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An even better Arc Guard System™

TVOC-2, ABB’s latest Arc Monitor, builds on the well known TVOC design. Its new functions and features improve an already great product, putting even more focus on reliability, flexibility and simplicity.

Arc Guard System™ protects people and equipment, and eliminates unnecessary production stops.

Arc monitor type TVOC-2 is ABB’s state-of-the-art solution for arc fault protection in all applications, providing functional safety.

With over 35 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 switchgears.

Reliability
- Certified according to functional safety (SIL-2) standard
- Over 35 years experience in Arc Guard Systems™
- Pre-calibrated optical sensors

Flexibility
- HMI (Human Machine Interface) can be mounted on the panel door
- Expandable with up to 30 optical sensors
- Configure the system according to various needs

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

System description

**Arc Guard System™**

Arc Guard System™ quickly detects an arc fault and trips the incoming circuit-breaker. Using light as the main trip criteria, 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.

**How it works**

The system acts in three phases:

1. **Light passes through an optical sensor (Detection)**
2. **The Arc monitor determines the intensity of light (Recognition)**
3. **The Arc monitor sends signal to trip breaker(s) (Action)**

**Arc Faults**

Short-circuit faults in LV and MV switchgears are often accompanied by an electric arc. An arc fault always leads to considerable damage to equipment and injury to personnel unless it is detected very quickly. To avoid serious damage and give the person involved a good chance of surviving the accident without severe injury, the fault should be disconnected as fast as possible, typically in less than 30-50 ms.
General information
Overview

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 puts 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 20.10 - 20.11 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 monitor. 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 20.6, 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

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

Current Sensing Unit (optional)
The Current Sensing Unit (CSU) is an accessory needed only in those few specific applications where strong light is expected on a regular basis.

CSUs are connected with a fiber optic cable using light as signal for normal current. If this was removed by accident, the system would treat it as an over-current and trip if an arc flash is seen of reliability reasons.

Adding a CSU will result in an additional operating time depending on the size of the over-current and the number of phases measured. Under normal conditions the time from over-current occurring to actuating optical output is in the region between 2 and 8 milliseconds.
## Arc monitor with detectors

Supply voltage 100-240 V DC or AC 50-60 Hz

<table>
<thead>
<tr>
<th>Description</th>
<th>Catalog number</th>
<th>Weight lbs.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Arc Monitor</strong></td>
<td>TVOC-2-240</td>
<td>2.09</td>
</tr>
<tr>
<td>Supply voltage 100-240V DC or AC 50-60 Hz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>including one HMI and door mounting accessories</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Extension (1-30m)</strong></td>
<td>TVOC-2-E1</td>
<td>0.33</td>
</tr>
<tr>
<td>10 optical inputs</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Extension (60m)</strong></td>
<td>TVOC-2-E3</td>
<td>0.33</td>
</tr>
<tr>
<td>10 optical inputs for 60 meter</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>HMI (Human machine interface)</strong></td>
<td>TVOC-2-H1</td>
<td>0.33</td>
</tr>
<tr>
<td>additional</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Detectors

<table>
<thead>
<tr>
<th>Cable length</th>
<th>TVOC-2-DP1</th>
<th>0.04</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 m, 39.37 in</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 m, 78.74 in</td>
<td>TVOC-2-DP2</td>
<td>0.04</td>
</tr>
<tr>
<td>4 m, 157.48 in</td>
<td>TVOC-2-DP4</td>
<td>0.09</td>
</tr>
<tr>
<td>6 m, 236.22 in</td>
<td>TVOC-2-DP6</td>
<td>1.32</td>
</tr>
<tr>
<td>8 m, 314.96 in</td>
<td>TVOC-2-DP8</td>
<td>1.76</td>
</tr>
<tr>
<td>10 m, 393.70 in</td>
<td>TVOC-2-DP10</td>
<td>0.22</td>
</tr>
<tr>
<td>15 m, 590.55 in</td>
<td>TVOC-2-DP15</td>
<td>0.33</td>
</tr>
<tr>
<td>20 m, 787.40 in</td>
<td>TVOC-2-DP20</td>
<td>0.44</td>
</tr>
<tr>
<td>25 m, 984.25 in</td>
<td>TVOC-2-DP25</td>
<td>0.55</td>
</tr>
<tr>
<td>30 m, 1181.10 in</td>
<td>TVOC-2-DP30</td>
<td>0.66</td>
</tr>
<tr>
<td>60 m, 2362.20 in</td>
<td>TVOC-2-DP60</td>
<td>1.32</td>
</tr>
</tbody>
</table>

