ABB Ability™ Condition Monitoring for electrical systems – CMES

User Manual
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- jQueryui.com version 1.12.1 Copyright JS Foundation and other contributors, exact contribution history see https://github.com/jquery/jquery
- Perfect scrollbar version 1.1.0 The MIT License (MIT) Copyright (c) 2012-2017 Hyunje Jun and other contributors
- Selectric version 1.13.0 Copyright (c) 2016 Leonardo Santos
- D3.js version 5.9.2 BSD license
- C3.js version 0.7.1 MIT
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1. General

1.1. Target Group

Audiences of this manual are service technicians and switchgear operators of the MNS Digital or MNS iS switchgear solution ABB Ability™ Condition Monitoring for electrical systems (short: ‘CMES’).

This document describes the software user interface, the required hardware and network communication.

The reader shall be familiar with the terminology and concept of ABB MNS Low Voltage Switchgear.

1.2. Use of Warning, Caution, Information and Tip icon

This publication includes Warning, Caution, and Information icons where appropriate to point out safety related or other important information. It also includes Tip icons to point out useful hints to the reader. The corresponding symbols should be interpreted as follows:

- The electrical warning icon indicates the presence of a hazard that could result in electrical shock.

- The warning icon indicates the presence of a hazard that could result in personal injury.

- The information icon alerts the reader to pertinent facts and conditions.

Although Warning notices are related to personal injury, and Caution notices are associated with equipment or property damage, the operation of damaged equipment could, under certain operational conditions, result in impaired process performance leading to personal injury or death. It is, therefore, imperative that you comply fully sigh all Warning and Caution notices.
# 1.3. Terminology

List of the terminology, acronyms, abbreviations and definitions that the document uses.

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alarm</td>
<td>Alarm is defined as status transition from any state to abnormal state. Status transition to abnormal state can be data crossing over a pre-defined Alarm limit.</td>
<td></td>
</tr>
<tr>
<td>Dashboard</td>
<td>A dashboard is a user interface that organizes and presents information in a way that is easy to read.</td>
<td></td>
</tr>
<tr>
<td>Eth</td>
<td>Ethernet is a local area network (LAN) technology. The Ethernet standard specifies the physical medium, access control rules and the message frames.</td>
<td></td>
</tr>
<tr>
<td>Event</td>
<td>An event is a status transition from one state to another. It can be defined as Alarm, if the state is defined as abnormal or as warning as a pre-Alarm state.</td>
<td></td>
</tr>
<tr>
<td>LVS</td>
<td>Low Voltage Switchgear</td>
<td>A factory-built assembly built to conform with IEC 61439-1</td>
</tr>
<tr>
<td>MCC</td>
<td>Motor Control Center</td>
<td>Common term for switchgear used for motor control and protection.</td>
</tr>
<tr>
<td>MNS</td>
<td>MNS Digital switchgear configuration and parameterization tool</td>
<td></td>
</tr>
<tr>
<td>MNS</td>
<td>Modular Low Voltage Switchgear family from ABB</td>
<td></td>
</tr>
<tr>
<td>Motor Starter</td>
<td>Consists of motor controller and electrical components to control and protect a motor, part of Motor Control Center</td>
<td></td>
</tr>
<tr>
<td>NAMUR</td>
<td>NAMUR is an international user association of automation technology in process industries.</td>
<td></td>
</tr>
<tr>
<td>OPC UA</td>
<td>The industrial standard for exchange of information between components and process control application.</td>
<td></td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Term</td>
<td>Description</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>PLC</td>
<td>Programmable Local Controller</td>
<td>Low level control unit</td>
</tr>
<tr>
<td>Trip</td>
<td></td>
<td>A consequence of an Alarm activated or an external Trip command from another device to stop the motor or Trip the circuit breaker.</td>
</tr>
<tr>
<td>UPS</td>
<td>Uninterruptible Power Supply</td>
<td>Provides emergency power when the input power source or mains power fails.</td>
</tr>
<tr>
<td>Widget</td>
<td></td>
<td>A widget is an application, or a component of an interface, that enables a user to perform a function or access a service.</td>
</tr>
<tr>
<td>Windows OS</td>
<td>Windows Operating System.</td>
<td>Windows® is a registered trademark of Microsoft Corporation. All other trademarks are the property of their respective owners.</td>
</tr>
</tbody>
</table>
1.4. Related Documentation


1.5. Related System Version

The content of this document is related to MNS Digital Release 2.0

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2. Introduction

This document introduces the ABB Ability™ Condition Monitoring for electrical systems (subsequent 'CMES'), its features and web-browser based user interface (UI) which is running on the Edge device hardware platform.

The CMES offers:

- Convenient navigation options via tree, electrical single line or cubicle front view
- Clear indication of process and diagnosis values
- Trend display for online and historic measurement and diagnostic values
- Alarm and Event log history with time stamp and filter function
- Inbuilt user guidance and knowledge base providing suggested actions for Alarms and Trips
- Condition based and predictive maintenance support through Condition Assessment Module (CAM) including Asset Health information for maintenance-based analytics
- Energy and condition reporting function

The CMES supervises all electrical devices and digital switchgear solutions, which are connected to MNS Digital or MNS IS internal communication structure.

This includes but is not limited to:

- Motor starter and feeder, which are equipped with intelligent devices M10x-M or UMC1003
- Softstarter and VSDs
- Air Circuit Breaker and MCCB (i.e. Emax 2, Tmax XT series)
- Protection relay REF615
- MNS Temperature monitoring system (TMS)
- Power meter M2M
2.1. Switchgear Network and Client/Plant Network

The ABB Ability CMES is installed in an on-premise Edge device that requires an Ethernet connection to the MNS Digital Gateway(s) / MLink(s) to read status information from the switchgear devices (ETH2).

The data in CMES are presented via the web-browser based user interface on Ethernet interface ETH1. Only a web browser is required in client computers (see chapter 4.2) to present the information, no separate software installation is required.

An optional interface to cloud based ABB Ability solutions i.e. MyRemoteCare is provided through an Ethernet interface ETH3.

Figure 1: MNS Digital Network Example
3. User Interface

This chapter describes the user interface of the CMES system which provides online and historic data from the connected switchgear and devices (e.g. motor starter).

3.1. Getting started

To login into the user interface the first step is to enter “https://” and the IP address of Edge device into the address bar of the web browser (see chapter 4.2, Firefox or Google Chrome are supported).

Example: https://192.168.220.180

Note: the IP address depends on actual site network configuration, consult the network administrator for details.

It is recommended to create a Shortcut link on the computer desktop or a Favorite item in the web browser software for easy access.

After entering in address, following login window appears:

![Login view](image)

Here the user username and respective password as defined for the installation must be entered.

