User Manual

This document describes the programming interface for the Automation Controller. The software programming interface is embedded in the Automation Controller and requires a web browser. Pre-programming and configuration cannot be performed without an Automation Controller product.
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Warnings

Read through the following instructions carefully and familiarise yourself with the device prior to installation, operation and maintenance. The warnings listed below can be found throughout the documentation and indicate potential risks and dangers, or specific information that clarifies or simplifies a procedure.

The addition of a symbol to “Danger” or “Warning” safety instructions indicates an electrical danger that could result in serious injuries if the instructions are not followed.

This symbol represents a safety warning. It indicates the potential risk of personal injury. Follow all safety instructions with this symbol to avoid serious injuries or death.

![DANGER]

DANGER indicates an imminently hazardous situation that will inevitably result in serious or fatal injury if the instructions are not observed.

![WARNING]

WARNING indicates a possible danger that could result in death or serious injuries if it is not avoided.

![CAUTION]

CAUTION indicates a possible danger that could result in minor injuries if it is not avoided.

![NOTICE]

NOTICE provides information about procedures that do not present any risk of physical injury.

Further information

The information provided must be complied with, otherwise program or data errors may occur.

Additional information is provided here to make your work easier.
Depictions in this document

Style and text features used

<table>
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<th>Meaning</th>
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<tbody>
<tr>
<td>[F6]</td>
<td>Keys on the keyboard</td>
</tr>
<tr>
<td>[Ctrl] + [N]</td>
<td>Press both keyboard keys at the same time</td>
</tr>
<tr>
<td><strong>Configurator</strong></td>
<td>Software module (Start page)</td>
</tr>
<tr>
<td></td>
<td>Click the button to open the software module.</td>
</tr>
<tr>
<td><strong>Objects</strong> tab</td>
<td>Tab</td>
</tr>
<tr>
<td></td>
<td>Click the tab to open its window. The window contains elements like lists, buttons, editors. Some windows are divided into several parts.</td>
</tr>
<tr>
<td><strong>Objects</strong> list</td>
<td>List</td>
</tr>
<tr>
<td></td>
<td>Click the tab (Objects) to display the list.</td>
</tr>
<tr>
<td><strong>Event</strong> column</td>
<td>Column</td>
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<tr>
<td><strong>Add new object</strong> button</td>
<td>Click the button to open a window, activate/deactivate a function or to display parameters and values.</td>
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<tr>
<td><strong>Objects</strong> tab</td>
<td>Parameters</td>
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<td>Parameters</td>
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</tr>
<tr>
<td><strong>Edit object</strong></td>
<td>Pre-set values in the software are highlighted in bold in the tables.</td>
</tr>
<tr>
<td><strong>Application</strong></td>
<td>Composed address in the Name column in the Objects list</td>
</tr>
<tr>
<td><strong>Add new object</strong> button</td>
<td>Composed address in the Group address column of the Objects list</td>
</tr>
<tr>
<td><strong>Operation chapter</strong></td>
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<td>LUA script</td>
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<td><strong>Project-Hostname_yyyy_mm_dd.hh.mm.tar.gz</strong></td>
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C-Bus operation

Requirements for safe operation
Knowledge of the basic rules for operating a computer and a browser such as Google Chrome, Safari or Firefox is a prerequisite for operation.

Knowledge of C-Bus operation is required. This includes using the C-Bus Toolkit software to select and commission C-Bus applications for export to a CGL file.

To use client-server communication with Modbus or BACnet, knowledge of these systems is required.

Special features of the C-Bus Toolkit
The C-Bus Toolkit Software enables configuration, exporting and importing of a C-Bus project.

Appropriate C-Bus Toolkit version
Use the current version of C-Bus Toolkit (1.15.x or higher). The included drivers are needed to access the Automation Controller via USB-B.

Firmware
It is recommended to update the firmware to install the latest features, security updates and bug fixes.

https://www.clipsal.com/Trade/Support/Software
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1 For your safety

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- It is illegal for persons other than an appropriately licensed electrical contractors or other persons authorised by legislation to work on the fixed wiring of any electrical installation.
- To comply with all safety standards, the product must be used only for the purpose described in this instruction and must be installed in accordance with the wiring rules and regulation in the location where it is installed.
- There are no user serviceable parts inside the product.

Failure to follow these instructions will result in death or serious injury.

CAUTION

EQUIPMENT DAMAGE HAZARD

- Install the device according to instructions in the printed Quick Start Guide and in this document.
- Pay attention to the specifications and wiring diagrams related to the installation.
- Do not use this product for any other purpose than specified in the printed Quick Start Guide and in this instruction.

Failure to follow these instructions can result in minor injuries or equipment damage.

1.1 Qualified personnel

This document is aimed at personnel responsible for setting up, installing, commissioning and operating the device and the system in which it is installed. Personnel must possess basic knowledge in the following areas:

- Connection to installation networks
- Connecting several electrical devices
- Laying electric cables
- Connecting and establishing C-Bus networks and other used Building Management System (BMS) like BACnet or Modbus
- Commissioning C-Bus installations and other used BMS.

Detailed expertise gained by means of training in the C-Bus system and other used BMS is a prerequisite.
2 General overview

This document describes the programming interface for the Automation Controller. The software programming interface is embedded in the Automation Controller and requires a web browser. Pre-programming and configuration cannot be performed without an Automation Controller.

Access the embedded web server via the Ethernet or USB type B connections on the Automation Controller (see Getting started on page 25).

2.1 Access

Access the embedded web server via the Ethernet or USB type B connections on the Automation Controller. The chapter Getting started on page 25 provides information about administrator access, saving data, setting date and time, firmware upgrade and monitoring the Automation Controller.

The default IP address for the ethernet connection is 192.168.0.10. The default IP address for the USB type B connection is 192.168.254.10. The administrator username is admin and the default password is admin.

2.2 Modules of the web server

The following modules of the web server can be accessed from the Start page:

- PC/Tablet Visualization: user module
- Smartphone Visualization: user module
- Scheduler: user module
- Trends: user module
- Configurator.

The following screen shot shows the buttons of the Start page:

![Button Screenshot]

Administrators can configure the four user modules via the Configurator. Once visualization pages, schedulers or trend logs have been configured, the result can easily be viewed. These four modules can be accessed by end users.
2.3 Modules for the end user

The following images show examples of pages for each user module.

Page in the **PC/Tablet Visualization** user module:

![Meeting Room](image1)

Page in the **Smartphone Visualization** user module:

![Smartphone Visualization](image2)

Page in the **Scheduler** user module:

![Scheduler](image3)
Page in the *Trends* user module:

2.3.1 **Configurator**

Access the configurator from the *Start* page. Tabs on the configurator page provide access to different aspects of configuration. The configurator main page can:

- Access general and visualization configuration
- Open the System page to access network, update and reset functions, and status information.

**Utilities** tab on the *Configurator* page:

**Objects**

Objects are the basis of all communication via the Automation Controller and represent different C-Bus applications for sending and receiving values. Objects can also be used for visualization, scripting, exchange with BACnet IP or Modbus and the control of outputs and inputs. The chapter *C-Bus objects on page 36* describes different applications, how to add and edit objects and how to exchange applications configured with the C-Bus Toolkit.
Objects are used in the following steps of configuration.

**Objects** tab with **Object** list on with 2 C-Bus objects:

<table>
<thead>
<tr>
<th>Name</th>
<th>Group address</th>
<th>Event sc...</th>
<th>Current value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local/Measurement/Temp/2</td>
<td>0/228/25/2</td>
<td></td>
<td>24 °C</td>
</tr>
<tr>
<td>Local/Lighting/Room 2</td>
<td>0/66/2</td>
<td></td>
<td>255 - 100%</td>
</tr>
</tbody>
</table>

**Tag map**

In addition to the objects list, a tag map is available (see Tag map on page 43). In this map, object names (tags) can be edited and used in other steps of configuration.

**Tag map** with network, application, group and level:

**Scheduler and trends**

Schedulers provide control of different building functions based on date and time (see Schedulers on page 109). Trend logs (data logging) store the selected data and compare that data over different time periods (see Trend logs on page 113).

Objects can be added in the configurator. Users can access schedulers or trends from the **Start page** or from a visualization. (Images of visualization pages are shown on page 15.)

**Trend logs** tab with two objects for logging:

<table>
<thead>
<tr>
<th>Name</th>
<th>Object</th>
<th>Log type</th>
<th>Decimal p...</th>
<th>Trend res...</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy</td>
<td>Local/Measure...</td>
<td>Counter</td>
<td>2</td>
<td>1 hour</td>
<td>180 days</td>
</tr>
<tr>
<td>Voltage</td>
<td>Local/255/254...</td>
<td>Absolute value</td>
<td>2</td>
<td>1 hour</td>
<td>180 days</td>
</tr>
</tbody>
</table>

**Scenes**

Scenes allows changes to multiple room functions at the touch of a button. For example, use a scene to dim the room lighting to a specific value, move the blinds into the desired position and switch on the power outlets.

Scenes configured in the Automation Controller can be controlled from a visualization page, the scheduler, or from other C-Bus devices such as push buttons.

The basis of scene communication is a **trigger group** (see Add new trigger group on page 43). The chapter **Scenes on page 117** describes the configuration of scenes and all components (objects) linked with those scenes.
When configuring scenes on a visualization page or schedulers, add a trigger group object (Objects on page 136 and Schedulers and events on page 110).

**Scenes** tab with one trigger group and three scenes:

<table>
<thead>
<tr>
<th>ID</th>
<th>Name</th>
<th>Group address</th>
<th>Action selector</th>
<th>Keyword</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Video</td>
<td>Local/Scenes/Trigger Group 1 (0/202/1)</td>
<td>Video (1)</td>
<td>Video</td>
</tr>
<tr>
<td>2</td>
<td>Day</td>
<td>Local/Scenes/Trigger Group 1 (0/202/1)</td>
<td>Day (2 - 1%)</td>
<td>Day</td>
</tr>
<tr>
<td>3</td>
<td>Night</td>
<td>Local/Scenes/Trigger Group 1 (0/202/1)</td>
<td>Night (3)</td>
<td>Night</td>
</tr>
</tbody>
</table>

**Visualization**

The Automation Controller provides an embedded **Smartphone** and **PC/Tablet** visualization (see Modules of the web server on page 15).

The elements of a visualization, such as objects, can be configured on visualization plans (pages) that can be accessed on both visualization modules. The **Smartphone Visualization** provides a list with control objects and links. The **PC/Tablet Visualization** provides additional elements such as images and graphs.

The chapter Visualization on page 120 describes the main steps of configuration, how to create a structure, how to use the plan editor and how to configure different elements such as control types for C-Bus applications.

**Visualization** tab with plan editor and structure:

**User access**

The Automation Controller is designed for a maximum of 50 users for visualization. The Wiser™ for C-Bus® Automation Controller is limited to a maximum of 8 users.

The chapter User access on page 163 describes how to configure individual access rights. Access can be given without restriction for all users, with a common PIN code for all users, or with individual user logins. Different user access levels can be configured for visualization pages, schedulers and trends.

**User** window with selection of pages for a user (opened on the User Access tab):
Scripting
A script is a small, non-compiled program written in the scripting language LUA. Event-based scripts are commonly used. In this case, define conditions and actions to perform when the object values meet certain criteria.

The chapter Scripting on page 150 provides an introduction to different types of scripts, script editor usage, the script commands available in the helpers tab, common functions like sending emails, tools and alerts. Find script examples in Inputs and Outputs on page 167 and Modbus settings using scripts on page 186.

Script editor with a script example (opened from a list on the Scripting tab):

CNI Functionality
CNI is enabled by default on port 10001. When enabled, the Automation Controller can act as a C-Bus network interface for commissioning and maintenance.

The CNI functionality in the Automation Controller can be enabled/disabled and the port can be changed, if desired, through the Automation Controller’s configuration page.

In toolkit configure connection details for each C-Bus network are as follows:

- Type: CNI
- Address: IP address
- The default IP address of the Automation Controller is 192.168.0.10 (or 192.168.254.10 if connected using the USB-B interface)
- Port: 10001.

2.3.2 Inputs and Outputs
The Automation Controller is equipped with a LED driver output, a relay output and a digital input. The chapter Inputs and Outputs on page 167 describes how to control these interfaces via scripts.

The LED and relay output can be controlled via C-Bus applications. The digital input of the Automation Controller is compatible with either a potential-free contact or a monitored cable using End of Line Resistance.
General overview

Configuration of the Automation Controller

LED driver output A, relay output B and digital input C:

USB-A

A USB type A connector in the Automation Controller provides connection with USB expansion devices (see USB-A on page 172). FAT and FAT32 file system formatted flash drives can be attached. Data transmission is performed via script configuration commands.

Ethernet

The Automation Controller includes an RJ45 interface for 10/100 Base-T UTP Ethernet. Use the Ethernet connection to integrate IP devices (see Camera on page 148), web services (see NTP client/server on page 30) and additional building management functions (see Modbus on page 177 and BACnet on page 194). C-bus networks configured with the C-Bus Toolkit software can be commissioned and maintained in online mode via the configured Ethernet connection of the Automation Controller (on page 38).
RS-232
The RS-232 serial interface is one of the most widely used communication standards for data transmission between two devices over short distances.

Interaction with other equipment is possible via the isolated RS-232 interface in the Automation Controller (see RS-232 on page 174). The script configuration commands are listed in the Helpers tab of the script editor.

RS-232 interface connections: Common, Receive, Transmit.

RS-485
The Automation Controller has an isolated RS-485 interface, which can be used for serial data transmission between two or more devices (see RS-485 on page 176).

Modbus
Modbus is an open standard for client/server communication. The client sends a request message and the addressed device (the server) sends a response message. The values of a server are saved in registers which can be accessed by the client. In Modbus RTU mode, the client is usually referred to as the master and the server as the slave.

The Automation Controller supports Modbus RTU serial communication via the RS-485 interface and Modbus TCP communication via the RJ45 Ethernet interface. It has been tested to conform to Modbus over serial line standards at the Modbus-SL Interoperability test lab in Marktheidenfeld.

By Modbus specification a serial line is limited to 31 slaves. The Network Automation Controller is not limited but designed for 31 slaves. The Wiser for C-Bus Automation Controller is limited to a maximum of 6 Modbus slaves.

Using the preinstalled profiles, Modbus devices can be easily configured (see Configure preinstalled profiles on page 180). The devices are displayed in a list, with links to Modbus registers with objects of the C-Bus application 250 - User Parameter.
Principle of Modbus RTU communication with the Automation Controller:

* By Modbus specification a serial line is limited to 31 slaves.

Principle of Modbus TCP communication with the Automation Controller:

**BACnet**

BACnet is designed to allow communication with building automation and control systems for applications such as heating, ventilation, air conditioning control, lighting control, access control, fire detection systems and their associated equipment. The BACnet protocol provides exchange information for building automation devices, regardless of the particular building service they perform.

The Automation Controller supports the BACnet IP format using the RJ45 Ethernet connector.

The Automation Controller can act only as a BACnet server (not as a client). The Automation Controller serves data which can be read by BACnet client devices (such as Buildings Management Systems) and BACnet client devices can write data to the server.

The Automation Controller has been certified by BACnet Testing Laboratories (BTL) as a BACnet Application Specific Controller (B – ASC).

The chapter BACnet on page 194 describes how to configure the Automation Controller as a BACnet server. This is done by activating the object export function and configuring BACnet communication.

The Network Automation Controller is designed for a maximum of 500 BACnet data points. The Wiser™ for C-Bus® Automation Controller is limited to a maximum of 50 BACnet data points.
**Objects** tab with objects available for BACnet selected in the **Export** column:

![Objects tab example](image)

### 2.3.3 Advanced network functions

The chapter [Advanced network functions on page 198](#) describes network settings, utilities and remote functions.

Network utilities (opened in the **Services** tab of the **System** page):

![Network utilities](image)

### 2.4 Limitations of the Automation Controller

The Network Automation Controller is designed for a maximum of:

- Objects (C-Bus and internal): 2000*
- Users for visualization: 50* 
- Modbus devices: 31* 
- BACnet data points: 500*.

* Limits not physical but dependent on maximum CPU load.

The Wiser for C-Bus Automation Controller is designed for a maximum of:

- Objects (C-Bus and internal): 2000*
- Users for visualization: 8
- Modbus devices: 6
- BACnet data points: 50.

* Limits not physical but dependent on maximum CPU load.

The bottom bar of the **Configurator** page displays information about the processor load, the used memory and the status of C-Bus. For more detailed information about processor load, used memory and partitions, see [Status of the Automation Controller on page 33](#).
3 Getting started

The Automation Controller is programmed via its embedded web server. Access the web server using a Google Chrome, Safari or Firefox web browser. When accessing the web server, the start page is displayed. From the start page, access the configurator and the following user modules:

- PC/Tablet Visualization
- Smartphone Visualization
- Scheduler
- Trends.

As administrator, configure the modules via the configurator and control user access to these four modules (see User access on page 163).

The following screen shot shows the buttons of the Start page:

Tabs on the configurator page give access to the configuration options. From the main page of the configurator, allows access to general and visualization configuration as well as the system page. From the system page, access network, update and reset functions, and status information.

3.1 Access to the Controller

Access the embedded web server of the Automation Controller using a web browser.

Use either Google Chrome, Safari or Firefox. No other browser is supported.

Physical connection between the Automation Controller and the PC hosting the browser can be established via either:

- Ethernet connection, or
- USB Type B connection.
3.1.1 Access via Ethernet and IP address

**Preconditions**
- The Automation Controller will be supplied with an external 24 V DC regulated power supply (10 W min.) or USB (5 V, 500 mA).
- The default IP address is: 192.168.0.10.

**Steps**
1. Connect an Ethernet cable to the PC.
2. Change the IP address of the computer to the same range, e.g. 192.168.0.9; subnet mask 255.255.255.0.
3. Start Google Chrome, Safari or Firefox and go to 192.168.0.10.
4. Click the **Configurator** button.
5. Enter the username. The default username is: admin.
6. Enter the password. The default password is: admin.

3.1.2 Access via USB Type B front connection and IP address

**Preconditions**
- The Automation Controller be supplied with an external 24 V DC regulated power supply (10 W min.) or USB (5 V, 500 mA).
- The IP address is 192.168.254.10.
- USB drivers are included with the latest C-Bus Toolkit installation. Use the most recent version (1.15 or higher) and install the full package including USB drivers.

Prior to first installation, accept installation of USB drivers for the Automation Controller.

**Steps**
1. Connect the USB-B port on the Automation Controller to a USB port on the PC. The PC is given a DHCP IP address in the range of 192.168.254.1 – 192.168.254.9.
2. Start Google Chrome, Safari or Firefox and go to 192.168.254.10.
3. Click the **Configurator** button.
4. Enter the username. The default user name is: admin.
5. Enter the password. The default password is: admin.

The USB connection to the network adaptor is independent of the Ethernet connection and so both can be used concurrently.

3.1.3 Access via hostname

Access via *hostname* is possible when a network router is present and the Automation Controller is properly configured. See [Change IP settings of the Ethernet interface on page 27](#).

The default hostname is the product part number:
- LSS5500NAC for the Network Automation Controller
- LSS5500SHAC for the Wiser™ for C-Bus® Automation Controller.

Access example: [http://LSS5500NAC.local](http://LSS5500NAC.local)

The hostname is used for identification of Automation Controller in installation as well as in files names (e.g. backup).
Change the hostname on the System page.
Path: Configurator → Utility tab → System button → System tab → Hostname.

3.2 Change password
Change the default password on the System page.
Path: Configurator → Utility tab → System button → System tab → Admin Access

3.3 Direct access to a module
Access a module directly from the browser by using the module’s address.

Table 1: Module addresses

<table>
<thead>
<tr>
<th>Page/Module</th>
<th>Address (with default IP address)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PC/Tablet Visualization</td>
<td><a href="http://192.168.0.10/scada-vis">http://192.168.0.10/scada-vis</a></td>
</tr>
<tr>
<td>Smartphone/Visualization</td>
<td><a href="http://192.168.0.10/scada-vis/touch">http://192.168.0.10/scada-vis/touch</a></td>
</tr>
<tr>
<td>Scheduler</td>
<td><a href="http://192.168.0.10/scada-vis/schedulers">http://192.168.0.10/scada-vis/schedulers</a></td>
</tr>
<tr>
<td>Trends</td>
<td><a href="http://192.168.0.10/scada-vis/trends">http://192.168.0.10/scada-vis/trends</a></td>
</tr>
<tr>
<td>Start page</td>
<td><a href="http://192.168.0.10/home">http://192.168.0.10/home</a></td>
</tr>
<tr>
<td>Configurator</td>
<td><a href="http://192.168.0.10/scada-main">http://192.168.0.10/scada-main</a></td>
</tr>
</tbody>
</table>

When accessing a module in this way, provide the username and password. Settings for users are described in the chapter User access on page 163.

3.4 Change IP settings of the Ethernet interface
Change the IP settings on the System page.
Path: Configurator → Utility tab → System button → Network tab → Interfaces → IP address.
Click the IP address to open the window Interface eth0.

Table 2: IP settings

<table>
<thead>
<tr>
<th>Protocol</th>
<th>Static IP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Static IP address (default is 192.168.0.10).</td>
</tr>
<tr>
<td></td>
<td>DHCP</td>
</tr>
<tr>
<td></td>
<td>DHCP protocol used to get IP configuration, e.g. from a router or gateway with DHCP server.</td>
</tr>
<tr>
<td>IP address</td>
<td>Enter a static IP address.</td>
</tr>
<tr>
<td>Network mask</td>
<td>Network mask (default is 255.255.255.0).</td>
</tr>
<tr>
<td>Gateway IP</td>
<td>IP address of the router or gateway.</td>
</tr>
<tr>
<td>DNS server 1</td>
<td>Primary DNS server IP address (resolution of address names). In general set the IP address of the network router.</td>
</tr>
<tr>
<td>DNS server 2</td>
<td>Secondary DNS server IP address. Visit public-dns.info for a list of public DNS servers.</td>
</tr>
<tr>
<td>MTU</td>
<td>Maximum transmission unit: The largest size of the packet which can be passed in the communication protocol (default is 1500).</td>
</tr>
</tbody>
</table>
Getting started

Configuration of the Automation Controller

• Add new IP settings to personal documentation before applying the changes. When selecting the DHCP, note the MAC address of the network interface. This helps to identify the IP address set by the DHCP server. It is recommended to test the access via hostname (on page 26) before changing the IP settings.

• With USB-B, it provides independent local access to the Automation Controller. The linked IP address can not be changed from its default (192.168.254.10).

• When changes are made, the Apply changes button appears in the top-right corner of the window (see A in the next figure). Click this button to apply the changes—the Automation Controller will automatically reboot. Once the reboot process is complete, use the new IP address to access the Automation Controller.

![Interfaces table]

<table>
<thead>
<tr>
<th>Name</th>
<th>MAC address</th>
<th>IP address</th>
<th>MTU</th>
<th>TX Bytes</th>
<th>RX Bytes</th>
<th>Errors</th>
</tr>
</thead>
<tbody>
<tr>
<td>eth0</td>
<td>00:17:DD:09:00:0B</td>
<td>192.168.0.10</td>
<td>1500</td>
<td>0 B</td>
<td>0 B</td>
<td>0 / 0</td>
</tr>
</tbody>
</table>

A  Apply changes button

B  MAC address

C  IP address.

3.5  Reset and Save Data

This section describes how the the Automation Controller can be reset, and data backed-up and restored.

3.5.1  Save data during configuration

To save data during configuration:

Path: Configurator → Sync project data button.

Click the Sync project data button on the bottom bar of the configurator:

![Sync project data button]

The project will be immediately synchronised to the microSD card. If power is removed from the Automation Controller without pressing this button, any configuration change may be lost.

3.5.2  Backup and Restore

All objects, trends, logs, scripts, icons, images, backgrounds and visualizations are backed up.

Path: Configurator → Utility tab.

Backup regularly and before the following functions are executed:

• Factory reset
• Clean-up selected functions
• Installation of updates
• Firmware update.
Default file name
Project-Hostname_yyyy_mm_dd.-hh.mm.tar.gz

The file name includes the device time and date when the backup is made.
The file name can be changed as desired (*.tar.gz).

3.5.3 Backup
Click the Backup button.

The following settings are not backed up:
• System configuration
• Network settings
• Passwords
• C-Bus settings.

Ensure that the backup size is no greater than 32 MB as this is the maximum restore size.

3.5.4 Restore
① Click the Restore button.
② Select the file and save.

• Do not switch off the Automation Controller during the restore procedure. The Automation Controller will automatically reboot.
• Clean the browser cache after a restore. Use the settings of the browser or the short cuts [Ctrl] + [N] or [Ctrl] + [F5].
• Backup files >32 MB cannot be restored.

3.5.5 Reboot or hardware reset
Perform a reboot or hardware reset via either the configurator or buttons on the Automation Controller.

Table 3: Reboot options

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
<th>Access</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reboot</td>
<td>Forces running processes to stop and then reboots the Automation Controller.</td>
<td>Configurator → Utility tab → System button → System tab → Reboot</td>
</tr>
<tr>
<td>Shutdown</td>
<td>System shuts down and data is saved. To run the system, power must be switched off and back on again or switching on via Hardware Reset is possible.</td>
<td>Configurator → Utility tab → System button → System tab → Shutdown</td>
</tr>
<tr>
<td>Hardware Reset</td>
<td>Power switches off and back again. Data is not saved. Use to restart an Automation Controller that has shut down.</td>
<td>HR</td>
</tr>
</tbody>
</table>
• Use the *Shutdown* function to power off the Automation Controller. The database is saved.

• Use the *Sync project data* function before performing a Hardware Reset to avoid the loss of data (the database is not saved during a Hardware Reset). See *Reset/Clean-up on page 30.*

• If the Automation Controller has locked up and does not respond to the Software Reset Button, the Hardware Reset can be used. Unsaved data will be lost.

### 3.5.6 Reset/Clean-up

It is possible to delete the following items:

- Objects
- Object logs
- Object and high priority logs
- Alerts
- Logs
- Error logs
- Script storage.

If *Objects* is selected, they will be deleted from the visualization part as well.

Perform a back up before using this function. See *Backup on page 29.*

Path: *Configurator → Utility* tab → *Reset/clean-up* button.

### 3.5.7 Factory reset

Perform a factory reset via either the configurator or the software reset button on the Automation Controller.

- Perform a back up before using the *Factory reset* function.
- IP settings and security credentials are set to defaults:
  - IP: 192.168.0.10
  - User name: admin
  - Password: admin

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
<th>Access</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factory Reset</td>
<td>Deletes all configurations and resets to the factory default settings.</td>
<td><em>Configurator → Utility</em> tab → <em>Factory reset</em> button</td>
</tr>
</tbody>
</table>

Table 4: Factory reset options

3.6 Set Date and time

#### 3.6.1 NTP client/server

By default, the Automation Controller gets its date and time from remote network time protocol (NTP) servers. On the system page, configure the NTP client for the Automation Controller.

Path: *Configurator → Utility* tab → *System* button → *Services* tab → *NTP client/server.*
The following remote servers are selected by default:

- Server 1: 0.schneider.pool.ntp.org
- Server 2: 1.schneider.pool.ntp.org
- Server 3: 2.schneider.pool.ntp.org
- Server 4: 3.schneider.pool.ntp.org

Enable/disable the default servers and edit other servers.

Enable the sending of the local server status so that the Automation Controller can act as a local time server for other Automation Controllers.

To use this function, enter the IP address of the Automation Controller in the NTP server/client settings of other Automation Controllers.

- After enabling the local time server function on the Automation Controller, perform a reboot. See Reboot or hardware reset on page 29.
- Check if the time server can be accessed. Ping the NTP server via the Network utilities. (Configurator → Utility tab → System button → Status tab).

### 3.6.2 Date and time

Path: Configurator → Utility tab → Date and time button. Edit the following parameters.
**Getting started**

**Configuration of the Automation Controller**

- **Get from system** - Synchronise the Automation Controller to the date and time zone from the connected PC.

- **Timezone** - Select the correct time zone. Even if the NTP client is enabled, check that the time zone is correct.

- **First day of week** - This option changes calendar views, e.g. calendars displayed in schedulers.

- **Latitude and Longitude** - Sunrise and sunset are calculated from the selected time zone. Specify exact sunrise and sunset times for your location by entering the location latitude and longitude. Sunrise and sunset can be used for time functions.

**3.7 Updates and Firmware upgrade**

It is recommended to update the firmware to install the latest features, security updates and bug fixes.

**3.7.1 Install updates**

Updates provide a way to install improvements and new features to the Automation Controller. Updates may require a particular firmware version to be installed. See [Upgrade firmware on page 32](#).

Path: **Configurator** → **Utility** tab → **Install updates** button.

Update files have the file extension *.lmup (LMUP).

Click the **Install updates** button and select the file. The Automation Controller reboots after a successful installation.

- **Do not switch off** the Automation Controller during the installation.
- **Clean** the browser cache after the installation. Use the settings in your browser or the short cuts [Crtl] + [R] or [Crtl] + [F5].

**3.7.2 Upgrade firmware**

Scan the QR code on your Automation Controller using the Facility hero application to get information specific to your device. Download the Facility hero application from Google Play or from iTunes.

**Firmware version**

Check the firmware version installed in the Automation Controller before updating.

The firmware version is displayed in the left corner of the **Configurator** page (e.g. v1.6).

**Version: 1.6**

**Installation**

Install a firmware upgrade via the **System** page.

Path: **Configurator** → **Utility** tab → **System** button → **System** tab → **Upgrade firmware**.
The file name is: *.img

Click **Upgrade Firmware** and select the file.

A firmware upgrade can take up to several minutes. During the upgrade, the device will not respond but will reboot several times.

- **Do not switch off** the Automation Controller during the installation.
- Clean the browser cache after the installation. Use the settings in your browser or the short cuts [Ctrl] + [N] or [Ctrl] + [F5].

### 3.8 Status of the Automation Controller

Information about the processor load, the used memory and the status of C-Bus is displayed on the bottom bar of the **Configurator** page:

![CPU/IO: 0.59 0.59 0.61, Memory: 109MB free, C-Bus: Offline, C-Bus status, Sync project data](image)

Information about the processor load, memory, partitions and System log is shown on the **System** page.

Path: **Configurator** → **Utility** tab → **System** button → **Status** tab → **System status**.

System information is shown in **Error logs** and **Alerts** tab of the **Configurator**.

### 3.8.1 Processor load

The power LED on the Automation Controller blinks at a rate proportional to the processor load:

- <1 green
- >1 and <5 black (to be precise)
- >5 red (to be precise).