**Cable straps**

1 set incl. 50 pcs TVOC-2-MK1 0.22

**Mounting kit**

600 mm, 23.62 in AGS-MK600 0.77
800/1000 mm 31.49/ 39.37 in AGS-MK1000 1.32

**Label**

1 set incl.10 pcs AGS-LABEL 0.04

**Mounting bracket**

1 set incl. 5 bracket pcs and 10 cable strap pcs TVOC-MB 0.55

ⓘ Only to be used with TVOC-2-E3
### Current sensing unit

<table>
<thead>
<tr>
<th>Description</th>
<th>Catalog number</th>
<th>Weight lbs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Sensing Unit (CSU)</td>
<td>AGS-CS240</td>
<td>3.31</td>
</tr>
</tbody>
</table>

**Optical cable between CSU and TVOC-2 Arc monitor and**

<table>
<thead>
<tr>
<th>Cable length</th>
<th>TVOC-1TO2-OP1</th>
<th>Weight lbs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 m, 39.37 in</td>
<td>0.02</td>
<td></td>
</tr>
<tr>
<td>2 m, 78.74 in</td>
<td>0.04</td>
<td></td>
</tr>
<tr>
<td>4 m, 157.48 in</td>
<td>0.08</td>
<td></td>
</tr>
<tr>
<td>6 m, 236.22 in</td>
<td>0.13</td>
<td></td>
</tr>
<tr>
<td>8 m, 314.96 in</td>
<td>0.18</td>
<td></td>
</tr>
<tr>
<td>10 m, 393.70 in</td>
<td>0.22</td>
<td></td>
</tr>
<tr>
<td>15 m, 590.55 in</td>
<td>0.33</td>
<td></td>
</tr>
<tr>
<td>20 m, 787.40 in</td>
<td>0.44</td>
<td></td>
</tr>
<tr>
<td>25 m, 984.25 in</td>
<td>0.55</td>
<td></td>
</tr>
<tr>
<td>30 m, 1181.10 in</td>
<td>0.66</td>
<td></td>
</tr>
</tbody>
</table>

**Optical cable between TVOC-2 and TVOC-2 Arc monitors (transferring CSU signal)**

<table>
<thead>
<tr>
<th>Cable length</th>
<th>TVOC-2-OP1</th>
<th>Weight lbs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 m, 39.37 in</td>
<td>0.02</td>
<td></td>
</tr>
<tr>
<td>2 m, 78.74 in</td>
<td>0.04</td>
<td></td>
</tr>
<tr>
<td>4 m, 157.48 in</td>
<td>0.08</td>
<td></td>
</tr>
<tr>
<td>6 m, 236.22 in</td>
<td>0.13</td>
<td></td>
</tr>
<tr>
<td>8 m, 314.96 in</td>
<td>0.18</td>
<td></td>
</tr>
<tr>
<td>10 m, 393.70 in</td>
<td>0.22</td>
<td></td>
</tr>
<tr>
<td>15 m, 590.55 in</td>
<td>0.33</td>
<td></td>
</tr>
<tr>
<td>20 m, 787.40 in</td>
<td>0.44</td>
<td></td>
</tr>
<tr>
<td>25 m, 984.25 in</td>
<td>0.55</td>
<td></td>
</tr>
<tr>
<td>30 m, 1181.10 in</td>
<td>0.66</td>
<td></td>
</tr>
</tbody>
</table>
## Technical data

### 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 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 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_{F}**

- 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_{F} = 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_{F}**

- 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_{F} = 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

#### 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
- **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
- **Rated supply voltage, \( U_s \)**
  - 100-240 V AC, 50-60 Hz
  - 100-250 V DC
- **\( U_s \) variation**
  - AC -20% – +10%
  - DC -25% – +30%
- **Rated insulation voltage, \( U_i \)**
  - 250 V with reinforced insulation
- **Rated impulse withstand Voltage \( U_{imp} \)**
  - 4 kV
- **Main MCB/fuse**
  - Max. 10 A char. C/fuse 10 A gG
- **Power consumption**
  - 5 W

#### 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

#### Start-up time
- Trip possible
  - < 15 ms from power on

#### Environmental conditions
- **Permissible ambient temperature in operation**
  - - 25 to + 55 °C
- **Permissible ambient temperature in transportation and storage**
  - - 25 to + 70°C
- **Humidity**
  - Maximum 95%
- **Altitude**
  - 2000 meter 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 x 10^{-03}