Note: How to configure user profiles is described in the “ABB Ability™ Condition Monitoring for electrical systems - CMES - User Management Quick Guide” document.

3.2. Selecting layout

After successful login into the system a page asking for user layout preference appears.

It enables to select:
- Standard layout
- Mobile layout

Release MNS Digital 2.1 introduces Mobile layout which adjusts dashboards and widgets in a way that they are more comfortable for users accessing HMI with mobile devices.

These dashboards and widgets are improved for devices with smaller screen and touchscreen.
Figure 3 - Select layout

After clicking on one of the button (Standard layout/ Mobile layout) appropriate layout is loaded.

This manual describes dashboards and widgets presented in standard layout. Mobile layout dashboards and widget have the same functionality only the component arrangement and visualization may differ. Standard layout may also contain functionality which is not yet fully introduced in mobile layout.

MNS Digital CMES can be accessed via these options:

- **General**
  - “https://” and the IP address of an Edge device
  - Example: https://192.168.220.180
  - After login the select layout page appears.
- **Standard layout preselected**
  - “https://” and the IP address of an Edge device and “/standard”
  - Example: https://192.168.220.180/standard
  - After login the standard layout is directly loaded.
- **Mobile layout preselected**
  - “https://” and the IP address of Edge device and “/mobile”
  - Example: https://192.168.220.180/mobile
  - After login the mobile layout is directly loaded.
3.3. CMES User Interface – General Description

The CMES user interface provides following main areas:

![User Interface Diagram]

**Figure 4: User Interface**

<table>
<thead>
<tr>
<th>Area</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 &lt;Tree View&gt;</td>
<td>To select plant, substation, switchgear sections or motors/consumers</td>
</tr>
<tr>
<td>2 &lt;Main Menu&gt;</td>
<td>Area on top of the window. It contains generic features, an indications about Alarms/Trips and logged in user. The Alarm/Trip counter indicates the number of devices of all integrated switchgears having at least one active alarm/trip.</td>
</tr>
<tr>
<td>3 &lt;Widgets&gt;</td>
<td>Area of available widgets which have been collapsed ([X] symbol in upper right corner of the widget). Re-opening a widget by click on the respective widget icon.</td>
</tr>
<tr>
<td>4 &lt;Info&gt;</td>
<td>User Help document for CMES</td>
</tr>
<tr>
<td></td>
<td>Software version information</td>
</tr>
<tr>
<td>5 &lt;Widget Area&gt;</td>
<td>Place where the available widgets are displayed. The content (available widgets) depends on the navigation level.</td>
</tr>
<tr>
<td>6 &lt;Navigation Path&gt;</td>
<td>This area indicates the current navigation path</td>
</tr>
</tbody>
</table>

It is recommended to limit the simultaneous login to 5 users for best navigation performance results.
3.3.1. Navigation

Depending on the navigation level (Plant ➔ Substation ➔ Switchgear ➔ Cubicle/Section ➔ Devices) different information content is presented.

This allows the user to navigate from a bird’s eye view with general statistical data to fully detailed data and analytics received from the field level:

Plant dashboard
- Health Condition
- Event list

Substation dashboard
- Health Condition
- Event list

Switchgear dashboard
- Health Condition
- Event list
- Electrical Single Line diagram
- Physical Position

By selecting the widget window control functions user can minimize, maximize or close a selected widget:

Figure 5: Widgets of Dashboard and its Selection

Figure 6: “Square” – Minimize / Maximize Widget, “X” – Close Widget
3.4. Tree View Navigation

Tree navigation allows the user to select a switch gear or a starter module/consumer. By clicking on the icon “Show Tree” the tree view will be enlarged for easy user navigation.

Figure 7: Show Tree Icon

The tree topology has following structure:

```
<PLANT>
  |--- SUBSTATION
  |--- SWITCHGEAR
  |--- CUBICLE / SECTION
  |--- MODULE
  |--- DEVICE / SENSOR
```

Notes:
- For the CMES one PLANT only exists (on-premise installation)
- One PLANT can have one or many SUBSTATION
- One SUBSTATION can have one or many CUBICLE / SECTION
- One CUBICLE / SECTION can consist of one or many MODULE
- One MODULE can consist of one or many DEVICE / SENSOR (with communication interface)
**View Options:**

Depending on the interest user can select from different tree view options:

![Selectable Views](image-url)

**Location view** Modules in the tree view are organized according the physical arrangement in the switchgear

**Bus bar view** Modules in the tree view are organized according the affiliation to bus bar sections
### Communication view

Modules in the tree view are organized according to the communication relationship.

![Communication view](image)

### Project view

Modules in the tree view are organized according to project engineering.

![Project view](image)

**Table 1: Tree view selection**
The ‘Search’ function provides an easy way to find motors / devices.

Examples:

Search for devices with “M2” in the name:

![Search for devices with “M2” in the name](image)

Search function lists all modules with “6E” in the name:

![Search function lists all modules with “6E” in the name](image)

Table 2: Search function
3.5. Start Screen – Plant dashboard

The Plant dashboard is the start screen after successful login to the CMES system:

Figure 9: Start Screen – Plant dashboard

Following information is provided in the plant dashboard view:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><strong>&lt;Plant Health Condition&gt;</strong></td>
</tr>
<tr>
<td>2</td>
<td><strong>&lt;Event List&gt;</strong></td>
</tr>
</tbody>
</table>
3.6. Substation dashboard

Substation dashboard shows live data related to the selected substation (selection via tree). The screen has following components:

**Figure 10: Substation dashboard**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>&lt;Navigation Path&gt; Indicates the name of the Substation: &lt;Plant Name&gt; / &lt;Substation Name&gt;</td>
</tr>
<tr>
<td>2</td>
<td>&lt;Substation Health Condition&gt; Health Condition widget displays information related to the selected SUBSTATION (for details ref. to section 3.9)</td>
</tr>
<tr>
<td>3</td>
<td>&lt;Event List&gt; Event List widget displays information related to the selected plant. (for details ref. to section 3.8)</td>
</tr>
</tbody>
</table>
### 3.7. Switchgear dashboard

Switchgear dashboard shows provides more insights than the upper level Plant / Substation dashboards of the selected switchgear (selection via tree). The screen has following components:

![Switchgear Dashboard](image)