The processor load is also displayed on the bottom bar of the **Configurator** page, under the heading CPU/IO. The processor load numbers (examples 0.59, 0.59, 0.61 shown above) represent averages over progressively longer periods of time. Lower numbers indicate better performance.

If the load exceeds 0.70 for the 5 min or 15 min average, check the possible reasons, which may include:

- Number of active users accessing the visualization
- Number and resolution of images used for visualization
- Number of objects in the Objects list
- Frequency of updating objects:
  - Delta for sending a new value
  - Delta for change on the client side (BACnet COV setting)
  - Cycle time for sending
  - Polling cycle of the master/client – slave/server communication (Modbus).
- Number of active scripts:
  - Sleep time interval (resident scripts with sleep interval 0 have high impact on CPU load)
  - Using resident scripts instead of scheduled scripts.
- Logging policy (e.g. log all new objects). Excessive object logging degrades performance.
### 3.8.2 Memory

The used system memory is displayed on the right-hand side bottom bar of the *Configurator* page.

Memory will display in colour to indicate memory used:
- >60 MB available in green
- >30 MB < 60 MB in black (to be precise)
- <30 MB in red.

To view detailed memory usage: *Configurator* > *System* > *Status* > *System Status* > *Memory* tab.

In the case of memory overflow, a pop-up will appear every 10 seconds until trends or scripts are cleared. Bus sniff will be turned off and disabled until the pop-up is cleared.

### 3.8.3 Partitions

View the values of total, used and free space for storage partitions on the *System page* *Partitions* tab: *Configurator* > *System* > *Status* > *System Status* > *Partitions* tab. For example, check the free space for data on the MicroSD card (see: /data in the partition table).

### 3.8.4 Bus Status

The status of C-Bus is displayed in the bottom bar of the *Configurator* page:

<table>
<thead>
<tr>
<th>Status</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>C-Bus powered</td>
<td>Online</td>
</tr>
<tr>
<td>No C-Bus power</td>
<td>Offline</td>
</tr>
</tbody>
</table>

When C-Bus is connected and a clock is running, the status is *Online*. Otherwise, *Offline* is displayed. See *Sniffer function on page 105*.

C-Bus must be physically connected via one of the C-Bus RJ45 connectors.

A *C-Bus status* button is located on the bottom bar of the *Configurator* page. Click this button to get detailed information about C-Bus status.
C-Bus status is also displayed by the C-Bus LED on the Automation Controller. The C-Bus LED indicates the following states:

<table>
<thead>
<tr>
<th>State</th>
<th>Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>C-Bus powered and clock running</td>
<td>Green</td>
</tr>
<tr>
<td>C-Bus voltage warning</td>
<td>Green flashing</td>
</tr>
<tr>
<td>No C-Bus power</td>
<td>Off</td>
</tr>
</tbody>
</table>

Test C-Bus online and offline status on the **Objects** tab. See *Edit and test objects* on page 104.

### 3.8.5 Error logs

Error logs are displayed in the **Error log** tab of the **Configurator** page. Errors messages come from the system. Errors in the configuration or in a running script can be detected.

#### Example Modbus slave configuration

In this example, a Modbus slave/server is configured but does not respond, e.g. the device is not connected to the Modbus line.

Click the line to get the message:

![Error log example](image)

#### Example script

In this example, a lighting channel *(local network/Lights 1/room 99)* does not respond, e.g. the address *Room 99* does not exist in **Objects** list or **Tag map**.

![Example script](image)

### 3.8.6 Alerts

System messages and alert information for user-edited scripts are displayed in the **Alerts** tab of the **Configurator** page. See *Alerts* on page 161.

#### Example

In this example, system start alerts and a user-edited temperature alert are shown.

<table>
<thead>
<tr>
<th>Alert time</th>
<th>Script name</th>
<th>Message</th>
</tr>
</thead>
<tbody>
<tr>
<td>09.02.2017 01:00:10</td>
<td>Event for 0/225/5/1</td>
<td>Temperature too high, 36.0 °C</td>
</tr>
<tr>
<td>08.02.2017 08:11:35</td>
<td>system</td>
<td>System start</td>
</tr>
</tbody>
</table>
4  C-Bus objects

4.1  Overview

The objects in the Objects list are the basis of all communication via the Automation Controller. These objects represent different C-Bus applications for sending and receiving values. In the case of the Lighting application, the Target level and the Ramp rate are sent. The objects can also be used for visualization and scripting.

With the special application 250 - User Parameter, values can be used for visualization or scripting. Note that user parameters are not exported to a C-Bus Toolkit project.

The application User Parameter must be used for the connection to Modbus register values (see Modbus Mapping on page 183). By default, the Automation Controller works as a Modbus client/master.

Objects can be exported for communication with BACnet (see Object export on page 195). The Automation Controller can share its BACnet information with a BACnet client (such as a BACnet IP-BMS client).

C-Bus objects can be imported, manually added or automatically detected and displayed.

In addition to the Objects list, a Tag map list is available. When importing or adding new objects, the corresponding entry is available in the tag map. In the tag map, change all names (tags) and add new applications, groups and levels. See Tag map on page 43.

4.2  Properties

All added or imported objects are visible in the Objects list. If activated, new objects are automatically displayed.

All objects in the list have a unique composed address with 3 or 4 entries. These addresses are visible in the Group address column. All objects in this column are addressed as (network address)/(application identifier)/ + object information. The network address for the local network of the Automation Controller is 0.

For the following examples, refer to the previous screenshot.

Example: Lighting (0/56/2)  

<table>
<thead>
<tr>
<th>Name</th>
<th>Group address</th>
<th>Current Value</th>
<th>Keywords</th>
<th>Set value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local/Lighting/Main</td>
<td>0/56/2</td>
<td>128</td>
<td>Light_Main</td>
<td>14.01....</td>
</tr>
<tr>
<td>Local/Enable/Enable</td>
<td>0/203/1</td>
<td>ON (25...)</td>
<td>Enable</td>
<td>14.01....</td>
</tr>
<tr>
<td>Local/Measurement/</td>
<td>0/228/53</td>
<td>25.5 °C</td>
<td>Basement</td>
<td>14.01....</td>
</tr>
<tr>
<td>Local/Scenes/Scene</td>
<td>0/202/1</td>
<td>Night (3)</td>
<td>All_12</td>
<td>12.01....</td>
</tr>
</tbody>
</table>

* 56 = default lighting application, 48-95 reserved for lighting applications (must be decimal format)
Example: Measurement (0/228/5/3)

<table>
<thead>
<tr>
<th>Local Network</th>
<th>Measurement application</th>
<th>Device ID</th>
<th>Channel number</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>228</td>
<td>5</td>
<td>3</td>
</tr>
</tbody>
</table>

Example for Tags

The names added to the composed address are called *tags*. The tagged names for example are: Local/Lighting/Main office = (0/56/2).

### 4.3 Edit objects

Objects in the list can be edited by clicking the row. In this mode, undertake editing of the following functions and information:

- Keywords
- Log
- High priority log
- Export
- Object comment.

These functions are described in *Additional parameters for all applications on page 103*.

The network, application and group names are visible in the **Name** column of the object list.

The names can not be changed in the **Objects** list. To edit names, use the tag map. *See Tag map on page 43.*

### 4.4 C-Bus settings

Select the default network, application and device description in the C-Bus settings.

Path: **Configurator** → **Utilities** tab → **C-Bus settings** tab.

The following table shows the default C-Bus settings.

**Table 5: Default C-Bus settings**

<table>
<thead>
<tr>
<th>Local network</th>
<th>0 - Local</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>The C-Bus Toolkit auto-assigns networks in descending order, starting at 254 (254, 253, ...). Applications imported from the Toolkit are added to the local network (0) of the Automation Controller.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Default lighting application</th>
<th>56 - Lighting</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Device description</th>
<th>Defaults</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LSS5500NAC (Network Automation Controller)</td>
</tr>
<tr>
<td></td>
<td>LSS5500SHAC (Wiser for C-Bus Automation Controller)</td>
</tr>
</tbody>
</table>

The device description is used by the Control Systems IP Utility software that comes with Toolkit to help identify different devices on the C-Bus network. It may be customised to your requirements in this dialog, or from the IP Utility.

<table>
<thead>
<tr>
<th>Enable CNI functionality</th>
<th>If enabled, the Automation Controller can act as a C-Bus Network interface for commissioning and maintenance.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>In C-Bus Toolkit, the Automation Controller can be used as an interface to C-Bus networks. In Toolkit configure connection details for each C-Bus network:</td>
</tr>
<tr>
<td></td>
<td>• Type: CNI</td>
</tr>
<tr>
<td></td>
<td>• Address: IP address</td>
</tr>
<tr>
<td></td>
<td>The default IP address of the Automation Controller is 192.168.0.10</td>
</tr>
<tr>
<td></td>
<td>(or 192.168.254.10 if connected using the USB-B interface)</td>
</tr>
<tr>
<td></td>
<td>• Port: 10001</td>
</tr>
<tr>
<td></td>
<td>The default port of the Automation Controller CNI is 10001</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CNI port</th>
<th>10001 (default)</th>
</tr>
</thead>
</table>
4.5 Automation Controller as network interface

In C-Bus Toolkit, the Automation Controller can be used as an interface to C-Bus networks. See C-Bus settings on page 37. C-bus networks configured with the C-Bus Toolkit software can be commissioned and maintained in online mode via the configured Ethernet connection of the Automation Controller. There are three ways to fill the objects list: Import; Sniffer function; and Add new objects.

4.5.1 Import

A project created with the Toolkit software can be imported as CGL file (Utilities tab → Import Toolkit CGL file button).

4.5.2 Sniffer function

The bus sniffer detects objects from the C-Bus network and automatically adds them to the list.

Objects are visible when C-Bus is connected and the discover function is activated (Utilities → General Configuration tabs).

4.5.3 Add new objects

New objects can be added manually (Objects tab → Add new object button).

Use any of these three ways to find the objects for visualization and exchange with other systems, however the most typical way is to prepare a Toolkit project and import it are as follows, and detailed in the next steps.

1. Export from Toolkit into the Automation Controller.
2. Import CGL file into the Automation Controller.
3. Add new objects manually or via the bus sniffer function.

Export from Toolkit into the Automation Controller

Export any network in one of the projects configured in the C-Bus Toolkit. When importing to the Automation Controller, all applications are added to the local network (0) of the Automation Controller.

Install the complete C-Bus Toolkit, including C-Gate software and any USB drivers that Toolkit asks to install. The C-Gate software is required to export from the Toolkit and import to the Automation Controller. C-Gate can also be used as part of a C-Bus control system.

Steps

1. Open Toolkit.
2. Select the Toolkit project and a network. 254 is the default number of the local network in the Toolkit. 0 is the number of the local network in the Automation Controller (C-Bus settings on page 37).
3. Click the Export CGL button of the main menu of Toolkit.
4. Select the applications to export. As a default, all application addresses are selected (checked).
5. Select the folder, where the file is saved (see icon on the left side of the path).
6. Click the Export button. The message The export was successful appears.
7. The CGL file is now in the selected folder: (e.g. Import_Export\My_PROJ-254-20170123150827.cgl).
When exporting, the Export Network window is displayed:

Import CGL file into the Automation Controller

Import a network with applications using the Utilities tab.

Path: Configurator → Utilities tab → Import Toolkit CGL file button.

Once the Toolkit CGL file has been imported, the applications are listed in the Objects tab and are available in the Tag map tab.

Steps

In the Configurator page of the Automation Controller:

1. Click the Import Toolkit CGL file button.
2. Select the file (*.cgl).
3. Click the Save button.

An Import result message is displayed after import.

Existing object names of the same application and group address are overwritten with the imported values. To change the names (tags), open the Tag map list. See Tag map on page 43.
Add new/additional objects via Bus sniffer function
To use additional objects, import an updated C-Bus Toolkit file.
Alternatively, manually add new objects in the objects list. See Add new objects on page 43.
When the sniffer function is activated and C-Bus is online, new objects are automatically added to the objects list. See Sniffer function on page 105.
Any objects added can then be edited See “4.3 Edit objects” on page 37.

4.6 Export from Automation Controller to Toolkit
When adding new applications to the Automation Controller, export all applications to your original Toolkit project.

Use the most recent version of C-Bus Toolkit (1.15 or higher). Install the full package including USB drivers. The C-Gate software is required to export and import to the Automation Controller. C-Gate can also be used as part of a C-Bus control system.
The export of the applications of the Automation Controller is done in the Utilities tab.
Path: Configurator → Utilities tab → CGL export button.

Steps in the Configurator of the Automation Controller
① Click the CGL export button.
② The file will be downloaded to the computer, where your browser runs (e.g. CGL-AutomationController-2017.01.31-10.16.cgl).

Steps in the Toolkit
① Open C-Bus Toolkit.
② Create a new C-bus project or select an existing project to import the CGL file. If more than one Automation Controllers is in a site, they will each have their own unique CGL file.
③ Click the Import CGL button at the button of the project window.
④ Select file to import (e.g. CGL-AutomationController-2017.01.31-10.16.cgl).
⑤ By default, a backup project will be created before import.
⑥ Click the Import button.
⑦ Save the backup file (e.g. MY_PROJ_31_Jan_2017_1029_1.15.0.cbz).
⑧ A message about the import appears (see next screen shot).
Import A Network

Import a network and associated objects that were exported from a C-Bus Network Application Controller or C-Bus Smart Home Automation Controller unit to a file in the CGL format.

Import:

c:sers\Username\Downloads\CGL-5500NAC-2017.01.31-21.53.cgl

To: MY_PROJ

Backup project before importing

Import summary:

Created new group 264/1/2 ('Status')
Created new group 254/1/3 ('tmp')
Created new group 254/1/4 ('Lvl_PoT')
Created new group 254/1/5 ('KeyWords')
Created new application 264/88 ('Modbus')
Created new group 254/88/0 ('0')
Created new group 254/88/1 ('1')
Created new group 254/88/2 ('2')
Created new group 254/88/4 ('4')
OK.

Saving project...SUCCESS.

Finished at 01-02-2017 08:40:21.433
4.7 Add new objects

Manually add new objects to the **Objects** list. Once saved, the newly composed addresses are visible in the **Name** and the **Group Address** columns of the **Objects** list.

The following applications are predefined.

**Table 6: Predefined addresses**

<table>
<thead>
<tr>
<th>Number</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>56 (48-127)</td>
<td>Lighting</td>
</tr>
<tr>
<td>192</td>
<td>Media Transport</td>
</tr>
<tr>
<td>202</td>
<td>Trigger control</td>
</tr>
<tr>
<td>203</td>
<td>Enable</td>
</tr>
<tr>
<td>205</td>
<td>MRA</td>
</tr>
<tr>
<td>206</td>
<td>Error</td>
</tr>
<tr>
<td>208</td>
<td>Security</td>
</tr>
<tr>
<td>228</td>
<td>Measurement</td>
</tr>
<tr>
<td>250</td>
<td>User Parameter</td>
</tr>
<tr>
<td>255</td>
<td>Unit Parameter</td>
</tr>
</tbody>
</table>

Each application has specific parameters that must be set when editing the address elements of a new object. Some options are common for all applications.

Click on the **Add new object** button at the bottom of the **Objects** tab to open an **Edit object** window.

The window is displayed with empty fields and the default application **56 - Lighting** selected. Click the **Application** drop-down list to select from the currently defined applications.

Click on the Application **Add** button to create a new lighting application.

- Change names (tags) linked to the composed addresses in the **Tag map** tab.
- Activate/deactivate the Log, High priority log and the Export functions.
- Once a new application is saved, its application address cannot be edited. To change the address, first delete the existing address and then create a new one with the correct number.

4.7.1 Lighting application

The **Lighting** application is used for lighting and lighting-related applications. This includes switching different loads such as fans, curtains and shutters. The numbers 48–127 are reserved for lighting and lighting-related applications.

Click the **Add new object** button at the bottom of the **objects** tab to open an **Edit object** window:

**Add a new application**

By default, the lighting application (56) is opened. Click the Application **Add** button to create a new lighting application.
Add new group address
Click the Group address *Add* button to create a new group address.
This group address is linked with the new application.

<table>
<thead>
<tr>
<th>ID</th>
<th>Select: 0–254</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Max. 32 characters, except &quot;&quot;. The name is linked with the ID. Change the name in the <em>Tag map</em> tab.</td>
</tr>
</tbody>
</table>

4.7.2 Add new trigger group
The *Trigger* application is similar to the lighting application and is used to trigger scenes. Different scenes are triggered with different values of the action selector. Configure scenes in the *Scenes* tab.

Click the *Add new object* button at the bottom of the *objects* tab to open an *Edit object* window.

Select the trigger application
In the *Application* list, select: 202 - *Trigger*.

Add trigger group
Click the Trigger group *Add* button to create a new *Trigger group* (0–254).
This Trigger group is linked with the *Trigger* application.

<table>
<thead>
<tr>
<th>ID</th>
<th>Select: 0–254</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Max. 32 characters, except &quot;&quot;. The name is linked with the ID. Change the name in the <em>Tag map</em> tab.</td>
</tr>
</tbody>
</table>

4.7.3 Add new enable group
The *Enable* application is similar to the lighting application and is used to enable/disable additional functions of a C-Bus device.

Click the *Add new object* button at the bottom of the *objects* tab to open an *Edit object* window.

Select the Enable application
In the Application list, select: 203 - *Enable*. 
Add network variable
Click the Network variable Add button to create a new Network variable (0–254). This network variable is linked with the Enable application.

<table>
<thead>
<tr>
<th>ID</th>
<th>Select: 0–254</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Max 32 characters, except &quot;/&quot;. The name is linked with the ID. Change the name in the Tag map tab.</td>
</tr>
</tbody>
</table>

4.7.4 Add new measurement device and channel
The Measurement application is used to send and receive measured values and units (e.g. temperature with °C). The measured value is transferred with a 24 bit floating point number and the unit is coded with 8 bit.

The measurement application is linked with a Device ID and a Channel number.
Click the Add new object button at the bottom of the objects tab to open an Edit object window.

Select the measurement application
In the Application list, select: 228 - Measurement.

![Edit object window](image)

<table>
<thead>
<tr>
<th>Device ID</th>
<th>Select: 0–254</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channel number</td>
<td>Select: 0–254</td>
</tr>
<tr>
<td>The device ID is the group in the Tag map tab. Add a name (tag) in the Tag map tab.</td>
<td></td>
</tr>
<tr>
<td>The channel number has no tag and so is not visible in the Tag map tab.</td>
<td></td>
</tr>
</tbody>
</table>

In the Group address column of the Objects list, the composed address for a measurement object looks like this example: 0/228/1/3

<table>
<thead>
<tr>
<th>Local Network</th>
<th>Measurement application</th>
<th>Device ID</th>
<th>Channel number</th>
</tr>
</thead>
<tbody>
<tr>
<td>0/</td>
<td>228/</td>
<td>1/</td>
<td>3</td>
</tr>
<tr>
<td>Groundfloor</td>
<td>Measurement</td>
<td>Temperature</td>
<td>3</td>
</tr>
</tbody>
</table>

Add a new device ID
Click the Device ID Add button to add a new Device ID (0–254).

<table>
<thead>
<tr>
<th>ID</th>
<th>Select: 0–254</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Max 32 characters, except &quot;/&quot;. The name is linked with the ID. Change the name in the Tag map tab.</td>
</tr>
</tbody>
</table>

Add a channel number
Select a channel number (0–254) from the Channel number list.
4.7.5 Security application

A C-Bus enabled security system can be added to your Automation Controller through the security application. The security application is used for monitoring and controlling C-Bus enabled security panels.

Typical uses include:
- Remote security keypad emulation
- Arming security systems
- Setting security system mode
- Monitoring alarms
- Monitoring security zones.

*Table 7* is an example of a security system installation in a house with 8 monitored zones.

*Table 7: Example of security system zones*

<table>
<thead>
<tr>
<th>Zone number</th>
<th>Description (Location)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lounge</td>
</tr>
<tr>
<td>2</td>
<td>Dining Room</td>
</tr>
<tr>
<td>3</td>
<td>Bedroom 1</td>
</tr>
<tr>
<td>4</td>
<td>Bedroom 2</td>
</tr>
<tr>
<td>5</td>
<td>Bedroom 3</td>
</tr>
<tr>
<td>6</td>
<td>Games Room</td>
</tr>
<tr>
<td>7</td>
<td>Kitchen</td>
</tr>
<tr>
<td>8</td>
<td>Bathroom</td>
</tr>
</tbody>
</table>

*Table 8 on page 45* is a list of the read-only objects which report status of the security application. Unless listed, they are all boolean types. Objects with a number of 20 (Zone isolation), and higher are per-zone—note that zones are indexed from 1.

*Table 8: Read-only objects that report status of the security application*

<table>
<thead>
<tr>
<th>Address</th>
<th>Variable Name</th>
<th>Usage</th>
<th>Value</th>
<th>Settable?</th>
</tr>
</thead>
<tbody>
<tr>
<td>0/208/0</td>
<td>Key press</td>
<td>CBusSecurityKeypress(net, key)</td>
<td>Send key on the security application to network net. Key can either be a number from 0-255, a single character or one of the following strings:  • Enter  • Shift  • Panic  • Fire  • Arm  • Away  • Night  • Day  • Vacation.</td>
<td>Yes</td>
</tr>
<tr>
<td>0/208/0</td>
<td>Raise Alarm</td>
<td>CBusSecurityRaiseAlarm(net)</td>
<td>Returns the value of a user parameter or nil if not found.</td>
<td>Yes</td>
</tr>
<tr>
<td>Address</td>
<td>Variable Name</td>
<td>Usage</td>
<td>Value</td>
<td>Settable?</td>
</tr>
<tr>
<td>---------</td>
<td>--------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>0/208/0</td>
<td>Arm</td>
<td>CBusSecurityArm(net, level)</td>
<td>Send an arm system to level message on the security application to net where level is one of the following strings (or nil for highest):  • Away  • Night  • Day  • Vacation  • Highest.</td>
<td></td>
</tr>
<tr>
<td>0/208/0</td>
<td>Raise Tamper</td>
<td>CBusSecurityRaiseTamper(net)</td>
<td>Send a raise tamper message on the security application to network net.</td>
<td>Yes</td>
</tr>
<tr>
<td>0/208/0</td>
<td>Drop Tamper</td>
<td>CBusSecurityDropTamper(net)</td>
<td>Send a drop alarm message on the security application to network net.</td>
<td>Yes</td>
</tr>
<tr>
<td>0/208/1</td>
<td>Alarm sounding</td>
<td>CBusSecurityArm(level)</td>
<td>True if the alarm is sounding</td>
<td>No</td>
</tr>
<tr>
<td>0/208/2</td>
<td>All zones OK</td>
<td>CBusSecurityArm(level)</td>
<td>True if all zones are sealed or isolated</td>
<td>No</td>
</tr>
<tr>
<td>0/208/3</td>
<td>Arm failed</td>
<td>CBusSecurityArm(level)</td>
<td>True if the alarm system failed to arm</td>
<td>No</td>
</tr>
<tr>
<td>0/208/4</td>
<td>Arm ready</td>
<td>CBusSecurityArm(level)</td>
<td>False if any zone failed to arm</td>
<td>No</td>
</tr>
<tr>
<td>0/208/5</td>
<td>Armed state</td>
<td>CBusSecurityArm(state)</td>
<td>Current arm state</td>
<td>No</td>
</tr>
<tr>
<td>0/208/6</td>
<td>Battery charging</td>
<td>CBusSecurityArm(state)</td>
<td>True if the backup battery is being charged.</td>
<td>No</td>
</tr>
<tr>
<td>0/208/7</td>
<td>Entry delay</td>
<td>CBusSecurityArm(delay)</td>
<td>True if entry delay is running</td>
<td>No</td>
</tr>
<tr>
<td>0/208/8</td>
<td>Exit delay</td>
<td>CBusSecurityArm(delay)</td>
<td>True if exit delay is running</td>
<td>No</td>
</tr>
<tr>
<td>0/208/9</td>
<td>Fire alarm</td>
<td>CBusSecurityArm(alarm)</td>
<td>True if fire is detected</td>
<td>No</td>
</tr>
<tr>
<td>0/208/10</td>
<td>Gas alarm</td>
<td>CBusSecurityArm(alarm)</td>
<td>True if gas is detected</td>
<td>No</td>
</tr>
<tr>
<td>0/208/11</td>
<td>Line cut alarm</td>
<td>CBusSecurityArm(alarm)</td>
<td>True if phone line cut detected</td>
<td>No</td>
</tr>
<tr>
<td>0/208/12</td>
<td>Low battery</td>
<td>CBusSecurityArm(alarm)</td>
<td>True if backup battery is sub 1 hour</td>
<td>No</td>
</tr>
<tr>
<td>0/208/13</td>
<td>Mains failure</td>
<td>CBusSecurityArm(alarm)</td>
<td>True if mains power not detected</td>
<td>No</td>
</tr>
<tr>
<td>Address</td>
<td>Variable Name</td>
<td>Usage</td>
<td>Value</td>
<td>Settable?</td>
</tr>
<tr>
<td>-----------</td>
<td>-------------------</td>
<td>----------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
<td>-----------</td>
</tr>
<tr>
<td>0/208/14</td>
<td>Normal operation</td>
<td>Is the operation normal (no alarms or warnings)</td>
<td>True if no alarms detected.</td>
<td>No</td>
</tr>
<tr>
<td>0/208/15</td>
<td>Other alarm</td>
<td>Is there another alarm sounding?</td>
<td>True if a special alarm condition is detected.</td>
<td>No</td>
</tr>
<tr>
<td>0/208/16</td>
<td>Panic</td>
<td>Is the system in the panic state?</td>
<td>True of the system has emitted a panic message.</td>
<td>No</td>
</tr>
<tr>
<td>0/208/17</td>
<td>Password status</td>
<td>Status of the password entry:</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td>0/208/18</td>
<td>Password OK</td>
<td>Was the last password correct?</td>
<td>True if last password entry successful.</td>
<td>No</td>
</tr>
<tr>
<td>0/208/19</td>
<td>Tamper</td>
<td>Is the system in the tamper state?</td>
<td>True if system detects a tamper condition.</td>
<td>No</td>
</tr>
<tr>
<td>0/208/20</td>
<td>Zone isolated</td>
<td>Is a security zone isolated (disabled)?</td>
<td>True if system has isolated this zone</td>
<td>No</td>
</tr>
<tr>
<td>0/208/21</td>
<td>Security Zone</td>
<td>Security zone status:</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Status</td>
<td>0 = Sealed</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 = Unsealed</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 = Open</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 = Short</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0/208/22</td>
<td>Security Zone</td>
<td>Name of a security zone.</td>
<td></td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Name</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

When adding a security object for the first time, all the associated tags are created for the security application. If a security object is deleted, so are the associated tags. Adding the object back will also re-create the tag/s.

The Automation Controller maintains state internally of the security application based on messages it receives from a security panel operating on the network. All except the exposed security objects are read-only and reflect direct or derived state reported by the panel. The only control the Automation Controller has of the security application is via the parameter **Command (0/208/0)** which provides a way for visualisation and scripting to send the following messages and arguments:

- Simulate keypress (argument: keypress)
- Raise the alarm (no argument)
- Arm the system (argument: level to arm to)
- Raise tamper (no argument)
- Drop tamper (no argument)
- Display message on panel (argument: message to be displayed).

Due to the nature of operation, messages will not necessarily have an immediate effect on the state of the system. For example, if a script or UI event causes an Arm system message to be sent the value of Armed state will not change until the panel processes the message and send a status message back.
**Example Project**
This example project describes how to add the security objects to the Automation Controller.

**Create a security related object**
Path: **Configurator → Objects tab → Add new object button → System tab → Admin Access**

In the *Edit object* window, select:
- Network = *Home (Local)*
- Application = *208 - Security*
- Parameter = *Command*.

![Edit object window](image)

Click *Save*. The parameter *Command* is created for the security application.

**Add security related objects**
Refer to *How to create a Security related object on page 48* to add each of the following parameters:
Add security zones

Refer to How to create a Security related object on page 48 to add Zones 1 to 8, one at a time.

In the Edit object window, select:

- Network = Home (Local)
- Application = 208 - Security
- Parameter = Zone state
- Zone = 1, then Save.
Repeat to add Zones 2 to 8.

Add zone isolated objects
Select Zone Isolated in the Parameter field, then select Zone = 1 and click Save.

Repeat for Zones 2 to 8.
The added parameters will show in the **Objects** tab, identifying the name and group address.

<table>
<thead>
<tr>
<th>Name</th>
<th>Group address</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home/Security/Command</td>
<td>0/208/0/0</td>
</tr>
<tr>
<td>Home/Security/Alarm sounding</td>
<td>0/208/1/0</td>
</tr>
<tr>
<td>Home/Security/All zones OK</td>
<td>0/208/2/0</td>
</tr>
<tr>
<td>Home/Security/Armed state</td>
<td>0/208/5/0</td>
</tr>
<tr>
<td>Home/Security/Fire alarm</td>
<td>0/208/9/0</td>
</tr>
<tr>
<td>Home/Security/Normal operation</td>
<td>0/208/14/0</td>
</tr>
<tr>
<td>Home/Security/Zone isolated/1</td>
<td>0/208/20/1</td>
</tr>
<tr>
<td>Home/Security/Zone isolated/2</td>
<td>0/208/20/2</td>
</tr>
<tr>
<td>Home/Security/Zone isolated/3</td>
<td>0/208/20/3</td>
</tr>
<tr>
<td>Home/Security/Zone isolated/4</td>
<td>0/208/20/4</td>
</tr>
<tr>
<td>Home/Security/Zone isolated/5</td>
<td>0/208/20/5</td>
</tr>
<tr>
<td>Home/Security/Zone isolated/6</td>
<td>0/208/20/6</td>
</tr>
<tr>
<td>Home/Security/Zone isolated/7</td>
<td>0/208/20/7</td>
</tr>
<tr>
<td>Home/Security/Zone isolated/8</td>
<td>0/208/20/8</td>
</tr>
<tr>
<td>Home/Security/Zone state/1</td>
<td>0/208/21/1</td>
</tr>
<tr>
<td>Home/Security/Zone state/2</td>
<td>0/208/21/2</td>
</tr>
<tr>
<td>Home/Security/Zone state/3</td>
<td>0/208/21/3</td>
</tr>
<tr>
<td>Home/Security/Zone state/4</td>
<td>0/208/21/4</td>
</tr>
<tr>
<td>Home/Security/Zone state/5</td>
<td>0/208/21/5</td>
</tr>
<tr>
<td>Home/Security/Zone state/6</td>
<td>0/208/21/6</td>
</tr>
<tr>
<td>Home/Security/Zone state/7</td>
<td>0/208/21/7</td>
</tr>
<tr>
<td>Home/Security/Zone state/8</td>
<td>0/208/21/8</td>
</tr>
</tbody>
</table>

**Preparing security icons**

If special security icons are required, other than the default icons provided, select path **Vis.Graphics** tab to display icons.

