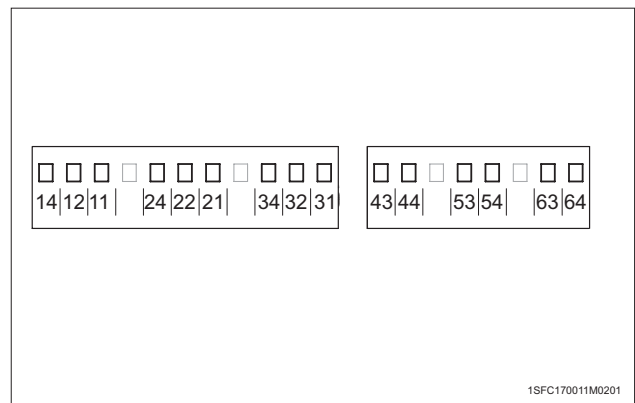


Figure 18
Connecting the trip signal relays and trip contacts

Connect Power Supply. To connect the power supply of the TVOC-2 unit 1SFA664001R1001 and 1SFA664001R1003 do the following steps:

1. Connect wires for power supply, use a torque of 0.5 Nm.
2. Use screwdriver 2.5 x 0.6 mm (0.98 x 0.23 inches).
3. Cable area 0.2 - 2.5 mm² (0.078 x 0.98 inch²).
4. Connect the cable for power supply 100-240V AC / 100-250V DC. See **Figure 19**.

For 1SFA664001R1002 and 1SFA664001R1004 connect the cable for power supply 24-48V DC. The unit has dual power supplies (A1, A3) for redundancy with a common minus (A2). The supplies can be used separately. See **Figure 20**.



WARNING

Always connect PE to Protective Earth!

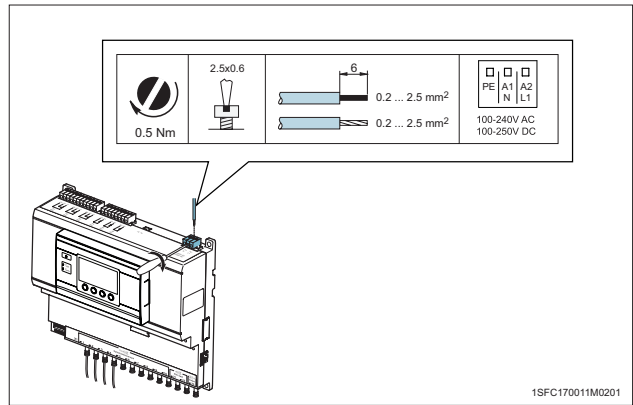


Figure 19
Connecting power supply

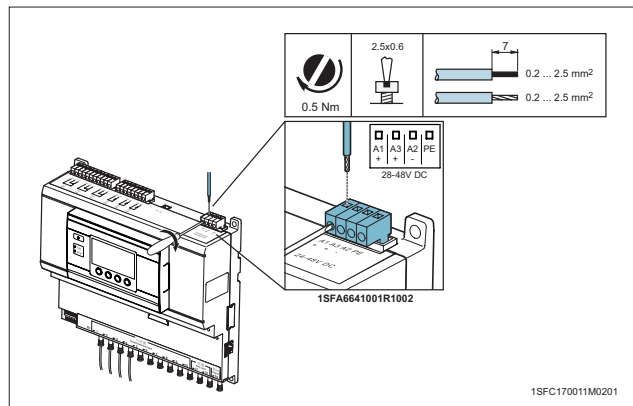


Figure 20
Dual power supply

4.2.3 Mounting TVOC-2-COM

Follow these steps to connect TVOC-2-COM module to the Arc Monitor:

⚠ WARNING
Make sure that supply voltage is switched off!

1. **➊** Remove the TVOC-2 HMI module from the Arc Monitor by pressing on both sides on HMI and at the same time. **➋** Pull straight out from the Arc Monitor.

i INFORMATION
The removed TVOC-2 HMI module can be mounted on the door.
See **Mounting the HMI on door** on page 21.

2. **➌** Place the TVOC-2-COM into the Arc Monitor.

3. **➍** Cut the cable casing 10 millimeters.
➎ Insert the cable into the contact on the top of the TVOC-2-COM

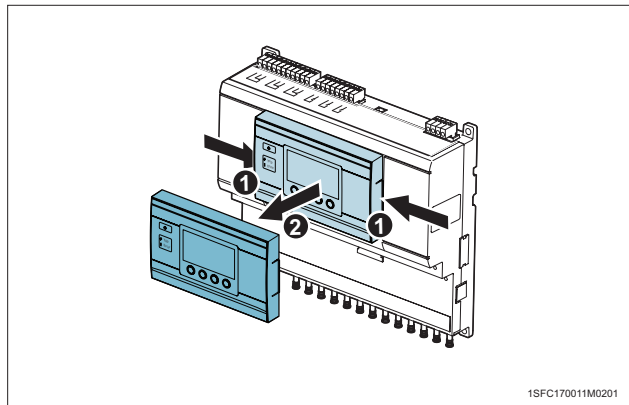


Figure 21
Remove the HMI

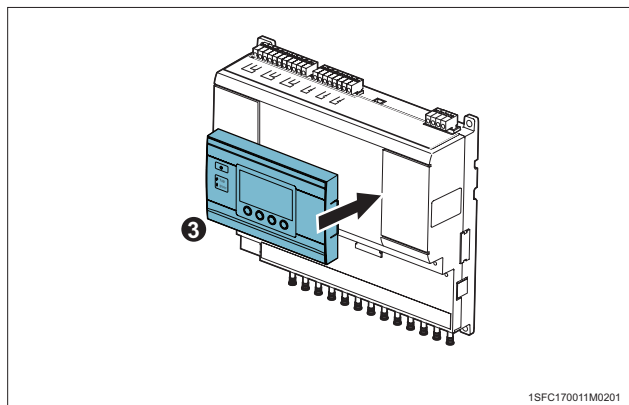


Figure 22
Place TVOC-2-COM

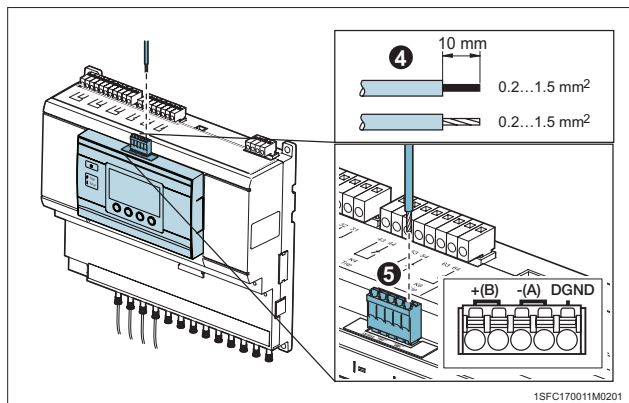













Figure 23
Fasten cable into the TVOC-2-COM

4.2.4 Configuring TVOC-2-COM

Follow this steps to configure the TVOC-2-COM module:

1. Press **Menu** button  to reach the menu.
2. Press **Down** button  down to **3. Configuration** and then press **Ok** button  to reach the configuration menu.
3. Press **Down** button  down to **3.4 Modbus** and then press **Ok** button  to reach the modbus menu.
4. **1** Use the selection buttons   to choose between the settings in modbus menu. Press **Edit** button  to change setting. Use the selection buttons   to change the value. **2** Then press **OK** button  to save settings.



INFORMATION

Please see 1SFC170017M0201 TVOC-2-COM Modbus Configuration Manual for further information.

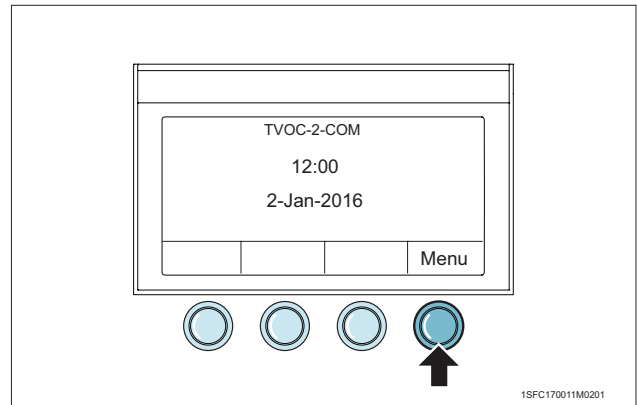


Figure 24
TVOC-2-COM main menu

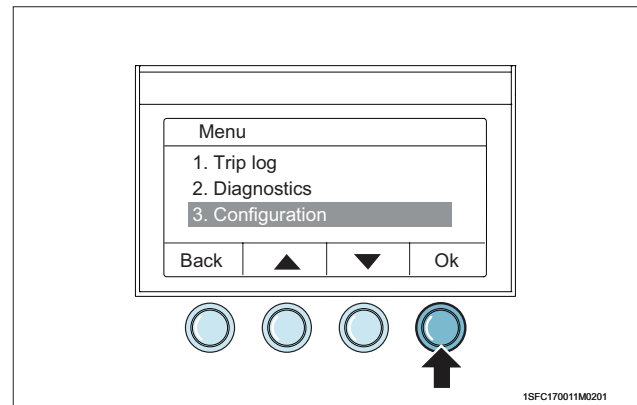


Figure 25
TVOC-2-COM main menu

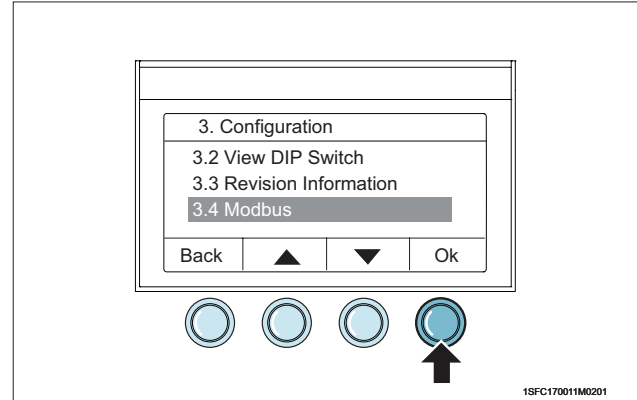


Figure 26
TVOC-2-COM Configuration

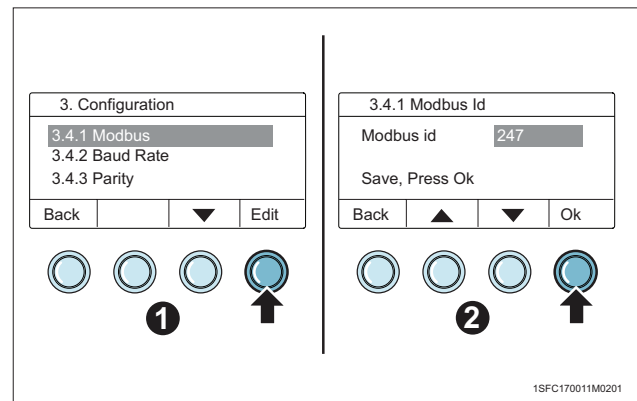


Figure 27
TVOC-2-COM Modbus Id

4.2.5 Configurations



WARNING

Make sure that supply voltage is switched off!