**Figure 11: Switchgear dashboard**

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><strong>&lt;Navigation Path&gt;</strong> Indicates the name of the Substation:</td>
</tr>
<tr>
<td></td>
<td><strong>&lt;Plant Name&gt;</strong> / <strong>&lt;Substation Name&gt;</strong></td>
</tr>
<tr>
<td>2</td>
<td><strong>&lt;Switchgear Health Condition&gt;</strong> Health Condition widget displays information related to the selected SWITCHGEAR (for details ref. to section 3.9)</td>
</tr>
<tr>
<td>3</td>
<td><strong>&lt;Event List&gt;</strong> Event List widget displays information related to the selected plant. (for details ref. to section 3.8)</td>
</tr>
<tr>
<td>4</td>
<td><strong>&lt;Single Line&gt;</strong> Single line widget displays simplified single line diagrams of modules contained in the selected switchgear. Details about Single line widget is available in section 3.10.</td>
</tr>
<tr>
<td>5</td>
<td><strong>&lt;Physical Position&gt;</strong> Physical position widget displays physical visualization of cubes and modules belonging to the selected switchgear. Details about Physical Position widget is available in section 3.11 and 3.12</td>
</tr>
</tbody>
</table>
3.8. Widget – Event List

The Event List provides in general an overview about pending or/and historic Events, Alarms and Trips for the Plant or selected Substation / Switchgear.

In the Event List already a default filter is applied which is set to “Alarms”. This filter includes Alarm and Trip messages. Events are excluded by default to prevent that the list is filled with mainly events like “Motor running” / Motor Stopped” and important information which are Alarms and Trips are hidden in between such frequent events.

Nevertheless, it is possible to select manually a different severity filter to see also events or filter by specific severity, like only maintenance related messages (see further description below in this chapter).

<table>
<thead>
<tr>
<th>Plant dashboard</th>
<th>Event list displays events, alarms and trips generated by all device belonging to the Plant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Substation dashboard</td>
<td>In this Event list a pre-selected filter is active to show only events, alarms, events belonging to the selected Substation</td>
</tr>
<tr>
<td>Switchgear dashboard</td>
<td>In this Event list a pre-selected filter is active to show only events, alarms, events belonging to the selected Switchgear</td>
</tr>
</tbody>
</table>

The severity of the information is marked by different colors for quick identification. Next to the time stamp also further clear text details about the events/alarms/trips are provided in the line. Depending on the user rights it is possible to acknowledge list entries. Various selections are provided for the user to filter the Event List.

Figure 12: Event List
The list can be filtered by:

<table>
<thead>
<tr>
<th>FILTER</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SEVERITY</strong></td>
<td>Severity of list entry, All / Active / New / Active or New</td>
</tr>
<tr>
<td><strong>STATE</strong></td>
<td>All / Active / New / Active or New</td>
</tr>
<tr>
<td><strong>TIME</strong></td>
<td>All / Last Hour / Last Day / Last Week / Last Month / Last Year</td>
</tr>
<tr>
<td><strong>DEVICE</strong></td>
<td>All Devices / &lt;Device Identifier Name&gt;</td>
</tr>
</tbody>
</table>

“Active” means the Alarm or Trip is present and “New” means the Alarm or Trip is not acknowledged.
The events, alarms and trips are colored. The color coding is according to the NAMUR recommendation [2]. Following table describes the color and meaning.

<table>
<thead>
<tr>
<th>Severity</th>
<th>Sub-Condition</th>
<th>Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - 99</td>
<td>Normal</td>
<td>Green</td>
<td>Motor is available. Status is ‘normal’. Asset functionality is fully available. No maintenance is required.</td>
</tr>
<tr>
<td>100 - 399</td>
<td>Maintenance required</td>
<td>Blue</td>
<td>Motor is available. Status is ‘maintenance required (soon)’. Asset functionality fully available but maintenance required soon to avoid functional restrictions, e.g. caused by a nearly exhausted wear reserve or operating conditions.</td>
</tr>
<tr>
<td>400 - 749</td>
<td>Out of Specification</td>
<td>Yellow</td>
<td>Motor is still available. Status is ‘out of specification’. Asset functionality available but decreased due to operating conditions outside the specified limits.</td>
</tr>
<tr>
<td>750 – 899</td>
<td>Function Check</td>
<td>Orange</td>
<td>Motor has been stopped. Operation is not possible. Status is ‘function check’. Asset functionality might be temporarily restricted, due to on-going work on the asset, e.g. as local operation, maintenance (main-switch off), simulation or a function check (test-position).</td>
</tr>
<tr>
<td>900 – 1000</td>
<td>Failure</td>
<td>Red</td>
<td>Motor has been stopped. Status is ‘failure’. Asset Functionality lost due to malfunction of its peripherals or due to operating conditions.</td>
</tr>
</tbody>
</table>

Table 3: Color Coding of Alarms and Trips

The colors are predefined according to NAMUR recommendation and cannot be changed by the user.
The user can acknowledge an Alarm or Trip in the left box by a mouse click:

<table>
<thead>
<tr>
<th>Date/Time</th>
<th>Device ID</th>
<th>Status</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2023-04-01 00:00</td>
<td>Device1</td>
<td>Active</td>
<td>Unbalance Alarm</td>
</tr>
<tr>
<td>2023-04-02 01:00</td>
<td>Device2</td>
<td>Not Active</td>
<td>Trip</td>
</tr>
</tbody>
</table>

Figure 13: Trip Acknowledged by User

The Background color is dynamic depending on the status of a list entry:

- Yellow: Alarm or Trip is active
- White: Alarm or Trip is not active

Events like “Motor started” cannot be acknowledged. An alarm or trip is stored in the historical database independent if it was acknowledged or not or if the alarm or trip is still active or not.

Filtering options allow to show only entries of interest, for example only active and only new Alarms and Trips (new = not acknowledged).

Knowledge Base

The CMES contains an inbuilt user guidance, the Knowledge Base. The knowledge base provides for each alarm or trip a detailed description of the message, possible root cause and suggested action(s) of that issue. It can easily be accessed by clicking in the ‘i’ button on the right of each line in the Event list.

Figure 14: Knowledge Base example
3.9. Widget – Health Condition

The widget provides an online view of switchgear / device Health Condition. Depending on the navigation level different Health Conditions are available:

<table>
<thead>
<tr>
<th>Level</th>
<th>Health Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Plant level</strong></td>
<td>Plant wide health conditions of all configured and connected devices integrated into the Edge device and CMES are monitored.</td>
</tr>
<tr>
<td><strong>Substation level</strong></td>
<td>Substation wide health conditions of all configured and connected devices integrated into the Edge device and CMES are monitored. Total number of devices can be different from number indicated on plant level in case multiple substations are configured in the system.</td>
</tr>
<tr>
<td><strong>Switchgear level</strong></td>
<td>Switchgear wide health conditions of all configured and connected devices integrated into the Edge device and CMES are monitored. Total number of devices can be different from number indicated on plant level in case multiple substations are configured in the system.</td>
</tr>
</tbody>
</table>

![Switchgear Health Condition](image)
The widget is split into three sections:

**Device Health Status**

- **Switchgear Health**
  - Total no. of devices: 44
  - Good: 40
  - Medium: 4
  - Critical: 0
  - Offline: 0

  **Legend:**
  - Red: Critical
  - Yellow: Medium
  - Green: Good
  - Blue: Offline

  Shows total number and percentage of devices (based on total no. in the selected navigation level) configured in corresponding plant/substation/switchgear.