To add more icons → **Add icons** button.

*Choose File* to add your own icons file. Click **Save**.

**Add a security user interface page/plan**

Path: **Vis.Structure** → **Add/Import** button.
When the Select an action box appears, select Add plan.

![Select an action](image1.png)

When the Plan window appears, at Name enter Security, then click Save.

![Plan window](image2.png)

The Vis. Structure tab, Levels/Plan tab displays Security in the Main list.

![Vis. Structure tab](image3.png)

Create visualization elements (icons) for commands on security page/plan

Ensure no visual element is selected on the Levels/plan page.

Path: Configurator → Visualization tab → Structure view → Security object.
Click **Unlock current plan for editing** at the bottom right to enter edit mode.

To add object visualization elements, click the **Object** drop down arrow, then select *Home/Security/Command (0/208/0/0)*.

Click **Visualization parameters**.

Click the **Local (per-element) parameters** button.

In the **Visualization parameters** window, enter **Control Type** = *Arm* and **Value** = *Day*, then click **Save**.
In Plan Editor, on the **Object** tab, select **Display mode** = **Icon**, select the **Default icon** for the command **Armdaytime** mode.

Click **Add to plan** to add the icon on to the security page grid.

Click the icon on the grid to adjust the position and size, then drag the icon to the desired location.

With the icon selected, use **Element position** and **Element size** to align the icon. Click **Apply**.

Repeat above steps to add icons for all visualization elements.

**Status Name** and **Possible Value** can be added to each icon, as per Table 9.

**Table 9: Status names and possible values for security icons**

<table>
<thead>
<tr>
<th>Status Name</th>
<th>Possible Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal operation</td>
<td>True/False</td>
</tr>
<tr>
<td>Alarm sounding</td>
<td>True/False</td>
</tr>
<tr>
<td>All zones OK</td>
<td>True/False</td>
</tr>
<tr>
<td>Fire alarm</td>
<td>True/False</td>
</tr>
<tr>
<td>Armed state</td>
<td>Disarmed/Fully armed/Partially armed</td>
</tr>
<tr>
<td>Zone 1 isolated</td>
<td>True/False</td>
</tr>
<tr>
<td>Zone 2 isolated</td>
<td>True/False</td>
</tr>
<tr>
<td>Zone 3 isolated</td>
<td>True/False</td>
</tr>
<tr>
<td>Zone 4 isolated</td>
<td>True/False</td>
</tr>
<tr>
<td>Zone 5 isolated</td>
<td>True/False</td>
</tr>
<tr>
<td>Zone 6 isolated</td>
<td>True/False</td>
</tr>
<tr>
<td>Zone 7 isolated</td>
<td>True/False</td>
</tr>
<tr>
<td>Zone 8 isolated</td>
<td>True/False</td>
</tr>
<tr>
<td>Zone 1 state</td>
<td>Sealed/Unsealed/Open/Short</td>
</tr>
<tr>
<td>Zone 2 state</td>
<td>Sealed/Unsealed/Open/Short</td>
</tr>
<tr>
<td>Zone 3 state</td>
<td>Sealed/Unsealed/Open/Short</td>
</tr>
</tbody>
</table>
### Configuration of the Automation Controller

<table>
<thead>
<tr>
<th>Status Name</th>
<th>Possible Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zone 4 state</td>
<td>Sealed/Unsealed/Open/Short</td>
</tr>
<tr>
<td>Zone 5 state</td>
<td>Sealed/Unsealed/Open/Short</td>
</tr>
<tr>
<td>Zone 6 state</td>
<td>Sealed/Unsealed/Open/Short</td>
</tr>
<tr>
<td>Zone 7 state</td>
<td>Sealed/Unsealed/Open/Short</td>
</tr>
<tr>
<td>Zone 8 state</td>
<td>Sealed/Unsealed/Open/Short</td>
</tr>
</tbody>
</table>

Add Command description, Control Type and Values for security objects from [Table 10].

#### Table 10: Command descriptions, control types and values

<table>
<thead>
<tr>
<th>Command description</th>
<th>Control type</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arm in day mode</td>
<td>Arm</td>
<td>Day</td>
</tr>
<tr>
<td>Arm in away mode</td>
<td>Arm</td>
<td>Away</td>
</tr>
<tr>
<td>Arm in vacation mode</td>
<td>Arm</td>
<td>Vacation</td>
</tr>
<tr>
<td>Keypad 0</td>
<td>Keypress</td>
<td>0</td>
</tr>
<tr>
<td>Keypad 1</td>
<td>Keypress</td>
<td>1</td>
</tr>
<tr>
<td>Keypad 2</td>
<td>Keypress</td>
<td>2</td>
</tr>
<tr>
<td>Keypad 3</td>
<td>Keypress</td>
<td>3</td>
</tr>
<tr>
<td>Keypad 4</td>
<td>Keypress</td>
<td>4</td>
</tr>
<tr>
<td>Keypad 5</td>
<td>Keypress</td>
<td>5</td>
</tr>
<tr>
<td>Keypad 6</td>
<td>Keypress</td>
<td>6</td>
</tr>
<tr>
<td>Keypad 7</td>
<td>Keypress</td>
<td>7</td>
</tr>
<tr>
<td>Keypad 8</td>
<td>Keypress</td>
<td>8</td>
</tr>
<tr>
<td>Keypad 9</td>
<td>Keypress</td>
<td>9</td>
</tr>
<tr>
<td>Keypad *</td>
<td>Keypress</td>
<td>*</td>
</tr>
<tr>
<td>Keypad Enter</td>
<td>Keypress</td>
<td>Enter</td>
</tr>
<tr>
<td>Keypad Arm</td>
<td>Keypress</td>
<td>Arm</td>
</tr>
</tbody>
</table>

Repeat to add all new icons required.

Click **Save and reload plan**. When selected, the icon sends C-Bus commands.

Clicking **Save and reload plan** after adding each element avoids having to exit edit mode for each element.
Create visualization elements for status on security page/plan

Ensure no visual element is selected on the page/plan.

Path: **Configurator → Visualization** tab → **Structure** view → **Security** object.

Click **Unlock current plan for editing**.

In the **Plan Editor**, select the **Object** tab.

At **Object**, select Local/Security/Normal operation (0/208/14/0).

At the **Display Mode** dropdown, select **Icon**.

At **On icon**, select an icon for visualization representing true (on).

At **Off icon**, select an icon for visualization representing false (off).

*Normal operation* has 2 possible values: **True** and **False**.

Click **Add to plan**.

Select the newly created icon on the grid to adjust position and size.

Click **Apply**.

Click **Save and reload plan**.

Repeat to add other icons to the security page.
### Viewing armed state and zone state values

Path: Tag map tab → Local → Security object → Armed state object.

Expand Armed state to view the values: Disarmed (0); Fully armed (1); and Partially armed (2).

Expand Armed state to view the values: Disarmed (0); Fully armed (1); and Partially armed (2).

Scroll to Zone state to view the values: Sealed (0); Unsealed (1); Open (2); and Short (3).

### Setting up icons for armed state

Ensure no visual element is selected on the levels/plan page.

Path: Configurator → Visualization tab → Structure view → Security object.

Click Unlock current plan for editing at the bottom right to enter edit mode.

To add object visualization elements, click the Object drop down arrow, then select Local/Security/Armed state.

Select a Default icon from the available selection.

Scroll down to select the button for Additional icons.

In the Additional icon window, click Add icon.

Enter the Min value and Max value, and select the icon for the values Disarmed (0); Fully armed (1); and Partially armed (2).
Click **Save**.

**Setting up icons for zone state**

Unlock the plan for editing. See *[Setting up icons for armed state on page 57]*.

Click the **Object** drop down arrow, then select *Local/Security/Zone state/1 (0/208/21/1)*.

Select **Display mode** = **Icon**.

Select the **Default icon** from the available selection.

Repeat for all Zone states required.

Click **Save and reload plan**.
Creating text labels for the zones

Ensure no visual element is selected on the levels/plan page.

Path: Configurator → Visualization tab → Structure view → Security object.
Click Unlock current plan for editing at the bottom right to enter edit mode.

Select an Object drop down arrow to add a label to.

Click the Visualization tab, then select Text label from the Plan editor.
In the Text field, enter the required text label.

![Plan editor interface with text label options](image)

Click Add to plan.
Click the text label on the grid to adjust size and position.
Click Apply.
Click Save and reload plan.
Repeat until all text labels required are in position. In this example, we have used the following labels.

<table>
<thead>
<tr>
<th>Zone number</th>
<th>Description (Location)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lounge</td>
</tr>
<tr>
<td>2</td>
<td>Dining Room</td>
</tr>
<tr>
<td>3</td>
<td>Bedroom 1</td>
</tr>
<tr>
<td>4</td>
<td>Bedroom 2</td>
</tr>
<tr>
<td>5</td>
<td>Bedroom 3</td>
</tr>
<tr>
<td>6</td>
<td>Games Room</td>
</tr>
<tr>
<td>7</td>
<td>Kitchen</td>
</tr>
<tr>
<td>8</td>
<td>Bathroom</td>
</tr>
</tbody>
</table>

To run a test view, select the view icon in the bottom left window.
All the visual elements in this example security page could be arranged like this:

Clicking any command icon, e.g. a keypad button, sends a C-Bus message from the C-Bus Diagnostic Utility. An example of the command record is as follows:
When using the Security panel or C-Bus Diagnostic Utility to change a related status, the status icon changes on the security page. The icon changes for **Alarm sounding** becoming *True* when issued an **Alarm on** message on Zone 1 from the C-Bus Diagnostic Utility.

**Lua scripting example**

This Lua scripting is based on the example in “4.9.1 Setting up security” on page 48 and demonstrates triggering a script on a security event. In this example, a disarm event triggers a script which activates the **Welcome Home** scene.

**Add Tag map name**

Path: **Configurator → Tab map** tab.
1. Scroll to **Trigger Control (202)** and click **+**.
2. Enter **Group address** = 5.
3. Enter **Name** = **Welcome Home**.
4. Click **Save**.

![Tag map](image-url)
Assign trigger group

1. Open the **Objects** tab.
2. Click **Add new object**.
3. In the **Edit object** window select **Application = Trigger Control (202)**, then select **Trigger group = Welcome Home (5)**.
4. Click **Save**.

![Edit object window](image)

Add Scene

1. Open the **Scenes** tab.
2. Select **Add Scene**.
3. At the **Scene** window, set **Name = Welcome Home**.
4. Select the **Group address = Home/Trigger Control/Welcome Home (0/202/5)**.
5. Enter **Action selector = 6**.
6. Click **Save**.

![Scene window](image)
Set Scene
Click **Sequence** to add reactions for this scene.

![Sequence window](image)

Click **Add objects**.

When the **Sequence for scene: Welcome Home** page displays, add **Group Address** = Home/Lighting/grp1 (0/56/1).

Set **Value** at 168.

![Object filter window](image)

Lua script for disarm event trigger
Path: **Configurator** → **Scripting** tab → **Event-based** button → **Add new script** button.

In the **Event-based script** window, enter the **Script name** Trigger Welcome Home Scene when disarmed.

Select the **Group address** Home/Security/Armed state (0/208/5/0).
Check **Active**.
Click **Save**.

Scroll to the Script name *Trigger Welcome Home Scene*, then click **Editor**.

The following script sets the *Trigger Welcome Home Scene*.

```
-- if armed state has a value changed to 0 (disarmed)
if event.getvalue() == 0 then
  -- Set trigger level of group 5 to 6
  SetTriggerLevel=(5, 6)
end
```

Click **Run script**.

At the *Set object value* window click **Save**. The script list status changes to **Active**.

If *Armed state* is set to *Fully armed* and then to *Disarmed* on Zone 1 from the C-Bus Diagnostic Utility (the value need to be changed to *Fully armed* hence setting it to another value first). The scene *Welcome Home* sets the trigger group 5 to value 6.
Lua script for fire alarm event trigger

Path: Configurator → Scripting tab → Event-based button → Add new script button.

In the Event-based script window, enter the Script name Email fire alarm.

Select Group Address = Home/Security/Fire alarm (0/208/9/0).

Check Active.

Click Save.
In the **Script name** window, scroll to *Email fire alarm*, then click **Editor**.

The following script sets the Email fire alarm:

```lua
if event.getvalue() == true then
    return
end
-- make sure mail settings are set in user function library before using this function
local subject = 'Fire Alarm'
local message = 'You have got a fire alarm\n'
message = message .. 'Current status:\n'
local detailedInfo={} 
detailedInfo.alarmSounding = CBusSecurityGet(0, 'Alarm sounding')
detailedInfo.allZonesOK = CBusSecurityGet(0, 'All zones OK')
detailedInfo.armedState = CBusSecurityGet(0, 'Armed state')
detailedInfo.fireAlarm = CBusSecurityGet(0, 'Fire alarm')
detailedInfo.normalOperation = CBusSecurityGet(0, 'Normal operation')
message = message .. tab2str(detailedInfo)
mail('user@example.com', subject, message)
```

Enter a valid email address instead of *user@example.com* at Line 15 in the above example.

> To enable email settings, refer to the section **E-mail on page 159**.

Click **Run script**, then **Save**.

In the **Scripts** tab, select **Event-based**, and the event *Email fire alarm* will appear with a green arrow indicating **Active** status.

Test by setting the C-Bus Diagnostic Utility to send a *Fire Alarm Cleared* message followed by a *Fire Alarm Raised* message on Zone 1 by changing the value to *Fire Alarm Raised* and checking for the email.
4.7.6 Multi-Room Audio and Media Transport Control – Control C-Bus

The C-Bus Automation Controller supports Multi-Room Audio (MRA) and Media Transport Control (MTC) applications, which can be controlled by C-Bus Matrix Switcher and Amplifier, and status information can be obtained from the Automation Controller. This section explains how to set up the Automation Controller to support MRA and MTC applications.

Prerequisites

The following Application Notes must be read and configured before completing any MRA installation:
- Configuring MRA in Toolkit Software
- Configuring MRA with MRAPA Software
- Configuring MRA with PICED Software, and
- Configuring C-Bus Ripple Software.

Importantly, the settings and configurations must be completed for the following devices:
- one Matrix Switcher
- one Amp
- one EDLT, and
- a Ripple media server.

MRA Objects

An MRA object address must be specified by a network number, zone number and a function address. The Automation Controller does not use Matrix Switcher number in MRA objects, therefore the zone number is used to configure both Matrix Switcher number and zone number used in Toolkit, PICED and MRAPA. See Table 12 for Zone number mapping.

Table 12: Zone numbers for MRA objects

<table>
<thead>
<tr>
<th>Zone Number in Automation Controller</th>
<th>Matrix Switch Number</th>
<th>Zone number in Toolkit, PICED and MRAPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>7</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>8</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>10</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>11</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>12</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>13</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>14</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>15</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>16</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>17</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>
Table 13: MRA object function addresses

<table>
<thead>
<tr>
<th>Function Address</th>
<th>Meaning</th>
<th>Value Type</th>
<th>Value Range</th>
<th>Access Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Volume</td>
<td>int</td>
<td>0-255</td>
<td>R/W</td>
</tr>
<tr>
<td>1</td>
<td>Balance</td>
<td>int</td>
<td>0-255</td>
<td>R/W</td>
</tr>
<tr>
<td>2</td>
<td>Bass</td>
<td>int</td>
<td>0-255</td>
<td>R/W</td>
</tr>
<tr>
<td>3</td>
<td>Treble</td>
<td>int</td>
<td>0-255</td>
<td>R/W</td>
</tr>
<tr>
<td>4</td>
<td>Mute</td>
<td>int</td>
<td>0, 2, 5, 7, 255</td>
<td>R/W</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0 – Turn amplifier off.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2 (1%) – Turn amplifier on, Volume normal and speakers off.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5 (2%) – Turn amplifier on, Volume at pre-set and speakers off.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>7 (3%) – Turn amplifier on, Volume at pre-set and speakers on.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>255 (100%) – Turn amplifier on, Volume normal and speakers on.</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Source Number</td>
<td>int</td>
<td>0-6 (As defined 1-7 in MARPA)</td>
<td>R/W</td>
</tr>
<tr>
<td>6</td>
<td>Dynamic 1 Label</td>
<td>string</td>
<td>Max 255 bytes</td>
<td>R/W</td>
</tr>
<tr>
<td>7</td>
<td>Dynamic 2 Label</td>
<td>string</td>
<td>Max 255 bytes</td>
<td>R/W</td>
</tr>
<tr>
<td>8</td>
<td>Source Descriptor</td>
<td>string</td>
<td>Max 255 bytes</td>
<td>R/W</td>
</tr>
<tr>
<td>9</td>
<td>Zone Descriptor</td>
<td>string</td>
<td>Max 255 bytes</td>
<td>R/W</td>
</tr>
<tr>
<td>10</td>
<td>MRA Command</td>
<td>string</td>
<td>See Table 3</td>
<td>See Table 3</td>
</tr>
</tbody>
</table>

The MRA object's function address could be from 0 to 10, as shown in Table 13.

MRA command is a predefined string command with one or additional parameters. See Table 14 for MRA command definitions.
Table 14: MRA command definitions

<table>
<thead>
<tr>
<th>Predefined Command</th>
<th>P1</th>
<th>P2</th>
<th>Description</th>
<th>Example</th>
<th>Access Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Next Feed</td>
<td>N/A</td>
<td>N/A</td>
<td>Go to next feed/source</td>
<td>&quot;Next Feed&quot;</td>
<td>R/W</td>
</tr>
<tr>
<td>Previous Feed</td>
<td>N/A</td>
<td>N/A</td>
<td>Go to previous feed/source</td>
<td>&quot;Previous Feed&quot;</td>
<td>R/W</td>
</tr>
<tr>
<td>All Off</td>
<td>N/A</td>
<td>N/A</td>
<td>Send an All Off command to all zones</td>
<td>&quot;All Off&quot;</td>
<td>R/W</td>
</tr>
<tr>
<td>Zone Descriptor Request</td>
<td>N/A</td>
<td>N/A</td>
<td>Request zone description</td>
<td>&quot;Zone Descriptor Request&quot;</td>
<td>R/W</td>
</tr>
<tr>
<td>Feed Descriptor Request</td>
<td>N/A</td>
<td>N/A</td>
<td>Request feed/source description</td>
<td>&quot;Feed Descriptor Request&quot;</td>
<td>R/W</td>
</tr>
<tr>
<td>Current Feed Request</td>
<td>N/A</td>
<td>N/A</td>
<td>Request current feed/source description</td>
<td>&quot;Current Feed Request&quot;</td>
<td>R/W</td>
</tr>
<tr>
<td>Dynamic1</td>
<td>N/A</td>
<td>N/A</td>
<td>Dynamic1 is pressed</td>
<td>&quot;Dynamic1&quot;</td>
<td>R/W</td>
</tr>
<tr>
<td>Dynamic2</td>
<td>N/A</td>
<td>N/A</td>
<td>Dynamic2 is pressed</td>
<td>&quot;Dynamic2&quot;</td>
<td>R/W</td>
</tr>
<tr>
<td>Priority On</td>
<td>N/A</td>
<td>N/A</td>
<td>Set high priority on</td>
<td>&quot;Priority On:80:3&quot;</td>
<td>R/W</td>
</tr>
<tr>
<td>Priority Off</td>
<td>N/A</td>
<td>N/A</td>
<td>Set high priority off</td>
<td>&quot;Priority Off&quot;</td>
<td>R/W</td>
</tr>
<tr>
<td>Set Off Timer</td>
<td>N/A</td>
<td>N/A</td>
<td>Set power off timer</td>
<td>&quot;Set Off Timer:120&quot;</td>
<td>R/W</td>
</tr>
<tr>
<td>Cancel Off Timer</td>
<td>N/A</td>
<td>N/A</td>
<td>Cancel power off timer</td>
<td>&quot;Cancel Off Timer&quot;</td>
<td>R/W</td>
</tr>
<tr>
<td>Error Code</td>
<td>Error code number</td>
<td>N/A</td>
<td>Report error code</td>
<td>&quot;Error Code:20&quot;</td>
<td>R/W</td>
</tr>
<tr>
<td>Status Request</td>
<td>N/A</td>
<td>N/A</td>
<td>Request status</td>
<td>&quot;Status Request&quot;</td>
<td>R/W</td>
</tr>
<tr>
<td>Off Timer Expired</td>
<td>N/A</td>
<td>N/A</td>
<td>This is a notification when power off timer is expired. Read only.</td>
<td>&quot;Off Timer Expired&quot;</td>
<td>R</td>
</tr>
</tbody>
</table>

MTC Objects

A MTC object address must be specified by a network number, media link group and a function address. A MTC object’s function address is from 0 to 32, Table 15 has the details.

Table 15: MTC object function addresses

<table>
<thead>
<tr>
<th>Function Address</th>
<th>Meaning</th>
<th>Value Type</th>
<th>Value Range</th>
<th>Access Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Play Stop</td>
<td>int</td>
<td>0:stop, 1:play</td>
<td>R/W</td>
</tr>
<tr>
<td>1</td>
<td>Pause Resume</td>
<td>int</td>
<td>0:pause, 255:resume</td>
<td>R/W</td>
</tr>
<tr>
<td>2</td>
<td>Category</td>
<td>int</td>
<td>0-127</td>
<td>R/W</td>
</tr>
<tr>
<td>3</td>
<td>Selection</td>
<td>int</td>
<td>0-32767</td>
<td>R/W</td>
</tr>
<tr>
<td>4</td>
<td>Track</td>
<td>int</td>
<td>0-2147483647</td>
<td>R/W</td>
</tr>
<tr>
<td>5</td>
<td>Shuffle</td>
<td>int</td>
<td>0: shuffle off, 255: shuffle on</td>
<td>R/W</td>
</tr>
<tr>
<td>6</td>
<td>Repeat</td>
<td>int</td>
<td>0: repeat off, 1: repeat current, 255: repeat all</td>
<td>R/W</td>
</tr>
<tr>
<td>7</td>
<td>Forward</td>
<td>int</td>
<td>0: normal speed, 2: 2x speed, 4: 4x speed, 6: 8x speed, 8: 16x speed, 10: 32x speed, 12: 64x speed</td>
<td>R/W</td>
</tr>
<tr>
<td>8</td>
<td>Rewind</td>
<td>int</td>
<td>0: normal speed, 2: 2x speed, 4: 4x speed, 6: 8x speed, 8: 16x speed, 10: 32x speed, 12: 64x speed</td>
<td>R/W</td>
</tr>
<tr>
<td>Function Address</td>
<td>Meaning</td>
<td>Value Type</td>
<td>Value Range</td>
<td>Access Type</td>
</tr>
<tr>
<td>------------------</td>
<td>--------------------------</td>
<td>------------</td>
<td>--------------------------------------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>9</td>
<td>Source Power Control</td>
<td>int</td>
<td>0: source power off, 255: source power on</td>
<td>R/W</td>
</tr>
<tr>
<td>10</td>
<td>Total Tracks</td>
<td>int</td>
<td>0-2147483647</td>
<td>R/W</td>
</tr>
<tr>
<td>11</td>
<td>Current Track Name</td>
<td>string</td>
<td>Max 255 bytes</td>
<td>R/W</td>
</tr>
<tr>
<td>12</td>
<td>Current Selection Name</td>
<td>string</td>
<td>Max 255 bytes</td>
<td>R/W</td>
</tr>
<tr>
<td>13</td>
<td>Current Category Name</td>
<td>string</td>
<td>Max 255 bytes</td>
<td>R/W</td>
</tr>
<tr>
<td>14</td>
<td>Next Track Name</td>
<td>string</td>
<td>Max 255 bytes</td>
<td>R/W</td>
</tr>
<tr>
<td>15</td>
<td>Next Selection Name</td>
<td>string</td>
<td>Max 255 bytes</td>
<td>R/W</td>
</tr>
<tr>
<td>16</td>
<td>Next Category Name</td>
<td>string</td>
<td>Max 255 bytes</td>
<td>R/W</td>
</tr>
<tr>
<td>17</td>
<td>Previous Track Name</td>
<td>string</td>
<td>Max 255 bytes</td>
<td>R/W</td>
</tr>
<tr>
<td>18</td>
<td>Previous Selection Name</td>
<td>string</td>
<td>Max 255 bytes</td>
<td>R/W</td>
</tr>
<tr>
<td>19</td>
<td>Previous Category Name</td>
<td>string</td>
<td>Max 255 bytes</td>
<td>R/W</td>
</tr>
<tr>
<td>20</td>
<td>Next2 Track Name</td>
<td>string</td>
<td>Max 255 bytes</td>
<td>R/W</td>
</tr>
<tr>
<td>21</td>
<td>Next2 Selection Name</td>
<td>string</td>
<td>Max 255 bytes</td>
<td>R/W</td>
</tr>
<tr>
<td>22</td>
<td>Next2 Category Name</td>
<td>string</td>
<td>Max 255 bytes</td>
<td>R/W</td>
</tr>
<tr>
<td>23</td>
<td>Previous2 Track Name</td>
<td>string</td>
<td>Max 255 bytes</td>
<td>R/W</td>
</tr>
<tr>
<td>24</td>
<td>Previous2 Selection Name</td>
<td>string</td>
<td>Max 255 bytes</td>
<td>R/W</td>
</tr>
<tr>
<td>25</td>
<td>Previous2 Category Name</td>
<td>string</td>
<td>Max 255 bytes</td>
<td>R/W</td>
</tr>
<tr>
<td>26</td>
<td>MTC Command</td>
<td>string</td>
<td>See Table 16</td>
<td>See Table 16</td>
</tr>
<tr>
<td>27</td>
<td>Enumerate Category Size</td>
<td>int</td>
<td>0-255</td>
<td>R/W</td>
</tr>
<tr>
<td>28</td>
<td>Enumerate Selection Size</td>
<td>int</td>
<td>0-255</td>
<td>R/W</td>
</tr>
<tr>
<td>29</td>
<td>Enumerate Track Size</td>
<td>int</td>
<td>0-255</td>
<td>R/W</td>
</tr>
<tr>
<td>30</td>
<td>Enumerate Category Names</td>
<td>string</td>
<td>Max 255 bytes</td>
<td>R/W</td>
</tr>
<tr>
<td>31</td>
<td>Enumerate Selection Names</td>
<td>string</td>
<td>Max 255 bytes</td>
<td>R/W</td>
</tr>
<tr>
<td>32</td>
<td>Enumerate Track Names</td>
<td>string</td>
<td>Max 255 bytes</td>
<td>R/W</td>
</tr>
</tbody>
</table>

MTC command is a predefined string command with some commands having one or two additional parameters. Parameter is followed by the command and separated by ".".

Table 16: MTC command objects

<table>
<thead>
<tr>
<th>Predefined Command</th>
<th>P1</th>
<th>P2</th>
<th>Description</th>
<th>Example</th>
<th>Access Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Next Category</td>
<td>N/A</td>
<td>N/A</td>
<td>Go to next category</td>
<td>“Next Category”</td>
<td>R/W</td>
</tr>
<tr>
<td>Previous Category</td>
<td>N/A</td>
<td>N/A</td>
<td>Go to previous category</td>
<td>“Previous Category”</td>
<td>R/W</td>
</tr>
<tr>
<td>Next Selection</td>
<td>N/A</td>
<td>N/A</td>
<td>Go to next selection</td>
<td>“Next Selection”</td>
<td>R/W</td>
</tr>
<tr>
<td>Previous Selection</td>
<td>N/A</td>
<td>N/A</td>
<td>Go to previous selection</td>
<td>“Previous Selection”</td>
<td>R/W</td>
</tr>
<tr>
<td>Next Track</td>
<td>N/A</td>
<td>N/A</td>
<td>Go to next track</td>
<td>“Next Track”</td>
<td>R/W</td>
</tr>
<tr>
<td>Previous Track</td>
<td>N/A</td>
<td>N/A</td>
<td>Go to previous track</td>
<td>“Previous Track”</td>
<td>R/W</td>
</tr>
<tr>
<td>Media Status</td>
<td>N/A</td>
<td>N/A</td>
<td>Request media status</td>
<td>“Media Status”</td>
<td>R/W</td>
</tr>
</tbody>
</table>
Example project

Prior to commencing an example project, compile a list of each source (an input into the MRA system) and zone (an area where an amplifier is installed). *Table 17 on page 71* and *Table 18 on page 71* show the sources and zones for an example project. These examples are used throughout the series of MRA programming application notes.

In *Table 14* Media Sources, the left column shows the source name, which is fixed in MRA. The middle column shows the type of input, while the right column shows a ‘real world’ name or description applied for easy identification. *Table 15* Output zones shows eight zones (or locations).

### Table 17: Media sources

<table>
<thead>
<tr>
<th>Source</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local*</td>
<td>Line-level input on amplifier</td>
<td>iPod</td>
</tr>
<tr>
<td>Analogue 1</td>
<td>Line-level input #1 into Matrix Switcher</td>
<td>Cable TV</td>
</tr>
<tr>
<td>Analogue 2</td>
<td>Line-level input #2 into Matrix Switcher</td>
<td>DVD</td>
</tr>
<tr>
<td>Analogue 4/AUX**</td>
<td>RCA sockets on the rear panel of the Matrix Switcher</td>
<td>AUX input socket on front panel of Matrix Switcher</td>
</tr>
<tr>
<td>Tuner 1</td>
<td>Internal AM/FM tuner</td>
<td>Radio 1</td>
</tr>
<tr>
<td>Tuner 2</td>
<td>Internal AM/FM tuner</td>
<td>Radio 2</td>
</tr>
<tr>
<td>Streaming</td>
<td>Internal Streaming Module (deluxe model of Matrix Switcher only)</td>
<td>MP3</td>
</tr>
</tbody>
</table>

* The local input on the amplifier does not need to be configured for operation, but its position is reserved. This allows for a total of six additional source inputs to be configured on the Matrix Switcher.

** The 3.5mm AUX socket on the front of the matrix switcher is internally (electrically) connected to Analogue Input 4. Either the AUX socket OR Analogue input 4 may be used, not both.