Arc Monitor can be configured to trip selected breakers depending on which optical detector or CSU-2 is connected. This configuration is done with a DIP switch.

DIP switches

The DIP switches are located on the front left hand on the Arc Monitor. There are 8 DIP switches. Only DIP switches 1, 2, 3, 4 and 6 are activated. As default all DIP switches are set to position 0. See **Figure 28**.

Breaker trip

The trip contacts are located on top of the Arc Monitor. See **Figure 29**.

DIP switches 3 and 4 configure trip contacts, K4, K5 and K6. All detectors, X1, X2 and X3, operate the trip signal relays K2 and K3. Adjust the DIP switches to achieve the desired breaker configuration K4, K5, K6. See **Figure 29**.

DIP switches 3 and 4 to position 0

DIP switches 3 and 4 in position 0 is the default state (factory settings).

Any detector on X1, X2 or X3 operates trip contacts, K4, K5 and K6. See **Figure 30**.

DIP switch 3 in position 0, DIP switch 4 to position ON

Set DIP switch 3 to position 0 and DIP switch 4 to position ON.

- Detectors X1 operate trip contact K4.
- Detectors X2 operate trip contact K5.
- Detectors X3 operate trip contact K6.

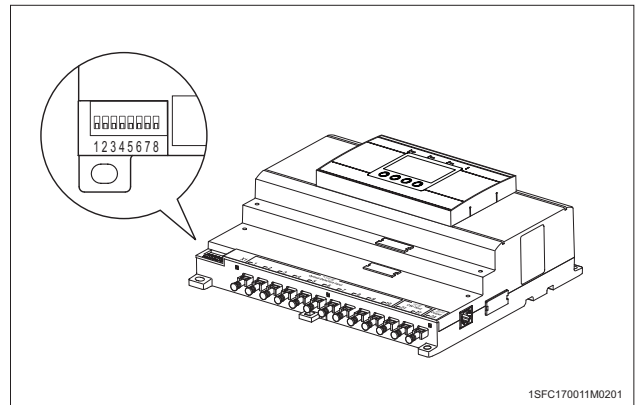


Figure 28
DIP switches

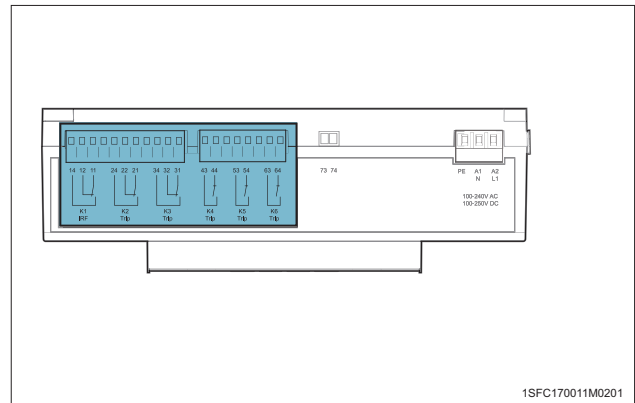


Figure 29
Breaker trip

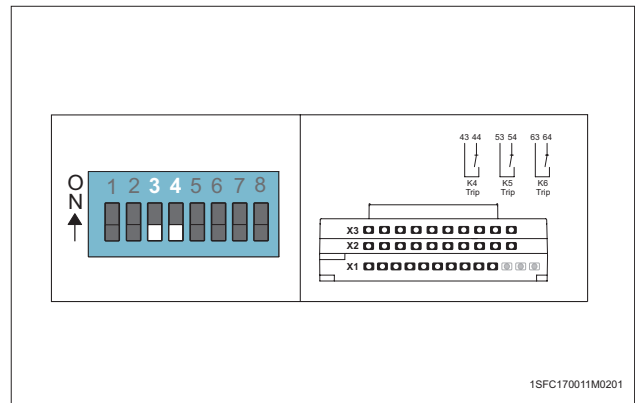


Figure 30
DIP switches 3 and 4 to position 0

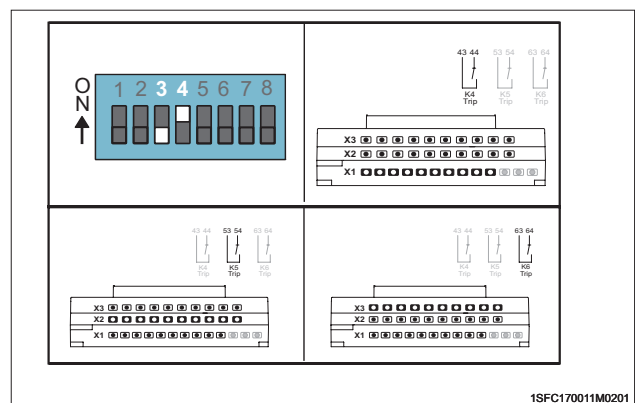


Figure 31
DIP switch 3 in position 0, DIP switch 4 to position ON

DIP switch 3 to position ON and DIP switch 4 to position 0.

Set DIP switch 3 to position ON and DIP switch 4 to position 0.

- Detectors X1: 1-3 operate trip contact K4.
- Detectors X1: 4-6 operate trip contact K5.
- Detectors X1: 7-10 and all detectors on X2 and X3, operate trip contact K6.

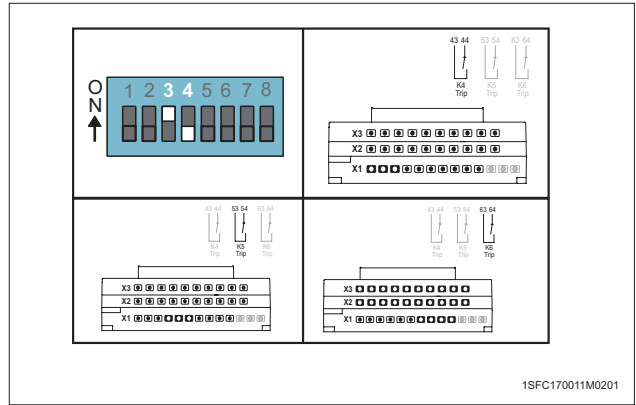


Figure 32
DIP switch 3 to position ON, DIP switch 4 to position 0

Manual/Auto reset configuration

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

Configuration Auto reset, set DIP switch 6 to position ON.

Configuration Manual reset, set DIP switch 6 to position 0.

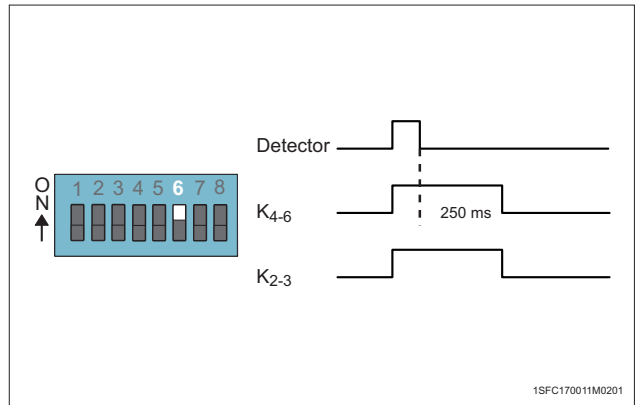


Figure 33
Configuration Auto reset

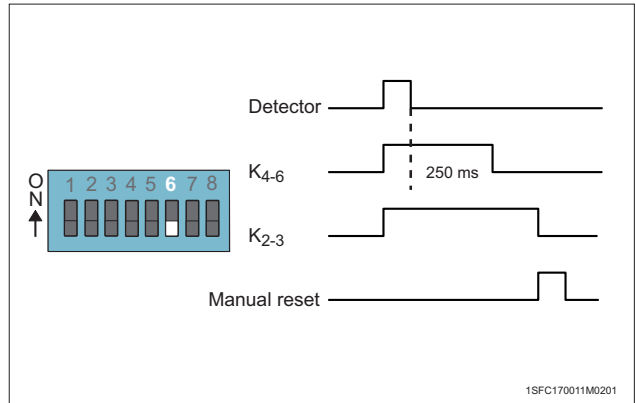


Figure 34
Configuration Manual reset

Current Sensing Unit (option)

DIP switch (A) 1 and 2 configure the CSU-2 input (B) 21, 22 to the Arc Monitor.

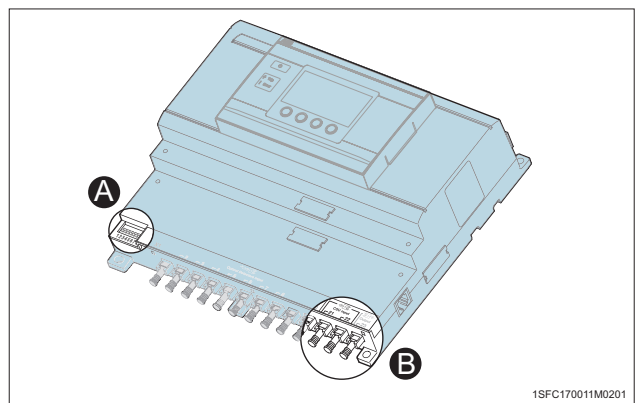


Figure 35
Current sensing unit (option)

No CSU-2 connected

When there is no CSU-2 connected to the Arc Monitor then set the DIP switch 1 and 2 to position 0.

DIP switch 1 and 2 in position 0 is the default state (factory settings).

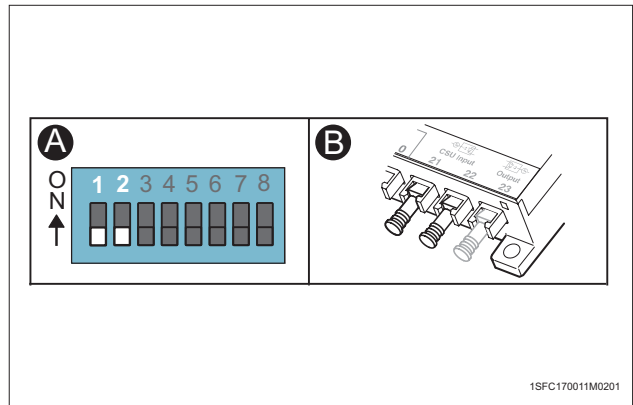


Figure 36
No CSU-2 connected

One (1) CSU-2 connected

If there is one (1) CSU-2 connected to the CSU-2 input X1, 21 then set the DIP switch 1 to position ON.

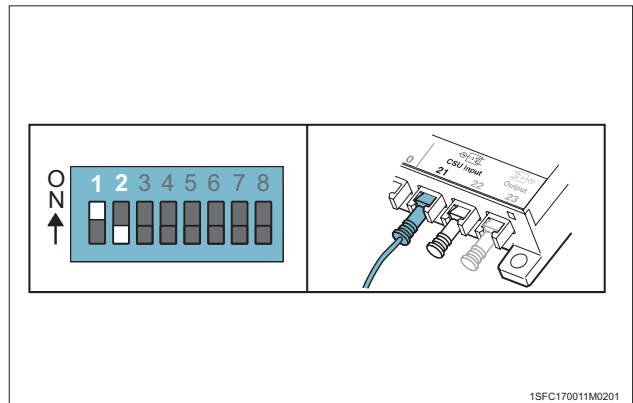


Figure 37
One CSU-2 connected

DIP switches 1, 2, 3 and 4 to position ON

Set DIP switches 1, 2, 3 and 4 to position ON. In this configuration two CSU-2 are connected.