#### 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

#### Safety integrity level
- **SIL 2 when not used with CSU**
Technical data

Current sensing unit

<table>
<thead>
<tr>
<th>Rated current</th>
<th>Selectable, for connection of external current transformers with secondary rated current</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1, 2 or 5 A</td>
</tr>
<tr>
<td>Load on the external current transformers</td>
<td>0.2 VA connected for 1 A</td>
</tr>
<tr>
<td>The Current Sensing Unit withstands a maximum of:</td>
<td>0.7 VA connected for 5 A</td>
</tr>
<tr>
<td>Continuously</td>
<td>1 x rated current</td>
</tr>
<tr>
<td>For 1 s</td>
<td>15 x rated current</td>
</tr>
</tbody>
</table>

Optical outputs:
- To Arc Monitor/Current Sensing Unit: Quantity: 2
- From other Current Sensing Unit: Quantity: 1

Indications:
- Signal to Arc Monitor/Current Sensing Unit: Green LED lit up at load current < set overcurrent level
- Pre-warning: Yellow LED lit up at load current < approx. 70% of set overcurrent level
- Test position: Red LED

Control devices/settings:
- (on the p.c.b.)
  - Change-over switch: On/Off
  - Test position: On/Off
  - Optical input is used or not: On/Off
  - Trimming potentiometers
  - Setting of overcurrent level: 0.5 – 3.5 x rated current
  - Simulation of overcurrent level in test position:

Supply voltage:
- Permitted variation:
  - +/- 20% at DC
  - +/- 10% at 110-127 V AC
  - +/- 10% – 15% at 230 V AC

Power consumption:
- 1 W at 24 V
- 11 W at 220 V

Permissible ambient temperature:
- -25...+55 °C

Operating times:
- From overcurrent occurring to actuating optical outputs:
  - 3-phase supply: < 2 ms
  - 1-phase supply: < 8 ms
- Current conditions from optical input to optical outputs: < 0.3 ms

Degree of protection: IP 54

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

IEC61010-1
- Safety requirements for electrical equipment for measurement, control and laboratory use
General information
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 cabinet. Tripping is handled by a separate tripping circuit. The task of the Arc Monitor is to close 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.

CSU (Current Sensing Unit)
The CSU is an accessory used if you cannot prevent direct sunlight or other highly intensive light reaching the sensors frequently. CSUs can be mounted in series if more than two are needed.

Connection of current transformers (for CSU)
The CSU measures either 1, 2 or 3-phase. Three-phase is, however, preferable for reasons of safety and reliability. Current transformers with a secondary current of 1, 2 or 5 A are used for this purpose.

Note: Current transformers for relay protection are preferable since they do not saturate as quickly as standard current transformers. The transformers should not saturate before at least twice the set over-current level.

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.

© AWG estimated.
Example 1:
Arc Guard System™ installed to trip all breakers in case of an arc.

Example 2:
Arc Guard System™ installed to trip different breakers depending on where the arc occurs.
Configurations
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.

<table>
<thead>
<tr>
<th>DIP switches</th>
<th>Breaker trip output</th>
<th>Detector inputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sw1 Current condition inputs Terminals X1:21-22</td>
<td>Sw5 Not used</td>
<td>Output relay K4 Terminals X1:1-10</td>
</tr>
<tr>
<td>Sw2 Current condition output Terminal X1:23</td>
<td>Sw6 Autoreset K2, K3 (signal relays)</td>
<td>Output relay K5 Terminals X2:1-10</td>
</tr>
<tr>
<td>Sw3 Trip output assign</td>
<td>Sw7 Not used</td>
<td>Output relay K6 Terminals X3:1-10</td>
</tr>
<tr>
<td>Sw4 Trip output assign</td>
<td>Sw8 Not used</td>
<td></td>
</tr>
</tbody>
</table>

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.

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. Therefore the standard configuration is without CSUs (Current Sensing Units).

All trip configurations on page 20.12 can be combined with an additional current condition. It is possible to connect up to two CSUs directly to the Arc Monitor (AM) (input 21 and 22). Connecting additional current sensing units in series is also possible if required. Sharing the current condition between different Arc Monitors can be done by connecting output 23 on the first Arc Monitor to the standard CSU input on the other. The Arc Monitor will then block the trip condition until it sees an over current.