### Table 18: Output zones

<table>
<thead>
<tr>
<th>Zone No*</th>
<th>Description (location)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zone 0</td>
<td>Living</td>
</tr>
<tr>
<td>Zone 1</td>
<td>Bathroom</td>
</tr>
<tr>
<td>Zone 2</td>
<td>Bedroom</td>
</tr>
<tr>
<td>Zone 3</td>
<td>Ensuite</td>
</tr>
<tr>
<td>Zone 4</td>
<td>Patio</td>
</tr>
<tr>
<td>Zone 5</td>
<td>Pool area</td>
</tr>
<tr>
<td>Zone 6</td>
<td>Dining</td>
</tr>
<tr>
<td>Zone 7</td>
<td>Study</td>
</tr>
</tbody>
</table>

* The zone number is from 0 to 7, which is corresponding to Matrix Switcher 1 and zone number 1 to 8 in Toolkit, MARPA and PICED settings. See *Table 12* for details.
**Media Link Group**

The following media link groups are used for Streaming Audio, Radio 1 and Radio 2.

- Media Link Group 000 – Streaming Audio
- Media Link Group 001 – Radio Tuner 1, and

*Table 19* shows all MRA objects used in the example project.

*Table 19: MRA objects used in the example project*

<table>
<thead>
<tr>
<th>Network</th>
<th>Application</th>
<th>Zone Number</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home(Local)</td>
<td>MRA</td>
<td>0</td>
<td>Volume</td>
</tr>
<tr>
<td>Home(Local)</td>
<td>MRA</td>
<td>0</td>
<td>Dynamic 1 Label</td>
</tr>
<tr>
<td>Home(Local)</td>
<td>MRA</td>
<td>0</td>
<td>Dynamic 2 Label</td>
</tr>
<tr>
<td>Home(Local)</td>
<td>MRA</td>
<td>0</td>
<td>MRA Command</td>
</tr>
</tbody>
</table>

*Table 20 on page 72* shows all MTC objects used in the example project.

*Table 20: Objects used in the example project*

<table>
<thead>
<tr>
<th>Network</th>
<th>Application</th>
<th>Media Link Group</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home(Local)</td>
<td>Media Transport</td>
<td>Streaming Audio (0)</td>
<td>Play/Stop</td>
</tr>
<tr>
<td>Home(Local)</td>
<td>Media Transport</td>
<td>Streaming Audio (0)</td>
<td>Current Track Name</td>
</tr>
<tr>
<td>Home(Local)</td>
<td>Media Transport</td>
<td>Streaming Audio (0)</td>
<td>Current Selection Name</td>
</tr>
<tr>
<td>Home(Local)</td>
<td>Media Transport</td>
<td>Streaming Audio (0)</td>
<td>Current Category Name</td>
</tr>
<tr>
<td>Home(Local)</td>
<td>Media Transport</td>
<td>Radio Tuner 1</td>
<td>Current Selection Name</td>
</tr>
<tr>
<td>Home(Local)</td>
<td>Media Transport</td>
<td>Radio Tuner 1</td>
<td>MTC Command</td>
</tr>
<tr>
<td>Home(Local)</td>
<td>Media Transport</td>
<td>Radio Tuner 2</td>
<td>Current Selection Name</td>
</tr>
<tr>
<td>Home(Local)</td>
<td>Media Transport</td>
<td>Radio Tuner 2</td>
<td>MTC Command</td>
</tr>
</tbody>
</table>

This example project explains how to control C-Bus media system using an Automation Controller. These steps detail how to create control objects for zone 0. The steps for other zones are similar.
Create MRA Related Objects

Path: Configurator → Objects tab → Add new object.

In Edit object window enter:
- **Network** select Home (Local)
- **Application** select MRA - 205
- **Zone Number** select 0
- **Parameter** select Volume.

Click **Save**.

Add the remaining objects in Table 19 on page 72. The object window will display all four entries in the object screen.
Create MTC related objects

Path: Configurator → Objects tab → Add new object.

In Edit object window box enter:

- **Network** select Home (Local)
- **Application** select Media Transport
- **Media Link Group** select 0
- **Parameter** enter Streaming Audio.

Click **Save**.

At **Parameter** select **Play/Stop**.

Add the remaining objects listed in **Table 20 on page 72**.

Click **Save**.

Add the other objects listed in **Table 15 on page 69**.
Add an MRA/MTC user interface page/plan
Path: Configurator → Vis. Structure tab → Add/Import.
At Select an action select Add plan.

At the Plan window appears, enter Media - Living in the Name field and then click Save.

Create visualization elements for media living page/plan
Path: Configurator → Visualization → Media Living page → Unlock current plan for editing.

Ensure no visual elements are selected in the page/plan.
In the Plan editor, select the Object tab.
At the Object dropdown, select Home/MRA/Zone 0/Volume (0/205/0/0).
Change the **Default icon** to a volume icon.

Click **Add to plan**.

Drag to a desired location and click **Apply**.

To add a text label, click the **Text label** tab.

Enter text in the **Text** field.

Adjust any preferred font characteristics, then click **Add to Plan**.

Drag the text label to the preferred location on page.

Repeat the steps for **Dynamic 1 Label** and **Dynamic 2 Label**.

Click **Save and reload plan**.
### Add MRA Command Object

**Path:** Configurator → Visualization → Media Living page → Unlock current plan for editing.

Ensure no visual elements are selected in the page/plan.

In Plan editor, select the Object tab.

At the Object dropdown, select Home/MRA/Zone 0/MRA Command (0/205/0/10).

Click Visualization parameters.

![Visualization parameters](image)

At Select which parameters to edit window click Local (per-element) parameters.

![Select which parameters to edit](image)

At Visualization parameters window click Control Type box Next Feed.

Click Save.

![Visualization parameters](image)

In Plan editor change the Display mode to Icon.

Click Add to plan.

Drag the icon to a preferred location on the plan.

In Plan editor, select the Text label tab, and enter Text = Next Source/Feed.

Change any font preferences.

Click Add to plan.

Drag the text label to the preferred location next to the icon.

Click Save and reload plan.
Adding visual elements for MTC objects

Path: Configurator → Visualization → Media Living page → Unlock current plan for editing.

Ensure no visual elements are selected in the page/plan.

In Plan editor, select the Object tab.

At the Object dropdown, select Home/Media Transport/Streaming Audio/Play/Stop (0/192/0/0).

At Display mode select Icon.

Select the preferred Default Icon from the dropdown.

Set the On icon to a preferred On Icon from the Select Image window.

Set the Off icon to a preferred Off Icon from the Select Image window.

Click Add to plan.

Drag the icon to a preferred location on the plan, then select the icon, and in Plan Editor, select the Text label tab.

Enter text = Play/Stop.

Adjust any preferred font characteristics, then click Add to plan.

Move the label to the desired position above the icon in the plan.

Click Save and reload plan.
Adding other visual elements

Ensure no visual elements are selected in the page/plan.

Path: Configurator → Visualization → Media Living page → Unlock current plan for editing.

In Plan editor, select the Object tab.

At the Object dropdown, select Home/Media Transport/Streaming Audio/Current Track Name (0/192/0/11).

At Default icon select a preferred icon.

Click Add to plan.

Drag the icon to preferred location on the plan, and from Plan Editor/Text label, enter Text = Streaming: Current Track Name.

Adjust any font characteristics to Text label, then click Add to Plan.

Adjust the Text label to preferred location next to icon. Click Save and reload plan.

Repeat the steps to add visualization elements for the objects:
- Streaming Audio (0)/Current Selection Name
- Streaming Audio (0)/Current Category Name
- Current Selection Name/Radio Tuner 1
- Current Selection Name/Radio Tuner 2.

Adding MTC command visual element

Path: Configurator → Visualization → Media Living page → Unlock current plan for editing.

Ensure no visual elements are selected in the page/plan.

In Plan editor, select the Object tab.

At the Object dropdown, select Home/Media Transport/Streaming Audio/MTC Command (0/192/0/26) - Living.

At Display mode select Icon.

Select the preferred Default Icon from the dropdown.

Click Visualization parameters.

At Select which parameters to edit window click Local (per-element) parameters.
At **Visualization parameters** window click **Control Type** box **Next Track**.

Click **Save**.

In Plan Editor, click **Add to plan**.

Drag the icon to a desired and add a text label **Next Track**.

Repeat the steps to add visualization elements for the objects:

- Home/Media Transport/Radio Tuner 1/MTC Command (0/192/1/26)
- Home/Media Transport/Radio Tuner 2/MTC Command (0/192/2/26). In Visualization parameters for this object change the **Control Type** to **Next Selection**.

When the example project plan displays similar to this plan, click **Save and reload plan**.
4.7.7 Error application

C-Bus error reporting can be added to your Automation Controller through use of the C-Bus Error application. The Error Application is used for monitoring events and notifications in the C-Bus system.

Table 21 shows an office with two C-Bus devices that support error reporting (two 4-channel universal dimmer with device ID 7 and device ID 8).

Table 21: C-Bus Error report enabled device in an office

<table>
<thead>
<tr>
<th>Installed location</th>
<th>C-Bus device</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reception</td>
<td>universal dimmer channel 1</td>
</tr>
<tr>
<td>File Room</td>
<td>universal dimmer channel 2</td>
</tr>
<tr>
<td>Shipping Room</td>
<td>universal dimmer channel 3</td>
</tr>
<tr>
<td>Lunch Room</td>
<td>universal dimmer channel 4</td>
</tr>
<tr>
<td>VP Office</td>
<td>universal dimmer channel 1</td>
</tr>
<tr>
<td>Sales</td>
<td>universal dimmer channel 2</td>
</tr>
</tbody>
</table>

In the Automation Controller there are two types of error devices: physical and virtual.

- **A physical device** refers to a tangible device. The universal dimmer channel 1 is a physical device.
- **A virtual device** refers to an object that is made by logic, and will never send error reports.

If there are more than 2000 errors, a pop-up message will display requesting removal of the unwanted error objects. The Bus Sniffer will be turned off and disabled until this pop-up appears, and the unwanted error objects are cleared.

Virtual devices are used to aggregate errors from multiple channels and devices. There are three types of virtual devices:

- **Project** – Aggregate any error seen by the Automation Controller
- **Network** – Aggregate any error seen on the associated network by the Automation Controller
- **Device** – Aggregate any error seen for the associated system ID and device ID by the Automation Controller.

Each of the physical/virtual object support *most severe* and *most recent* error types. Each physical/virtual object has a unique address assigned to it which is used to refer to it in the Automation Controller for scripting. Note that the address has no meaning in and of itself and is in no way related to a group address or other C-Bus address. *Most recent* error messages reflect the present status of the error condition. *Most severe* error messages reflect the most severe error condition which has existed since the condition was last cleared. A *most severe* error can be cleared using `CBusClearMostSevereError()` function in Lua.

Table 22 shows the physical objects created for this example project in the Automation Controller, assuming the local network `net ID = 0` is tagged as Office.
### Table 22: Physical error objects

<table>
<thead>
<tr>
<th>Name</th>
<th>Object Address</th>
<th>Most recent/ Most severe</th>
<th>Group Address</th>
<th>Device Type</th>
<th>Device ID</th>
<th>System ID</th>
<th>Channel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office/Error/ UniDim MS CH 1</td>
<td>2</td>
<td>Most Severe</td>
<td>0/206/2</td>
<td>Physical</td>
<td>7</td>
<td>Universal Dimmer</td>
<td>1</td>
</tr>
<tr>
<td>Office/Error/ UniDim MR CH 1</td>
<td>3</td>
<td>Most Recent</td>
<td>0/206/3</td>
<td>Physical</td>
<td>7</td>
<td>Universal Dimmer</td>
<td>1</td>
</tr>
<tr>
<td>Office/Error/ UniDim MS CH 2</td>
<td>4</td>
<td>Most Severe</td>
<td>0/206/4</td>
<td>Physical</td>
<td>7</td>
<td>Universal Dimmer</td>
<td>2</td>
</tr>
<tr>
<td>Office/Error/ UniDim MR CH 2</td>
<td>5</td>
<td>Most Recent</td>
<td>0/206/5</td>
<td>Physical</td>
<td>7</td>
<td>Universal Dimmer</td>
<td>2</td>
</tr>
<tr>
<td>Office/Error/ UniDim MS CH 3</td>
<td>6</td>
<td>Most Severe</td>
<td>0/206/6</td>
<td>Physical</td>
<td>7</td>
<td>Universal Dimmer</td>
<td>3</td>
</tr>
<tr>
<td>Office/Error/ UniDim MR CH 3</td>
<td>7</td>
<td>Most Recent</td>
<td>0/206/7</td>
<td>Physical</td>
<td>7</td>
<td>Universal Dimmer</td>
<td>3</td>
</tr>
<tr>
<td>Office/Error/ UniDim MS CH 4</td>
<td>8</td>
<td>Most Severe</td>
<td>0/206/8</td>
<td>Physical</td>
<td>7</td>
<td>Universal Dimmer</td>
<td>4</td>
</tr>
<tr>
<td>Office/Error/ UniDim MR CH 4</td>
<td>9</td>
<td>Most Recent</td>
<td>0/206/9</td>
<td>Physical</td>
<td>7</td>
<td>Universal Dimmer</td>
<td>4</td>
</tr>
<tr>
<td>Office/Error/ UniDim 2 MS CH 1</td>
<td>10</td>
<td>Most Severe</td>
<td>0/206/10</td>
<td>Virtual Network</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Office/Error/ UniDim 2 MR CH 1</td>
<td>11</td>
<td>Most Recent</td>
<td>0/206/11</td>
<td>Virtual Network</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Office/Error/ UniDim 2 MS CH 2</td>
<td>14</td>
<td>Most Severe</td>
<td>0/206/13</td>
<td>Virtual Network</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Office/Error/ UniDim 2 MR CH 2</td>
<td>15</td>
<td>Most Recent</td>
<td>0/206/14</td>
<td>Virtual Network</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Office/Error/ WholeNet MS</td>
<td>16</td>
<td>Most Severe</td>
<td>0/206/15</td>
<td>Virtual Project</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Office/Error/ WholeProject MS</td>
<td>17</td>
<td>Most Recent</td>
<td>0/206/16</td>
<td>Virtual Project</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>

### Table 23 shows the virtual error objects to be used.

### Table 23: Virtual error objects

<table>
<thead>
<tr>
<th>Name</th>
<th>Variable Address</th>
<th>Most recent/ Most severe</th>
<th>Group Address</th>
<th>Device Type</th>
<th>Device ID</th>
<th>System ID</th>
<th>Channel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office/Error/ UniDim MS</td>
<td>0</td>
<td>Most Severe</td>
<td>0/206/0</td>
<td>Virtual Unit</td>
<td>7</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Office/Error/ UniDim MR</td>
<td>1</td>
<td>Most Recent</td>
<td>0/206/1</td>
<td>Virtual Unit</td>
<td>7</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Office/Error/ UniDim 2 MS</td>
<td>10</td>
<td>Most Severe</td>
<td>0/206/10</td>
<td>Virtual Network</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Office/Error/ UniDim 2 MR</td>
<td>11</td>
<td>Most Recent</td>
<td>0/206/11</td>
<td>Virtual Network</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Office/Error/ WholeNet MS</td>
<td>14</td>
<td>Most Severe</td>
<td>0/206/13</td>
<td>Virtual Network</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Office/Error/ WholeNet MR</td>
<td>15</td>
<td>Most Recent</td>
<td>0/206/14</td>
<td>Virtual Network</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Office/Error/ WholeProject MS</td>
<td>16</td>
<td>Most Severe</td>
<td>0/206/15</td>
<td>Virtual Project</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Office/Error/ WholeProject MR</td>
<td>17</td>
<td>Most Recent</td>
<td>0/206/16</td>
<td>Virtual Project</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>
Table 23 on page 82 shows that Office/Error/UniDim, Office/Error/WholeNet, and Office/Error/WholeProject are all virtual devices as their values are only updated by logic and based on their children’s value. For instance, Office/Error/UniDim MS has 4 physical children:
- Office/Error/UniDim MS CH 1
- Office/Error/UniDim MS CH 2
- Office/Error/UniDim MS CH 3
- Office/Error/UniDim MS CH 4.

Similarly, Office/Error/WholeNet MS has 2 children: Office/Error/UniDim MS and Office/Error/Key Unit MS. The following example project will detail how to add them into Automation Controller.

Example project: Creating related error objects
Path: Configurator → Objects tab → Add new object button.

In the Edit object window, at Application select Error (206) from the drop down list.

At Variable Address click the + sign to add a variable address.

In the Tag Map window enter Group address = 2.

In the Name box enter UniDim MS CH 1.
Click **Save**.

Check the radio box next to **Most Severe**.

At **Device type** select **Physical**.

At **Device ID** select **7**. Refer to the reporting unit configuration to match with the correct device ID.

Device ID is the ID number of the devices sending the message (this is often, but not necessarily the same as the unit address)

At **System ID** select **Universal Dimmer**.

At **Channel** select **1**.

Click **Save**. The first error object is now created.
Repeat the steps until all physical error objects in Table 22 on page 82 are created, and then repeat the steps until all virtual error objects in Table 23 on page 82 are created.

The finished objects are shown below.

### Preparing icons

Each object shown in Table 22 on page 82 and Table 23 on page 82 may have both error level and severity level.

All C-Bus devices that support error reporting have five severity levels. The example in universal dimmer has seven error levels and key unit has no error levels.

View existing icons and add related icons if necessary. Prepare three icons for five severity levels:

- Green light for **All OK** and **OK**
- Yellow light for **Minor Failure**
- Red light for General Failure and **Extreme Failure**.

**Prepare seven icons ready for the seven error levels of the universal dimmer example**

Path: **Configurator → Vis. Graphics** tab.

Repeat until all required icons are added.

If more icons are needed, click the **Add icons** button at bottom left.

### Prepare image

Path: **Configurator → Vis. Graphics** tab → **Images/Backgrounds** tab.

Click the **Add images** button to add a floor plan.
Add an error user interface/page plan
Path: Configurator → Vis. Structure tab → Add/Import.
When the Select an action box appears, select Add plan.

When the Plan window appears, enter Error in the Name field and then click Save.

The Error page will now be visible in the Vis. structure tab.

Creating visualization elements for status and error messages on error page/plan
Path: Configurator → Visualization tab → Error page from the structure view.
Click **Unlock current plan for editing**.

Click the **Object** tab in the right-hand panel of the Plan Editor. At **Object**, select *Home/Error/UniDim MS CH 1 (0/206/2)* from the drop-down list.

![Object selection](image)

Click the **Visualization parameters** button.

![Visualization parameters](image)

At **Select which parameters to edit** window click **Local (per-element) parameters**.

![Select parameters](image)

Each universal dimmer channel object has error and severity information (level values and text messages).

Set **Control type** as **Severity**.
Click the **Save** button.

In the **Object** tab of the Plan Editor, select a **Default icon** from the dropdown selection.

Click **Additional icons**.

From the **Additional Icons** window, select **Add icon**.

Set the **Min Value** and **Max Value**.
Select the required icon from the *Icon* drop down, and repeat for all icons as required.

When all objects have been assigned an icon and values, click *Save*.

In the Plan Editor, select the *Object* tab, then click *Unlock current plan for editing*.

Click *Add to plan* to add new visual elements to the page.

Repeats steps to add *Error* type to Office/Error/UniDim MS CH 1 (0/206/2). Select *Control Type* as *Error* in the Visualization parameters > Local (per-element) parameters window.

Change the *Default* icon and modify the Additional icons as well.
Click **Save** when complete.

![Image of Additional Icons window](image)

Drag the elements and resize if desired.

Click **Apply** and then **Save and reload plan**.

![Image of Add to plan and Element position and size](image)

### Add a floor plan as the background

Path: **Configurator → Visualization** tab → **Error page** from the structure view.

Click the **Unlock current plan for editing**. Ensure no visual elements are selected in the page/plan.

In the Plan editor, select the **Image** tab.

At the **Select image** dropdown, select the required floor plan.

Change the **Element position** and **Element size** if required.

Click **Add to plan**.

Rearrange the elements by dragging them to the floor plan.

Change their **Element size** if necessary.

To only display the icon on the floor plan, select the visual element and choose **Display Mode = Icon** for both elements.

Click **Apply** after finalising the changes.
Adding object elements

Add four visual elements (error level and severity level) for both the Most severe object Office/Error/UniDim MS CH 1 and Most recent object Office/Error/UniDim MR CH 1 for Universal dimmer channel 1 on top of the Reception area. In the example, Table 24 shows that we have four visual elements for Reception and two for the restrooms.

**Table 24: Visual elements for the reception and restroom areas**

<table>
<thead>
<tr>
<th>Installed Location</th>
<th>C-Bus Device</th>
<th>Object Used</th>
<th>Most Severe / Most Recent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reception</td>
<td>universal dimmer channel 1</td>
<td>Office/Error/UniDim MS CH 1</td>
<td>Most Severe</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Office/Error/UniDim MR CH 1</td>
<td>Most Recent</td>
</tr>
<tr>
<td>File Room</td>
<td>universal dimmer channel 2</td>
<td>Office/Error/UniDim MR CH 2</td>
<td>Most Recent</td>
</tr>
<tr>
<td>Shipping Room</td>
<td>universal dimmer channel 3</td>
<td>Office/Error/UniDim MS CH 3</td>
<td>Most Severe</td>
</tr>
<tr>
<td>Lunch Room</td>
<td>universal dimmer channel 4</td>
<td>Office/Error/UniDim MR CH 4</td>
<td>Most Recent</td>
</tr>
<tr>
<td>VP Office</td>
<td>universal dimmer channel 1</td>
<td>Office/Error/UniDim 2 MS CH 1</td>
<td>Most Severe</td>
</tr>
<tr>
<td>Sales</td>
<td>universal dimmer channel 2</td>
<td>Office/Error/UniDim 2 MS CH 1</td>
<td>Most Severe</td>
</tr>
</tbody>
</table>

Add the remaining Object elements in Table 24. Each object will have two visual elements, resulting in 14 visual elements for the 7 objects.
Use the **Duplicate** button and then modify the copied elements to greatly speed up your task.

Arrange the icons based on *Table 24* on the floor plan image.

---

### Adding virtual objects to the plan page

Add the virtual objects shown in *Table 25* to the plan/page, including the virtual device objects of: virtual unit; virtual network; and virtual project.

**Table 25: Virtual objects for virtual unit, virtual network and virtual project**

<table>
<thead>
<tr>
<th>C-Bus Device</th>
<th>Object Used</th>
<th>Most Severe / Most Recent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Virtual Unit</td>
<td>Office/Error/UniDim MR</td>
<td>Most Recent</td>
</tr>
<tr>
<td></td>
<td>Office/Error/UniDim MS</td>
<td>Most Severe</td>
</tr>
<tr>
<td>Virtual Network</td>
<td>Office/Error/WholeNet MR</td>
<td>Most Recent</td>
</tr>
<tr>
<td></td>
<td>Office/Error/WholeNet MS</td>
<td>Most Severe</td>
</tr>
</tbody>
</table>

Based on *Table 25*, the following visualization shows all visual elements for this example.
Add text labels on the virtual device objects

To add a text label, click the **Text label** tab.

Enter text in the **Text** field.

Click the **Add to plan** button.

Click **Save and reload plan**.

Drag the text to the proper location and adjust the size using the **Font size** field.

The following visualization is how the page could appear, depending on your preferences.
Add error message text for error objects

Now that the icons to indicate the status of *Most severe* and *Most recent* have been entered, add the error objects to the page, including the Error text message shown in Table 26.

**Table 26: Error objects for locations used in the example**

<table>
<thead>
<tr>
<th>Installed Location</th>
<th>C-Bus Device</th>
<th>Object Used</th>
<th>Most Severe / Most Recent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reception</td>
<td>Universal dimmer channel 1</td>
<td>Office/Error/UniDim MS CH 1</td>
<td>Most Severe</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Office/Error/UniDim MR CH 1</td>
<td>Most Recent</td>
</tr>
<tr>
<td>File Room</td>
<td>Universal dimmer channel 2</td>
<td>Office/Error/UniDim MS CH 2</td>
<td>Most Severe</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Office/Error/UniDim MR CH 1</td>
<td>Most Recent</td>
</tr>
<tr>
<td>Lunch Room</td>
<td>Virtual Unit (universal dimmer)</td>
<td>Office/Error/UniDim MS</td>
<td>Most Severe</td>
</tr>
<tr>
<td>Shipping Room</td>
<td></td>
<td>Office/Error/UniDim MR</td>
<td>Most Recent</td>
</tr>
<tr>
<td>File Room</td>
<td></td>
<td>Office/Error/UniDim MS</td>
<td>Most Severe</td>
</tr>
<tr>
<td>Reception</td>
<td></td>
<td>Office/Error/UniDim MS</td>
<td>Most Severe</td>
</tr>
<tr>
<td>All areas</td>
<td>Virtual Network</td>
<td>Office/Error/WholeNet MS</td>
<td>Most Severe</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Office/Error/WholeNet MR</td>
<td>Most Recent</td>
</tr>
</tbody>
</table>

If continuing from the previous step, exit edit page/plan mode by clicking **Save and reload plan**.

If there is no connection to the physical devices, connect them to get values for the objects.

An alternative is to use the C-Bus Diagnostic Utility to send an error message for each of the physical objects. The next screenshot shows how to use the C-Bus Diagnostic Utility to send an error message for Office/Error/UniDim MS CH 1.

![Screenshot](image-url)
Add error message for severity of objects
Path: **Configurator** → **Visualization** tab → **Error page** on structure view.
Select **Unlock current plan for editing** in the Plan Editor.

Make sure no visual elements on the page are selected.

Click the **Object** Tab, and select **Object = Office/Error/UniDim MS CH 1**.

Click the **Visualization parameters** button.

At **Select which parameters to edit** window click **Local (per-element) parameters**.

To add severity for object **Office/Error/UniDim MS CH 1**, in the **Visualization parameters** window, select **Control type = Severity**.

Click **Save**.

In Plan Editor – **Object** tab, select **Display mode = Value** (from the drop down list).
Click **Add to plan**.
Drag to a desired location and click **Apply**.
In the Plan Editor, Text Label, enter **Text = All OK** to identify the icon.
Click **Add to Plan**, then **Save and reload plan**.
Repeat steps to add all objects in Table 26 on page 94.

The final plan with the finished visual elements might look like this:

Create visualization elements for commands on error page/plan

Add two user parameters to clear Most severe errors and to send acknowledge all error objects with an Lua script.

Path: Configurator → Objects tab → Add new object.

At the Edit object window, select Application = User Parameter (250).

Click the plus sign next to Variable address to enter Variable address of 0.

Enter the name ACK.

Click Save.
Repeat the steps to add the second user parameter object with **Variable address** as 1 and name it **CLEAR**.

Click the icon in the Event script column to enter the event script editor.

Enter following Lua script:

```lua
if event.getvalue() == true then
    -- for all error object in the network 0
    for _, varAddr in ipairs(GetCBusErrorVarAddr(0)) do
        local errobj = GetCBusErrorByVarAddr(0, varAddr)
        if (errobj ~= nil and errobj.ackd == 0 and errobj.devtype == 0) then
            CBusAckErrorByVarAddr(0, varAddr)
        end
    end
    SetUserParam(0, 0, false)
end
```

Click **Save and close** to exit.

Repeat these steps to add the following Lua script on the second user parameter via the event script editor:

```lua
if event.getvalue() == true then
    -- for all error object in the network 0
    for _, varAddr in ipairs(GetCBusErrorVarAddr(0)) do
        local errobj = GetCBusErrorByVarAddr(0, varAddr)
        if (errobj ~= nil and errobj.most_recent == 0 and errobj.devtype == 0) then
            CBusClearMostSevereErrorByVarAddr(0, varAddr)
        end
    end
    SetUserParam(0, 1, false)
end
```

Path: **Configurator** → **Visualization** tab → **Error page** on structure view.

Click **Unlock current plan for editing**, making sure that no visual elements are selected.

In the Plan Editor, select the **Object** tab.
Set **Object** = *Office/User Parameter/ACK (0/250/0)*.

In **Display** mode, from the drop list select **Icon**.

Add icons for *On* and *Off*.

Click **Add to plan**.

Drag icons to the required location on the page, then click **Apply**.

Repeat these steps to add the object *Office/User Parameter/CLEAR (0/250/1)*.
Add two text labels **ACK all** and **Clear all** in the front of the 2 buttons. See *Add text labels on the virtual device objects on page 93.*

The C-Bus Diagnostic Utility or a configured physical C-Bus universal dimmer/key unit can now send an error report. When a report is received, the status icon changes and reports in the error page.

The C-Bus Diagnostic Utility sends these messages:

- universal dimmer channel 1 with severity level 1 and error level 1 for most severe and most recent without ACK.
- universal dimmer channel 2 with severity level 2 and error level 2 for most severe and most recent without ACK.
- universal dimmer channel 3 with severity level 3 and error level 3 for most severe and most recent without ACK.
- universal dimmer channel 4 with severity level 4 and error level 4 for most severe and most recent without ACK.

**Error codes:** The first two digits represent the channel and the last two digits represent the error value.

Example: *Data = 0404* is channel 4, error value 4.

After changes, the error page displays as follows:
Click the **ACK all** button to get ACK messages sent by the C-Bus Diagnostic Utility.

Click the **Clear all** button.

The Error Reporting tab can be enabled by right-clicking on the tab bar.
Example of automated email sent on error condition using event script

In this example, when a Most Recent error occurs at the project level, the Automation Controller will send an email to a nominated email address.

Path = Objects tab → Event script edit icon.