For more information See: **“Two (2) CSU-2 connected” on page 31.**

- Any detector with combination of over current condition in CSU-2 21, operates trip contacts K4 and K6. As well as signal relays K2 and K3.
- Any detector with combination of over current condition in CSU-2 22, operates trip contacts K5 and K6. As well as signal relays K2 and K3.

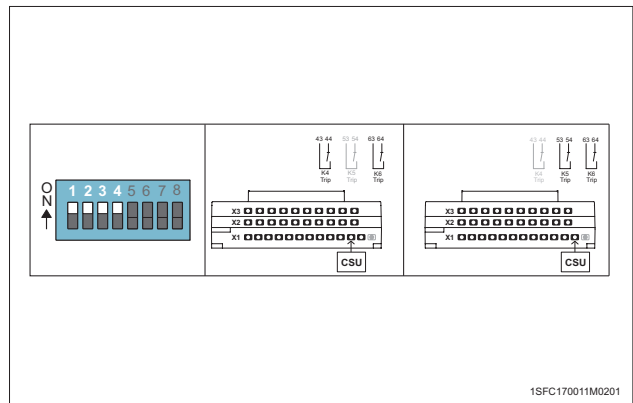


Figure 38
DIP switches 1,2,3 and 4 to position ON

Two (2) CSU-2 connected

If there are two (2) CSU-2s connected to the CSU-2 input 21 and 22 then set the DIP switch 1 and 2 to position ON.



WARNING

The CSU-2 cable is connected before configuration is made.

For more information how to connect CSU-2 cables, See: **“Connecting CSU-2 cable” on page 24.**

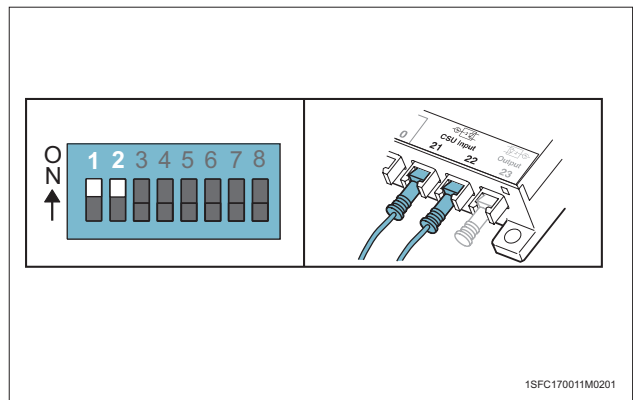


Figure 39
Two CSU-2 connected

Power on to the Arc Monitor



WARNING

Working with high voltage is potentially lethal.


Before switching the power supply on follow the steps below:

1. Check your installation.
2. Check that electrical connections are orderly connected.
3. Check that the configuration is set for your system.
4. Make sure the supply voltage is according to the products marking label.
5. Make sure you do not leave any working tools in the switchgear.

The Arc Monitor turns on automatically when the power is switched on. There is no ON/OFF switch.

Checking power on Arc Monitor

When the Arc Monitor is on check the following :

- Green LEDs “Power”  on left side of detector inputs is lit.
- Green LED “Power” on HMI is lit.
- HMI is showing text.

Add/Remove module from the Arc Monitor or changing configuration



WARNING

Make sure that supply voltage is switched off!

To add/remove a module to the system do the steps below:

1. Remove power to the Arc Monitor.
2. Physically add/remove a module to the Arc Monitor.
3. Ensure DIP Switches are set correctly.
4. Power on.
5. Follow Start-Up sequence.

The Arc Monitor requires configuration of the system and its modules to work.

The Human Machine Interface, HMI automatically guide the user through a Start-Up Sequence.



INFORMATION

For more information concerning Start-Up Sequence, **See: “4.3 Settings” on page 33.**

4.3 Settings

This chapter describes the five mandatory steps to succeed in setting the system. All settings are done in the Human Machine Interface, HMI. Settings are made only with the power on.

4.3.1 Start-Up Sequence

Installation of the Arc Monitor requires configuration of the system and its modules to work. This start-up is mandatory. The same start-up occurs when operating the Arc Monitor for the first time and when adding/removing modules for the Arc Monitor. The Human Machine Interface (HMI) automatically go through the different configuration steps.

To do the Start-Up sequence follow the steps below:

1. Set language of the system menu
2. Set time and date
3. Confirm connected modules
4. Check DIP Switches
5. Final confirmation



INFORMATION

The system will not require the Start-Up sequence in the event of a power loss.

Step 1: Setting menu language

This is the first step to make the system work after installing the Arc Monitor.

Use this procedure to choose the language of the system menu during startup.

In the Start-Up menu do the following:

1. Mark the language to use and press OK.
2. Confirm by pressing YES.

Available languages

Language currently available in the system is:

- English (us/uk)

Step 2: Setting time

This is the second step to make the system work after installing the Arc Monitor. Use this procedure to set the time and date in the system.

In window, 3.4 Set Time do the following:

1. Scroll to correct hour, press OK.
2. Scroll to correct minutes, press OK.
3. Scroll to correct day, press OK.
4. Scroll to correct month, press OK.
5. Scroll to correct year, press OK.

Step 3: Confirming connected modules

This is the third step to make the system work after installing the Arc Monitor. Use this procedure to confirm connected modules during start up.

In window, 3.1.1 View connected do the following:

1. Check the list of modules and if all modules are included, press Yes.
2. If all modules not are included, press No. See next step 3, below.



WARNING

Make sure that supply voltage is switched off!

3. Remove the power and check the connections to the modules.
4. Power on.
5. Start-Up sequence will start again with step 1. **See: “Step 1: Setting menu language” on page 33.**

Step 4: Checking DIP Switches

This is the fourth step to make the system work after installing the Arc Monitor. Use this procedure to check the DIP switches.

In window, 3.2 View DIP Switch do the steps below:

1. Check the DIP Switch and scroll with right arrow to next switch.
2. Check through all DIP switches menus.
3. The last switch menu, 3.2 View DIP display,
4. DIP Switch OK? If all DIP Switches are OK, press Yes.
5. If some of the DIP switches are not OK, Press NO. See next step 6, below.



WARNING


Make sure that supply voltage is switched off!

6. Remove power and check the DIP switch.
7. Power on.
8. Start-Up sequence will start again with step 1. **See: “Step 1: Setting menu language” on page 33.**

Step 5: Final confirmation

This is the fifth step to make the system work after installing the Arc monitor. Use this procedure to confirm that all Start-Up settings are done.

In the Start-up menu do the steps below:

1. Press OK. All settings done. The system is now ready to run accordingly and will return to Start window.
2. Check that the green LEDs “Power”  on left side of extension modules on Arc Monitor is lit.
3. Check that the Green LED “Power” on HMI is lit.
4. Check that HMI is showing text.

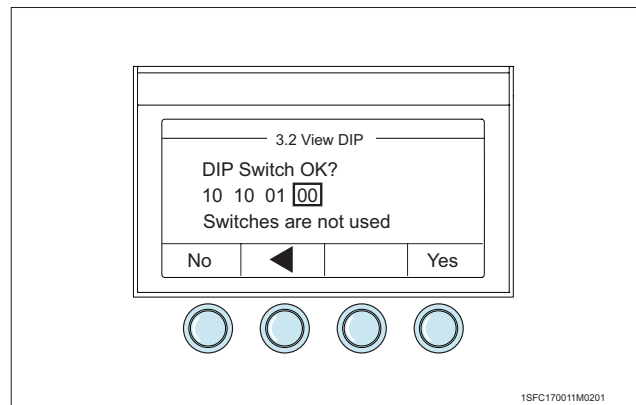


Figure 40
Checking DIP switches

**INFORMATION**

After completed Start-Up Sequence at the first time installation the complete sytem needs checking.

This includes checking that the detectors and HMI works as intended.

See: “4.3.1 Start-Up Sequence” on page 33.

4.3.2 Check

**INFORMATION**

Do the test after installation and before the Arc Monitor is used!

This test is done for each installed detector and the Arc Monitor. The test will check that the detectors react to a simulated arc and the HMI will display a notification window showing which detector and which circuit breaker is tripped. The breaker that is connected to the Arc Monitor should trip. Use a camera flash to simulate an arc. At normally sensitivity the Arc Monitor will react to the flash.

**INFORMATION**

Flash specifications to simulate an arc, 16 (m) guide no. 21 DIN/100 ASA.

4.3.2.1 Sensor supervision (E6-S extension module)

Check that the sensor supervision is working for each of the 10 detectors with the following steps:

1. Force an error by removing either the detector head, the detector cable or a dummy plug.
2. Check the HMI: When the error is applied the system error popup shall be displayed within 30 seconds on the HMI showing the bit for sensor supervision error and by pressing page down the correct detector shall be marked with a zero (0) for faulty detector.

4.3.2.2 Arc detection

To check the detectors and the Arc Monitor, simulate an arc by using a camera flash, repeat the following steps:

1. Set the camera flash to approximately 0.5 ms.
2. Place the camera flash at a distance between 1.5 - 2 meters (60-80 inches) from the detector.
3. Make sure no object is standing in the way.
4. Point the camera flash towards the detector.
5. Press the flash test button.
6. Carry out the following steps to check the Arc Monitor
 - a. Check the HMI display.
 - b. If the detector reacts correctly and causes a trip then it should show on the HMI display as a notification window.
 - c. The notification window shows, Trip has Occurred, which detector, which trip contact, at what time and date.
 - d. The breaker that is connected to the Arc Monitor should trip, depending on the configuration.
 - e. At the notification window, if manual reset is configured, press Reset. If auto reset is configured, press Menu.

5 Human Machine Interface (HMI)

38	5.1 Introduction
38	5.2 Overview HMI and HMI-COM
38	5.2.1 LED signals
38	5.2.2 HMI Display
38	5.2.3 Soft keys
38	5.3 HMI menu structure
39	5.3.1 Menu and languages
39	5.4 HMI start menu
39	5.4.1 Trip Log
40	5.4.2 Diagnostics
42	5.4.3 Configuration
43	5.4.4 Language
43	5.4.5 Set Time and Date
43	5.4.6 Factory reset

5.1 Introduction

The Human Machine Interface, HMI is used for all communication with the user and also to confirm any changes. If power is lost (max 48 hours) the Time and Date will be restored. After very long power interruptions the Time and Date are set to a default value and needed to be set by the user.

This chapter consists of the following sections:

- Overview HMI
- HMI functions
- HMI menus

Prerequisites



WARNING

The reader should have knowledge and act according to applicable safety laws and standards as well as local safety instructions.