  Displays numbers of monitored assets which are in one of the following conditions:
  - Good: no issue with device
  - Medium: asset is in medium severity state – there is at least one alarm activated for this asset
  - Critical: asset is in critical severity state – there is at least one trip activated for this asset.
  - Offline: asset is offline

**Health Index**

- Over all Plant / Substation / Switchgear Health Index
- Temperature Health Index (if no temperature monitoring system (TMS) is installed then value will be permanent zero!)
- Mechanical Health Index

The Health Index is split in up to three parts:

- The overall Health Index and the Temperature Health Index are calculated for the Plant and each Substation / Switchgear as minimum value of the next lower level.
- The Mechanical Health Index is calculated as described below.
Device Health status chart provides a timeline view of the Health status (Good/Medium/Critical/Offline) of the monitored assets in the Plant / Substation / Switchgear.

This timeline view including historical data enables the user to monitor the overall condition and indicates developing issues to enable corrective maintenance actions at earliest time.

General definition of Health Index values in CMES:

| Health Index – Plant / Substation / Switchgear | >= 90% | Item is in healthy state; no problems are detected |
| <=70% | Alarm issued by controller or temperature supervision device missing |
| <=50% | Device has issued a trip and is in critical state |
| 25% | Device is out of service (communication error) |
| 0 | Device is not available (no communication) |

| Temperature Health Index | 100 % | Temperature sensor is available and has no alarm |
| 99% | There is no temperature measurement sensor foreseen |
| <=70% | One or more phases indicate a delta-T alarm |
| <=50% | One or more phases indicate a temperature limit alarm |
| <= 25% | Temperature sensor(s) are currently not communicating, the temperature value shown is the last measured value |

<p>| Mechanical Health Index for switchgears and cubicles | 100 % | More than 31 days left till next maintenance |
| 99 - 70% | Between 31 and 0 days left till next maintenance |
| 50% | Maintenance of switchgear overdue |</p>
<table>
<thead>
<tr>
<th>Mechanical Health Index for Power Modules and Devices</th>
<th>The value is calculated based on status of the controller, the insertion cycles, switch cycles and other maintenance indications</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;=90 %</td>
<td>The power module and the devices are in good condition</td>
</tr>
<tr>
<td>51 - 90%</td>
<td>A controller or temperature measurement device inside the power module indicates an alarm. Please check the maintenance related values. Please check also insertion cycles and contactor switch cycles of the power module. If there the temperature sensors configured and installed, please check also the communication of temperature sensors.</td>
</tr>
<tr>
<td>26 - 50%</td>
<td>A controller or temperature measurement device inside the power module indicates a trip. Please fix the problem to get back to normal operation</td>
</tr>
<tr>
<td>0 - 25%</td>
<td>The controller inside the power module has communication errors</td>
</tr>
</tbody>
</table>
3.10. Widget – Single Line Diagram

The Single Line diagram provides a quick electrical overview of the actual status of the motors, consumers and sensors connected to a busbar section, which includes:

- Main Switch open/closed
- Contactor(s) open/closed
- Motor running CW/CCW
- Alarm/Trip status (indicated by colorization of the frame indicating the severity)
- Pre-selected measurement values

![Single Line Diagram](image)

Figure 15: Single Line diagram

If there are multiple busbar sections configured, then user can select a different section from the list available in the drop-down menu.

![Drop-down Menu](image)

The colors in the single line indicate following conditions:

<table>
<thead>
<tr>
<th>Color</th>
<th>Condition Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green</td>
<td>Ready/Open - no pending Alarm/Trip</td>
</tr>
<tr>
<td>Blue</td>
<td>Runs/Closed Alarm/Trip</td>
</tr>
<tr>
<td>Orange</td>
<td>Alarm/CCW Alarm/Trip</td>
</tr>
<tr>
<td>Red</td>
<td>Device is not present, or communication is disturbed</td>
</tr>
<tr>
<td>Red and “Not present”</td>
<td>Status of device is unknown</td>
</tr>
<tr>
<td>Black</td>
<td></td>
</tr>
</tbody>
</table>
3.11. Widget – Physical Position – Status View

The widget provides an online front view of cubicle alignment including all the modules. All cubicles belonging the selected switchgear are displayed. Actual status of the modules is indicated by different colors defined for the different severities (ref. to table in section 3.10 before).

Figure 16: Physical Position – Status view

The widget provides an online thermographic overview indicating the thermal condition of the assets equipped with the Temperature Monitoring System (TMS).

The TMS provides different sensors for different parts of thermal supervision in a switchgear:

<table>
<thead>
<tr>
<th>Module</th>
<th>Thermal supervision of module contact temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACB(*)</td>
<td>Thermal supervision of cable termination section in an ACB cubicle</td>
</tr>
<tr>
<td>Busbar(*)</td>
<td>Thermal supervision of the main busbar shipping splits</td>
</tr>
</tbody>
</table>

(*) The thermal supervision is only enabled in CMES after the required sensors are integrated into CMES. Details about availability of this solution in CMES will be published in respective MNS Digital Release Note.

The busbar is indicated by a rectangle section above the switchgear. The location of the temperature sensor for busbar shipping split supervision is indicated by a square inside the busbar.

The thermal status is indicated by colors defining different severities:

<table>
<thead>
<tr>
<th>Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gray</td>
<td>No temperature sensors installed / configured</td>
</tr>
<tr>
<td>Green</td>
<td>Temperature values are within set limits</td>
</tr>
<tr>
<td>Orange</td>
<td>Temperature has crossed a parameterized Alarm-threshold value</td>
</tr>
</tbody>
</table>

Figure 17: Physical Position – Thermal view
3.13. Widget – Detailed View

Clicking on a module/device in Physical Position widget or in the Single Line widget or by selection from the Tree View a detailed view of the selected module/device is opened.

The detailed view provides next to detailed monitoring and diagnostic data received from the field device also the possibility to view historical data in a trend display, look to filtered Alarm and Events of the selected device and view engineering and device specific data and parameters.
3.14. Widget – Detailed View - Data

The widget provides detailed insight information of the selected asset.

**DIAGRAM**

Animated Single Line diagram with detailed information about the status of the power module including status of the connected motor / load.