Enter this Lua script modifying user@example.com with a preferred email address.

```lua
errobj = event.getvalue()
if (errobj.severity <= 2 or errobj.ackd == 1) then -- If severity is low then 2 or is has not been acknowledged
  return
else

  subject = CBusFormatError(errobj)
  if (errobj.severity == 0) then
    StrSeverity = “All OK”
  elseif (errobj.severity == 1) then
    StrSeverity = “OK”
  elseif (errobj.severity == 2) then
    StrSeverity = “Minor”
  elseif (errobj.severity == 3) then
    StrSeverity = “General”
  elseif (errobj.severity == 4) then
    StrSeverity = “Extreme”
  else
    StrSeverity = “Unknown”
  end

  message = ‘There is an ‘ .. StrSeverity .. ‘ ‘ .. errobj.error .. ‘ Error has occurred on ‘ .. errobj.sysidstr .. ‘ Channel ‘ .. errobj.channel

  mail(‘user@example.com’, subject, message)
end

Click Save and close to exit.
4.7.8 Add User parameters

User parameters are variables of different data types (e.g. signed integer or boolean). They can be used for visualization or for scripting. They are also used for mapping with values of Modbus Registers. They can also be exported to BACnet IP. User parameters are not exported to C-Bus Toolkit projects.

Click on the Add new object button at the bottom of the objects tab to open an Edit object window.

Select the user parameter application

In the Application list, select: 250 - User Parameter.

Add a new device ID

Click the Variable address Add button to create a new Device ID (0–65535).

ID

Select: 0–65535.

Name

Max 32 characters, except "/". The name is linked with the ID. Change the name in the Tag map tab.

Select a data type

• Boolean
• Unsigned integer (32 bit)
• Signed integer (32 bit)
• Floating point (32 bit)
• RGB colour
• Time/day
• Date
• String (255 Byte).

4.7.9 Add Unit parameters

The Unit parameter application is used to get pre-set information such as the C-Bus voltage. The Automation Controller polls C-Bus units to get these values. The measured value is transferred with a 24 bit floating point number and the unit is coded with 8 bit.

Click on the Add new object button at the bottom of the Objects tab to open an Edit object window.

Select the unit parameter application

In the Application list, select: 255 - Unit Parameter.
Add unit address
Click the Unit address Add button to create a new Unit address (0–255).

Only select units that can deliver the requested value.

ID Select: 0–255.
Name Max 32 characters, except ".". The name is linked with the ID. Change the name in the Tag map tab.

Unit parameters
• Voltage (C-Bus voltage measured by a C-Bus device with a unit address)
• Light level
• Temperature.

4.7.10 Additional parameters for all applications
The following parameters can be set for all applications when adding a new object or editing an existing one.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Keywords</td>
<td>Keywords are assigned to the object. Keywords can be used in scripts. For example, the Keyword &quot;Light&quot; can be used for a central function and the keyword &quot;LED&quot; for some LED lights.</td>
</tr>
<tr>
<td>Log</td>
<td>Activates logging for this object. Logs appear in the Object logs tab. This parameter can also be selected in the objects list.</td>
</tr>
<tr>
<td>High priority log</td>
<td>This option shifts high priority logs towards the top of the list in the Object logs tab. If the defined limit of logs is exceeded, low priority logs at the end of the list are deleted first.</td>
</tr>
<tr>
<td>Export</td>
<td>The Export parameter makes the object visible to remote XML requests, for example to make the object available in BACnet. This parameter can also be selected in the objects list.</td>
</tr>
<tr>
<td>Object comment</td>
<td>Optional additional information.</td>
</tr>
</tbody>
</table>

Table 27: Additional parameters for applications
### 4.8 Edit and test objects

Edit all objects in the *Objects* list.

<table>
<thead>
<tr>
<th>Name</th>
<th>Group address</th>
<th>Ev.</th>
<th>Current value</th>
<th>L.</th>
<th>E.</th>
<th>Keywords</th>
<th>Update</th>
<th>Set value</th>
<th>Vis.</th>
<th>Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local/Lighting/Main...</td>
<td>0/56/2</td>
<td>128</td>
<td></td>
<td></td>
<td></td>
<td>Light_Main</td>
<td>14.01</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Local/Enable/Enable</td>
<td>0/203/1</td>
<td>ON 25</td>
<td></td>
<td></td>
<td></td>
<td>Enable</td>
<td>14.01</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Local/Measurement/...</td>
<td>0/228/5/3</td>
<td>25.5 °C</td>
<td></td>
<td></td>
<td></td>
<td>Basement</td>
<td>14.01</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Local/Scenes/Scene...</td>
<td>0/202/1</td>
<td>Night (3)</td>
<td></td>
<td></td>
<td></td>
<td>All_1_2</td>
<td>12.01</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Click an object in the list to display the object properties. Edit the parameters *Keywords*, *Logs*, *High priority Log* and *Export*. See *Additional parameters for all applications on page 103*.

- Change the names (tags) linked to the composed addresses in the *Tag map* tab.
- The new composed addresses, which are visible in the *Group Address* column cannot be changed. If necessary, delete the object and then create a new one.

### 4.8.1 Preparation for visualization

Edit visualization parameters in the *Vis. Parameters* and via the *Levels* button in the *Objects* list.

**Table 28:** Vis. Parameters and Levels

<table>
<thead>
<tr>
<th>Vis. Parameter</th>
<th>Click a slider icon under <em>Vis. Parameter</em> in the <em>Objects</em> list and then select a control type. For more information, see <em>Visualization parameters and control type on page 139</em>.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Levels</td>
<td>Link levels with names (e.g. 0 = Off and 255 = On). Use levels and names in the visualization (see <em>Overview of control types on page 137</em>). Edit levels and names in the <em>Tag map</em> tab.</td>
</tr>
</tbody>
</table>

### 4.8.2 Control values

**Table 29:** Control values

<table>
<thead>
<tr>
<th>Set values</th>
<th>When C-Bus is connected, the information <em>C-Bus Online</em> appears at the bottom of the window. With this button open a window and select values for sending. In the case of a lighting application select a level and a ramp rate. If there is a prepared a temperature alarm, send the value that triggers the alarm. Set and save values. The new value is then visible in the <em>Current value</em> column. When the value is send, the background colour of row turns for same seconds to green and then to grey.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current value</td>
<td>This column displays the last send or received value.</td>
</tr>
<tr>
<td>Auto update enabled</td>
<td>Object values will automatically be updated when changed. They will highlight green for a few seconds. With a click on the <em>Auto update enabled button</em> this function can be disabled.</td>
</tr>
<tr>
<td>Refresh button</td>
<td>Click the <em>Refresh button</em> at the bottom of the list to manually refresh the list.</td>
</tr>
<tr>
<td>Bus sniffer</td>
<td>By default, the Bus sniffer function is enabled. When the sniffer function is disabled or C-Bus is offline, new objects will not be displayed. See <em>Sniffer function on page 105</em>.</td>
</tr>
</tbody>
</table>
**4.8.3 Additional options for editing**

Table 30: Additional options for editing

<table>
<thead>
<tr>
<th>Delete</th>
<th>Click a delete button 🗑️ in the list to delete the associated object.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clear</td>
<td>Click the Clear button at the bottom of the list to delete all currently visible objects in the list. This is useful when used with the filter function. A warning is displayed when this button is clicked.</td>
</tr>
<tr>
<td>Mass delete</td>
<td>Click the Mass Delete button at the bottom of the list to delete objects from the current filter. A warning is displayed when this button is clicked.</td>
</tr>
</tbody>
</table>
| Object filter | • **Name:** Any part of the object name.  
• **Address:** The wild cards “*” and “,” can be used, e.g. 0/2/*  
• **Application:** Select from a list.  
• **Keywords:** Separate multiple keywords with “,” and select whether the filter will find matches for all keywords entered, or just one or more keywords.  
The object filter is located on the left side of the list and can be opened and closed with a button. |

**4.9 Sniffer function**

When the sniffer function is enabled and C-Bus is online, new objects are automatically added to the **objects** list. Existing objects with the same composed address are not overwritten.

New objects are not automatically added to the **Tag map** list, they can be added manually and optionally change the names. See **Tag map** on page 43.

**4.9.1 Communication with C-Bus**

C-Bus must be physically connected via one of the C-Bus RJ45 connectors on the Automation Controller. If C-Bus is online, the status is shown in the bottom bar of the **Configurator** page. See “3.8.4 Bus Status” on page 34.

**Set and send values**

The value appears in the **Current value** column of the **Objects** list (click on the **Objects** tab of the configurator page). When the value is saved, the background colour of the row turns green for a few seconds.

**4.9.2 Discover new objects**

By default, the sniffer function is disabled. Enable the sniffer function in the **General configuration** tab.

Path: **Utilities** tab → **General configuration** tab.

When a new object is discovered, a new row appears and the background colour of the row is green for a few seconds. The row background colour also turns green for a few seconds when a new value for an object is received.
4.10 Object logs

An object’s event history is displayed in Object logs tab. Logging must be enabled for the object, after which all events are logged.

<table>
<thead>
<tr>
<th>Log time</th>
<th>Name</th>
<th>Object address</th>
<th>Decoded value</th>
<th>Object data (nu)</th>
</tr>
</thead>
<tbody>
<tr>
<td>06.04.20...</td>
<td>Local/Lighting/R...</td>
<td>0/56/1</td>
<td>0 - 0%</td>
<td>00000000</td>
</tr>
<tr>
<td>06.04.20...</td>
<td>Local/Lighting/R...</td>
<td>0/56/1</td>
<td>175 - 70%</td>
<td>B2B20000</td>
</tr>
<tr>
<td>06.04.20...</td>
<td>Local/Measurement</td>
<td>0/228/25/2</td>
<td>24 °C</td>
<td>41C000000</td>
</tr>
</tbody>
</table>

### 4.10.1 Filter functions

**Table 31: Filter functions**

<table>
<thead>
<tr>
<th>Filter function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start date</td>
<td>Enter date and time</td>
</tr>
<tr>
<td>End date</td>
<td>Enter date and time</td>
</tr>
<tr>
<td>Group address</td>
<td>Enter composed address (e.g. 0/56/3)</td>
</tr>
<tr>
<td>Network</td>
<td>Select network from list (e.g. 0-local)</td>
</tr>
<tr>
<td>Application</td>
<td>Select application from list.</td>
</tr>
<tr>
<td>Keywords</td>
<td>Enter one or more keywords. Keywords must be separated with a comma (e.g. floor1,left).</td>
</tr>
<tr>
<td>Value</td>
<td>Enter a value (e.g. 255).</td>
</tr>
</tbody>
</table>

### 4.10.2 Clear

Click the Clear button at the bottom of the Object logs tab to clear all logs.

### 4.10.3 Export all logs

Click the Export all Logs button to exports logs to a .CSV file.

### 4.10.4 High priority log

This option moves high priority logs closer to the top of the list. If the defined limit of logs is exceeded, low priority logs at the end of the list are deleted first.

### 4.10.5 Log size

By default, the log size is set to 200. The log size can be changed in the general configuration (path: Utilities tab → General configuration button).

Excessive object logging degrades the performance of the Automation Controller.
5 Tag map

The Tag map tab provides a detailed view about all objects. Once new objects are imported or added, access them in the tag map. Use the tag map to change all names (tags) and add new applications, groups and levels. The tag map view is hierarchical, and can be expanded and collapsed in sections to focus on the required objects.

Path: Configurator → Tag map tab.

5.1 Structure

The tag map is a tree structure using the following hierarchy:

- Network
- Application
- Group > (Sub-group)
- Level.

5.1.1 Example of a tag map

![Tag map example]

- Network (e.g. 0 - Ground floor)
- Application (e.g. 56 - Lighting)
- Group (e.g. 1 - Room 1)
- Level (e.g. 255 - On)

- Expand and show subordinate step
- Collapse and show superordinate step

Add:
- Network
- Application
- Group
- Level

- Delete step and all subordinated steps

5.1.2 Edit tag names

On each level, the number and the name (tag) are shown. In the Objects list, the numbers of network, application and group are composed and separated with a slash.

e.g. 0/58/1 = Local/Lighting Upper Floor/Room 1.
What cannot be edited
In the case of a measurement application, editing is possible for the tag names of network, application and device ID (group address), but not the channel number.

\[ \text{e.g.} \ 0/228/1/1 = \text{Local/Measurement/Temperature/1}. \]

5.1.3 Add new tags
Add new tags using the tag map, but it is recommended to add new applications and groups in the objects list or to import a CGL file from Toolkit. The new applications and groups are then displayed in the tag map.

An exception to this is for objects detected by the sniffer function. These objects appear in the Objects list but are not displayed in the tag map. In this case, use the tag map to add these applications and group addresses and optionally change the tag names.

Add application group level
Levels are used for the visualization (see Overview of control types on page 137).

Names can be defined for levels (e.g. 255 = On and 0 = Off). The levels defined in the tag map are also available in the Objects list.

Add a new tag via the Add new tag button or via an Add button in the Tag map list.
6 Schedulers

The Scheduler provides control of different building functions using date and time. Typical functions include lighting, shutter control, heating and cooling control, and scene control for multiple functions. Use the application 250 - User Parameter, to trigger an event-based script.

Use the Configurator to add objects and edit their schedule times.

The end user can edit scheduled times but cannot add new objects.

6.1 Access to the Scheduler

The end user can access the scheduler from either the main menu or the visualization view.

From the main menu
Click the Scheduler button on the main menu.

From the visualization view
Choose path: Configurator → Scheduler tab.

- To open the main Scheduler page from the Configurator, configure the Schedulers link in the plan editor of the visualization. See Links on page 143.
- To display the Scheduler as a frame within the visualization, configure a Frame in the plan editor of the visualization. See Frame on page 146.

Schedulers are not supported on the Smartphone Visualization page.

6.1.1 Link to a specific scheduler

1 In the Configurator > Schedulers tab (see page 110), click the Direct link button to display the Direct link window.

2 In the Direct link window, choose a Scheduler. The link to the scheduler is displayed in the Link field.

To link a scheduler in the visualization of another Automation Controller, complete IP address. Tick Include IP / host to display the complete IP address in the Link field.
3. Copy the scheduler link displayed in the *Link* field.
4. Open the configurator *Visualization* tab. See *Links on page 143*.
5. Configure a *Link* in the *Plan Editor*, using the following settings:

   **Link to:** Select “External link”
   
   **External Link:** Paste the link copied from the Link field (see step 3)
   e.g. /scada-vis/schedulers?id=1

### 6.2 Schedulers and events

Configure all scheduling functions using the configurator *Schedulers* tab. Each scheduler must be linked with an object.

#### 6.2.1 Add a scheduler

Path: *Configurator* → *Schedulers* tab → *Schedulers* button → *Add Scheduler* button.

*Table 32: Scheduler settings*

<table>
<thead>
<tr>
<th>Object</th>
<th>Select an object to control.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active</td>
<td>Set the scheduler to the <em>active</em> or <em>inactive</em> status. Can also be edited in a visualization—see 3 on page 110.</td>
</tr>
<tr>
<td>Name</td>
<td>Select a name. Can also be edited in a visualization—see 3 on page 110.</td>
</tr>
<tr>
<td>Start/End date</td>
<td>Defines when the Scheduler will work. The default dates are: January 1 to December 31. Can also be edited from a visualization—see 3 on page 110.</td>
</tr>
</tbody>
</table>

#### 6.2.2 Add an event

Add events in a visualization or in the configurator.

- In a *visualization*, click the *Add event* button—see 3 on page 110.
- In the *configurator*, click the *Add event* button in the *Events* list of the specific scheduler.

Path: *Scheduler* tab → *Schedulers* button → *Scheduler* List → *Events* icon.

*Table 33: Event settings*

<table>
<thead>
<tr>
<th>Active</th>
<th>Set the event to the active or inactive status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Select a name.</td>
</tr>
<tr>
<td>Run at</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Sunrise</td>
</tr>
<tr>
<td></td>
<td>• Sunset</td>
</tr>
<tr>
<td></td>
<td>Sunrise and Sunset times are dependent on the time zone or the specific longitude and latitude of the location. See <em>Set Date and time on page 30</em>.</td>
</tr>
<tr>
<td></td>
<td>• Specific time</td>
</tr>
</tbody>
</table>
### Start time offset
(Sunrise or Sunset)
Select a time offset: –11 h 59 min to +11 h 59 min

### Start time
(Specific time)
Time when the event is triggered (switching time)

### Day of the week
(Specific time)
None ... All (Mo, Tu, ... Su)
e.g. Tu-We, Fr
Default: All

### Weekday in month
(Specific time)
None to All (1st, 2nd, 3rd, 4th, 5th, last)
e.g. 1st, 3rd
Default: All

### Days of the month
(Specific time)
None ... All (1, 2, ... 31)
e.g. 1, 14,
Default: All

### Months
(Specific time)
None ... All (Jan, Feb, ... Dec)
e.g. Jan-Mar

### Year
No entry, Year
e.g. 2017 = only in 2017
Default: No entry = recurring every year

### Holidays
Holiday periods can by defined can be applied for all schedulers. For each event select one of the following options:
- No effect
- Do not run on holidays
- Run only on holidays
Default: No effect

### Value
Select values specific to the application of the object e.g. Lighting: Target level and Ramp rate

When all settings are selected, click the **Save** button.

### Example with day of week
To schedule for every Friday to switch the light off at 10 pm, apply the following settings:

<table>
<thead>
<tr>
<th>Setting</th>
<th>Setting Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start time</td>
<td>22:00</td>
</tr>
<tr>
<td>Day of the week</td>
<td>Fr</td>
</tr>
<tr>
<td>Weekday in month</td>
<td>All</td>
</tr>
<tr>
<td>Days of the month</td>
<td>All</td>
</tr>
<tr>
<td>Months</td>
<td>All</td>
</tr>
<tr>
<td>Year</td>
<td>No entry</td>
</tr>
<tr>
<td>Holidays</td>
<td>No effect</td>
</tr>
<tr>
<td>Value</td>
<td>Target level: 0</td>
</tr>
<tr>
<td></td>
<td>Ramp rate: 0 s</td>
</tr>
</tbody>
</table>

### 6.2.3 Add holidays
Holiday periods can be defined and applied to any scheduler. Holidays can be applied differently to each event:
- Event is not affected.
- Event does not run on holidays.
- Event runs only on holidays.

Add holidays in the visualization view or in the configurator.
- [In the visualization](#), click **Holidays** and then the **Add holiday** button.
- [In the configurator](#), click the **Add holiday** button in the **Holidays** list.

Path: **Schedulers** tab → **Holidays** button → **Holidays** List → **Events** icon.
**Settings for day of week (visualization view)**

*Table 34: Holiday settings (day of week)*

<table>
<thead>
<tr>
<th>Holiday type</th>
<th>Day of the week</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day of the week</td>
<td>Select a week of the month: 1st, 2nd, 3rd, 4th, 5th, last</td>
</tr>
<tr>
<td>Month</td>
<td>Select a day: Monday, Tuesday, ... Sunday</td>
</tr>
<tr>
<td>Duration (days)</td>
<td>Select a month: January, February, ... December</td>
</tr>
<tr>
<td>Recurring every year</td>
<td>Checked = yes, Unchecked = no</td>
</tr>
</tbody>
</table>

**Settings for specific date (visualization view)**

*Table 35: Holiday settings (specific date)*

<table>
<thead>
<tr>
<th>Holiday type</th>
<th>Specific date</th>
</tr>
</thead>
<tbody>
<tr>
<td>From date</td>
<td>Select in calendar view:</td>
</tr>
<tr>
<td>Month</td>
<td>Select a month: January, February, ... December</td>
</tr>
<tr>
<td>Recurring every year</td>
<td>Check to activate, Uncheck to deactivate</td>
</tr>
</tbody>
</table>

**6.2.4 Configuring from the visualization view of the Scheduler**

- **Scheduler:** Schedulers are created in the configurator.
- **Status:** Displays as active or inactive.
- **Edit Scheduler button:** Set scheduler status with start and end dates, holiday behaviour.
- **Add event button:** Set name, run time (e.g. switching) and value.
- **Edit event button:** Change name, run time (e.g. switching) and value.
- **Event.**
- **Holidays:** Set special time periods for all schedulers.

When an Object of an application is linked to a scheduler the user can add, edit and delete Events. In addition the user can edit different Holidays.
7 Trend logs

Trend logs, or data logging, allow the end user to store selected data and compare that data over time. Trends can be accessed via the main menu or via the visualization. Trend logs are stored on the Automation Controller’s internal memory and automatically synced to the internal microSD card. Use the Configurator to add and edit objects.

The end user can select different trend views but cannot create new objects.

7.1 Access to trend logs

The end user can access the trend logs from either the main menu or the visualization view.

From the main menu
Click the Trends button on the main menu.

From the visualization view

Link to all trend logs
• To open the main trends page from the visualization, configure the Trend link in the plan editor of the visualization (see Links on page 143).
• To display the trends as a frame within the visualization, configure the Frame in the plan editor of the visualization (see Frame on page 146). Trends are not supported on a Smartphone Visualization page.

Link to a specific trend log
1 In the configurator Trend logs tab (see page 118), click the Direct link button to display the Direct link window.

2 In the Direct link window, choose a Trend log. The link to the trend log is displayed in the Link field.

To link a trend log in the visualization of another Automation Controller, complete the IP address. Tick Include IP/host to display the complete IP address in the Link field.

3 Copy the Link field to use it in the plan editor of the visualization.
4 Open the configurator Visualization tab. See Links on page 143.
5 Configure a link in the plan editor, using the following settings:

<table>
<thead>
<tr>
<th>Link to:</th>
<th>Select “External link”</th>
</tr>
</thead>
<tbody>
<tr>
<td>External Link:</td>
<td>Paste the link copied from the Link field (see step 3) e.g. /scada-vis/trends?id=1&amp;mode=day</td>
</tr>
</tbody>
</table>
7.2 Views of trend logs

On the *Trends* page, select from different views.

![Calendar and View Options](image)

7.2.1 Available trend log views

- View period of trend:
  - Day
  - Week
  - Month
  - Year.

- View current and previous trend:
  - **Current**: Click the *Current* button and select the *day/month/year* in the calendar that will be the *Current* view. The curve *Current* is always shown.
  - **Previous**: click the *Previous* band and select the *day/month/year* in the calendar that will be the *Previous* view. The curve *Previous* is not shown until also the *Show previous* button is clicked.

- View single or multiple trends:
  - *Single trend* button
  - *Multiple trend* button.

- View graph or data:
  - *Graph* button
  - *Data* button.
Example with current and previous trend and period day

Example with multiple trend and period day

7.2.2 Add new trend log

To add a new trend log, click the Add new trend log button at the bottom of the trend log tab (see previous screen shot). Configure the following trend log parameters.

Table 36: Trend log parameters

<table>
<thead>
<tr>
<th>Object</th>
<th>Select object to log.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Name of the trend log.</td>
</tr>
</tbody>
</table>
| Log type | • Counter: Sums up the delta between the received value and the last received value (negative delta is not regarded).  
           • Counter with negative delta (negative delta is also taken into account).  
           • Absolute: Saves the actual values. |
| Trend resolution | Average value of the counted samples for the specific time interval to be displayed on the trend (5, 10, 15, 20, 30 min, 1 hour). |
### 7.2.3 Configure trend logs

Configure trend logs in the *Trend logs* tab.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy</td>
<td>Local/Measurement/Counter</td>
<td>2</td>
<td>1 hour</td>
<td>180 days</td>
<td>2 years</td>
<td>40 KB</td>
<td>2017</td>
<td></td>
</tr>
<tr>
<td>Voltage</td>
<td>Local/250/254/Monitor</td>
<td>2</td>
<td>1 hour</td>
<td>180 days</td>
<td>2 years</td>
<td>40 KB</td>
<td>2017</td>
<td></td>
</tr>
</tbody>
</table>

- **Decimal places**: If the object is a floating point type, it is mandatory to enter the number of decimal places.
- **Resolution data**: Storage time for short time data (max. 5 years).
- **Daily data**: Storage time for long term data (max. 10 years).
- **Always show zero**: If checked, the Y-axis begins with 0. If unchecked, the Y-axis begins at lowest real value. Unchecking this option improves trend resolution if values are always far from 0.
8 Scenes

The Scenes tab, allows easily configured scenes.

Path: Configurator → Scenes tab → Scenes list.

Use a scene to change multiple room functions at the touch of a button. Setting a scene allows dimming of the room lighting to a specific value, move the blinds into the desired position and switch on the power supply to the socket outlets in a room. As an example of a pure lighting scene, control three channels of a dim actuator using the scenes day, night and video.

For a standard scene, the following is needed:

- A Trigger group to set different scenes. Use the application 202 - Trigger Control.
- One Action selector for each scene. The action selector is associated with the Trigger Control.
- Components for each scene. These components will be controlled via applications (e.g. 56 Lighting).
- Values (e.g. levels and ramp rates) of the components for each scene. The values can be edited or saved online via C-Bus.
- Buttons or functions to set scenes. These buttons can be physical C-Bus push buttons or elements on a screen (see Visualization on page 120). Alternatively, a scene can be set by a physical timer or a software function (see Schedulers on page 109).

8.1 Configuration

For each scene, configure a Trigger group in the Scenes list.

<table>
<thead>
<tr>
<th>ID</th>
<th>Name</th>
<th>Group address</th>
<th>Action selector</th>
<th>Keywords</th>
<th>Sequence</th>
<th>Active</th>
<th>Duplicate</th>
<th>D...</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Video</td>
<td>Local/Scenes/Scene func...</td>
<td>Video (1)</td>
<td>Video</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Day</td>
<td>Local/Scenes/Scene func...</td>
<td>Day (2 - 1%)</td>
<td>Day</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Night</td>
<td>Local/Scenes/Scene func...</td>
<td>Night (3)</td>
<td>Night</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

8.1.1 Add scene

Click the Add scene button to open the scene parameters.

Table 37: Scene parameters

<table>
<thead>
<tr>
<th>Name</th>
<th>Name of the scene</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scene is active</td>
<td>Active: scene is ready for usage.</td>
</tr>
<tr>
<td>Group address</td>
<td>Select a trigger group (Application 202 Trigger Control).</td>
</tr>
<tr>
<td>Action Selector</td>
<td>For each value of the Action Selector, define the display text. The display text appears in a visualization (see Local and remote scene control on page 118). For example, if a night scene is triggered with value 3, edit a level with the object value 3 and the display text “Night”. Click the Levels button to configure levels.</td>
</tr>
<tr>
<td>Keywords</td>
<td>Keywords can be used for scripts.</td>
</tr>
</tbody>
</table>

Click Save button when parameters are set.

Click a row in the Scene list to open the scene parameters for editing.
8.1.2 Add components
A list of objects for one scene is called Sequence. Click the symbol in the Sequence column (see page 117) to add an object for each component and select values. The following actions are available.

8.1.3 Add objects to a scene
Click the Add objects button to open the list of objects. Select the objects required to be controlled by the scene and then click the Save button.

8.1.4 Set values to the objects of a scene
Select one or more objects and click the Set value button. Select a value and click the Save button.

8.1.5 Run scene
When controlling a scene online via C-Bus, click the Run scene button.

8.1.6 Save live values
With this function, it allows changing of the values of the components independent of the Automation Controller. For example, prepare a lighting scene by physically setting each light to the brightness required. Then, select the corresponding objects and click the Save live values button. The actual values are displayed in the list.

8.1.7 Delete
Click the Delete button to remove objects from a scene, e.g. to delete unwanted objects from a scene that is duplicated as a starting point.

8.1.8 Duplicate
In many cases, the same trigger groups and components are used in scenes. Click the symbol in the Duplicate column (see page 117) to create a copy of a scene.

8.1.9 Local and remote scene control
Scenes can be controlled via a PC/Tablet or a Smartphone visualization.

<table>
<thead>
<tr>
<th>PC/Tablet</th>
<th>Smartphone</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="PC/Tablet" /></td>
<td><img src="image2" alt="Smartphone" /></td>
</tr>
</tbody>
</table>

---
Remotely control local scenes configured in the Automation Controller by using a C-Bus push-button configured with a scene function:

① Configure Automation Controller keys as scene keys.
② Use the trigger group of the local scenes.
③ Use the values of the action selectors linked with local scenes.

Scenes configured in another C-Bus device can be controlled from the PC/Tablet or Smartphone visualization. The same trigger group can be used in the Automation Controller and the other C-Bus device.
9 Visualization

A visualization is a structured collection of pages called *Plans*. Each plan is linked with a *Level*, which normally represents one floor of a building. A plan can contain graphics, text and control elements. Communication with active elements is based on C-Bus *Objects*.

Each plan can be used as *PC/Tablet visualization*, *Smartphone visualization* or both.

9.1 Example of a visualization page for PC/Tablet

- **Text label**: The name of the plan.
- **Object (switch)**: Touch the object icon for direct control and status indication.
- **Object (control)**: Touch the object to display a slider control to adjust a setting.
- **Gauge**: Touch the selected control element to display a value, e.g. temperature.
- **Links**: Provides access to other visualization pages in the plan. Touch a link to display that visualization page.
9.2 Example of a visualization page for Smartphones

The Smartphone Visualization displays a list with the configured object and link elements. Text label, image, gauge and graph elements are only displayed in the PC/Tablet Visualization. Each object, link and frame element can optionally be hidden in the Smartphone Visualization.

The Smartphone Visualization adapts automatically to the screen size. For PC/Tablet Visualization, however, defining the plan size is mandatory. Templates are available for various resolutions and screen types (e.g. landscape WSVGA or portrait HD).

By default, start the PC/Tablet Visualization or the Smartphone Visualization via the Start page.

To create a visualization, click the Configurator button.

Configure user access to visualization pages (see User access on page 163). For each user, different levels of access can be given for visualization pages (plans), schedulers and trends.

The Network Automation Controller is designed for a maximum of 50 users for visualization. The Wiser for C-Bus Automation Controller is limited to a maximum of 8 users.
9.2.1 Steps of a visualization

1. (Optional) Start with a general configuration of the visualization pages in the Vis. configuration tab.
2. Upload any background and Plan images (e.g. icons) via the Vis. graphics tab.
3. Create at least 1 Level and 1 Plan in the Vis. structure tab (each visualization page is linked to a Level).
4. (Optional) Create other structure elements such as Layouts and Widgets.
5. Add the content to the Layouts, Widgets and Plans in the Visualization tab.
6. When adding objects to the plan, the objects must be available (see C-Bus objects on page 36). (An object is a C-Bus object in a network with an application and a group.)

Table 38: Visualization steps

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Path</th>
<th>Steps</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visualization configuration on page 123</td>
<td>Configurator → Utilities → Vis. configuration or Configurator → Visualization → Vis. configuration button</td>
<td>(Optional) Select general settings for the visualization. Default Settings: • PC/Tablet sidebar: Shows as overlay. • PC/Tablet view: Centers plans, enables auto-sizing. • PC/Tablet page transition: No transition.</td>
</tr>
<tr>
<td>Visualization graphics on page 125</td>
<td>Configurator → Vis. graphics</td>
<td>(Optional) Add graphical elements to include later via the Visualization → Image tab. • Icons: Add icons for new functions. • Images/Backgrounds: Add project-related images. • Fonts: Add fonts for Text labels. • Edit Custom CSS: If available, upload and edit new Cascading Style Sheets.</td>
</tr>
<tr>
<td>Layouts and Widgets on page 128</td>
<td>Configurator → Vis. structure → Layout/Widgets</td>
<td>(Optional) Add layouts and widgets to the structure. A Layout can be used as a template for one or more plans (visualization page). A Widget is a small visualization page which pops up when pressing the associated button (icon) on the plan. A widget is linked with an object. The elements for the layouts and widgets must be added in the Visualization tab.</td>
</tr>
<tr>
<td>Levels and Plans on page 130</td>
<td>Configurator → Vis. structure → Levels/Plans</td>
<td>Mandatory Add Levels and Plans to the structure. (Minimum = 1 level with 1 plan) A level is usually a part of a building (e.g. ground floor). A plan is a room or a functional overview. Default plan settings: • Plan size: 1024 x 768 • Layout: PC/Tablet visualization: show Smartphone visualization: show. The plan elements must be added in the Visualization tab.</td>
</tr>
</tbody>
</table>
9.3 Visualization configuration

Configure all pages of the visualization via the Vis. Configuration button:

Open the visualization configuration via one of the following paths:

- **Configurator → Utilities** tab → **Vis. configuration** button or
- **Configurator → Visualization** tab → **Vis. Configuration** button.

9.3.1 Visualization configuration parameters

![Visualization configuration settings](image)
PC/Tablet sidebar
Enables a sidebar containing a list of plans in the visualization. The sidebar is used to
navigate between visualization pages (plans). Sidebar display options include:
• Show as overlay (auto-hide)
• Show docked
• Hide (full-screen mode)
• Docked/with auto-hide option/hidden.

PC/Tablet view
Defines how plans will be displayed. Options include:
• Align plans to top left, no size limits
• Center plans, limit size
• Center plans, enable auto-sizing
• Center horizontally, auto size width.

Information about auto-sizing
If using Google Chrome, Safari or Firefox, auto-sizing is supported.

PC/Tablet page transition
Enables different transition effects for page changes in the visualization.

PC/Tablet auto/size upscaling
Enables automatic rescaling for multiple screen resolutions.

PC/Tablet background colour
Applies a common background colour for all visualization pages. Alternatively, select
a background colour per Layout or per Plan.

PC/Tablet background image
Applies a common background image for all visualization pages. Alternatively, select
a background image per Layout or per Plan.

Custom font
Applies a common font for the visualization.

Use dark theme
Inverts colours, fonts, graphs and controls to match a dark styled visualization.

Enable swipe gesture
Enables swiping between plans on tablets and smartphones.

Disable object click animation
By default, objects change their size slightly when clicked on. Select this option to
prevent this effect.
Dim inactive visualization after
An energy-saving feature for battery powered devices. Select the number of minutes before an inactive visualization is dimmed.

Dimming level
Adjusts the brightness level of dimmed screens as a percentage of full brightness.

Show alerts in PC/Tablet
By default, alerts are displayed in the Alerts tab within the configurator. When this parameter is enabled, alerts are also displayed as pop-up messages in the PC/Tablet visualization:

9.4 Visualization graphics
Graphics must first be uploaded before they can be used in the visualization. In the Vis. graphics tab, the following sub-tabs are available:
- Icons
- Images/Backgrounds
- Fonts
- Edit custom CSS.

9.4.1 List of Icons


9.4.2 Icons and images

Icons
A basic package of icons is pre-installed. Additional icons can be downloaded.

Image formats
JPEG, GIF, PNG and SVG images are supported. The file name can contain letters, numbers, underscore and minus characters.

Name (optional)
Add a name for an image to appear in the list when adding a new object. An image name can contain letters, numbers, underscore and minus characters.

Add/Delete new images
- Use the Add/Delete buttons on the bottom of the Icons tab and Images/Backgrounds tabs to add or delete images.
- Upload individual files as-is, or multiple files in a ZIP archive.
- Max size of an individual graphic: 2 MB.
- Max size of a whole ZIP archive: 32 MB.

9.4.3 Fonts
True Type (TTF) and Open Type (OTF) fonts are supported. In order to access new fonts in the visualization editor, firstly install the font(s) and then click the Save and reload plan button.

9.4.4 Edit custom Cascading Style Sheets
Advanced function: The visualization style and design is controlled by a Cascading Style Sheet (CSS). The CSS determines the style of all control buttons, Smartphone visualization, Scheduler and Trend.
Install a modified CSS containing different style definitions for the visualization elements.

Any replacement CSS must contain all of the classes and definitions of the original CSS to avoid degrading the appearance and functionality of the visualization pages.

9.5 Visualization structure
Use the Vis. Structure tab to create all building Levels and Plans.
Additionally, it allows creation of Layouts and Widgets.

A Plan is a visualization page, which can contain graphics, text and control elements.

A Layout is an advanced background layer for plans. The layout can:
- contain the same type of elements as a plan, and
- be associated with one or many plans.

All elements of a layout are visible in the background of the plan, while elements of the plan are displayed in the foreground. Typically, a layout contains common elements for the plans, such as menu buttons or time and date.
The dimensions (pixel size) of the layout and plan can be different or identical. The center point of both layout and plan is the same when displayed in the visualization.

A **Widget** is a small visualization page which can pop-up on top of the plan when a button is clicked or tapped.

The widget size must always be smaller than the plan size.

**Example of a Plan with a Layout and a Widget**

- **Layout**: The area in the blue frame.
- **Plan**: The area in the red frame.
- **Widgets**: The area in the orange frame.

Content cannot be added to **Layouts**, **Widgets** and **Plans** using the **Vis. Structure** tab. Once the structure is created using the **Vis. Structure** tab, add the content via the **Visualization** tab.
### 9.5.1 Layouts and Widgets

*Layouts/Widgets* are optional design elements that can be used on plans.

A layout can be added to a plan ([see Levels and Plans on page 130](#)).

A widget can be added to an object ([see Objects on page 136](#)).

#### Add new Layout/Widget

Add a new *Layout* or *Widget* with these controls:

- The + button (layout or widget)
- The *Add new layout* button
- The *Add new widget* button.

#### Actions with levels including all plans or individual plans

- Export as file (*.tar) with the *Export* button
- Import a file (*.tar) with the *Add/Import* button
- Duplicate with the *Duplicate* button
- Delete with the *Delete* button

#### Example of Layout parameters

![Example of Layout parameters](image-url)
**Plan Size**

The size of the *Layout* and the *Plan* can be different. When displayed, the center point of both layout and plan is the same. The *Widget* size must be smaller than the plan on which it is placed.

**Background images**

First import the image via the *Vis. Graphics* tab. First import the image via the *Vis. Graphics* tab.

A background image is aligned with the top left corner of the plan and is displayed at its original size.

In the *Visualization* Tab, images can be placed as image elements and positioned freely when the page is designed.

**Repeat background image**

A small image can be repeated (tiled) across the *Layout*.

**Example of Widget parameters**

![Widget parameters](image)

**Widget position**

By default, *Widgets* are displayed next to the icon which calls the widget. Define another position on the plan for the widget if desired.
9.5.2 Levels and Plans

A Plan is visualization page which can contain graphics, text and control elements. In the Vis. structure tab, Plans are linked to the Levels. Define the size and background colours and images in the Vis. structure tab, however the content of a plan has to be added in the Visualization tab.

Levels usually represent a part of a building, such as a floor. Levels can also be used for different functions such as lighting, shutter control and heating. Use levels as structure elements for plans in the navigation/sidebar of the visualization.

The Levels/plans sub-tab in the Vis. Structure tab contains the function icons and buttons for creating and editing levels and plans.

Add new level
Add a new main Level with the Add new level button (several main levels are possible). Protect access to the level with a Pin Code (3–8 digits).

Add a second level or plan
Add a second Level or a new Plan by clicking the Add/Import button:

Plans can be added to a second level, but not a third level. Protect access to the level with a Pin Code (3–8 digits).

Actions with levels including all plans or individual plans
- Re-order within a Level using the Move up/down buttons
- Export as file (*.tar) with the Export button
- Import a file (*.tar) with the Add/Import button
- Duplicate with the Duplicate button
- Delete with the Delete button.
Example of plan parameters

Plan size in pixels
Click the plan size button to set the plan size:

Enter specific values or select a pre-set size:

Layout (optional)
Assign a layout to the plan. (First create a layout—see Layouts and Widgets on page 128).
PC/Tablet visualization and Smartphone visualization
- Show
- Show make default (= start page)
- Hide.

Background images (optional)
Firstly import the image via the Vis. Graphics tab.
A background image is aligned with the top left corner of the plan and displayed at its original size.
In the Visualization Tab, images can be placed as elements and positioned freely when the page is designed.

Repeat background image
An small image can be repeated (tiled) across the Layout.

9.6 Create visualization content
In the Visualization tab, add or modify the content to the plans, layouts and widgets. Toggle between editing and visualization mode.
- In visualization mode select a plan, layout or widget in the structure and test functions on the visualization map.
- In editing mode add/modify content on the visualization map using plan editor.

Areas of the Visualization tab in the visualization mode

- Structure panel
  List of Plans, Layouts and Widgets created in Vis. structure.

- Visualization map
  Content of the Plan/Layout/Widget currently selected in the structure.

- Plan editor
  Tool to add and configure elements which are visible in the visualization map.
Main steps of editing

To add or modify content, follow these steps:

1. Select a Plan, Layout or Widget in the Structure panel.
2. Click the Unlock current plan for editing button to activate editing mode.
3. Add content using the Plan editor.
4. Select elements on the Visualization map and modify them as needed.
5. Click on the Save and reload plan button to finish editing.
6. Perform a final check by opening the PC/Tablet visualization and the Smartphone visualization.

9.6.1 Structure panel

Use the structure panel to select a Plan, Layout or Widget for configuration.

9.6.2 Additional tools and functions

Reorder Smart phone objects

In a newly created Smartphone visualization, the objects are listed in a default order. Click the button at the bottom of the structure panel to reorder the objects.

Access to PC/Tablet visualization

Click the button at the bottom of the structure panel to open the final PC/Tablet visualization in the default browser.

Access to Smartphone Visualization

Click the button at the bottom of the structure panel to open the final Smartphone visualization in the default browser.

Visualization configuration

Click the button at the bottom of the structure panel to open the visualization general settings. See Visualization configuration on page 123.

Size of a Plan/Layout/Widget

In editing mode, modify the size of the selected visualization map using selectors at the bottom of the structure panel. See Levels and Plans on page 130.
9.6.3 Visualization map

Use the visualization map to test the visualization and to edit while in editing mode. Toggle between visualization and editing modes using the buttons on the bottom of the plan editor.

Editing functions on the visualization map

In editing mode, the visualization map is shown with a 20 × 20 pixel grid.

When an object is selected, the buttons on the bottom of the visualization map can be used for the following functions.

<table>
<thead>
<tr>
<th>Table 39: Visualization map function buttons</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Delete</strong></td>
</tr>
<tr>
<td><strong>Duplicate</strong></td>
</tr>
<tr>
<td><strong>Copy</strong></td>
</tr>
<tr>
<td><strong>Paste</strong></td>
</tr>
</tbody>
</table>

9.7 Plan editor

Use the Plan Editor to add or modify elements, including size and position to the visualization map.

<table>
<thead>
<tr>
<th>Table 40: Plan editor elements</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Object</strong></td>
</tr>
<tr>
<td>See Objects on page 136.</td>
</tr>
<tr>
<td><strong>Link</strong></td>
</tr>
<tr>
<td>See Links on page 143.</td>
</tr>
<tr>
<td><strong>Text label</strong></td>
</tr>
<tr>
<td>See Text label on page 145.</td>
</tr>
<tr>
<td><strong>Image</strong></td>
</tr>
<tr>
<td>See Image on page 145.</td>
</tr>
<tr>
<td><strong>Frame</strong></td>
</tr>
<tr>
<td>See Frame on page 146.</td>
</tr>
<tr>
<td><strong>Gauge</strong></td>
</tr>
<tr>
<td>See Gauge on page 147.</td>
</tr>
<tr>
<td><strong>Camera</strong></td>
</tr>
<tr>
<td>See Camera on page 148.</td>
</tr>
<tr>
<td><strong>Graph</strong></td>
</tr>
<tr>
<td>See Graph on page 148.</td>
</tr>
</tbody>
</table>

* These elements are not displayed in the Smartphone Visualization.
9.7.1 Actions in the plan editor

The following actions can be applied for all elements in the plan editor.

Plan editor (example view)

Add a new element
1. Click the Unlock current plan for editing button (if visualization mode is active).
2. Select and edit parameter values.
3. Click the Add to plan button.

Modify an existing element
1. Click the Unlock current plan for editing button (if visualization mode is active).
2. Select element on the visualization.
3. Select and edit parameter values.
4. Click the Apply button.

Save or cancel changes before changing to visualization mode
- Click the Save and reload plan button to save your changes.
- Click the Cancel button at the bottom of the plan to cancel your changes.

Element position
The element will be placed on the visualization map in the position entered here (default 10,10 = top left corner).
Element size
- Optionally change the size of elements such as icons, images or frames here.
- Once the element is added to the plan, directly resize the element on the visualization map by dragging the nodes on the borders (stretch) or the corners (keep ratio).
- Click the Restore button to restore the element’s original size.

9.7.2 Main steps of editing
Follow these steps to add or modify content:
1. Select a Plan, Layout or Widget in the Structure panel.
2. Click the Unlock current plan for editing button to activate editing mode.
3. Add content using the Plan editor.
4. To modify an element, select the element on the Visualization map. Position, copy, duplicate or delete elements on the visualization map. It is also possible to send values. Many object elements have additional functions in the PC/Tablet visualization. See Objects on page 136.
5. Click the Save and reload plan button to finish editing.
6. Perform a final check by opening the PC/Tablet Visualization and the Smartphone Visualization. Text label, image, gauge and graph elements are only displayed in the PC/Tablet Visualization. Each object, link and frame element can optionally be hidden in the Smartphone Visualization.

After changing settings, refresh the browser to view the changes in the visualization. Refresh via browser menu or use the keyboard short-cuts [Crtl] + [N] or [Crtl] + [F5].

9.7.3 Objects
In a visualization, Objects are used to control or monitor different functions. Depending on the applications and the function, different Control types and parameters can be set.

To configure a control type, open the Object tab of the Plan editor.
Path: Visualization tab → Structure → Plan editor → Object tab.

Steps
1. Select an object in the Object tab of the plan editor.
2. Click the Visualization parameters button:
   - Select the control type, additional parameters and then save.
   - These parameters can also be edited in the Objects list (see Edit and test objects on page 104).
3. Select other parameters in the Objects tab of the plan editor.
4. Add the configured object to the plan with the Add to plan button.
5. Check the function:
   - On the plan it allows sending of values.
   - Complex control types like the Circular slider are not visible until the plan is reloaded. Click the Save and reload plan button on the plan editor.
   - On the PC/Tablet Visualization and the Smartphone Visualization, check the final functions of the element. Open the visualizations from the start page.

After changing the settings, refresh the browser to see the changes in the visualization. Refresh via the browser menu or use the keyboard short cuts [Crtl] + [N] or [Crtl] + [F5].
To use names (tags) instead of values, add and edit levels in the **Objects** list (see *Edit and test objects on page 104*). In the case of the shutter/blind, for example, add levels for additional control functions and optionally use the **Tag map** (see *Add new tags on page 108*).

**Overview of control types**

Different control types are available, depending on the application.

**Table 41: Control types**

<table>
<thead>
<tr>
<th>Application/Description</th>
<th>Control type</th>
</tr>
</thead>
<tbody>
<tr>
<td>48-127 Lighting and related 228 Measurement 250 User parameter values</td>
<td>Circular slider (PC/Tablet):</td>
</tr>
<tr>
<td>• Custom name</td>
<td></td>
</tr>
<tr>
<td>• On/Off button</td>
<td></td>
</tr>
<tr>
<td>• Nudge/Steps: –, +</td>
<td></td>
</tr>
<tr>
<td>• Value or name (tag) for levels is displayed</td>
<td></td>
</tr>
</tbody>
</table>

Circular slider (Smartphone):

- Circular slider opens via click on icon

48-127 Lighting and related 228 Measurement 250 User parameter values

Slider (PC/Tablet):

- Vertical or horizontal slider  
- Nudge/Steps: – and +

Slider (Smartphone):

- Custom name  
- Horizontal slider  
- Nudge/Steps: – and +

48-127 Lighting and related 250 User parameter boolean

Toggle (PC/Tablet):

- Value or name (tag) for level is displayed

Toggle (Smartphone):

- Custom name  
- Value or name (tag) for level is displayed
<table>
<thead>
<tr>
<th>Application/Description</th>
<th>Control type</th>
</tr>
</thead>
<tbody>
<tr>
<td>48-127 Lighting and related</td>
<td>Doorbell (PC/Tablet):</td>
</tr>
<tr>
<td>• Sends a value when button is pressed and 0 when released</td>
<td></td>
</tr>
<tr>
<td>• Value or name (tag) for level is displayed</td>
<td></td>
</tr>
<tr>
<td>• Custom name</td>
<td></td>
</tr>
<tr>
<td>• Sends a value when button is pressed and 0 when released</td>
<td></td>
</tr>
<tr>
<td>• Value or name (tag) for level is displayed</td>
<td></td>
</tr>
<tr>
<td>Doorbell (Smartphone):</td>
<td></td>
</tr>
<tr>
<td>• Custom name</td>
<td></td>
</tr>
<tr>
<td>• Sends a value when button is pressed and 0 when released</td>
<td></td>
</tr>
<tr>
<td>• Value or name (tag) for level is displayed</td>
<td></td>
</tr>
<tr>
<td>Pre-Set (PC/Tablet):</td>
<td></td>
</tr>
<tr>
<td>• Custom name</td>
<td></td>
</tr>
<tr>
<td>• Sends a value when button is pressed</td>
<td></td>
</tr>
<tr>
<td>• Value or name (tag) for level is displayed</td>
<td></td>
</tr>
<tr>
<td>Pre-Set (Smartphone):</td>
<td></td>
</tr>
<tr>
<td>• Custom name</td>
<td></td>
</tr>
<tr>
<td>• Sends a value when button is pressed</td>
<td></td>
</tr>
<tr>
<td>• Value or name (tag) for level is displayed</td>
<td></td>
</tr>
<tr>
<td>Shutter/Blind (PC/Tablet):</td>
<td></td>
</tr>
<tr>
<td>• Sends a value when button is pressed (level)</td>
<td></td>
</tr>
<tr>
<td>• 3 levels are pre-set (level translation mode):</td>
<td></td>
</tr>
<tr>
<td>- Close (0)</td>
<td></td>
</tr>
<tr>
<td>- Stop (5)</td>
<td></td>
</tr>
<tr>
<td>- Open (255)</td>
<td></td>
</tr>
<tr>
<td>• Additional levels can be added to reach positions (e.g. 128 = Half)</td>
<td></td>
</tr>
<tr>
<td>Shutter/Blind (Smartphone):</td>
<td></td>
</tr>
<tr>
<td>• Custom name</td>
<td></td>
</tr>
<tr>
<td>• List with levels opens when button is pressed</td>
<td></td>
</tr>
<tr>
<td>Cycle/Fan (PC/Tablet):</td>
<td></td>
</tr>
<tr>
<td>• Sends next value when + or – button is pressed</td>
<td></td>
</tr>
<tr>
<td>• Cycle:</td>
<td></td>
</tr>
<tr>
<td>- max. to min. level</td>
<td></td>
</tr>
<tr>
<td>- min. to max. level</td>
<td></td>
</tr>
<tr>
<td>• Levels: names and values must be set</td>
<td></td>
</tr>
<tr>
<td>• Actual level is displayed</td>
<td></td>
</tr>
<tr>
<td>Cycle/Fan (Smartphone):</td>
<td></td>
</tr>
<tr>
<td>• Custom name</td>
<td></td>
</tr>
<tr>
<td>• Sends next value when + or – button is pressed</td>
<td></td>
</tr>
<tr>
<td>• Actual level is displayed</td>
<td></td>
</tr>
</tbody>
</table>
### Application/Description | Control type
--- | ---
202 Trigger Control
(Set scenes) | Trigger select (PC/Tablet):
- Sends a value when button is pressed (action selector)
- Levels: can be edited in the **Visualization** tab or **Scenes** tab
- Actual level is displayed

Trigger select (Smartphone):

<table>
<thead>
<tr>
<th>Scenes</th>
<th>Video</th>
</tr>
</thead>
</table>

228 Measurement
250 User parameter values | Direct input/Step +/- (PC/Tablet):
- Sends next value when + or – button is pressed
- Direct input
- Decimal places
- Nudge/steps: step width
- Min. and max. value

Direct input/Step +/- (Smartphone):

<table>
<thead>
<tr>
<th>Temperature</th>
<th>21.5</th>
</tr>
</thead>
</table>

**Visualization parameters and control type**

Control types are described in *Overview of control types on page 137.*

Access the visualization parameters in two ways:
- Click the **Visualization parameters** button in the **Object** tab of the plan editor.
- Click the **Vis. parameters** button in the **Objects** list ([see Edit and test objects on page 104](#)).

When starting in the **Object** tab of the plan editor, select an object there first and then go to **Visualization parameters** and select the **Control type**.

*Circular slider* and *Shutter/Blind* control types are explained below.
Circular slider

Example

<table>
<thead>
<tr>
<th>Application/Description</th>
<th>Control type</th>
</tr>
</thead>
<tbody>
<tr>
<td>48-127 Lighting/Lighting like</td>
<td>Slider (PC/Tablet):</td>
</tr>
</tbody>
</table>

- Vertical or horizontal slider
- Nudge/Steps: – and +

- Circular slider opens via click on icon

Circular slider (Smartphone):

Table 42: Visualization parameters for circular slider

<table>
<thead>
<tr>
<th>Control type</th>
<th>Circular slider</th>
</tr>
</thead>
</table>
| Value display | • Percentage (0-100)  
• Level (0-255)  
• Tags  
In the example, Tags is selected. The levels are set in the Objects list of the Levels column.  
Path: Configurator → Objects tab → Objects list.  
|  |
| Ramp rate | Set the time to reach the value (from 0 to 255):  
• Minimum: 0 s (instantaneous)  
• Maximum: 15 min.  
| Minimum value | 0  
Example: 25 = Dimming starts at 10%.  
| Maximum value | 255  
Example: 230 = Dimming stops at 90%.  
| Nudge/step value | Step width for control: 1-255 (e.g. 25 = steps in 10%).  
| Slider colour | Select a colour for the slider.  
| Background colour | Select (pre-set: no colour).  
| Round line cap | Use a rounded shape at the beginning and end of the circle line.  
| Hide title | Do not display the default or custom name.  
| Hide nudge buttons | Disable the step + and – buttons.  
| Line thickness | Select the line thickness.  
| Size | Select the control size.  
| Custom On/Off label | Change the text displayed for the On/Off button in the center of the controller.  

When all parameters are selected, press the Save button. Now set the parameters in the Object tab of the plan editor (see Object element parameters on page 142).
Shutter/Blind

Example

<table>
<thead>
<tr>
<th>Application/Description</th>
<th>Control type</th>
</tr>
</thead>
<tbody>
<tr>
<td>48-95 Lighting/Lighting like</td>
<td>Shutter/Blind (PC/Tablet):</td>
</tr>
</tbody>
</table>

- Sends a value when button is pressed (level)
- 3 levels are pre-set (level translation mode):
  - Close (0)
  - Stop (5)
  - Open (255)
- Additional levels can be added to reach positions (e.g. 128 = Half)

Shutter/Blind (Smartphone):

- Custom name
- List with levels opens when button is pressed

Table 43: Visualization parameters for shutter/blind

<table>
<thead>
<tr>
<th>Control type</th>
<th>Shutter/blind</th>
</tr>
</thead>
</table>
| Value display | • Percentage (0-100)  
• Level (0-255)  
• Tags |

Tags must be selected. Set the levels in the Objects list of the Levels column. The levels Close (0), Stop (5) and Open (255) are pre-set. These values are used in the level translation mode. Each level triggers a command.

For added convenience, set additional position values (levels) in the range 3% to 97% (7-247).

In the example, the pre-set values and 2 additional levels are set in the Objects list of the Levels column.

Path: Configurator → Objects tab → Objects list.

Show icons in PC/Tablet

Icons can be displayed instead of names. Add icons in the Object tab of the plan editor, using the Additional icons button.

Path: Configurator → Visualization tab → Plan editor → Object tab.
**Global and local parameters**

By default, use global visualization parameters for each object. If using several elements to control an object, use local visualization parameters.

Initially, global and local parameters are the same. Change the local parameters, for example, to use one button for dimming with a slider and another to switch on and off with a toggle button. In this case, select different control types in the local parameters of each object element.

Access global and local parameters via the **Visualization parameters** button in the plan editor **Object** tab.

Local parameters cannot be set in the **Objects** list.

**Object element parameters**

Configure object elements in the **Object** tab of the plan editor.

After selecting an object, open the **Visualization parameters** and select the **Control type**. Now select the object’s element parameters.

**Table 44: Object element parameters**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Object</strong></td>
<td>Select object from the drop down list.</td>
</tr>
<tr>
<td><strong>Visualization parameters</strong></td>
<td>Click this button and select the <strong>Control type</strong> and other parameters, then save. Then continue setting the following parameters.</td>
</tr>
<tr>
<td><strong>Custom name</strong></td>
<td>A unique name for the object. <strong>Custom name</strong> is used for some control types and for the <strong>Smartphone Visualization</strong>.</td>
</tr>
<tr>
<td><strong>Read only</strong></td>
<td>Select this option to only monitor, not control, values.</td>
</tr>
<tr>
<td><strong>Hide in smartphone</strong></td>
<td>Select object is not visible in <strong>Smartphone Visualization</strong>.</td>
</tr>
<tr>
<td><strong>Hide background</strong></td>
<td>Show icon without background.</td>
</tr>
<tr>
<td><strong>Pin code</strong></td>
<td>Add a PIN to protect the object element value. Once set, the PIN is required whenever an attempt is made to change the value.</td>
</tr>
<tr>
<td><strong>Widget</strong></td>
<td>Assign a <strong>Widget</strong> that opens when the element is pressed. The widget must first be created so that it appears in the list. A widget cannot be tested in the editor mode, only in <strong>PC/Tablet Visualization</strong>.</td>
</tr>
<tr>
<td><strong>Display mode</strong></td>
<td>Display mode refers to the first level of visualization. The options include: • Icon and value • Icon only • Value only. Additional elements can be opened for the control. See <strong>Overview of control types on page 137</strong>.</td>
</tr>
<tr>
<td><strong>Default icon</strong></td>
<td>The icon which is displayed when no other icon is assigned to the actual value (See <strong>Additional icons</strong> below). For same control types, set an <strong>On icon</strong> and an <strong>Off icon</strong>.</td>
</tr>
<tr>
<td><strong>Smartphone icon</strong></td>
<td>(Optional) If different icons are required between the <strong>PC/Tablet</strong> and <strong>Smartphone</strong> visualizations, use this parameter to set a different icon for the <strong>Smartphone</strong> visualization.</td>
</tr>
<tr>
<td><strong>Font size</strong></td>
<td>Affects the font size of the value display</td>
</tr>
<tr>
<td><strong>Text style</strong></td>
<td>Affects the text style (e.g. bold, italic) of the value display</td>
</tr>
<tr>
<td><strong>Show value background</strong></td>
<td>A solid background is displayed behind the value.</td>
</tr>
<tr>
<td><strong>Show control (Inline in PC/Tablet)</strong></td>
<td>Shows the control element instead of the icon button. (PC/Tablet only.)</td>
</tr>
<tr>
<td><strong>Additional icons</strong></td>
<td>Shows different icons, depending on the current value. For each new icon, define a minimum and a maximum value. In operation, if the object value does not fall within the range of any of the additional icons, the default icon is displayed.</td>
</tr>
</tbody>
</table>
9.7.4 Links

Navigation links between the visualization pages are automatically created and can be used without any additional configuration work. This is done in the Vis. structure tab, where plans must always be linked to a level or a sub-level. All pages can be accessed via the sidebar on the left of the visualization page.

In addition, Links can be added to the visualization map. Use an icon, text or transparent surface as a link to other pages. To configure a link, open the Link tab of the Plan editor.

Parameter

Plan editor with activated Link tab

![Plan editor with Link tab](image)

**Table 45: 'Link to' options**

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start page</td>
<td>The start page of the visualization.</td>
</tr>
<tr>
<td>Name of plan</td>
<td>A plan created in the Vis Structure tab.</td>
</tr>
<tr>
<td>Trend logs</td>
<td>Default visualization pages (has to be configured).</td>
</tr>
<tr>
<td>Scheduler</td>
<td>Default visualization pages (has to be configured).</td>
</tr>
<tr>
<td>External link</td>
<td>Opens a web page (http://...). Can be used to view one trend. Copy the trend path via the Direct link button on the Trend log tab. See the next screen shot (Direct link).</td>
</tr>
<tr>
<td>Next plan</td>
<td>Navigation link to the next plan.</td>
</tr>
<tr>
<td>Previous plan</td>
<td>Navigation link to the previous plan.</td>
</tr>
</tbody>
</table>

When configuring an external link to a trend log, it is possible to link to a trend log in the same Automation Controller or another one. When linking to another Automation Controller, tick the Include IP/host option in the Direct link window to display the complete IP address. See Trend logs on page 113.
Custom name
If setting Display mode to Value (see Display mode below), the custom name is displayed as the link.

Hide background
The background of the icon is not shown.

To create a transparent area for a link, select an empty SVG file for the icon and then hide the icon background.

Display mode

<table>
<thead>
<tr>
<th>Display mode</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Icon</td>
<td>An icon is used as the link.</td>
</tr>
<tr>
<td>Value</td>
<td>The text of the Custom name parameter is used as the link.</td>
</tr>
</tbody>
</table>

Active state icon
Set another image to display in the icon when the linked page is opened. For example, create both grey (standard) and yellow (active) versions of an icon image and then assign the grey image to Icon and the yellow image to Active state icon.

Examples

Link with icons
In this example, when a plan is opened either by the link icon or by the sidebar menu, the active state icon for the link is shown in green colour and the other icons are shown in grey colour. Three link icons are placed on a layout associated with the three plans.

<table>
<thead>
<tr>
<th>Display mode</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Icon</td>
<td>Icon with grey colour</td>
</tr>
<tr>
<td>Active state icon</td>
<td>Icon with green colour</td>
</tr>
</tbody>
</table>

Link with text
In this example, a user can click on some text to open a plan. Three link texts are placed on a plan with three rooms.

| Custom name | Text (e.g. Main Office) |
| Display mode | Value (= Custom name) |
| Font size/color | As required |

Link as transparent area
In this example, the user can click transparent links that are positioned over rooms on part of a building plan. Empty SVG files can be used as icons (see Hide background on page 144).

| Display mode | Icon |
| Icon         | Empty SVG file |
| Hide background | Activated (makes icon with empty.svg transparent) |
9.7.5 Text label

A Text label is a static element. Add text labels and position them on the visualization map. Open the Link tab of the Plan editor to edit a text label.

Text labels are only visible in the PC/Tablet Visualization.

Parameters

Plan editor with activated Text label tab

Set the Font size, Text Style, Font and the Font Color.

9.7.6 Image

Images can be positioned and resized on the visualization map. Use local static images stored in the Vis. graphics tab, or remote web pages (e.g. a URL with dynamic content). Open the Image tab of the Plan editor to configure an image.

Images are only viable in the PC/Tablet Visualization view.

Parameters

Plan editor with activated Image tab
Image source

Local
Select an image previously added to Vis graphics → Images / Backgrounds.

Remote
Select the source URL of the image (http://...). This option is useful for example to grab dynamic weather forecast images.

Image size

- After the image has been added to the plan, resize it directly on the visualization map by dragging either the nodes on the borders (stretch) or the nodes on the corners (keep ratio).
- It is possible to specify the image size by entering numbers.
- Restore the image to its original size by clicking the Restore button on the bottom of the Image tab.

External link (optional)
Enter a URL to open an external web page when the image is clicked/pressed.

9.7.7 Frame

Use a frame to display internal or external web pages in the visualization. Schedulers and Trend logs can be shown in a frame on a visualization page. To configure a frame, open the Frame tab of the Plan editor.

Parameters

Plan editor with activated Frame tab

Source
- URL = http://...
- Scheduler
- Trend logs

Frame size
The width and height of the frame

Refresh interval
The rate at which element values are updated. The refresh interval options are 0, or a setting between 1 s and 3600 s.
• Frames do not display well in Smartphone Visualization view and will be hidden in this visualization.
• Stretch the frame to maximum width if Scheduler or Trend is used. The recommended minimum width is 1024.
• Not all web pages work correctly in frames. Test external web pages within frames using the PC/Tablet Visualization view.

9.7.8 Gauge
Use a gauge to display values. The gauge is typically used to display measured values such as temperature, brightness or energy.

A gauge is only visible in PC/Tablet Visualization view.

To configure a gauge, open the Gauge tab of the Plan editor.

Parameters

Plan editor with activated Gauge tab

Data object: Select a C-Bus object. A typical application is measurement (228).
Gauge size: Minimum size is 100, maximum size is 500.
Custom name: The name to display in the gauge (e.g. Temp. office).
Read only: Enabled: The value is displayed but cannot be changed.
Disabled: The value can be changed by clicking/pressing the gauge.
Visualization parameters: Click the Visualization parameter button to open the visualization parameters (see Objects on page 136).
Define Global Parameters for an object or Local parameters for an element. (The local parameters are only applied to the configured gauge.)
9.7.9 Camera

The video stream of an IP camera can be displayed on a visualization page.

- Only cameras which support HTTP MJPEG streaming in a web browser can be visualized. The Automation Controller redirects the stream from the camera to the browser.
- If the camera is external to the Automation Controller network, the IP of the camera needs to be port-forwarded through the router. When adding the external camera, use the IP with the correct port (IP:port).
- If using Smartphone Visualization, check the plan in this view and adapt window size.

Parameters

Plan editor with activated Camera tab

Source URL: http://192.168.100.120/axis-c
Window size: 640 x 480
Custom name:
Icon: camera.svg
Auto open window:
Hide background: yes
Additional classes:

Source URL: The source address of the video stream.
Window size: The width and height of the camera view window.
Custom name: A unique name for the camera view.
Auto open window: Select this option to open the camera view automatically when the Plan opens.
Hide background: Make the background of the icon transparent.

9.7.10 Graph

A graph shows current and previous monitored values in the PC/Tablet Visualization view, e.g. logged temperature values. To configure a graph, open the Graph tab of the Plan editor.

Logging must be enabled on the Objects tab for the application being used.
Parameters
Plan editor with activated **Graph** tab

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Custom name</td>
<td>The name which is displayed as the graph title (e.g. Temperature graph).</td>
</tr>
<tr>
<td>Icon</td>
<td>Select an icon for the button that opens the graph.</td>
</tr>
<tr>
<td>Window size</td>
<td>The width and height of the graph.</td>
</tr>
<tr>
<td>Number of points</td>
<td>Number of data points to show in the graph (5-200).</td>
</tr>
<tr>
<td>Auto open window</td>
<td>Select this option to open the graph window automatically when the plan opens.</td>
</tr>
<tr>
<td>Auto-follow value</td>
<td>Select this option to improve graph resolution for objects which never reach zero value (e.g. CO₂ level).</td>
</tr>
<tr>
<td>Hide background</td>
<td>Select this option to make the background of the icon transparent.</td>
</tr>
</tbody>
</table>

- Graphs are not visible in the Smartphone Visualization view.
- Use a gauge to show an actual measured value (see Gauge on page 147 and Links on page 143) and then configure the gauge to open the graph when clicked. To set this up, do the following:
  1. Create and save an empty SVG file.
  2. Add the empty SVG file to the Images/Backgrounds tab in the Vis. graphics tabs.
  3. Select the empty SVG file as Icon (Parameter of the Graph).
  4. Activate the check box Hide background (Parameter of the Graph).
  5. Click the Add to plan button to get the icon on the Visualization map (Parameter of the Graph).
  6. Position the icon (empty SVG) over the gauge and adapt the size of the icon to the gauge (Visualization map).
10 Scripting

A script is a small, non-compiled program, written in the scripting language LUA. LUA is a general scripting language used in many products/computers. A reference manual is available for purchase at www.lua.org

Scripting can be used for wide ranging of functions. Examples of commands are:
- If-elseif-else-then
- While
- Repeat and for loops
- Math functions
- Compare functions
- Logic functions
- I/O functions.

LUA can also be used for special functions, such as:
- Calculate sunrise/sunset
- Send e-mail
- Control of RS-232
- Control of Modbus.

Logic functions that can an be created with C-Bus products can also be created with LUA scripts.

10.1 Prepare a script

When creating a new script, first decide how the script will be triggered (started). Then choose a script type in the Scripting tab.

The following script types are available:
- Event-based scripts:
  - Scripts are triggered when the associated Objects are updated. The composed Group Address of an application or a Keyword can be used. With a keyword, a script can be updated by all objects assigned to the keyword.
  - Event-based scripts are the most commonly used.
- Resident scripts are triggered according to specified cycle time in seconds (0-60 s).
- Scheduled scripts:
  - Scripts are triggered according to specified time and/or date.
  - Scripts can be triggered by the specific minute, hour, day of the week, day of the month and month of the year.
  - Scripts can be triggered more frequently, such as every x minutes/hours/days.
- Start up scripts are triggered every time the system starts (power up, reboot or hardware reset).
Steps to prepare a script

1. Open the Scripting tab. (Path: Configurator → Scripting)
2. Select the type of script with one of the following buttons:
   - Event-based
   - Resident
   - Scheduled
   - Start-up (init) script.
3. Press the Add new script button at the bottom of the Scripting list, edit the parameters and save. A new line in the in scripting list is displayed.
4. Start editing the script. Click the icon in the Editor column of the scripting list.

If the script editor is already open, event-based scripts can also be opened from the Objects list.

10.1.1 Event-based scripts

Event-based scripts are triggered when the associated Objects are updated. The composed Group Address of an application (see Add new objects on page <?>) or a Keyword can be used. See Additional parameters for all applications on page 103.

Click the Event-based button and set the following parameters.

<table>
<thead>
<tr>
<th>Table 46: Event-based script parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Script name</strong></td>
</tr>
<tr>
<td><strong>Group address/keyword</strong></td>
</tr>
<tr>
<td><strong>Active</strong></td>
</tr>
<tr>
<td><strong>Category</strong></td>
</tr>
<tr>
<td><strong>Description</strong></td>
</tr>
</tbody>
</table>

To edit the new script, click the corresponding icon in the Editor column of the scripting list.

10.1.2 Resident scripts

Resident scripts are triggered according to a specified cycle time in seconds (0–60 s). Click the Resident button and set the following parameters.

<table>
<thead>
<tr>
<th>Table 47: Resident script parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Script name</strong></td>
</tr>
<tr>
<td><strong>Sleep interval (seconds)</strong></td>
</tr>
<tr>
<td><strong>Active</strong></td>
</tr>
<tr>
<td><strong>Category</strong></td>
</tr>
<tr>
<td><strong>Description</strong></td>
</tr>
</tbody>
</table>

To edit the new script in the list press the script icon in the Editor column.

* Avoid using a short sleep interval, especially 0. Resident scripts with sleep interval 0 have a high impact on the CPU load.
10.1.3 Scheduled scripts

Click the Scheduled button and set the following parameters.

Table 48: Scheduled script parameters

<table>
<thead>
<tr>
<th>Script name</th>
<th>The name to display in the scripting list.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minute/Hour/Day of the month</td>
<td>Uses the cron format for date/time parameters. Lookup Help for more information about the date/time format. Example values for minutes:</td>
</tr>
<tr>
<td>Value</td>
<td>Execute</td>
</tr>
<tr>
<td>*</td>
<td>Every minute</td>
</tr>
<tr>
<td>*/20</td>
<td>Every 20 minutes</td>
</tr>
<tr>
<td>20</td>
<td>When the minute is 20</td>
</tr>
<tr>
<td>1-10</td>
<td>Every minute from 1 to 10 (inclusive)</td>
</tr>
<tr>
<td>15,50-51</td>
<td>When the minute is 15, 50 and 51.</td>
</tr>
<tr>
<td>Month of the year</td>
<td>(Optional) Select the check box if required.</td>
</tr>
<tr>
<td>Day of the week</td>
<td>(Optional) Select the check box if required.</td>
</tr>
<tr>
<td>Active</td>
<td>When Active is selected, the script is enabled. Otherwise, the script is disabled. This parameter can also be set from the scripting list.</td>
</tr>
<tr>
<td>Category</td>
<td>An optional name that can be used to group scripts in the Scripting list and the Print script listing (Scripting tab → Tools button).</td>
</tr>
<tr>
<td>Description</td>
<td>Optional.</td>
</tr>
</tbody>
</table>

To edit the new script in the list press the script icon in the Editor column.

10.1.4 Start up script

The start up script runs each time the system starts (e.g. power up, reboot or hardware reset). There are no parameters to edit for the start up script.

Click the Start up (init) script button to open the script editor.

If the script editor is already open, open the start up script for editing via the Scripts tab on the left side of the editor.

Example

In this example, the start up script is configured to wait for C-Bus to come online and then switch a floor light on at full brightness (level 255) immediately after the system starts (or is restarted). The composed group address of the light is: (0/56/3).