5.2 Overview HMI and HMI-COM

The HMI module consists of:

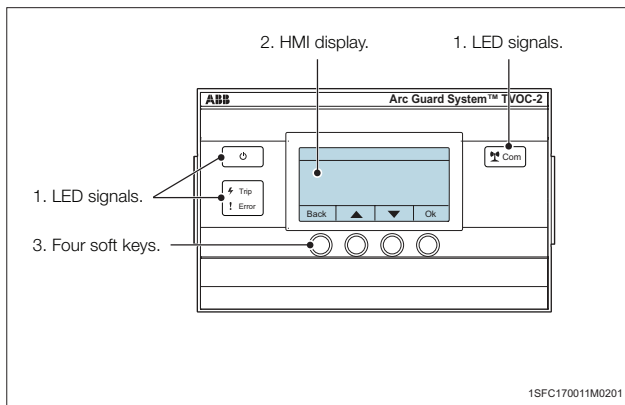


Figure 41
Overview of the HMI

5.2.1 LED signals

The four LED signals are used for visual signalling and they are:

- **Power LED**



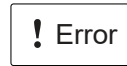
- Green light in LED indicates that power is on.
- No light in LED signals no power to HMI.

- **Trip LED**



- Red light indicates Trip.

- **Error LED**



- No light in LED indicates that no error is detected in the Arc Guard System.
- Red light in LED signals that error is detected in the system and the Internal Relay Fault (IRF), K1 is de-energized.

- **Com LED**



- Yellow light indicates active communication

5.2.2 HMI Display

The HMI start window displays Name of Arc Guard System, Time and Date.

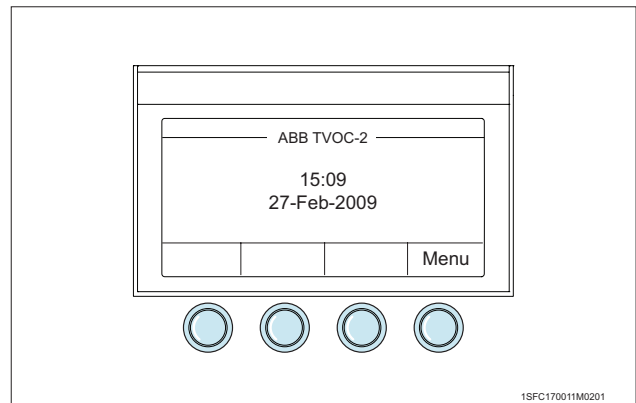


Figure 42
HMI Display

The bottom of display shows the tasks assigned to the four soft keys.

5.2.3 Soft keys

The four soft keys are used to navigate in the menu. Each key is assigned a task, displayed in the window.

5.3 HMI menu structure

The menu is structured in five main categories. Each category is divided into subcategories. Some subcategories have sub-sub categories. All categories are numbered according to the structure.

5.3.1 Menu and languages

The Arc Monitor includes a menu shown in the display. The menu language can be chosen in the start-up sequence but it can also be changed during operation. Languages available in the system menu are:

- English (us/uk)

5.4 HMI start menu

The Start menu display following main categories.

- Trip Log
- Diagnostics
- Configuration
- Language
- Set Time and Date
- Factory reset

5.4.1 Trip Log

When the optical detectors detect arcs, the Arc Monitor reacts by energizing the trip contacts according to the configuration of the DIP switches. The Arc Monitor is designed to save information about arc events the Trip Log. The Trip Log can store 7 trips in a circular buffer, where the oldest will be overwritten.

This section describes how to handle the Trip Log.

Trip notification window

When a trip occurs a notification window will be displayed on the display.

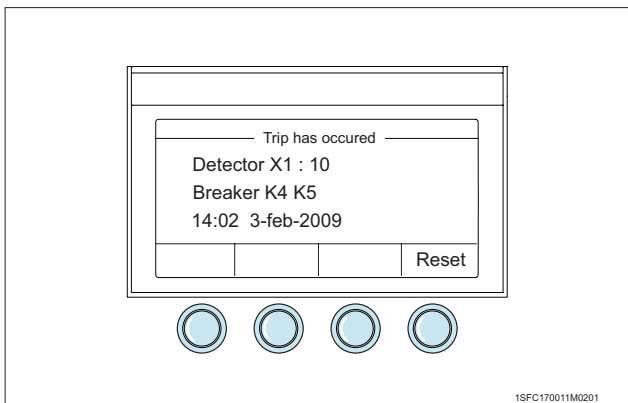


Figure 43
Trip notification window

The notification window display the following:

- Position of activated detector.
- Identification of energized trip contact.
- Time and Date of arc detection.

To reset the Trip Signal Relays, K2 and K3 do the following steps:

1. In the notification window press Reset.
2. The notification window disappears and the system returns to Start window.
3. The trip is stored in the Trip Log.



INFORMATION

If Auto reset of K2 and K3 is configured with the DIP switches, the notification window will appear at a trip but there is no need to reset. Press Menu to return to Start window.

Checking the trip log

To check the Trip Log from the Start Menu do the following steps:

1. Select 1. Trip Log
2. Press OK
3. The Trip Log window displays:
 - Trip Log 1 (3), one of three in the trip log list
 - Position of activated detector
 - Identification of energized trip contact
 - Time and Date of event

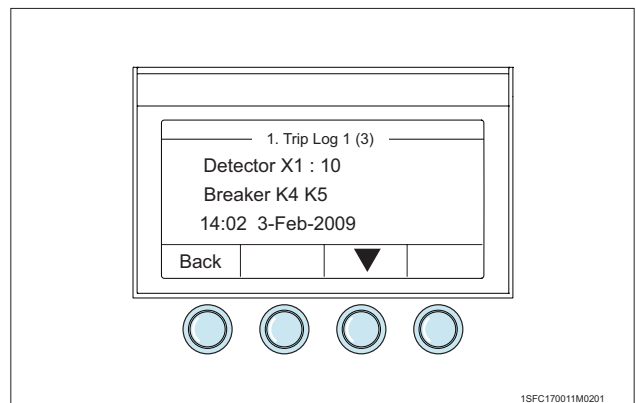


Figure 44
Checking the trip log

Three detectors can be listed in the same window.

4. Press Back to return to Start window.
5. Scroll down with the arrow key to see previous trip events.

5.4.2 Diagnostics

The Arc Guard System™ does automatic periodical diagnostics of the system.

Diagnostics menu consists of 3 subcategories:

- System Status
- Perform Diagnostics
- Error Log

System Status

The system status displays the status of the system after a diagnosis is made.

The window displays the following:

- System OK
- Diagnostics performed
- Time and Date

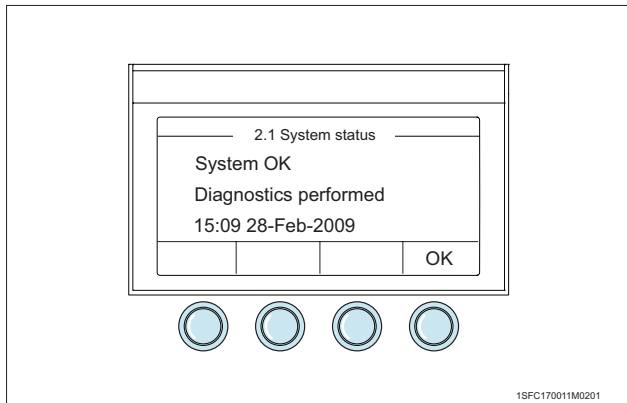


Figure 45
System status

Perform Diagnostics

In addition to the systems automatic diagnostic, it is also possible to perform manual diagnostics. To perform a manual diagnostic do the following steps:

1. From Start window, press Menu
2. Select 2. Diagnostics and press OK

3. In 2. Diagnostics menu, select 2.2 Perform Diagnostics

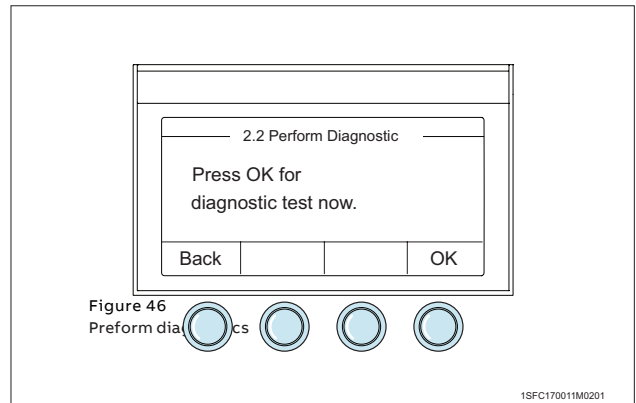


Figure 46
Perform dia

4. Press OK for diagnostic test now.
5. The window displays Performing diagnostics tests.

If the system is OK, the window will display:

- 2.1 System status.
- System OK.
- Diagnostics performed.
- Time and Date.

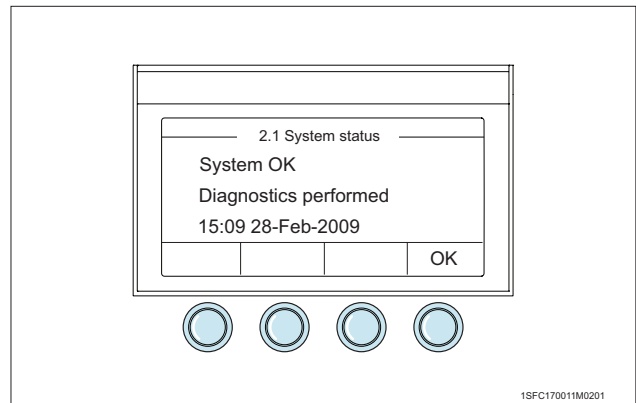


Figure 47
System status

05

6. Press OK to return to Start window.

If the system is not OK, a notification window appears displaying following:

- System Error
- Error code.
- Time and Date.

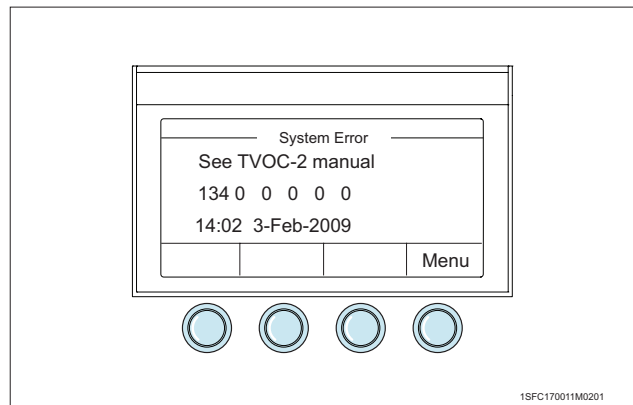


Figure 48
System Error

Press down arrow to display Sensor status. The status of all inputs of the extension modules (E6-S) are displayed with “1” indicating OK and “0” indicating FAIL,

Following are displayed:

- X2: “Status message”
- X3: “Status message”
- Time and Date.