Example for a REV-DOL motor starter

**MEASUREMENT**

Measurement values from selected device with colored bar graph

**DIAGNOSTIC**

Diagnostic values providing more device maintenance relevant information.

Figure 19: Detailed View – Data
The below example shows the measurement and diagnosis information which is provided for motor starters and reflect the most important data required by user.

Figure 20: Detailed View - Data – Measurement and Diagnosis Information

The colors of measurement bars indicate:

<table>
<thead>
<tr>
<th>Blue</th>
<th>Orange</th>
<th>Red</th>
<th>Gray</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement value is in normal range</td>
<td>Measurement value is out of range (threshold value 1)</td>
<td>Measurement value is out of range (threshold value 2)</td>
<td>Measured value is invalid. (e.g. in case the device is not connected, or the measurement value is identified as not valid)</td>
</tr>
</tbody>
</table>
3.15. Widget – Detailed View - Trends

The detailed view "Trends" shows the actual and historic recorded data in a graphical representation.

Following user actions are provided:

- When opening the trend pre-defined values in the graph are displayed
- User can switch on/off existing curves by simple click
- User can add/remove any recorded value to/from the graph
- Change the scale of the Y-axis by click on the max. value

Figure 21: Detailed View – Trends

Note: Adding/removing items to/from a trend is only persistent in the current session. After re-login, the defaults are restored.
To investigate more details with a higher resolution or view data recorded in a certain time range the Trend Display provides following controls to change:

- Start Date
- Time base and time resolution
- End date
- Floating or locked view

![Figure 22: Detailed View – Trends – Time Span parameter](image)

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lock Start Date</td>
<td>User can lock the start date to fix the left time of the trend</td>
</tr>
<tr>
<td>2</td>
<td>Select Start Date</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Select Time Span</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Select End Date</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Lock End Date</td>
<td>User can lock the end date to freeze the trend. Optional floating option can be selected, then trend display is updated as sliding window.</td>
</tr>
</tbody>
</table>
### 3.16. Widget – Detailed View - Alarms

The detailed view "Alarms" shows the events, Alarms and Trips for the selected module/device.

Following filter are pre-set:

- **Severity:** All Alarms (includes alarm and trip messages)
- **Time:** Last week (showing list entries from actual time back one week)

Nevertheless, the filter settings can be changed manually by user depending on intended use of the list.

![Detailed View - Alarms](image)

Figure 23: Detailed View – Alarms

For more details see chapter "Widget – Event List".
3.17. Widget – Detailed View - Information

The detailed view “Information” provides technical details of the selected module and/or device. The QR code contains a direct link to ABB Service web page for further information and support i.e. local ABB Service contact details.

Figure 24: Detailed View – Information
3.18. Widget – Detailed View – Reset Assessment

The CMES system has integrated algorithms for analytics (CAM – Condition Assessment Module) which provide further maintenance or process related information and calculate the Asset Health status of the individual devices or overall for the Plant / Substation or Switchgear. The results of the algorithms are presented inside different widgets or create entries in the Event List widgets.

The detailed view “Reset Assessment” provides the possibility to reset CAM alarms where applicable. Once an alarm is reset the respective calculation inside the algorithm will start again.

Depending on the device type one or multiple CAM algorithms can be defined.

<table>
<thead>
<tr>
<th>Data</th>
<th>Trends</th>
<th>Alarms</th>
<th>Information</th>
<th>Reset Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reset</td>
<td></td>
<td></td>
<td></td>
<td>Reset Repeated Start Limitation Alarm</td>
</tr>
<tr>
<td>Reset</td>
<td></td>
<td></td>
<td></td>
<td>Reset Repeated Start Limitation Trip</td>
</tr>
<tr>
<td>Reset</td>
<td></td>
<td></td>
<td></td>
<td>Reset Repeated TOL Alarm</td>
</tr>
<tr>
<td>Reset</td>
<td></td>
<td></td>
<td></td>
<td>Reset Repeated TOL Trip</td>
</tr>
<tr>
<td>Reset</td>
<td></td>
<td></td>
<td></td>
<td>Reset All</td>
</tr>
</tbody>
</table>

Figure 25: Detailed View – Reset Assessment
3.19. Widget – Cubicle View - Data

After clicking on the name of the cubicle in Physical Position widget or selection of the cubicle in the Tree View details about the cubicle and connected modules / devices are provided.

Figure 26: Select a cubicle for Cubicle View

The cubicle view provides in the tab “Data” following information:

- Animated cubicle front view of the selected cubicle with all the modules.
- Status of the modules indicated by different colors defined for the different severities. (for color definition ref. to section Single Line widget).
- Diagnostic values of the cubicle (colors as defined in section Detailed View-Data)

Figure 27: Cubicle View - Data
3.20. Widget – Cubicle View – Trends

The Cubicle view “Trends” provides cubicle related online and historic data.

Cubicle specific features:

- The CAM algorithm for the cubicle supervision is calculating in the background the power loss of the cubicle.
  
  If the max. permissible power loss of the cubicle is exceeded (e.g. by adding more and more modules and consumers during the lifetime of the switchgear) a respective warning will be provided by the CMES system.

- If busbar temperature sensors as part of TMS system are installed the user can also view the actual and historic data of the temperature values.

Details about using the Trend function are described in section “Detailed View - Trends”.

Figure 28: Cubicle View - Trends
3.21. Widget – Cubicle View – Alarms

The Cubicle view "Alarms" shows the Alarms and Trips belonging to the selected cubicle and all its modules/devices:

For more details see chapter "Widget – Event List".

Figure 29: Cubicle View - Alarms
3.22. Widget – Cubicle View – Information

The Cubicle view "Information" provides technical details of the selected cubicle. The QR code contains a direct link to ABB Service web page for further support.

Figure 30: Cubicle View - Information
3.23. Alarms & Events Tab

The “Alarms & Events” tab in the top menu bar shows an unfiltered global Alarm and Event List. The list provides an overview of all pending or/historic Alarms and Trips of all connected switchgears. The severity of the information is marked by different colors for quick identification. Next to the time stamp also further clear text details. For more details see chapter “Widget – Event List”.

Figure 31: Global Alarm & Event Tab
3.24. Reporting Tab

The “Reporting” tab in the top menu bar shows reporting widget which generates CMES reports. Version 2.1 supports Energy reports.

![Reporting Tab](image)

Figure 32: Reporting module

The reporting widget provides these options:

- **Report selection**
  - The widget provides report type selection – currently the selection is disabled and Energy report is preselected. Currently no other report types are supported.

- **Switchgear selection**
  - The widget provides possibility to select on or more switchgears from which data the report will be generated.