```
1 -- init script (comment)
2 WaitForCBusStatus (nil)
3 SetCBusLevel(0, 56, 3, 255, 0)
```

Backup and restore

Backup and restore the start up script (see Backup and restore libraries on page 158).

Path: Configurator → Scripting tab → User libraries button.
10.2 Script editor

Existing event-based, resident and scheduled scripts are located in the corresponding Script list (see Prepare a script on page 150). Click the corresponding Script icon in the list to open the script editor. The editor opens directly when the Start-up (init) script button is pressed.

Path: Configurator → Scripting tab → Event-based, Resident or Scheduled key → Script list.

Event-based scripts also open when the script icon is clicked in the Event script column of the Objects list.

10.2.1 Editor

The editor panel is displayed in the center of the script editor (see B in the next screen shot). Here, type script commands in line by line. The left and right panels of the script editor display features to support script editing.

The following screen shot shows the editor with the short event-based script.

This event-based script is triggered when a temperature value is sent. The script causes a control light to be switched on when the measured temperature is higher than 30 °C. In this script, four different functions are used.

Table 49: Event-based script functions

<table>
<thead>
<tr>
<th>Line</th>
<th>Functions</th>
<th>Description</th>
<th>Helpers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>event. getvalue()</td>
<td>The variable gets the temperature value of a C-Bus application, in this case a measurement application with the composed group address (0/228/4/1).</td>
<td>Objects → Get event value</td>
</tr>
<tr>
<td>3, 6, 9</td>
<td>if-then-else-end</td>
<td>Conditional function that includes actions when the condition is true and other actions when the condition is not true.</td>
<td>Conditionals → If - Then - Else</td>
</tr>
</tbody>
</table>
4, 7  `setCBus(net, app, group, value, ramp rate)` Sends a level command at a given ramp rate for the network, application and group. In this example, the values 0 and 255 are sent with the composed group address (0/56/1) found on the right side of the editor. This composed group address (0/56/1) must be adapted to the syntax of the `SetCBusLevel` command: 0, 56, 1, x, 0

2, 5, 8  // (2x dash)  Comment line

In this example, the **Helpers** tab ⑤ can be used to click a function and add it to the editor. The variable parts of the script can then be replaced. For example, in line 3 of the script, `(condition)` is replaced with `(tempoffice > 30)`.

### 10.2.2 Helpers

The **Helpers** tab contains predefined code snippets. Comment lines are included in the snippets to help edit the code. Click a Helper snippet to add the code to the Editor.

**Table 50: Helpers tab code snippets**

<table>
<thead>
<tr>
<th>Helper</th>
<th>Sub-function</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Conditionals</strong></td>
<td>If -Then, If (AND) -Then, If (OR) - Then</td>
</tr>
<tr>
<td></td>
<td>If - Then - Else</td>
</tr>
<tr>
<td></td>
<td>If - Else If</td>
</tr>
<tr>
<td><strong>Loops and Iteration</strong></td>
<td>Hashtable iteration, Array iteration</td>
</tr>
<tr>
<td></td>
<td>Numeric for loop, While loop, Repeat .. Until loop</td>
</tr>
<tr>
<td><strong>Maths</strong></td>
<td>Absolute value</td>
</tr>
<tr>
<td></td>
<td>Ceiling, Floor</td>
</tr>
<tr>
<td></td>
<td>Round to integer, Random value</td>
</tr>
<tr>
<td><strong>Objects</strong></td>
<td>Get event value (used for event-based scripts)</td>
</tr>
<tr>
<td><strong>Storage</strong></td>
<td>Get data from storage</td>
</tr>
<tr>
<td></td>
<td>Save data to storage</td>
</tr>
<tr>
<td><strong>Script Control</strong></td>
<td>Enable, Disable script</td>
</tr>
<tr>
<td></td>
<td>Get script status</td>
</tr>
<tr>
<td><strong>Alerts and Logs</strong></td>
<td>Alert, Formatted Alert, (appear in Alerts tab)</td>
</tr>
<tr>
<td></td>
<td>Log variables (appear in Log tab)</td>
</tr>
<tr>
<td><strong>Time functions</strong></td>
<td>Delay script execution</td>
</tr>
<tr>
<td><strong>Miscellaneous</strong></td>
<td>Send an email</td>
</tr>
<tr>
<td></td>
<td>Sunrise/sunset, Convert sunrise/sunset to readable</td>
</tr>
<tr>
<td><strong>Serial</strong></td>
<td>Communication via RS-232 or RS-485</td>
</tr>
<tr>
<td></td>
<td>Open connection, Close connection</td>
</tr>
<tr>
<td></td>
<td>Write to port, Blocking read, Timeout read</td>
</tr>
<tr>
<td><strong>Modbus</strong></td>
<td>Create Modbus TCP object, Create Modbus RTU object</td>
</tr>
<tr>
<td></td>
<td>Open Modbus TCP connection, Open Modbus RTU connection</td>
</tr>
<tr>
<td></td>
<td>Close connection</td>
</tr>
<tr>
<td></td>
<td>Set slave address</td>
</tr>
<tr>
<td></td>
<td>Read ..., (single/multiple coils, discrete input, registers, input registers)</td>
</tr>
<tr>
<td></td>
<td>Write ..., (single bit, multiple bits, single registers, multiple registers)</td>
</tr>
</tbody>
</table>
### 10.2.3 Lists

The right panel of the editor displays list boxes with preconfigured objects, storage values and scripts.

**Table 51: Examples of preconfigured list items**

<table>
<thead>
<tr>
<th>List</th>
<th>Examples of copy</th>
<th>Examples of usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group addresses</td>
<td>‘0/56/1’</td>
<td>value = GetCBusState(0, 56, 1)</td>
</tr>
<tr>
<td>Objects by name</td>
<td>‘Local/Light/Kitchen’</td>
<td>grp_number = GetCBusGroupAddress(0, 56, ‘Kitchen’)</td>
</tr>
<tr>
<td>Keywords</td>
<td>‘lights_office’</td>
<td>value = GetCBusByKW({‘lights_office’}, ‘or’)</td>
</tr>
<tr>
<td>Storage</td>
<td>‘light1_On’</td>
<td>data = storage.get(‘light1_On’)</td>
</tr>
<tr>
<td>Scripts</td>
<td>‘Office temp’</td>
<td>script.enable({‘Office temp’})</td>
</tr>
</tbody>
</table>

### 10.2.4 Find and replace

To search code in a script, replace code and enter code from the topic. For each of these functions, use keyboard shortcuts. Before starting, click a line of the script in the editor to place the text cursor.

**Table 52: Keyboard shortcuts for find and replace**

<table>
<thead>
<tr>
<th>Keys</th>
<th>Result</th>
<th>Next steps</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Ctrl] + [F]</td>
<td>Box for search opens</td>
<td>Enter code and press [Enter]</td>
</tr>
<tr>
<td></td>
<td>Code is highlighted in yellow</td>
<td></td>
</tr>
<tr>
<td>[Ctrl] + [G]</td>
<td>Shows next highlighted code</td>
<td></td>
</tr>
<tr>
<td>[Shift] + [Ctrl] + [G]</td>
<td>Shows previous highlighted code</td>
<td>Enter code “replace” and press [Enter] Enter code “with” and press [Enter] Select: Yes, No, All, Stop</td>
</tr>
<tr>
<td>[Shift] + [Ctrl] + [F]</td>
<td>Box for replace opens</td>
<td></td>
</tr>
<tr>
<td>[Ctrl] + [Space]</td>
<td>List with commands and functions opens</td>
<td>Select in the list and press [Enter]; or Enter first letter, select in list and press [Enter]</td>
</tr>
</tbody>
</table>

For more help, use functions and commands from the **Helpers** tab or the **Select Topic** list (see **Editor** on page 153).
10.2.5 Logs for testing

Use logs for testing and debugging a script. The `log` command converts variables to human readable form and stores them. In the Helpers list, access log variables via Alerts and logs → Log variables.

**Function**

`log(var1, var2, var3, ...)`

The function accepts variables of the following data types.

<table>
<thead>
<tr>
<th>Type of variable</th>
<th>Variable</th>
<th>Message</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boolean</td>
<td>var1 = true</td>
<td>boolean: true</td>
</tr>
<tr>
<td>Number</td>
<td>var2 = 255</td>
<td>number: 255</td>
</tr>
<tr>
<td>String</td>
<td>var3 = 'text'</td>
<td>string: text</td>
</tr>
<tr>
<td>Not found/valid</td>
<td>var4 not defined</td>
<td>nil</td>
</tr>
</tbody>
</table>

A table can be defined with up to 5 nested levels.