Following Status messages are possible:

- 11 01 11 11 11 (Or any Combination of 1 and 0)*
- All sensors OK
- All sensors FAIL
- Not Mounted
- Not Available

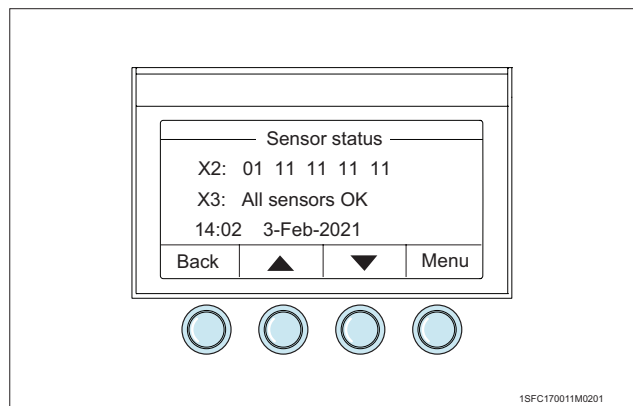


Figure 49
View sensor status

Press down arrow to display Ambient Light. The ambient light warning of all inputs of the extension. Modules (E6-S) are displayed with “1” indicating OK and “0” indicating WARNING,

Following are displayed:

- X2: “Status message”
- X3: “Status message”
- Time and Date.

Following Ambient light messages are possible:

- 11 11 10 11 11 (Or any Combination of 1 and 0)*
- All ambient light OK
- All ambient light WARNING
- Not Mounted
- Not Available

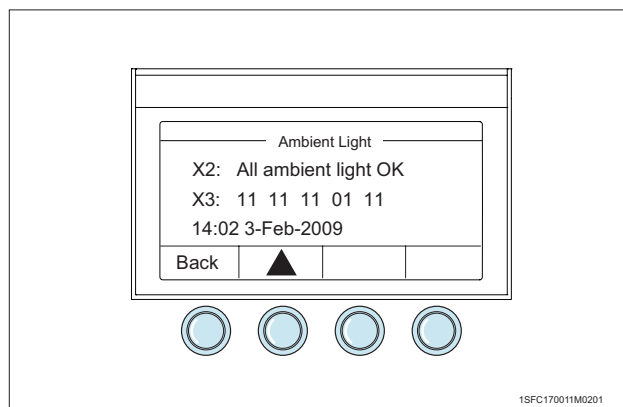


Figure 50
View ambient light

i **INFORMATION**
See: “Error Log” on page 50.

Error Log

In the Error Log are the 6 latest system error events stored, the oldest will be overwritten.

5.4.3 Configuration

Configuration consists of three subcategories as follows:

- View Modules.
- View DIP switches.
- Revision Information.

View Modules

View Modules displays which modules are connected to the Arc Monitor. To see the View Modules do the following steps:

1. From Start window, press Menu.
2. Select 3. Configuration, press OK.
3. Select 3.1 View Modules, press OK.

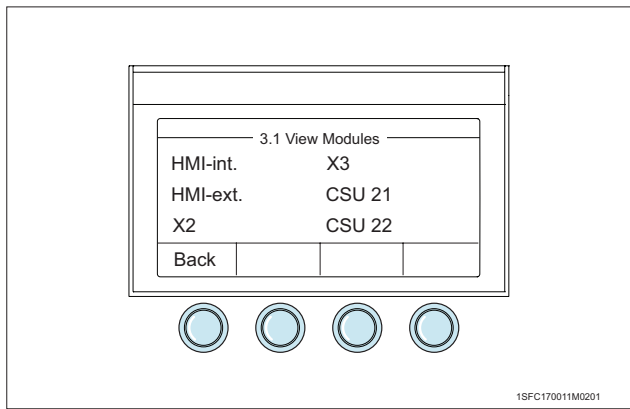


Figure 51
View modules

This figure shows the window, 3.1 View Modules, with the modules connected to the Arc Monitor.

View DIP switches

3.2 View DIP switches display information how the configuration are made to the DIP switches. To see the View DIP switches do the following steps:

1. From Start window, press Menu.
2. Select 3. Configuration, press OK.
3. Select 3.2 View DIP Switch, press OK.

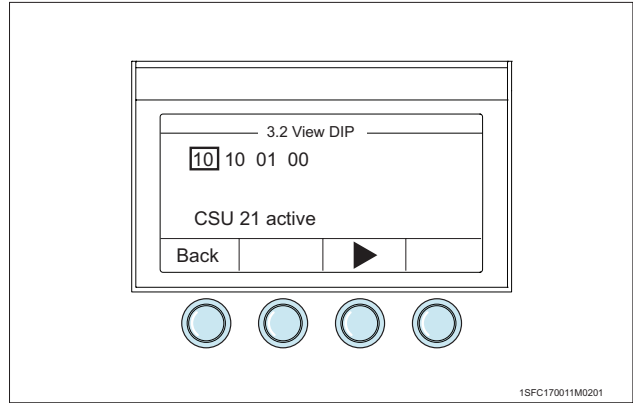


Figure 52
View DIP

The 3.2 View DIP menu displays:

- 3.2 View DIP.
- DIP switches settings.
- Status line.

The figure below is an example which describes how to read the DIP switches settings in HMI.

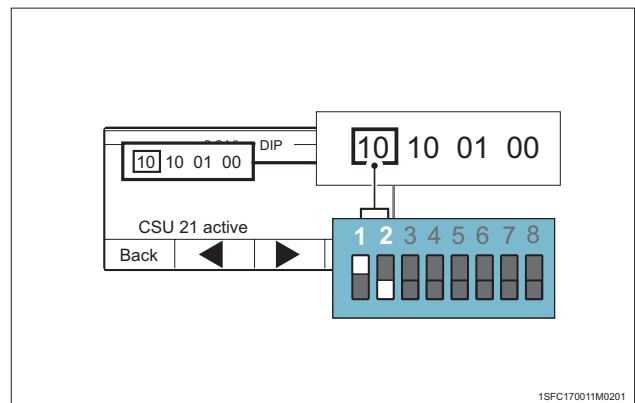


Figure 53
DIP switch settings in the HMI

The eight numbers reflect the 8 DIP switches.

The two first numbers 1 0, in line are the CSU-2 connections on the DIP switch.

Number 1 in number 10 shows that the setting is ON.

This example shows that the CSU-2 connection 21 is connected. CSU-2 22 is not in use.

4. Press arrow to scroll forward/backward, see all DIP switches.
5. Press Back to return to 3. Configuration.
6. Press Back to return to Start window.

Revision information

Revision Information displays connected modules to the Arc Guard System™ and latest revision of each module. This includes, software, hardware, and ID number.

This information is required when contacting ABB for support.

To view revision information about the module follow the steps below:

1. From Start window, press Menu.
2. Select 3. Configuration, press OK.
3. Select 3.3 Revision information, press OK.
4. The 3.3 Revision information displays connected modules.

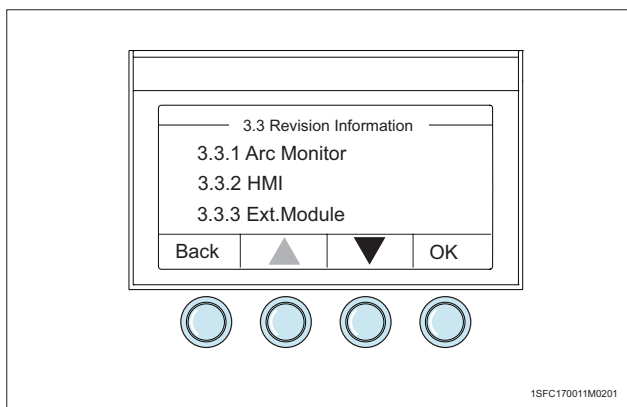


Figure 54
Revision information

To view Revision Information.

5. Select chosen module, press OK.
6. The chosen module is displayed:
 - 3.3.1 Arc Monitor (in this case)
 - The modules software revision
 - The modules hardware revision
 - The modules ID number

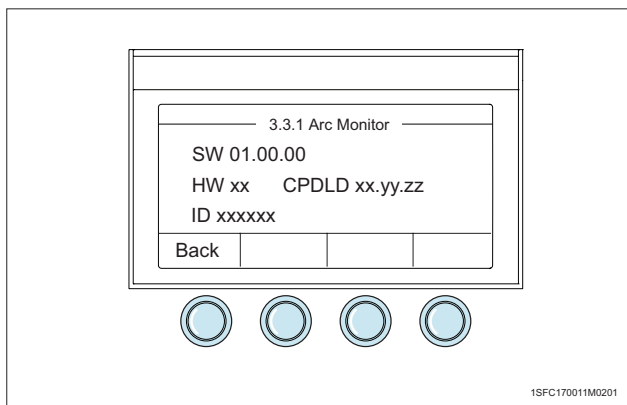


Figure 55
Arc monitor

5.4.4 Language

If you understand the current menu language, follow the steps to set the language of the system menu:

In the Main menu:

1. Select 4 Language, press OK.
2. Select the language to use, press OK.



INFORMATION

If you do not understand the menu language, use factory reset.

5.4.5 Set Time and Date

Use this procedure to set the time and date in the system.

In the Set Time menu do the steps below:

1. Scroll to correct hour, press OK.
2. Scroll to correct minutes, press OK.
3. Scroll to correct day, press OK.
4. Scroll to correct month, press OK.
5. Scroll to correct year, press OK to return to Start window.

5.4.6 Factory reset

Making the factory reset will force the HMI to start the Start-Up sequence.

Press and hold the 2 soft keys in the middle for more than 10 s.

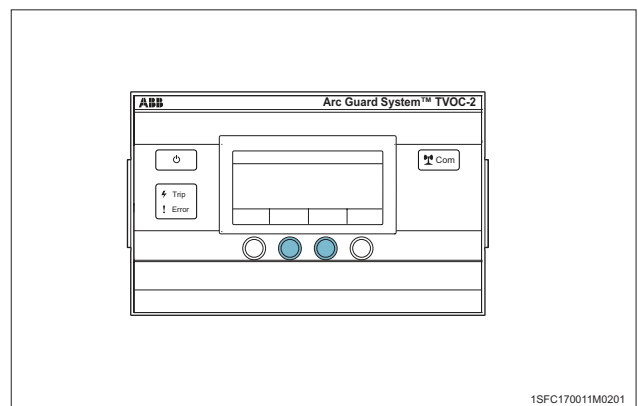


Figure 56
Factory reset

This will force the HMI to start the Start-Up sequence.

6 Maintenance

46	6.1 Introduction
46	6.2 Maintenance
46	6.2.1 Sensor supervision (E6-S extension modules)
46	6.2.2 Arc Monitor and Detectors

6.1 Introduction

The Arc Guard System™ requires maintenance once every year. The yearly maintenance includes checking detectors, The Arc Monitor and the light from CSU-2 (option).

6.2 Maintenance

6.2.1 Sensor supervision (E6-S extension modules)

Check that the sensor supervision is working for each of the 10 detectors with the following steps:

1. From start window, press menu.
2. Apply an error by removing the detector, the dummy plug or the lens.
3. Check the HMI: When the error is applied the system error popup shall within 30 seconds be displayed on the HMI showing the bit for sensor supervision error and by pressing page down the correct detector shall be marked with a zero (0) for faulty detector.