- **Time selection**
  - The widget provides option to select report type:
    - Daily – Creates report from selected day
    - Monthly – Creates report from selected month
    - Yearly – Creates report from selected year
  - After selection of report type the start date is required to be selected.

- **Report generation**
  - At the bottom of the widget there is “Create Report” button which initiate the report generation for the inputted parameters.
  - After few seconds the report itself is displayed in the widget.
  - The report is possible to:
    - View directly in the widget
    - Download and store as pdf file
    - Directly print
3.24.1. Report types – time intervals

Reporting module provides these types of report from time interval point of view

- **Daily report**
  - Report is processed for the selected day.
  - The report interval starts at 00:00:00 of the selected day and ends at 23:59:59 of the selected day.
  - If the report is selected for the current day, the reporting period ends with the current time.

- **Monthly report**
  - Report is processed for the selected month.
  - The report interval starts at 00:00:00 of the first day of the selected month and ends at 23:59:59 of the last day of the selected month.
  - If the report is selected for the current month, the reporting period ends with the current time of the current day.

- **Yearly report**
  - Report is processed for the selected year.
  - The report interval starts 00:00:00 of the first day of the selected year and ends at 23:59:59 of the last day of the selected year.
If the report is selected for the current year, the reporting period ends with the current time of the current day.

3.24.2. Energy Report

Energy report provides summary information about power loss and energy consumption of selected switchgear for selected time period. It also provides comparison between selected period and previous period.

It is possible to select individual switchgear for the report or more switchgears. If more than one switchgear is selected, then the energy report contains concatenated individual switchgear reports.

The Energy report is divided into several sections.

3.24.2.1. Title page

Title page provides information about CMES, Report type and report period.

![Energy report - Title page](image)

3.24.2.2. Information page

Information page provides summary information about the Company/Site name and location, Customer contact, Plant name, Substation name, Switchgear name, Date of report creation, username who created the report and template version information.
3.24.2.3. Executive Summary of the Report Content

Executive summary page consists of three sections. 

First section contains information about switchgear report summary: Reporting period, Plant name, Substation name, Switchgear name and number of cubicles the switchgear contains.

Second section contains information about Power losses of all cubicles contained in the switchgear. Power loss of a cubicle is sum of individual power losses of all devices belonging to this cubicle.

Provides average, minimal and maximal power loss for the selected period and compares with values fetched the previous period.
Figure 37: Cubicle power loss table

- Column Cubicle shows name of all cubicles in the selected switchgear
- Column Current Period – Minimum shows minimal value of power loss for selected reporting period.
- Column Current Period – Value shows average value of power loss for selected reporting period.
- Column Current Period – Maximum shows maximal value of power loss for selected reporting period.
- Column Previous Period – Minimum shows minimal value of power loss for previous reporting period.
- Column Previous Period – Value shows maximal value of power loss for previous reporting period.
- Column Previous Period – Maximum shows maximal value of power loss for previous reporting period.
- Column change – shows difference between value in current period and previous period (Current value minus Previous value).
  - Red arrow is displayed when the difference positive and higher than 10% of the current value.
  - Green arrow is displayed when the difference is negative and higher than 10% of the current value.
  - Yellow arrow is displayed if the change is less than 10%

Note to Min and Max calculation

The minimum and maximum is not calculated as aggregated value of subinterval.

For daily reports the subinterval is one hour. It means that each whole hour an average value of power loss is calculated. For daily report there is 24 hourly average values and the lowest one is used as minimum and the highest one is used as maximum.

For monthly report the subinterval is one day. It means that for monthly report there is from 28 to 31 daily averages and the lowest value is selected for minimum and highest one for maximum.

For yearly report the subinterval is 1 month.
If the reporting period is selected the current one (current day, current month, current year) only available subintervals are used.

**Third section** contains information about Active energy counter of all cubicles contained in the switchgear. Active energy counter of a cubicle is sum of individual Active energy counters of all devices belonging to this cubicle.

Provides energy consumption for the selected period and compares with values fetched the previous period. Consumption is calculated as difference between Active energy counter value fetch on the beginning of the period and Active energy counter value fetched on the end of the time interval.

![Active Energy Counter [kWh]](image)

<table>
<thead>
<tr>
<th>Cubicle</th>
<th>Current Period [kWh]</th>
<th>Previous Period [kWh]</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>F01_Sim</td>
<td>62</td>
<td>-54</td>
<td>116</td>
</tr>
<tr>
<td>F02_Sim</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>R01_Sim</td>
<td>-66</td>
<td>-27</td>
<td>-39</td>
</tr>
<tr>
<td>R02_Sim</td>
<td>-12</td>
<td>36</td>
<td>-48</td>
</tr>
<tr>
<td>R03_Sim</td>
<td>20</td>
<td>0</td>
<td>20</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>4</strong></td>
<td><strong>-45</strong></td>
<td><strong>49</strong></td>
</tr>
</tbody>
</table>

Figure 38: Cubicle Active energy counter table

- Column Cubicle shows name of all cubicles in the selected switchgear
- Column Current Period – Consumption shows energy consumption of the cubicle during the selected time interval.
- Column Previous Period – Consumption shows energy consumption of the cubicle during previous time interval.
- Column change – shows difference between value in current period and previous period (Current value minus Previous value).
  - Red arrow is displayed when the difference positive and higher than 10% of the current value.
  - Green arrow is displayed when the difference is negative and higher than 10% of the current value.
  - Yellow arrow is displayed if the change is less than 10%

Please note that the enclosed pictures show data from simulations which may result in values which would not appear in real system, e.g. negative energy consumption.

**3.24.2.4. Cubicle report**

There is cubicle report page for each cubicle contained in the Switchgear. Cubicle report page consists of three sections.

**First section** contains information about the cubicle
Figure 39: Cubicle report header

**Second section** contains information about Power losses of all devices contained in the mentioned cubicle.

Provides average, minimal and maximal power loss for the selected period and compares with values fetched the previous period.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>WD_R02_DA01_S1m</td>
<td>11 (daily avg) 11</td>
<td>0 (daily avg) 3</td>
<td>8 ↑</td>
</tr>
<tr>
<td>WD_R02_DA02_S1m</td>
<td>11 (daily avg) 11</td>
<td>0 (daily avg) 3</td>
<td>8 ↑</td>
</tr>
<tr>
<td>WD_R02_DA03_S1m</td>
<td>40 (daily avg) 41</td>
<td>0 (daily avg) 9</td>
<td>31 ↑</td>
</tr>
<tr>
<td>WD_R02_DA04_S1m</td>
<td>40 (daily avg) 41</td>
<td>0 (daily avg) 9</td>
<td>31 ↑</td>
</tr>
<tr>
<td>WD_R02_DA01_S1m</td>
<td>11 (daily avg) 11</td>
<td>0 (daily avg) 3</td>
<td>8 ↑</td>
</tr>
</tbody>
</table>
**Third section** contains information about Active energy counter of all devices contained in the selected cubicle.