```
var1 = {f1 = var4, t2 = var5, ...}
```

**Example of table**

```
var1 = {f1 = var4, t2 = var5}
```

**Example of message**

```
Table: 
[f1]: number: 25
[f2]: boolean: false
```

The logging messages are listed in the Logs tab of the Configurator page. When editing a script, open the current logs immediately with the Logs button.

**Example of a script with logging**

```
tempoffice = event.get_value()
-- Get measured temperature
if (tempoffice > 30) then
  SetBusLevel(0, 56, 1, 255, 0)
  -- Control light (0/56/1) = On
else
  SetBusLevel(0, 56, 1, 0, 0)
  -- Control light (0/56/1) = Off
end
-- Logging
-- Get level of Control light
Ctrl_light = GetBusLevel('Local', 'lighting', 'Control light')
log(tempoffice, Ctrl_light)
```

**Example of logs opened in the script editor**
**Options**
- Automatically scroll content when new logs appear
- Show logs only for current script
- Clear logs (button).

**10.2.6 Error logs**
Error logs are displayed in the *Error log* tab of the *Configurator* page. Error messages are generated by the system. Errors can be detected in scripts or in the configuration ([see Error logs on page 35](#)).

**Example script**
A lighting channel (local network/Lights 1/room 99) does not respond, e.g. the address *Room 99* does not exist in *Objects* list or *Tag map*.

![Error log example](image)

When editing a script, open error logs by clicking the *Error log* button.

**10.2.7 Finish the script**
Once finished editing the script, use the following buttons at the bottom bar of the script editor.

<table>
<thead>
<tr>
<th>Button</th>
<th>Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enabled/Disabled</td>
<td>Enabled: script is active and can be tested</td>
</tr>
<tr>
<td></td>
<td>Disabled: script is not active</td>
</tr>
<tr>
<td>Run</td>
<td>When enabled, it allows event-based scripts to run. Depending on the application, send different values to trigger the script.</td>
</tr>
<tr>
<td>Lighting</td>
<td>• Target level</td>
</tr>
<tr>
<td></td>
<td>• Ramp rate</td>
</tr>
<tr>
<td>Measurement</td>
<td>• Value</td>
</tr>
<tr>
<td></td>
<td>• Unit</td>
</tr>
<tr>
<td>Logs</td>
<td>Opens current logs (<a href="#">see Logs for testing on page 156</a>)</td>
</tr>
<tr>
<td>Error logs</td>
<td>Opens error logs. Error messages from scripts are displayed in the <em>Error logs</em> tab (<a href="#">see Error logs on page 35</a>).</td>
</tr>
<tr>
<td>Save</td>
<td>Save the script.</td>
</tr>
<tr>
<td>Save and close</td>
<td>Save the script and close the <em>Editor</em> window.</td>
</tr>
<tr>
<td>Close</td>
<td>Close the <em>Editor</em> window.</td>
</tr>
</tbody>
</table>
10.3 User libraries

User libraries usually contain user defined functions that can be called from other scripts. To use functions defined in a user library, they must be included at the start of the script. For example, a user library with the name ‘test’ will be included as follows: `require('user.test')`

Path: Configurator → Scripting tab → User libraries button.

10.3.1 Add and edit a library

Click the Add new library button in the bottom bar to prepare a new library.

The following parameters are available:

<table>
<thead>
<tr>
<th>Auto load library</th>
<th>Keep source</th>
</tr>
</thead>
<tbody>
<tr>
<td>When selected, the script is loaded when the Automation Controller starts.</td>
<td>By default, this parameter is enabled. Once disabled, the code is compiled and cannot be used for further editing.</td>
</tr>
</tbody>
</table>

Click the Editor icon in the list to open the script editor. Now edit the library script in the same way as other scripts.

From the script editor, access existing user libraries via the Scripts tab.

10.3.2 Backup and restore libraries

Click the Export libraries button to backup all User libraries, the Start-up (init) script and the Common functions. The backup file has the following name:

```
Libraries-Hostname-jjjj.mm.dd-hh.mm.tar
```

Click the Restore/add libraries button to load a backup file or a file containing new libraries.

- Existing libraries with the same name as a restored or added library are overwritten.
- It is also possible to exchange files from other Automation Controllers.

10.4 Common functions

Common functions is a library of globally used functions. They can be called from any script, any time, without special inclusions. The functions Send an e-mail and Sunrise/sunset calculation are included by default.

Path: Configurator → Scripting tab → Common functions button.

When the script editor is open, use the Scripts tab in the left panel.
10.4.1 E-mail

The function *Send an e-mail* is preconfigured with this email address: `example@gmail.com`. Use the e-mail function to send information related to an event. Examples include:

- Send an e-mail when the measured temperature is too high.
- For control, use a scheduled script.

To use the *Send an e-mail* function, perform the following checks and configuration:

1. The Automation Controller must be in a network with access to the Internet, e.g. access via a network router.
   - The basic network settings of the Automation Controller are explained in the chapter (see Change IP settings of the Ethernet interface on page 27).
   - Check the network connection with Network Utilities (see page 199).
2. An active e-mail account is mandatory together with information to connect to the SMTP server.
3. Insert the active e-mail account data into the *Common functions* script.
4. Prepare and edit an event-based script with the *Send an e-mail* function. Use a function in the *Helpers* tab: Miscellaneous → Send an e-mail.

Access via email has been tested. Be aware, however, that access configuration may be changed by email providers in the future (e.g. to enhance security standards).

**Insert individual e-mail data**

Edit the email function strings to include the settings for your email provider.

```plaintext
Common functions

-- user function library
-- send an e-mail

function mail(to, subject, message)
    -- make sure these settings are correct
    local settings = {
        "from" field, only e-mail must be specified here
        from = 'example@gmail.com',
        -- smtp username
        user = 'example@gmail.com',
        -- smtp password
        password = 'mypassword',
        -- smtp server
        server = 'smtp.gmail.com',
        -- smtp server port
        port = 465,
        -- enable ssl, required for gmail smtp
        secure = 'sslv23',
    }
```

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Default setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>from</td>
<td>Specify the sender e-mail</td>
<td><code>example@gmail.com</code></td>
</tr>
<tr>
<td>user</td>
<td>User name for the e-mail account used for this function</td>
<td><code>example@gmail.com</code></td>
</tr>
<tr>
<td>password</td>
<td>Password for the e-mail account used for this function</td>
<td><code>mypassword</code></td>
</tr>
<tr>
<td>server</td>
<td>SMTP server address</td>
<td><code>smtp.gmail.com</code></td>
</tr>
<tr>
<td>port</td>
<td>SMTP server port</td>
<td>465</td>
</tr>
<tr>
<td>secure</td>
<td>Type of secure connection</td>
<td>sslv23</td>
</tr>
</tbody>
</table>

Click the *Save* button at the bottom bar of the editor. The edited email data will be included whenever the *Send an e-mail* function in a script is used.
10.4.2 Sending an e-mail using a script

Use a function in the Helpers tab to include the Send an e-mail function in a script.

Path: Miscellaneous → Send an e-mail.

In the script, edit the following three strings (see lines 2, 3 and 4 in the following screenshot).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Default setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>subject</td>
<td>Subject of message</td>
<td>'E-Mail text'</td>
</tr>
<tr>
<td>message</td>
<td>Text of message</td>
<td>'Testing e-mail'</td>
</tr>
<tr>
<td>Destination</td>
<td>Email address of the receiver</td>
<td>'<a href="mailto:user@example.com">user@example.com</a>'</td>
</tr>
</tbody>
</table>

10.4.3 Backup and restore common functions

Backup and restore common functions (see Backup and restore libraries on page 158).

Path: Configurator → Scripting tab → User libraries button.

10.5 Tools

The tools offer various options for the export and import of scripts.

10.5.1 Backup and restore scripts

Backup

① Click the Tools button and select Backup scripts.
② (Optional) Include Common functions and the Start-up (init) script. The backup file has the following name:

Scripting-Hostname-jjjj.mm.dd-hh.mm.tar

Restore

① Click the Tools button and select Restore scripts.
② (Optional) Remove or keep the existing scripts before a backup.

10.5.2 Print script listing

① Click the Tools button and select Print script listings.

A text page appears. The list is structured by categories (optional set).

② Click with right mouse button
③ (Optional) Select from the following options:
   - Print
   - Save as
   - Show source code.
10.5.3  Edit custom Java script
This advanced function allows insertion of Java script code.

10.5.4  Show logs window
All log data are listed here (the list is a duplicate of the Logs list in the Logs tab). Use this tool to check the logged data when testing and debugging a script. Alternatively open this list from the script editor.

10.6  Alerts
System messages or user alert information from user edited scripts are displayed in the Alerts tab of the Configurator page.

In the following example, system starts and a user edited temperature alert are shown.

<table>
<thead>
<tr>
<th>Alert time</th>
<th>Script name</th>
<th>Message</th>
</tr>
</thead>
<tbody>
<tr>
<td>09.02.2017 01:00:10</td>
<td>Event for 0/2285/1</td>
<td>Temperature too high, 36.0 °C</td>
</tr>
<tr>
<td>08.02.2017 09:13:35</td>
<td>system</td>
<td>System start</td>
</tr>
<tr>
<td>08.02.2017 08:18:29</td>
<td>system</td>
<td>System start</td>
</tr>
</tbody>
</table>

10.6.1  Alert command in a script
The following command stores an alert message and the current system time in the main database:

`alert('message', var1, var2, ...)`

Example with alert message

```
1  tempval = event.getValue()
2  --Temperature of measurement application
3  if (tempval > 30) then
4    -- Control light on
5    SetCBusLevel(0, 56, 1, 255, 0)
6    alert('Temperature too high, %.1f °C', tempval)
7  else
8    -- Control light off
9    SetCBusLevel(0, 56, 1, 0, 0)
10  end
```

In this example, when a measured temperature is higher than 30 °C (e.g. 36 °C), the following message appears in the Alert list:

`Temperature too high, 36 °C`

Show alerts in PC/Tablet
By default, alerts appear in the Alerts tab within the configuration. They are displayed in the PC/Tablet visualization when enabled in the settings of the Visualization configuration (see page 123).
Show an alert as a message in PC/Tablet

The alert message can optionally be shown on a visualization page. Text and numeric values can be set to a string variable and set to User parameter application with data type String (255 byte):