6.2.2 Arc Monitor and Detectors

To check the detectors and the Arc Monitor, simulate an arc by using a camera flash, repeat the following steps:

1. Set the camera flash to approximately 0.5 ms.
2. Place the camera flash at a distance between 1.5–2 meters (60–80 inches) from the detector.
3. Make sure no object is standing in the way.
4. Point the camera flash towards the detector.
5. Press the flash test button.
6. Carry out the following steps to check the Arc Monitor.
 - a. Check the HMI display.
 - b. If the detector reacts correctly and causes a trip then it should show on the HMI display as a notification window.
 - c. The notification window shows, Trip has occurred, which detector, which trip contact, at what time and date.
 - d. The breaker that is connected to the Arc monitor should trip, depending on the configuration.
 - e. At the notification window, if manual reset is configured, press Reset. If auto reset is configured, press Menu.



INFORMATION

In order to prevent a shut-down of the whole switchgear during the maintenance process, replace the breakers which are connected to the Arc Monitor with test breakers. This can be done by replacing the terminal to K4, K5, K6 with the test breakers.



WARNING

Remember to replace the test breakers with terminal breaker K4, K5, K6 after testing!

The maintenance procedure to check the detectors and Arc Monitor is the same as for a Start-Up of the system for the first time.



INFORMATION

See: “4.3.2 Check” on page 35.

To check the light from Current Sensing Unit, CSU-2. Perform a manual diagnostic via the HMI to check if the light from CSU-2 is degenerating. This will show as a notification window in HMI with an Error code.



INFORMATION

How to perform a manual diagnostics,
See: “Perform Diagnostics” on page 40.

See: “List of error codes” on page 51.

7 Troubleshooting

50	7.1	Introduction
50	7.2	Requirements
50	7.3	Errors
53	7.4	Faulty detector (for TVOC-2-E6-S)
54	7.5	ABB support

7.1 Introduction

This chapter describes how to handle errors in the system and what measures to take. That includes the handling error log, list of error codes and how to contact ABB.

7.2 Requirements

Troubleshooting should be done by authorized personnel who are familiar with the Arc Guard System, the setup as well as the environment where it is located.

Troubleshooting should take into consideration:

- History, including events just before an arc.
- Situation, circumstances when an arc occurred.
- Environment, temperature, vibrations, power supply, electrical/magnetic disturbances.
- How an arc is indicated and nature of its occurrence.
- The different Arc Guard System™ modules and all connections.

Handling Error log

This section presents diagnostics and describes how to handle the error log. It includes view logs and error codes.

Diagnostics

The Arc Guard Systems is often operated without any personnel present. The error logging function is a way to store information about past events for future reference in order to facilitate trouble shooting. Performing diagnostics is a check on the system status and its error events.

7.3 Errors

Error event

An error event indicates an error in the system. Example of error events is:

- Overcurrent for a long time period.
- Optical detectors that detect light for a long time period.
- DIP switch is changed physically while Arc Monitor is powered.
- HMI display has lost contact and can not communicate with Arc Monitor.
- Disconnected supervised detector.

Error Log

During diagnostics the error events are logged in the Error Log. In the Error Log the error events are represented by error messages. Each message includes a code that gives information about the specific occurred event and the time stamp it occurred. The log is a circular buffer. It stores 6 error events. The oldest will be overwritten.

Error indication

When a system error occurs the HMI display a notification window.

- System Error
- Error code.
- Time and Date.

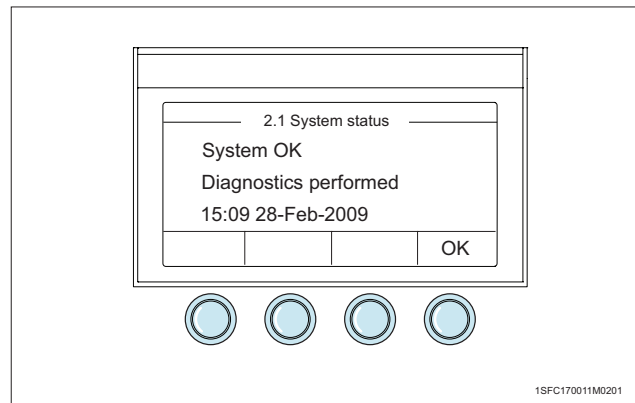


Figure 57
System status

The error codes are written in 6 columns. Every column can show a number between 0 - 255. (Figure 55)
See: “List of error codes” on page 52.

Press down arrow to display Sensor status.

The status of all inputs of the extension boards (E6-S) are displayed with “1” indicating OK and “0” indicating FAIL,

Following are displayed:

- X2: “Status message”
- X3: “Status message”
- Time and Date.

Following Status messages are possible:

- 11 01 11 11 11 ¹⁾(Or any Combination of 1 and 0)
- All sensors OK
- All sensors FAIL
- Not Mounted

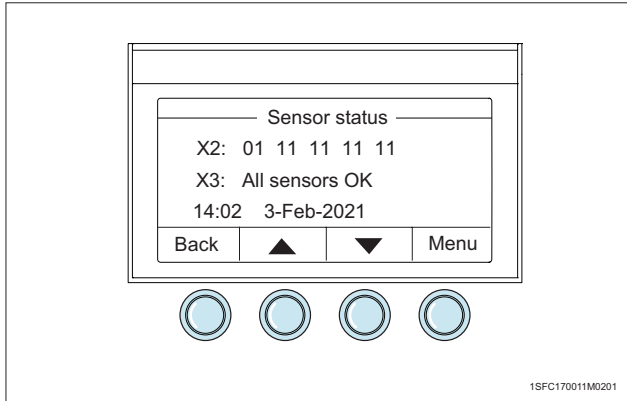


Figure 58
View sensor status

Press down arrow to display Ambient Light. The ambient light warning of all inputs of the extension boards (E6-S) are displayed with “1” indicating OK and “0” indicating WARNING,

Following are displayed:

- X2: “Status message”
- X3: “Status message”
- Time and Date.

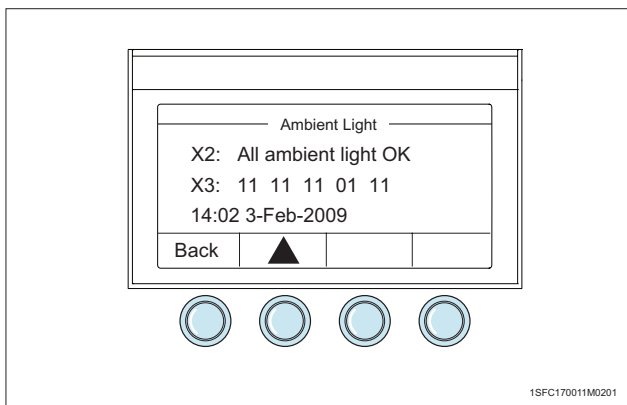


Figure 59
View ambient light

Following Ambient light messages are possible:

- 11 11 10 11 11 ¹⁾(Or any Combination of 1 and 0)
- All ambient light OK
- All ambient light WARNING
- Not Mounted

Note:

- 1) Each number 1 or 0 indicates the position of the detectors actual position on the extension unit (first position from left on extension module X2 = X2:1)

The error codes are written in 6 columns. Every column can show a number between 0 – 255.

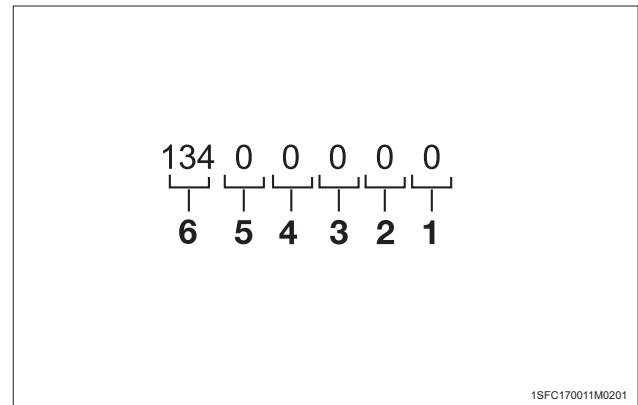


Figure 60
Error codes

See: “List of error codes” on page 51.

Attending errors

The error will exist until it is attended to and proper measures are taken. Then, when the Arc Monitor runs a diagnostics the error will disappear.

To view the Error Log do the steps below:

1. From the Start window, press Menu.
2. In the Menu, select 2. Diagnostics and press OK.
3. Select 2.3 Error Log and press OK.
4. The Error Log window displays Error code, Time, and Date.
5. Scroll forward/backward in the Error Log.
6. Press Back to return to window 2. Diagnostics.
7. Press Back to return to Start window.

List of error codes

The error codes and description of the codes are discussed in the following list:



INFORMATION

This is not a complete error code list!

This list only shows some of the most simple error codes in which the user may be able to take actions on their own.

Table 1 List of error codes

Error code	Description	Recommended actions
000200	DIP switch settings are changed during run-time.	Set settings back as it was before, after a while the System Error pop-up window will disappear and the IRF will be energized again.
0720000 0800000	CSU-2 21: CSU-2 22: 1. Optional cable is damaged. 2. Overcurrent longer than 10s. 3. Detector input damage at Arc Monitor. 4. LED at CSU-2 is damaged.	Check that optional cable from CSU-2 is not damaged or crushed. Check current level setting if setting is too low, then CSU-2 is indicating overcurrent too long time period. Increase level and see that you get light from CSU-2, if no light from CSU-2 then LED at CSU-2 is damaged. If none of this then detector input at Arc Monitor is corrupt.
200000 400000	CSU-2 21: CSU-2 22: Degenerated LED at CSU-2. The CSU-2 LED degeneration will only be tested by a manual Diagnostic Test (2.2 Perform Diagnostics) made from HMI. CSU-2 LED degeneration will not be tested by periodically diagnostics.	CSU-2 should be replaced due to degenerated LED at CSU-2.
800000	Failure to communicate with the HMI.	Make sure the HMI is connected properly. Re-run diagnostics through the HMI menu and if the error code still occurs, make a factory reset.
3200000	Long light detection.	A light detector has detected light during more than 10s. Can the light detector have been damaged or is there constantly light leaking into the cabinet.
002000 010000 012000	X2 X3 X2 & X3 ID value of connected module does not correspond to the setup, i.e. the wrong extension module is connected.	Check if the Extension modules can have switched places or one have been replaced.
020000 004000	X3 X2 No contact with extension module.	Check the that the extension module is connected correctly
010000	X3 present, is not the correct module. Extension module can have been switched. Wrong ID of Extension module, X2 and X3 can have been switched.	Check if the Extension module can have switched places.
020000	No contact with X3, module can have dropped off.	Check the Extension module.
6400000	Mismatch between configured setup and the actual setup.	Make sure the DIP switches are configured correctly Try rebooting the device or make a factory reset.
64720200	The error code indicates changed DIP switch configuration after setup.	Check the dip switch setting and then power ON/OFF and follow instruction on screen. Other indication on this error is no light from the CSU.
000800	Internal software issue.	Please re-run diagnostics through the HMI menu and if the error code still occurs, make a factory reset.