Provides energy consumption for the selected period and compares with values fetched the previous period. Consumption is calculated as difference between Active energy counter value fetch on the beginning of the period and Active energy counter value fetched on the end of the time interval.

### Active Energy Counter [kWh]

<table>
<thead>
<tr>
<th>Device</th>
<th>Current Period [kWh]</th>
<th>Previous Period [kWh]</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Value</td>
<td>Consumption</td>
<td>Value</td>
</tr>
<tr>
<td>WD_R02_DA01_Sim</td>
<td>3</td>
<td>-4</td>
<td>3</td>
</tr>
<tr>
<td>WD_R02_DA02_Sim</td>
<td>15</td>
<td>-6</td>
<td>7</td>
</tr>
<tr>
<td>WD_R02_DA03_Sim</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>WD_R02_DA04_Sim</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>WD_R02_FA01_Sim</td>
<td>9</td>
<td>-6</td>
<td>10</td>
</tr>
<tr>
<td>WD_R02_FA03_Sim</td>
<td>9</td>
<td>-4</td>
<td>2</td>
</tr>
<tr>
<td>WD_R02_KA01_Sim</td>
<td>9</td>
<td>3</td>
<td>11</td>
</tr>
<tr>
<td>WD_R02_RA01_Sim</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>WD_R02_TA01_Sim</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>XR_R02_MA01_Sim</td>
<td>2263</td>
<td>-19</td>
<td>2285</td>
</tr>
<tr>
<td>XR_R02_MC01_Sim</td>
<td>2274</td>
<td>11</td>
<td>2292</td>
</tr>
<tr>
<td>XR_R02_NC01_Sim</td>
<td>2283</td>
<td>13</td>
<td>2276</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>-12</td>
<td>36</td>
<td>-48</td>
</tr>
</tbody>
</table>

Figure 41: Device Active Energy Counter table

- Column **Device** shows name of all cubicles in the selected switchgear
- Column **Current Period – Value** shows value of Active energy counter of the device obtained on the end of the time interval.
- Column **Current Period – Consumption** shows energy consumption of the device during the selected time interval.
- Column **Previous Period – Value** shows value of Active energy counter of the device obtained on the end of the previous time interval.
- Column **Previous Period – Consumption** shows energy consumption of the cubicle during previous time interval.
- Column **change** – shows difference between consumption in current period and previous period (Current consumption minus Previous consumption).
  - Red arrow is displayed when the difference positive and higher than 10% of the current value.
  - Green arrow is displayed when the difference is negative and higher than 10% of the current value.
Yellow arrow is displayed if the change is less than 10%.

Please note that the enclosed pictures show data from simulations which may result in values which would not appear in real system, e.g. negative energy consumption. Value NA means that Active energy counter value is not available for this device.
3.25. Home Tab

After clicking the Home tab the standard information widget is shown again.

![Home Tab](image)

Figure 42: Home Tab

3.26. Help Button

At bottom of left side, the Help button is located. When clicking the button this user manual will be displayed in a separate browser tab.

![Help Button](image)

Figure 43: Help Button
3.27. About Button

On the left side the About button is located. Here the information about the actual software version of the CMES can be found.

Such information should be provided along with any support request.

3.28. Number of Alarm/Trip

The Alarm/Trip counter indication provides a quick overview about any developing or pending critical issue in the plant.

- Orange: The Alarm counter indicates the number of devices of all integrated switchgear having at least one active alarm.
- Red: The Trip counter indicates the number of devices of all integrated switchgear having at least one active alarm.

3.29. Logoff

To close the web session, use the Logoff button in the top bar.

Figure 44: Logoff Button

Afterwards the following information is shown.

**CMES User Log-out successful**

Please close the web browser window (tab) to finalize the logout process.
3.30. CMES Language and other system settings

Different system settings can be changed by user inside the CMES system by using the system setting icon:

Following system parameters can be changed:

<table>
<thead>
<tr>
<th>Display Language</th>
<th>Display language can be selected from the supported languages provided in the drop-down menu. If a different language is selected and change is confirmed by user, the user interface is refreshed:</th>
</tr>
</thead>
</table>
| ![Display Language](image) | Language Changed  
The page has to be refreshed for the change to take effect. Do you want to continue? |

4. Appendix

4.1. Hardware and accessories

ABB Ability CMES uses edge computing. The required hardware is an industrial grade computer system which includes an SSD type hard disk for historical data storage. See also [1].

Table 4 lists the required hardware components.

<table>
<thead>
<tr>
<th>Component</th>
<th>Picture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Edge device</td>
<td><img src="image" alt="Edge device" /></td>
</tr>
<tr>
<td>UPS Battery</td>
<td><img src="image" alt="UPS Battery" /></td>
</tr>
<tr>
<td>UPS connection cable (1m)</td>
<td><img src="image" alt="UPS connection cable" /></td>
</tr>
</tbody>
</table>

Table 4: Edge hardware components

![Info symbol] To prevent data loss or a corrupted operating system, the Edge device needs always a connected UPS battery!

After a voltage drop of the 24VDC power supply the Edge device is running for five (5) minutes on battery supply before a Windows OS shut down is initiated automatically. A Windows OS shutdown can last up to 10 minutes, required to save all system and process data to the hard disk.

A TCP/IP connection to the plant and switchgear network must be available to access the web server inbuilt in the Edge device. The settings of the IP addresses must match the settings of the plant / switchgear network. Consult the network administrator to obtain correct information.