<table>
<thead>
<tr>
<th>No current sensing unit</th>
<th>Sw1</th>
<th>Sw2</th>
<th>Function current condition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>0</td>
<td>Not used</td>
</tr>
</tbody>
</table>

One current sensing unit

<table>
<thead>
<tr>
<th>One current sensing unit</th>
<th>Sw1</th>
<th>Sw2</th>
<th>Function current condition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>0</td>
<td>Input CSU21 used</td>
</tr>
</tbody>
</table>

Two current sensing units

<table>
<thead>
<tr>
<th>Two current sensing units</th>
<th>Sw1</th>
<th>Sw2</th>
<th>Function current condition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>1</td>
<td>Both inputs used</td>
</tr>
</tbody>
</table>

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

See manual for more details
Approximate dimensions

Arc Monitor

A flange with 6 tapped holes (size 18.6 mm), 4 cable glands (sealing diameter 5.5-8.5 mm), and 2 plastic blank plugs are supplied.

Current Sensing Unit

HMI

Detector with optical cable

Drilling plan
Circuit diagrams

Arc Monitor

Current Sensing Unit

Terminals

<table>
<thead>
<tr>
<th>Terminals</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>X1 1-10</td>
<td>Detector input</td>
</tr>
<tr>
<td>X2 1-10</td>
<td>Extra detector unit detector input (option)</td>
</tr>
<tr>
<td>X3 1-10</td>
<td>Extra detector unit detector input (option)</td>
</tr>
<tr>
<td>A1, A2</td>
<td>Power supply</td>
</tr>
<tr>
<td>PE</td>
<td>Power supply</td>
</tr>
<tr>
<td>43, 44</td>
<td>Solid-state contacts</td>
</tr>
<tr>
<td>53, 54</td>
<td>Solid-state contacts</td>
</tr>
<tr>
<td>63, 64</td>
<td>Solid-state contacts</td>
</tr>
<tr>
<td>11, 12, 14</td>
<td>Indication contacts</td>
</tr>
<tr>
<td>21, 22, 24</td>
<td>Indication contacts</td>
</tr>
<tr>
<td>31, 32, 34</td>
<td>Indication contacts</td>
</tr>
</tbody>
</table>

Terminals

<table>
<thead>
<tr>
<th>Terminals</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 ... 6</td>
<td>Current transformer terminals</td>
</tr>
<tr>
<td>7 and 8</td>
<td>Output current signal to another Current Sensing Unit or Arc Monitor</td>
</tr>
<tr>
<td>9</td>
<td>Input current signal from another Current Sensing Unit</td>
</tr>
<tr>
<td>10 and 12</td>
<td>24 V DC</td>
</tr>
<tr>
<td>11 and 12</td>
<td>60 V DC</td>
</tr>
<tr>
<td>13 and 12</td>
<td>110 V - 125 V AC/DC</td>
</tr>
<tr>
<td>14 and 12</td>
<td>220 V DC, 230 V AC</td>
</tr>
</tbody>
</table>

A) Testing facilities:

- R29 Simulating a test current
- S1 1 = Test position
- 2 = Operation position
- V22 Red ON = S1 in test position
- OFF = S1 in operation position

B) Setting facilities:

- R21 Overcurrent setting
- S2 1 = Input 9 not used
- 2 = Input 9 used
- V27 Yellow ON = Load current less than 70% of set overcurrent level
- OFF = Load current more than 70% of overcurrent level
- V29 Green ON = Load current less than set overcurrent level
- OFF = Load current more than set overcurrent level

X) Current range bridge connections

<table>
<thead>
<tr>
<th>Range</th>
<th>Adjustable between</th>
<th>Connections</th>
</tr>
</thead>
<tbody>
<tr>
<td>1A:</td>
<td>0.5 - 3.5</td>
<td>24-17, 25-20, 26-23</td>
</tr>
<tr>
<td>2A:</td>
<td>1.0 - 7.0</td>
<td>24-16, 25-19, 26-22</td>
</tr>
<tr>
<td>5A:</td>
<td>2.5 - 17.5</td>
<td>24-15, 25-18, 26-21</td>
</tr>
</tbody>
</table>
Circuit diagrams
Arc Guard System with two separated circuit-breakers

Several Current Sensing Units
The Arc Monitor can be linked with several Current Sensing Units by connecting the Current Sensing Units in series.

Parallel connection of Arc Monitors
In installations with more than one Arc Monitor, Current sensing function is transmitted to next Arc Monitor via fibre cable (4).

A1 Switchgear or similar
F11, F12 Arc Monitor
F21, F22 Current Sensing Unit
Q1, Q2 Circuit-breaker
T1, T2 Current transformers (1ph or 3ph)
(1), (7) Detector cables (optical fibre cable)
(2), (8) Trip circuit for circuit-breaker (electric cable, separately powered)
(3) Current signal to Arc Monitor (optical fibre cable)
(4) Current signal is transmitted to second Arc Monitor via optical cable

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