16 0 0 0 6 136	The error indicates "illegal trip matrix"	<p>Please check the DIP switch setting. The only allowed DIP switch setting is as shown in the catalog:</p> <p>The setting SW1 SW2 SW3 SW4 0 0 1 1 (0= OFF, 1= ON)</p> <p>This setting not allowed and gives the error code 16 0 0 0 6 136.</p>
0 0 0 64 0 0	Error code 0-0-0-64-0-0 indicates bad connection to Extension unit X2.	If the TVOC-2 has an extension, please power off, remove extension and check the connector pins on the base unit. The connector pins shall be straight and aligned. Mount the extension unit and power on. This should help.
0 32 0 0 0 0	One or more X2 or X3 sensors has an ambient light warning	Press down button on System error popup twice or see menu 2.5 Ambient Light status for information on which sensor(s) has warning. Check ambient light level by the lens with warning
0 0 0 0 1 0	One or more X2 or X3 sensors are faulty	Press down button on System error popup or see menu 2.4 Sensor status for information on which sensor(s) is faulty Follow test sequence in chapter 7.4

7.4 Faulty detector (for TVOC-2-E6-S)

If the TVOC-2 unit indicates a faulty detector the arc detection functionality may be compromised. To identify if the error is present in the detector or the extension module follow these steps:

1. Read out which detector input that indicates a fault on the HMI.
2. Remove the detector in the faulty input.
3. Replace the detector removed in step 2 with any of the working detectors or dummy plugs in the same extension module
4. Wait 40 seconds
5. Look at the most recent error message in the HMI.
 - a. If the error remains on the same detector input as in step 1 there is an error with the extension module.
 - b. If the error follows the detector from step 2 to a new detector input then the detector is faulty and should be replaced.

7.5 ABB support

If you have problem with your Arc Guard System, contact ABB for support.

Contact information
ABB Electrification Sweden AB
Smart Power Division
 Motorgränd 20
 SE-721 61 Västerås / Sweden



Providing information

To get faster support when contacting ABB support it is beneficial to be prepared to answer the following questions:

- Description of how the error occurred.
- Which Arc Guard System™ modules are used, setup and configuration.
- Readings on LEDs and display.
- Output signals.
- What is the general situation.
- Application, location, ambient conditions.
- What has happened, situation before error, any event that happened in connection with error.
- Have you done trouble shooting? What did you check?
- Which are your findings?

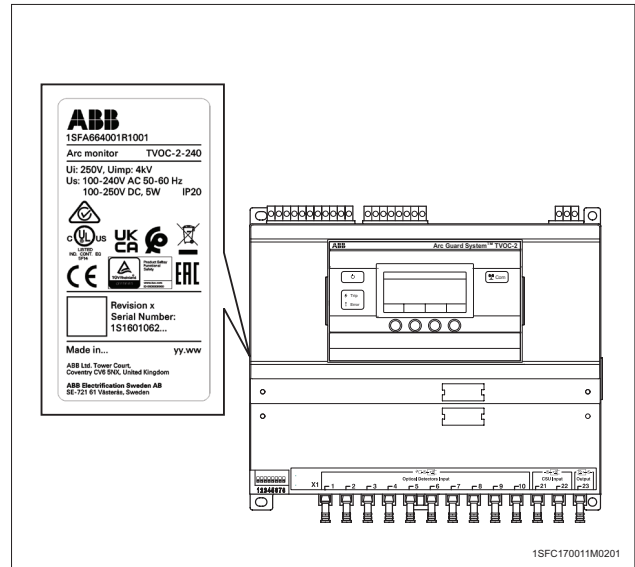


Figure 61
Serial number



INFORMATION

It is also important to know the serial number.

See label on Arc Monitor.

To get the Arc Monitors Revision Information,
See: “5.4.2 Diagnostics” on page 40.



INFORMATION

The QR code contains information regarding product ID, serial number, version number and is linked to product website.

8 Technical data

58	8.1	Technical data
60	8.2	Dimensions
61	8.3	Applications, Diagrams
61	8.3.1	Example 1
62	8.3.2	Example 2
63	8.4	Circuit diagrams

8.1 Technical data

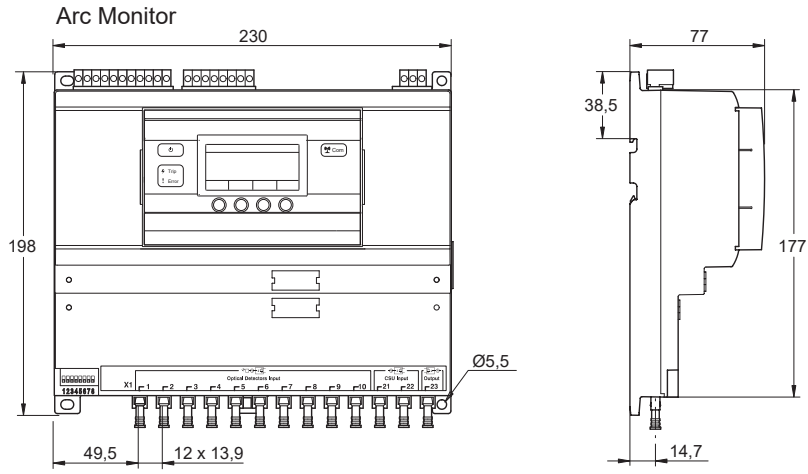
Table 1 Technical data

Common technical data	Overvoltage category		III		
	Pollution degree		3		
Power supply	Rated operation voltage U_e		TVOC-2-240: 100 - 250 V DC 100 - 240 V AC 50-60 HZ	TVOC-2-48: 24 - 48 V DC Possibility to connect two power supplies for redundancy. (Common minus)	
	Rated insulation voltage U_i		250 V with reinforced insulation		
	Rated impulse withstand voltage U_{imp}		4 kV		
Output contacts Contact rated voltage with reinforced insulation between different contacts	Terminals	Description	U_i	U_e	U_{imp}
	11, 12, 14	IRF signal	250 V	250 V AC 50-60 HZ, 250 V DC	4 kV
	21, 22, 23	Signal relay	250 V	250 V AC 50-60 HZ, 250 V DC	4 kV
	31, 32, 34	Signal relay	250 V	250 V AC 50-60 HZ, 250 V DC	4 kV
	43, 44	Trip contact	250 V	250 V AC 50-60 HZ, 250 V DC	4 kV
	53, 54	Trip contact	250 V	250 V AC 50-60 HZ, 250 V DC	4 kV
	63, 64	Trip contact	250 V	250 V AC 50-60 HZ, 250 V DC	4 kV
	73, 74	50 V	50 V DC	0.5 kV	
Environmental specifications	Permissible ambient temperature in operation		- 25 to + 55 °C		
	Permissible ambient temperature in transportation and storage		- 25 to + 70 °C		
	Humidity		Maximum 95%		
	Altitude		Less than 2000m above sea level.		
	Degree of protection		IP20 Arc Monitor IP54 HMI front side		
Safety parameters for application according to IEC61508	Life time		10 years		
	PFD		3.49×10^{-03}		
Optical inputs and outputs	Optical detectors		10 inputs (without extensions)		
	Current signal from CSU-2		2 inputs X21, X22 (optical)		
	Forward current signal to another Arc Monitor		1 output: X1.23 (optical)		
Trip contacts (K4, K5, K6)	Solid state contacts		3 NO solid state type IGBT		
	Rated voltage 250 V AC/DC		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	DC - 13
			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 Min. recommended load current 10 mA		
Signal relay (K2, K3)	Manual or auto resetable		2 CO gold-plated contacts		
	Rated voltage		250 V AC/DC		
	Continuous carry I_{th}		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		
		$I_{th} = 5 A$ Min switching load: 1 mA at 5 V DC with contacts not used for switching current > 0.5 A if inductive/capacitive load before.			

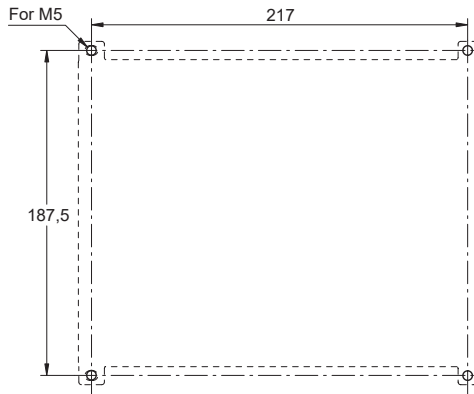
Table 1 Technical data

Internal Relay Fault (IRF, K1)	Self supervision alarm relay	1 CO gold-plated contact	
	Rated voltage	250 V AC/DC	
	Continuous carry I_{th}	5 A	
	Make and carry for 3 s	8 A	
	Breaking capacity	250 V	1,5 A
	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.		
	$I_{th} = 5 A$ Min switching load: 1 mA at 5 V DC with contacts not used for switching current > 0.5 A if inductive/capacitive load before.		
Settings and indications	Connections for HMI on Arc Monitor	1 output RJ45 male at front side 1 output RJ14 female at the right side)	
	Display on HMI	52 x 26 mm graphic LCD with LED backlight	
	Keyboard on HMI	Membrane buttons, 4 soft key	
	LED signal on HMI	Power, Trip, Error	
	LED signal on Arc Monitor and extension module	Power, Trip	
	Configuration switches	8 - pole DIP switch on Arc Monitor front	
	Settings (HMI)	Time and display language	
	Configuration (DIP switches)	Manual or auto reset of K2 and K3 Use of CSU-2 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, U_S	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)
	U_S variation	AC - 20% - +10% DC - 25% - + 30%	DC -25% - +30%
	Rated insulation voltage, U_S	250 V with reinforced insulation	250 V with reinforced insulation
	Rated impulse withstand voltage U_S	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
Reaction time	From light detection to trip contacts (K4, K5 ,K6)	Approx. 1ms (depends on light intensity)	
	From light detection to trip signal relays (K2, K3)	< 10 ms	
	Current condition from input to output	<0,4 ms	
Detector	Maximum length	30 m with AM and extension - E1 , E6-S 60 m with extension - E3	
	Service temperature range	- 25 to + 70 °C continuous - 25 to + 85 °C short-time	
	Smallest permissible bending radius	35 mm after installation 20 mm on handling	
	Acceptable backlight intensity light without tripping	3000 Lux	
Optical cable for connecting CSU-2 to an Arc Monitor	Maximum length	30 m	

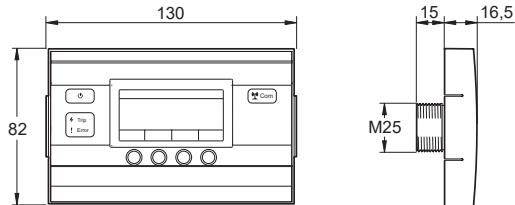
8.2 Dimensions



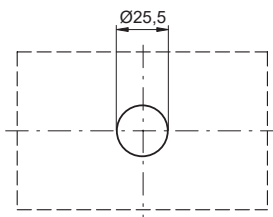
Drilling plan



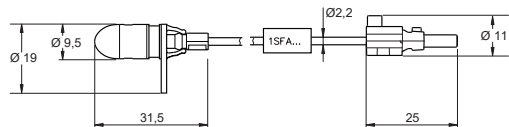
HMI



Drilling plan



Detector with optical cable



8.3 Applications, Diagrams

8.3.1 Example 1

Example 1: Arc Guard System™ configured to trip all contacts in case of an arc.