The Ethernet connector ETH2 on the Edge device is used to connect the device to MNS switchgear components, the MNS Digital Gateway(s) / MLink(s) in a system setup (see also Figure 1).
4.1.1. Connectors of the Edge device

The Edge device provides following interfaces:

![Image of Edge device interfaces](image)

1 IF Option 1  |  2 Eth2  |  3 Eth1  |  4 Power 24VDC  |  5 IF Option 2

Figure 45: Interfaces of Edge device

<table>
<thead>
<tr>
<th>Connector marking</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power 24VDC</td>
<td>24 VDC, max. 86 W</td>
</tr>
<tr>
<td>IF Option 1</td>
<td>Connector for UPS battery</td>
</tr>
<tr>
<td>ETH1</td>
<td>Ethernet 1 connector for Web browser</td>
</tr>
<tr>
<td>ETH2</td>
<td>Ethernet 2 connector for MNS Digital Gateway(s) / MLink(s)</td>
</tr>
<tr>
<td>IF Option 2</td>
<td>Ethernet 3 connector for connectivity to ABB cloud solutions</td>
</tr>
</tbody>
</table>

Table 5: Connectors of Edge device
4.1.2. Electrical Data

The required power supply for Edge device is described in following Table 6:

<table>
<thead>
<tr>
<th>Technical Data</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal Voltage</td>
<td>24 VDC ±25%, SELV(^1)</td>
</tr>
<tr>
<td>Power consumption</td>
<td>86W max.</td>
</tr>
<tr>
<td>Overvoltage category</td>
<td>EN 61131-2 II</td>
</tr>
<tr>
<td>Inrush current Type</td>
<td>6 A; max. 10 A for &lt;300 (\mu)s</td>
</tr>
<tr>
<td>Electrical isolation</td>
<td>Yes</td>
</tr>
<tr>
<td>Protected against reverse polarity</td>
<td>Yes</td>
</tr>
</tbody>
</table>

\(^1\) EN 60950 requirements must be observed. This device is only permitted to be supplied by a SELV / PELV power supply or with safety extra-low voltage (SELV) in accordance with EN 60950.

Table 6: Electrical data of Edge device

4.1.3. Technical Data

<table>
<thead>
<tr>
<th>Mechanical Data</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>3.75 kg</td>
</tr>
<tr>
<td>Dimensions H x W x D</td>
<td>270 mm x 91 mm x 255 mm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Environmental Data</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage Temperature</td>
<td>-20 to 60 °C</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>0 to 50 °C</td>
</tr>
<tr>
<td>Degree of Protection</td>
<td>IP 20</td>
</tr>
</tbody>
</table>

Table 7: Technical data of the Edge device
4.1.4. Power Supply Connector

The following table describes the power connector for the 24VDC supply voltage:

<table>
<thead>
<tr>
<th>Pin</th>
<th>Description</th>
<th>Power supply +24VDC</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+24VDC</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Functional Ground</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>-24VDC</td>
<td></td>
</tr>
</tbody>
</table>

Figure 46: Power Supply Connector

4.1.5. UPS Connector

The following table describes the power connector for the UPS battery:

<table>
<thead>
<tr>
<th>Pin</th>
<th>Description</th>
<th>4-pin male connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Temperature sensor</td>
<td>1 2 3 4</td>
</tr>
<tr>
<td>2</td>
<td>battery</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>0VDC</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>+24VDC</td>
<td></td>
</tr>
</tbody>
</table>

Figure 47: UPS connector
4.1.6. Status LED

The LEDs on the Edge device front plate indicate following device status:

<table>
<thead>
<tr>
<th>LED</th>
<th>Color</th>
<th>Status</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power</td>
<td>Green</td>
<td>On</td>
<td>Supply voltage Ok</td>
</tr>
<tr>
<td></td>
<td>Green</td>
<td>blinking</td>
<td>Device booted, internal battery status &quot;BAD&quot;</td>
</tr>
<tr>
<td>Red</td>
<td>On/ Blinking</td>
<td></td>
<td>Device faulty, for more details see APC910 user manual</td>
</tr>
<tr>
<td>Red/Green</td>
<td>Blinking</td>
<td></td>
<td>Device faulty, for more details see APC910 user manual</td>
</tr>
<tr>
<td>Yellow</td>
<td>On</td>
<td></td>
<td>Supply voltage not OK, system operating from UPS</td>
</tr>
<tr>
<td>HDD</td>
<td>Yellow</td>
<td>On</td>
<td>Indicates hard disk access</td>
</tr>
<tr>
<td>Link</td>
<td>Yellow</td>
<td></td>
<td>Not used</td>
</tr>
<tr>
<td>Run</td>
<td>Green/ Red</td>
<td></td>
<td>Not used</td>
</tr>
</tbody>
</table>

Figure 48: LEDs and Power / Reset Button
4.1.7. Power and Reset Button

The power and reset button is located behind the front plate of the Edge device. They have following function:

<table>
<thead>
<tr>
<th>Button</th>
<th>Action</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power</td>
<td>Press and Re-</td>
<td>Switches on the Edge device</td>
</tr>
<tr>
<td></td>
<td>lease</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Press and hold</td>
<td>Switches off the ATX power supply without shutting down the Edge device (data could be lost!)</td>
</tr>
<tr>
<td>Reset</td>
<td>Pushing the</td>
<td>Triggers a hardware and PCI reset. The Edge device is restarted (cold restart).</td>
</tr>
<tr>
<td></td>
<td>Button</td>
<td></td>
</tr>
</tbody>
</table>

Do not use the reset button and do not press and hold the power button.

A reset can result in loss of data or can corrupt the Windows OS.

To correctly shut down the system it is possible to disconnect the “Power 24VDC” connector (see Figure 25) and wait, until the UPS will shut down the PC (approx. 10-15min.).

Alternatively, lock on to Windows OS by Remote Desktop function and shut down the system by using the Windows OS shut down menu.

4.2. Software

All required software for the CMES is pre-installed on the Edge device. New versions or cyber security updates deployed by ABB can be installed as patches. Details are described in the respective CMES upgrade manual.

To access the web-based user interface of the CMES following internet browsers are supported and shall be installed on the client PC:

- Google Chrome™
- Firefox™
5. Troubleshooting and Maintenance

5.1. Troubleshooting

<table>
<thead>
<tr>
<th>Problem</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>No access to CMES web page</td>
<td>Check if ‘https://’ followed by the correct IP address has been entered in the address bar of the web browser.</td>
</tr>
<tr>
<td></td>
<td>Check if the Edge device is powered on and no fault is indicated by the front LEDs.</td>
</tr>
<tr>
<td></td>
<td>Ping the IP address of the Edge device</td>
</tr>
</tbody>
</table>

**Security Warning appears when loading the web page**

- Accept the untrusted certificate and continue with an unsecure marked connection (indicated in the browser by respective symbol): 
  
  🚸 https://1

- User can load an own certificate (e.g. issued by customer) into the MNS Digital Edge.

5.2. Maintenance

For details regarding maintenance of the Edge device check the device manual [1].
## Revision History

<table>
<thead>
<tr>
<th>Rev.</th>
<th>Page</th>
<th>Change Description</th>
<th>Date / Initial</th>
</tr>
</thead>
<tbody>
<tr>
<td>M0204</td>
<td>all</td>
<td>Initial release</td>
<td>2019-06-25 ELDS/FS</td>
</tr>
<tr>
<td>M0205</td>
<td>some</td>
<td>Update for release 2.1</td>
<td>2019-11-04 ELDS/MM</td>
</tr>
</tbody>
</table>