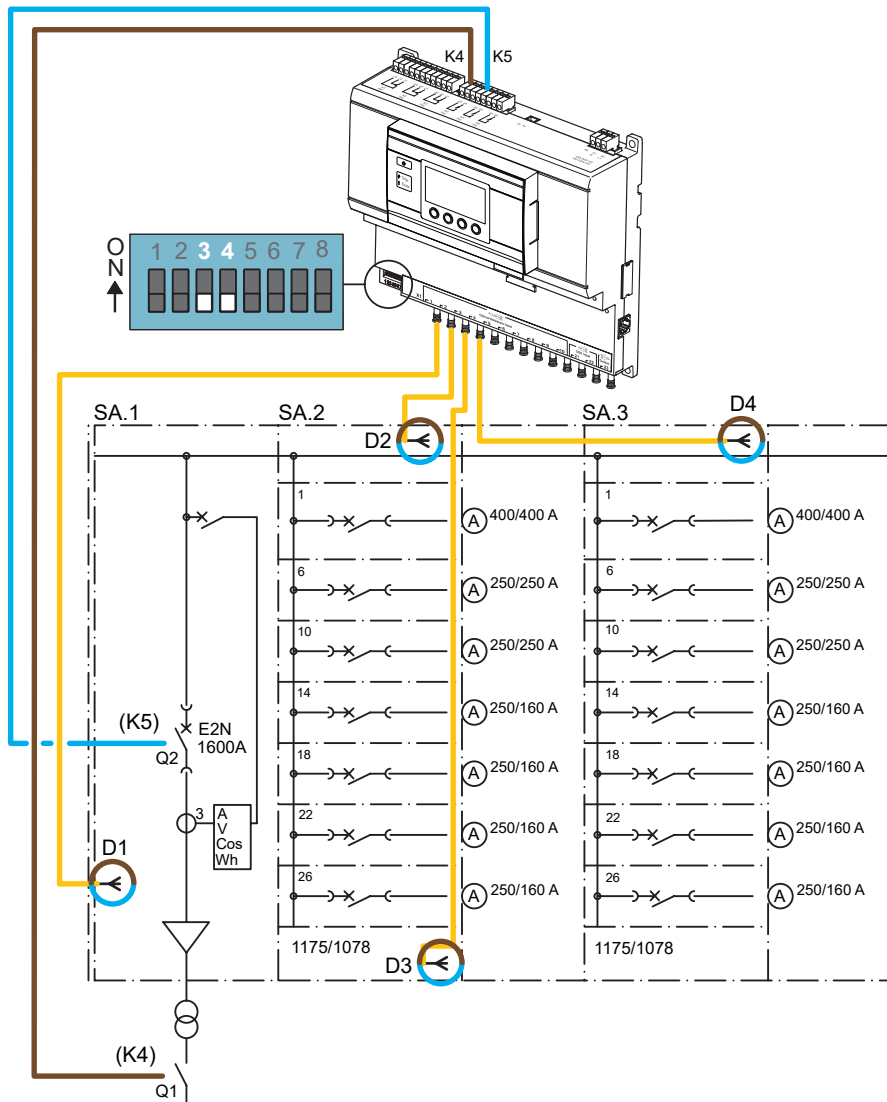


Table 2 Example 1. Applications, Diagrams

Connection	Description
SA...SA3	Switchgear
K4, K5	Solid state tripping contacts
Q1, Q2, Q3	Circuit-breaker
D1...D4	Detectors

8.3.2 Example 2

Example 2: Arc Guard system™ configured to trip different trip contacts depending on where the arc occurs.

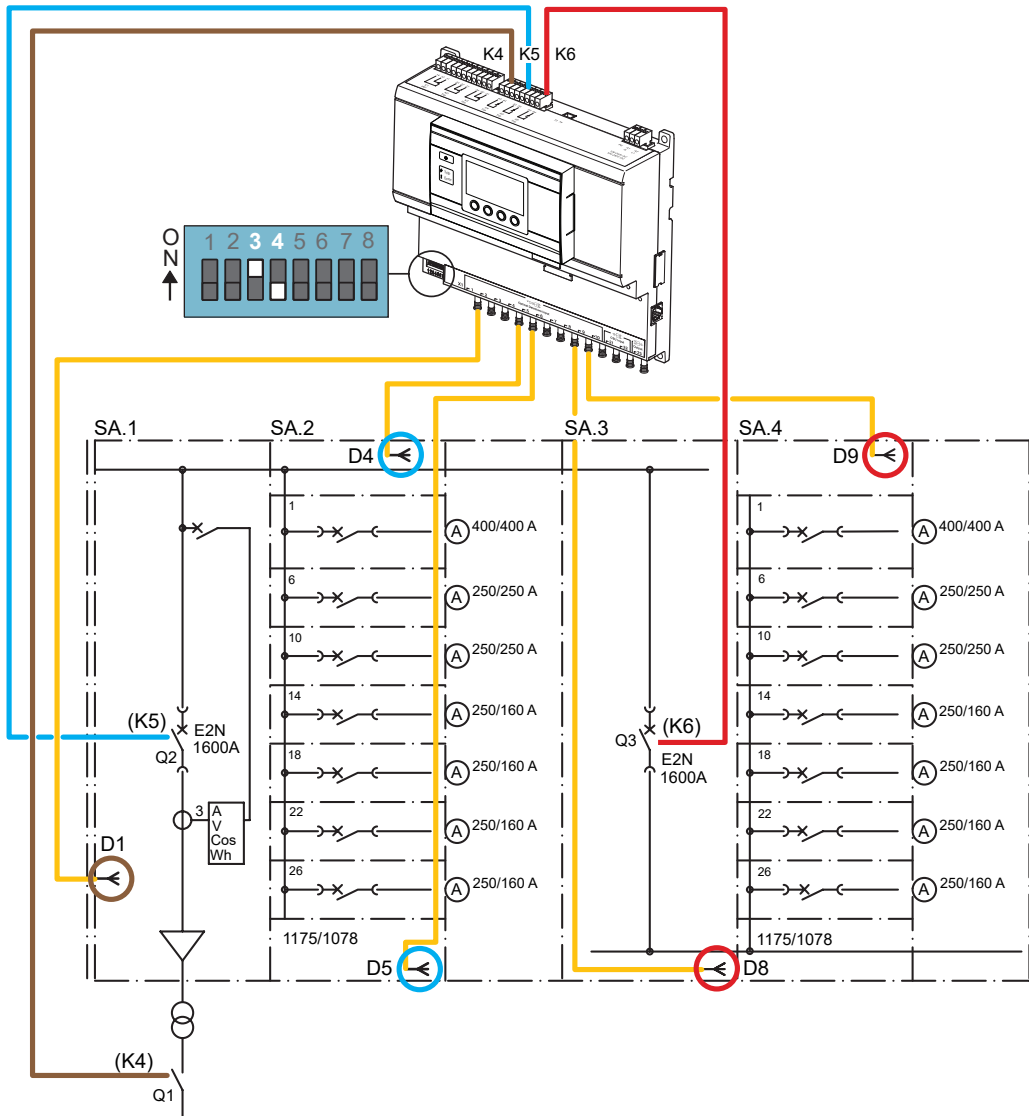
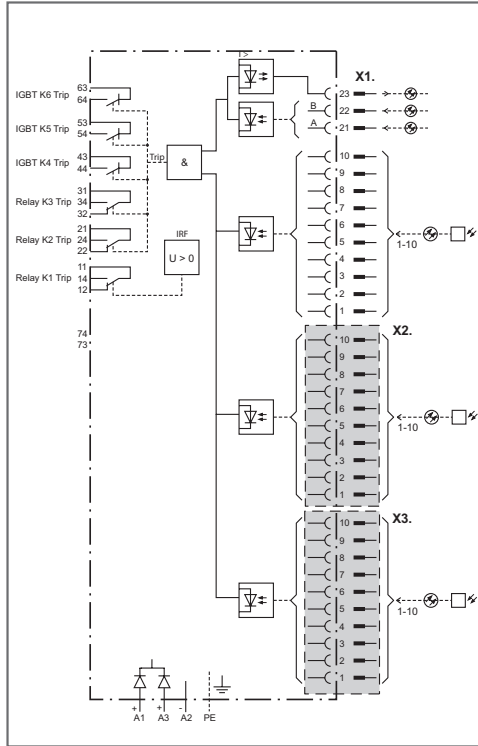


Table 3 Example 2. Applications, Diagrams

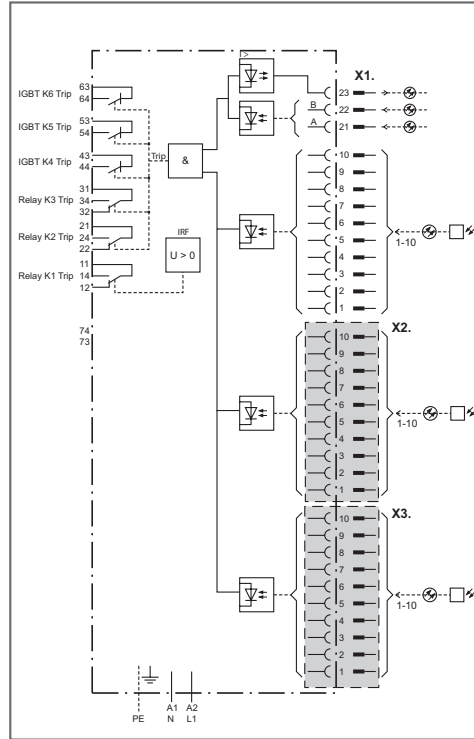
Connection	Description
SA...SA4	Switchgear
K4, K5, K6	Solid state tripping contacts
Q1, Q2	Circuit breaker
Q3	Bus couplar
D1...D9	Detectors

8.4 Circuit diagrams

Arc Monitor



TVOC-2-48 1SFA6641001R1002



TVOC-2-240 1SFA664001R1001

Table 4 Circuit diagrams, Arc Monitor

Terminals	Description
X1 1-10	Detector input
X2 1-10	Extra extension module detector input (option)
X3 1-10	Extra extension module detector input (option)
A1, A2	Power supply
PE	Power supply
43, 44	Solid-state trip contact
53, 54	Solid-state trip contact
63, 64	Solid-state trip contact
11, 12, 14	Internal relay fault, IRF
21, 22, 24	Signal relays
31, 32, 34	Signal relays

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sales organisation on the ABB home page.



<http://new.abb.com/low-voltage/products/arc-guard>



<http://www.abb.com/lowvoltage>

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