```lua
-- Set to variable message: string, digits of variable tempval and °C
message = 'Temperature too high,'..string.format("%d",tempval)..string.format("°C")
-- Set message to user parameter (variable address: Temp_info)
SetUserParam('Local', 'Temp_info', message).
```

The user parameter can be configured for a visualization page (see Objects on page 136).
11 User access

Add users with individual access rights. By default, users can access the following modules from the start page:

- PC/Tablet Visualization
- Smartphone Visualization
- Scheduler
- Trends.

Access can be partially or fully given, or denied, for each module. Partial access allows individual selection of pages. Access can be given or denied for each visualization page, scheduler and trend.

The Network Automation Controller is designed for a maximum of 50 users for visualization. This limit is not physical but dependent on maximum CPU load.

The Wiser for C-Bus Automation Controller is limited to a maximum of 8 users.

User access settings provide different levels of protection:

- **Unrestricted access**: All users are given access to all pages without restrictions.
- **Common restricted access**: All users are given access to all pages via a common PIN.
- **Individual restricted access**: Access to visualization, scheduler and trend logs is controlled via individual user login and password so that access can be defined for each user.

Access can be given to the start page or directly to one of the modules:

- PC/Tablet Visualization
- Smartphone Visualization
- Scheduler
- Trends.

Access to the configuration is defined under **Admin access** (See Access to the Controller on page 25). The default address is: http://192.168.0.10/scada-main.
### 11.1 Add and edit user

To add a user, click the *Add new user* button in the *User access* tab.

<table>
<thead>
<tr>
<th>Name</th>
<th>Login</th>
<th>Visualization access</th>
<th>Schedulers access</th>
<th>Trends access</th>
<th>Access logs</th>
</tr>
</thead>
<tbody>
<tr>
<td>user_1</td>
<td>user_1</td>
<td>Partial</td>
<td>None</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>user_2</td>
<td>user_2</td>
<td>Full</td>
<td>Full</td>
<td>Full</td>
<td></td>
</tr>
</tbody>
</table>

The user window is displayed:
11.2 User parameters

Table 55: User parameters

<table>
<thead>
<tr>
<th>Name</th>
<th>User name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Login</td>
<td>Length 2 to 20 characters, accepted characters: -_. a-z, A-Z, 0-9.</td>
</tr>
<tr>
<td>Password</td>
<td>Length: 8 to 20 characters. Any character accepted.</td>
</tr>
</tbody>
</table>
| Visualization/Schedulers/Trend access | For each module, access can be partially or fully given, or denied:  • None  • Partial  • Full.  
If partial is selected, access to visualization, scheduler and trend pages can be individually configured.  
The following example shows a configuration with access to 3 pages of the visualization for the specific user:

![User interface diagram]

Homepage  
This parameter depends on selected Default homepage in the User access Settings (see User access settings on page 166).  
If the Start page is selected in the user access settings, the start page is the homepage for all users. From the start page, the users get access to the other modules as configured.  
If another page is selected in the user access settings, an individual homepage can be selected for each user. If a user gets access to different modules, select the Start page:  • Start page  • PC/Tablet visualization  • Smartphone  • Schedulers  • Trend logs.
11.3 User access settings

User access settings are applied for all users.

Click the User access settings button in the User access tab.

Table 56: User access settings

| Disable password for visualization | • If the password is disabled, full access to visualization, schedulers and trends is given to everyone. A logout is not required. The user settings are not applied (see Add and edit user on page 164). If the Visualization PIN code is set, this common code is required to access visualization, schedulers and trends.  
• If the password is enabled, a login is required and the user settings are applied (see Add and edit user on page 164). |
| Default homepage | • If the Default homepage is set to Start page, this page is the home page for all users.  
• If the Default homepage is set to another page and a password for visualization is required, the homepage depends on the user settings (see Add and edit user on page 164). |
| Visualization PIN code | Access can be protected with a common PIN code (3 to 8 digits). The PIN code remains valid until the browser is closed. |

Direct access via browser address

Table 57: Direct access browser addresses

<table>
<thead>
<tr>
<th>Page/Module</th>
<th>Address (with default IP address)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PC/Tablet Visualization</td>
<td><a href="http://192.168.0.10/scada-vis">http://192.168.0.10/scada-vis</a></td>
</tr>
<tr>
<td>Smartphone/Visualization</td>
<td><a href="http://192.168.0.10/scada-vis/touch">http://192.168.0.10/scada-vis/touch</a></td>
</tr>
<tr>
<td>Scheduler</td>
<td><a href="http://192.168.0.10/scada-vis/schedulers">http://192.168.0.10/scada-vis/schedulers</a></td>
</tr>
<tr>
<td>Trends</td>
<td><a href="http://192.168.0.10/scada-vis/trends">http://192.168.0.10/scada-vis/trends</a></td>
</tr>
<tr>
<td>Start page</td>
<td><a href="http://192.168.0.10/home">http://192.168.0.10/home</a></td>
</tr>
<tr>
<td>Configurator</td>
<td><a href="http://192.168.0.10/scada-main">http://192.168.0.10/scada-main</a></td>
</tr>
</tbody>
</table>

Direct access is also protected with the login and password.
12 Inputs and Outputs

This chapter describes the configuration of the relay output, the LED driver output and the digital input. These external interfaces can be controlled via scripts. Script commands with comments are listed in the Helpers tab of the script editor (see Script editor on page 153). The following sections include examples of possible configurations.

12.1 Technical data

![Diagram of Inputs and Outputs]

- **A**  LED Output driver  40 mA current limited
- **B**  Relay output  NO, NC, Common
  48 V AC/24 V DC 1A max.
- **C**  Digital input  Potential-free contact (switch/relay)
  Monitored input:
  - Impedance 2.2 kΩ (closed)
  - Impedance 6.9 kΩ (open)

12.2 Configuration of relay output

The relay output can be switched on and off via C-Bus applications. A standard use case is to switch the output via a lighting application. It is also possible to configure a 250 - User Parameter. With this application, the output can be switched via values sent from Modbus slaves or visualization pages.

**Example**

In this example, a Lighting application is described. The load is connected to the NO (normally open) contact. The sequence is as follows:

- A sensor in the local network (0) sends the levels 0 or 255 with the ramp rate 0 s.
- If the state of the relay is set to true, the relay is switched on:
  - The NO contact is closed
  - The NC contact is open
  - The relay LED is green.

The following script sets the relay state:

```plaintext
Event-based: Event for relay (Local/Relay/Output NO (0/58/1))

1  -- Value from the sensor
2  switchoutput = event.getvalue()
3  if (switchoutput > 0) then
4    -- Set state of the relay true: NO contact - closed
5      SetRelayState(true)
6  else
7    -- Set state of the relay false: NO contact - open
8      SetRelayState(false)
9  end
```
All commands are listed in the *Helpers* tab of the script editor:

- **Conditionals**: If - Then - Else
- **I/O**: Set relay state.

Optionally, the relay can be switched from a visualization page. This can be configured via an Object element using the group address *Local/Relay/Output NO* (see *Objects* on page 136).

### 12.2.1 Commands in the Helpers tab

In the *Helpers* tab of the script editor, find an I/O command.

Path: *Configurator* → *Scripting* tab → *Event-based* button → *Editor* icon in the *Script* list.

**Set relay state**

-- Set state of the relay to on

SetRelayState(true)

If the value of the variable is set to *true*, the NO contact is closed.

**Get relay state**

-- Get state of the relay

value = GetRelayState()

If the NO contact is closed, the variable returns *true*.

The returned value of the relay state can also be used to switch an LED on or off.

### 12.3 Configuration of LED output

The LED output can be switched on and off via C-Bus applications. A common use case is to switch the LED via a lighting application. It is also possible to configure a *250 - User Parameter*. With this application, a LED can be switched via values sent from Modbus slaves or visualization pages.

**Example with on and off**

The LED output can be configured in a similar way to the relay output (see *Configuration of relay output on page 167*). Using an event-based script, the LED can be switched on and off.

**On command**

SetLEDState(true)

**Off command**

SetLEDState(false)

**Example with LED flashing on/off**

In this example, the LED flashes on/off when the temperature is higher than 30 °C. The minimal cycle (flashing) time is 1 s. The sequence is as follows:

- The temperature can be measured by a temperature sensor of a C-Bus device and sent by the application *228 - Measurement*.
- A resident script can be used to evaluate the measured temperature.
• If the temperature is above a specified value, the LED state toggles (on/off). For example, the **Toggle LED state** command can be triggered with a sleep interval (e.g. 1 s).

• If the temperature is lower than the specified value, the LED switches off.

The following script sets the LED to on/off flashing or to permanent off state:

```
1. -- Get temperature from measurement: temp_room_2 (floet)
2. -- Tag name of device ID: 'Sensor_room_2' Channel: 1
3. -- Tag name of network: Local
4. -- LED flashes, when temperature is > 30 °C (1 s on / 1 s off)
5. if temp_room_2 > 30 then
6.   -- Toggle LED state every second (time of resident script)
7.   ToggleLEDState();
8. else
9.   SetLEDState(false)
10. end

``` All commands are listed in the **Helpers** tab of the script editor:

• C-Bus: Get C-Bus measurement value

• Conditionals: If - Then - Else

• I/O: Toggle LED state

• I/O: Set LED state.

A high temperature event can also be shown in the alerts list (see Alerts on page 161).

### 12.3.1 Commands in the Helpers tab

In the **Helpers** tab of the script editor, find an **I/O** command.

Path: Configurator → Scripting tab → Event-based button → Editor icon in the Script list.

**Set LED state**

```
-- Set state of LED on
SetLEDState(true)
```

If the value of the variable is set to `true`, the LED is switched on.

**Get LED state**

```
-- Get state of LED
value = GetLEDState()
```

If the LED is switched on, the variable returns `true`.

**Toggle LED state**

```
-- Toggle state of LED
ToggleLEDState()
```

If the command is executed, the LED output toggles from the current state to the opposite state (e.g. from **off** to **on**).

**Set LED mode**

```
-- Set mode of LED to 'normal'
SetLEDMode('normal')
```

No other modes can be set.
12.4 Reading of digital input

The digital input of the Automation Controller is compatible with either a potential-free contact or a monitored cable using End of Line Resistance.

![Diagram of digital input](image.png)

① Digital input with potential free contact
② Digital input with monitored cable

12.4.1 States of potential free contact

<table>
<thead>
<tr>
<th>LED Controller</th>
<th>Potential free contact (switch/relay)</th>
<th>Text representation script</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yellow</td>
<td>Input is open circuit</td>
<td>open</td>
</tr>
<tr>
<td>Red</td>
<td>Input is closed circuit</td>
<td>short</td>
</tr>
</tbody>
</table>

12.4.2 States of monitored input

<table>
<thead>
<tr>
<th>LED Controller</th>
<th>Monitored input</th>
<th>Text representation script</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green</td>
<td>Input in high resistance (6.9 kΩ)</td>
<td>alarm</td>
</tr>
<tr>
<td></td>
<td>Switch open state</td>
<td></td>
</tr>
<tr>
<td>Yellow</td>
<td>Open circuit (&gt; 12 kΩ)</td>
<td>open</td>
</tr>
<tr>
<td>Red</td>
<td>Short circuit (&lt; 1 kΩ)</td>
<td>short</td>
</tr>
<tr>
<td>Off</td>
<td>Input in low resistance (2.2 kΩ)</td>
<td>ok</td>
</tr>
<tr>
<td></td>
<td>Switch closed state</td>
<td></td>
</tr>
</tbody>
</table>

Example

In this example, text messages are used to show if a potential free window contact is open or closed. The sequence is as follows:

- The state of the digital input is repeatedly read and evaluated in a resident script.
- A variable is set to “Window open” or “Window closed”, and then set to a User parameter application with the data type string.
- The characters of the user parameter can be shown on a visualization page. The user parameter can also be configured as an Object element (see Objects on page 136).

The following script can be used to set a text message as “Window open” or “Window closed” depending on the contact state.
All commands are listed in the **Helpers** tab of the script editor:
- I/O: Read digital input
- Conditionals: If - Then - Else
- C-Bus: Set user parameter
- I/O: Set LED state.

**Commands in the Helpers tab**

In the **Helpers** tab of the script editor, find an **I/O** command.

Path: **Configurator** → **Scripting** tab → **Event-based** button → **Editor** icon in the **Script** list.

**Read digital input**

```plaintext
-- Read state of digital input
value = ReadDigitalInput()
```

If the resistance is below 3.5 kΩ, the variable returns `true`.

**Read digital input range**

```plaintext
-- Read range of digital input
value = ReadDigitalInputRng()
```

If the resistance is between 1 kΩ, and 12 kΩ, the variable returns `true`.

**Read digital input text representation**

```plaintext
-- Read text representation of digital input state
value = ReadDigitalInputTxt()
```

The following strings are returned.

**Table 60: Digital input strings and LED indications**

<table>
<thead>
<tr>
<th>Value</th>
<th>Resistance</th>
<th>LED Controller</th>
</tr>
</thead>
<tbody>
<tr>
<td>alarm</td>
<td>Input in high resistance (6.9 kΩ)</td>
<td>Green</td>
</tr>
<tr>
<td></td>
<td>Switch open state</td>
<td></td>
</tr>
<tr>
<td>open</td>
<td>Open circuit (&gt; 12 kΩ)</td>
<td>Yellow</td>
</tr>
<tr>
<td>short</td>
<td>Short circuit (&lt; 1 kΩ)</td>
<td>Red</td>
</tr>
<tr>
<td>ok</td>
<td>Input in low resistance (2.2 kΩ)</td>
<td>Off</td>
</tr>
<tr>
<td></td>
<td>Switch closed state</td>
<td></td>
</tr>
</tbody>
</table>
12.5 USB-A

A USB type A connector on the Automation Controller provides connection to USB expansion devices.

- USB 1.1 and 2.0 devices are supported.
- FAT and FAT32 file system formatted flash drives can be attached.
- USB 2.0 provides a bandwidth of 480 Mbit/s, corresponding to an effective image data rate of 40 MB/s.
- Devices complying with the USB specification may consume a total of 500 mA from the bus. Devices with a power rating of up to 2.5 W can therefore be supplied via the bus.
- Data transmission is possible in both directions.

12.5.1 USB flash drive configuration commands

Commands are listened in the Input and Output Facilities topic list of the script editor.

Path: Configurator → Scripting tab → Event-based button → Editor icon in the Script list.

12.5.2 Mounting

Before a drive is read from or written to it must be mounted and when your script is done it will unmount it, doing so reduces the chance of data loss if the power fails.

The following script functions will perform this task:

```lua
function mount_usb(check)
    devs = io.ls('/sys/class/block/')
    table.sort(devs)
    for _, dev in ipairs(devs) do
        if dev:match('^sd%a%d$') then
            part = dev
            break
        elseif not devn and dev:match('^sd%a$') then
            devn = dev
        end
    end
    part = part or devn
    if part then
        os.execute('umount -f /mnt 2>&-')
        if check then
            io.readproc('fsck.fat -a /dev/' .. part)
        end
        res, stat = io.readproc('mount /dev/' .. part .. ' /mnt 2>&1')
        if stat == 0 then
            return true
        else
            return false, 'USB mount failed: ' .. tostring(res)
        end
    else
        return false, 'No valid USB devices found'
    end
end

function unmount_usb()
    os.execute('umount -f /mnt 2>&-')
end
```
Incorporate this into your script (or have it as a user library) when accessing the drive call ‘mount_usb’ from your script. When the function is successful it will mount the drive under the '/mnt' directory. It takes an optional boolean argument, if it is true then it will check the file system before mounting, it defaults to off as it takes several seconds to run.

• Note that only the first partition on the drive will be mounted.
• Also note that while it is possible to connect multiple USB drives via a hub the above script will only mount the first it detects. It is possible to extend it to properly handle more but that is beyond the scope of this document

The LUA reference manual available at [www.lua.org](http://www.lua.org) provides further information.

Additionally other file systems are supported such as EXT2/3/4, these have fewer intrinsic limits than FAT but require extra software to read on Microsoft Windows or MacOS X.

**Read**

`io.readfile(file)`

Function to read the entire contents of ‘file’ and return it as a string. Returns nil if there is an error.

**Write**

`io.writefile(file, data)`

Function that saves ‘data’ to ‘file’ and overwrites any existing content. ‘data’ is a value converted to a string. The function returns a true when the file can be opened for writing, or nil when the file cannot be accessed.

**Open**

`io.open(file, mode)`

The open command is a lower level function, which opens ‘file’ for IO and returns a file handle. The ‘mode’ can be one of the following:

- "r" Open the file read-only.
- "w" Open the file write-only and truncate any existing data.
- "a" Open the file write-only and append to the end of the file.
- "r+" Open the file read/write, fails if the file doesn’t exist.
- "w+" Open the file read/write and truncate any existing data.
- "a+" Open the file read/write and append to the end of the file.

Returns the file handle on success, returns nil and an error on failure.

The file will be closed when no longer required. Further information can be found in the Lua reference manual.
Example 1
-- Update the file '/mnt/data' with a value, replacing any contents with the string 'abcdef' and a new line.
-- Emits an alert if the flash drive is not accessible.
res, err = mount_usb()
if res then
    io.writefile('/mnt/data', 'abcdef
')
    unmount_usb()
else
    alert(err)
end

Example 2
-- Append 'abcdef' and a new line to the file '/mnt/data'
-- Emits an alert if the flash drive is not accessible.
-- Note that the maximum size of a file in FAT/FAT32 is 4Gbyte.
res, err = mount_usb()
if res then
    f, err = io.open('/mnt/data', 'a')
    if f ~= nil then
        f:write('abcdef\n')
        f:close()
    else
        alert('Unable to write to file: ' .. err)
        unmount_usb()
    end
else
    alert(err)
end

12.6 RS-232

Interaction with other equipment is possible via an isolated RS-232 interface. The RS-232 serial interface is one of the most widely used communication standards for data transmission between two devices over short distances.

Typical not guaranteed data transmission with different cable lengths:

<table>
<thead>
<tr>
<th>Baud rate (bit/s)</th>
<th>Max. cable length (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2400</td>
<td>60</td>
</tr>
<tr>
<td>4800</td>
<td>30</td>
</tr>
<tr>
<td>9600</td>
<td>15</td>
</tr>
<tr>
<td>19200</td>
<td>7.6</td>
</tr>
<tr>
<td>38400</td>
<td>3.7</td>
</tr>
<tr>
<td>57600</td>
<td>2.6</td>
</tr>
<tr>
<td>11500</td>
<td>1.5</td>
</tr>
<tr>
<td>230400</td>
<td>1.0</td>
</tr>
</tbody>
</table>
The achievable error free baud rate depends on the specific hardware, cable length, cable type and quality, electromagnetic noise and other factors.

Note the wiring and configuration instructions in the manuals of the connected RS-232 equipment.

### 12.6.1 Configuration commands

Commands for the data transfer between the Automation Controller and another device using RS-232 are described in the following script.

**Serial** commands are listed in the **Helpers** tab of the script editor.

Path: **Configurator** → **Scripting** tab → **Event-based** button → **Editor** icon in the **Script** list.

#### Open connection

```javascript
require('serial')
-- communication example with 38400 bit/s
port = serial.open('/dev/RS232', {
  baudrate = 38400,
  databits = 8,
  stopbits = 1,
  parity = 'none',
  duplex = 'half'
})
```

<table>
<thead>
<tr>
<th>Settings</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baud rate</td>
<td>300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400</td>
</tr>
<tr>
<td>Data bits</td>
<td>5, 6, 7, 8</td>
</tr>
<tr>
<td>Stop bits</td>
<td>1, 2</td>
</tr>
<tr>
<td>Parity</td>
<td>'none', 'even', 'odd'</td>
</tr>
<tr>
<td>Duplex</td>
<td>'half', 'full'</td>
</tr>
</tbody>
</table>

Note the configuration instructions in the manuals of the connected RS-232 equipment. The Automation Controller and the other device must use the same settings and values.

#### Write to port

```javascript
port:write('test data')
```

#### Blocking read

```javascript
-- script will block until 10 characters are read
data = port:read(10) Blocking read
```

#### Timeout read

```javascript
-- script will wait for 10 characters for 20 seconds
data = port:read(10, 20)
```

#### Close serial port

```javascript
port:close()
```
12.7 RS-485

The Automation Controller has an isolated RS-485 interface, which can be used for a serial data transmission between two or more devices.

![Diagram of RS-485 interface]

**Modbus**

A D1+ = Data transfer  
B D0– = Data transfer  
COM = Common  
1 = Optional in-build low power terminator of 120 Ω + 1 nF via link AT–BT  
2 = Optional in-build legacy terminator of 120 Ω = link BT-A

- D1+ and D0– = twisted wires of RS-485 cable.  
- COM = common wire.  
- Shield must be connected to earth at end of the line.  
- The line must be terminated at each end:  
  - The Automation Controller has an optional inbuilt low power terminator of 120 Ω + 1 nF via link AT–BT. This will be used when the Automation Controller is at one end of the line.  
  - In large installations, install the master in the middle of the line. In this case, the inbuilt line termination will not be used.  
- Topology:  
  - Daisy chain or multi-drop with short stubs (40 m/number of stubs/derivations, max. 20 m).  
  - The line must be terminated at each end.  
  - Cable: e.g. Belden 9842 (2 twisted pairs, shielded, imp. 120 Ω).

- Baud rate and cable length:  
  - The achievable error-free baud rate depends on length of a line, number of devices, cable type and quality, correct terminations, electromagnetic noise and other factors.  
  - The Automation Controller supports up to 230400 bit/s. When the data rate is below 100 kbps, data can typically not guaranteed be transmitted at a distance up to 1200 m. At higher data rates, the cable length must be reduced:

<table>
<thead>
<tr>
<th>Baud rate (bit/s)</th>
<th>Max. cable length (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600</td>
<td>1200 m</td>
</tr>
<tr>
<td>115200</td>
<td>750 m</td>
</tr>
<tr>
<td>230400</td>
<td>600 m</td>
</tr>
</tbody>
</table>

- All devices on a RS-485 line must use the same baud rate. The max. cable length for a given baud rate may be reduced.

The Modbus protocol can be used on the RS-485 port. The configuration of a Modbus line is described in the Modbus chapter on page 177:  
- Settings using profiles see Modbus RTU Settings on page 181  
- Settings using scripts see Modbus RTU configuration commands on page 190.
12.7.1 Configuration commands

In the following script commands for the data transfer between the Automation Controller and another device using RS-485 are described. Serial commands are listed in the Helpers tab of the script editor.

Path: Configurator → Scripting tab → Event-based button → Editor icon in the Script list.

Note the wiring and configuration instructions in the manuals of the connected RS-485 equipment.

12.7.2 Open connection

If using the scripts in the Helpers tab of the script command edit `/dev/RS485` instead of `/dev/RS232`.

```lua
require('serial')
-- communication example with 38400 bit/s
port = serial.open('/dev/RS485', {
    baudrate = 38400,
    databits = 8,
    stopbits = 1,
    parity = 'none',
    duplex = 'half'
})
```

Table 64: RS-485 open connection settings

<table>
<thead>
<tr>
<th>Settings</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baud rate</td>
<td>300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400</td>
</tr>
<tr>
<td>Data bits</td>
<td>5, 6, 7, 8</td>
</tr>
<tr>
<td>Stop bits</td>
<td>1, 2</td>
</tr>
<tr>
<td>Parity</td>
<td>'none', 'even', 'odd'</td>
</tr>
<tr>
<td>Duplex</td>
<td>'half'</td>
</tr>
</tbody>
</table>

Write to port

`port:write('test data')`

Blocking read

```lua
-- script will block until 10 characters are read
data = port:read(10) Blocking read
```

Timeout read

```lua
-- script will wait for 10 characters for 20 seconds
data = port:read(10, 20)
```

Close serial port

`port:close()`

12.8 Modbus

Modbus is an open standard for client/server communication. The client sends a request message and the server sends a response message. The values of a server are saved in registers which can be accessed by the client.
The Automation Controller supports Modbus RTU serial communication via the RS-485 interface and Modbus TCP communication via the RJ45 Ethernet interface. In Modbus RTU mode, the client is usually referred to as the master and the server as the slave.

In general, the Automation Controller is the Modbus master/client. The supported registers of a slave/server can be mapped with objects of the application User Parameter. Thus, inputs, outputs, measured values and states of a server can be monitored and controlled. Use these objects for the basic functions of the Automation Controller such as visualization, trend logging and scheduling, as well as for advanced functions using LUA scripting.

Tables of Modbus registers are available in Modbus device manuals. For general information about the Modbus protocol and data model, refer to Modbus.org.

As the Automation Controller supports both Modbus RTU and Modbus TCP, buildings can be analysed and controlled in depth. With Modbus TCP, it is also possible to communicate remotely with Modbus devices installed in different buildings.

### 12.8.1 Access via RS-485

The most common method of Modbus communication is Modbus RTU serial communication via the RS-485 interface. The Automation Controller has RS-485 connectors for Modbus and acts as a master.

* By Modbus specification a serial line is limited to 31 slaves.

#### Slaves

By Modbus specification a serial line is limited to 31 slaves. The Network Automation Controller is not limited but designed for 31 slaves. The Wiser™ for C-Bus Automation Controller is limited to a maximum of 6 Modbus slaves.

Schneider Electric offers a wide range of Modbus RTU devices which can be easily integrated with the Automation Controller:

- PM: Power Meter range (e.g. current, voltage, power, power factor, frequency, energy)
- iEM: Watt-hour meter range (e.g. current, voltage, power, power factor, frequency, energy)
- SIM10M: Smart Interface module (Pulse counter e.g. for water, gas, watt hours)
- Masterpact: Circuit Breaker Manager
- Compact: Circuit breakers for high loads
- Vigilohm: Insulation monitoring
- Smartlink RTU: smart communication I/O module
- SE 8000: Room Controllers
- TC 303: Digital Fan Coil Thermostat.
A complete building can be analysed and controlled in depth via a Modbus RTU line. Moreover, access Modbus slaves in another RTU line by using Modbus TCP over Modbus gateways.

**Easy configuration with profiles**

The slaves in a RTU line can be easily configured. Preinstalled profiles (*.json files) are available for the slaves. A profile provides a list of usable registers of the slave. Select the registers required and map these with objects of the application 250 - User Parameter. Step by step configuration is described in Configure preinstalled profiles on page 180. There is also a list of available profiles.

If there is no preinstalled profile for the device to be integrated, download a profile and adapt it for your product. See Add and edit profiles on page 183.

**Configuration with scripts**

If familiar with programming in LUA, use scripts (see Modbus settings using scripts on page 186). If using the Automation Controller as a slave, it it mandatory to use scripts instead of a profile. A combination of profiles and scripts cannot be used.

### 12.8.2 Access via Ethernet

The Automation Controller can communicate as a client with servers via TCP/IP. Servers or slaves can either be directly accessed via Ethernet or via a Modbus/IP gateway.

An example of direct connection via Ethernet is Smartlink IP, where the Automation Controller acts as a client and Smartlink IP acts as a server. The configuration of IP-communication, channels, inputs and mapping is done via the profile Smartlink TCP.

A gateway connects Modbus via Ethernet (RJ45) with a Modbus serial line (RS-485 interface). Up to 31 Modbus RTU slaves can be connected with a gateway. The configuration can be performed via the profiles of the RTU slaves. The connection type for each slave in the serial Modbus line is TCP/IP. All slaves must be linked with the IP address of the gateway.

Step by step instructions for configuring RTU slaves are described in Configure preinstalled profiles on page 180. Therein is a list of available profiles.

The Modbus TCP Interface allows up to 100 open TCP connections (e.g. servers/slaves).
12.8.3 Configure preinstalled profiles

Configuration is done in the Modbus tab. Modbus slaves (servers) can be added via either the Add device button or the RTU scan button.

Path: Configurator → Modbus tab.

These steps configure Modbus slaves (servers) using profiles:
1. Enable Modbus RTU communication (click the RTU Settings button).
2. (Optional) Scan for Modbus RTU devices. The List of preinstalled Modbus profiles on page 180 shows the Modbus devices which can be scanned via the RTU scan button. If RTU is not enabled, scanning does not work.
3. If the RTU scan function is not possible, click the Add device button and assign the correct profile.
4. Edit the Modbus device (Modbus list) to set the polling period.
5. Select registers and check the data type.
6. If necessary, create new objects of the 250 - User Parameter application.
7. Map the objects of the application to the selected registers.

List of preinstalled Modbus profiles

Table 65: Preinstalled Modbus profiles

<table>
<thead>
<tr>
<th>Profile</th>
<th>Description</th>
<th>RTU scan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compact_NSX-Compact_NSX_E</td>
<td>Distribution Application Type E for NSX</td>
<td>Yes</td>
</tr>
<tr>
<td>Masterpact_NT_NW-Masterpact_A</td>
<td>Circuit Breaker Manager for Masterpact</td>
<td>Yes</td>
</tr>
<tr>
<td>Masterpact_NT_NW-Masterpact_H</td>
<td>Circuit Breaker Manager for Masterpact</td>
<td>Yes</td>
</tr>
<tr>
<td>Masterpact_NT_NW-Masterpact_P</td>
<td>Circuit Breaker Manager for Masterpact</td>
<td>Yes</td>
</tr>
<tr>
<td>PM-PM1200</td>
<td>Power Meter PM1200</td>
<td>No</td>
</tr>
<tr>
<td>PM-PM210</td>
<td>Power Meter PM210</td>
<td>No</td>
</tr>
<tr>
<td>PM-PM3250</td>
<td>Power Meter PM3250</td>
<td>Yes</td>
</tr>
<tr>
<td>PM-PM3255</td>
<td>Power Meter PM3255</td>
<td>Yes</td>
</tr>
<tr>
<td>PM-PM5110</td>
<td>Power Meter PM5110</td>
<td>No</td>
</tr>
<tr>
<td>PM-PM5111</td>
<td>Power Meter PM5111</td>
<td>No</td>
</tr>
<tr>
<td>PM-PM5310</td>
<td>Power Meter PM5310</td>
<td>No</td>
</tr>
<tr>
<td>PM-PM5330</td>
<td>Power Meter PM5330</td>
<td>No</td>
</tr>
<tr>
<td>PM-PM5350</td>
<td>Power Meter PM5350</td>
<td>No</td>
</tr>
<tr>
<td>PM-PM710</td>
<td>Power Meter PM710</td>
<td>No</td>
</tr>
<tr>
<td>PM-PM750</td>
<td>Power Meter PM750</td>
<td>No</td>
</tr>
<tr>
<td>PM-PM810</td>
<td>Power Meter PM810</td>
<td>No</td>
</tr>
<tr>
<td>PM-PM820</td>
<td>Power Meter PM820</td>
<td>No</td>
</tr>
<tr>
<td>PM-PM850</td>
<td>Power Meter PM850</td>
<td>No</td>
</tr>
<tr>
<td>PM-PM870</td>
<td>Power Meter PM870</td>
<td>No</td>
</tr>
<tr>
<td>PM-PM9C</td>
<td>Power Meter PM9C</td>
<td>No</td>
</tr>
</tbody>
</table>
### 12.8.4 Modbus RTU Settings

In order to communicate with Modbus slaves connected over Modbus RTU (serial), it is mandatory to enable the communication and set the connection details.

Path: *Modbus* tab → *RTU-Settings* button.

**RTU (serial) enabled**

This option enables Modbus RTU communication.

**Port**

The default setting of the serial port is `/dev/RS485`. If the Port field is empty, `/dev/RS485` is automatically inserted when the *Save* button is pressed.

**Baud rate**

All Modbus devices must use the same setting.

All metering devices can run either on 9600 bit/s (max. cable distance 1200 m) or 19200 bit/s (max. cable distance 900 m). 19200 bit/s is default for most devices.

Some devices can also work with other speeds.

**Parity**

All Modbus devices must use the same setting.

Select either *None*, *Even*, or *Odd*. *Even* with *One stop bit* is the default for most devices.

**Duplex**

Must be *Half-duplex* for RS-485.

**Reset to defaults**

This button resets all RTU setting parameters to their default.
12.8.5 Modbus RTU scan

Devices with the RTU scan feature can be detected and added using the RTU scan function (see List of preinstalled Modbus profiles on page 180).

Path: Modbus tab → RTU scan button.

1. Ensure that Modbus slaves are connected to the Automation Controller via the RS-485 interface.
2. Click the RTU scan button.
3. Select the start and end device addresses of the slaves.
4. Click the Save button.
5. The Controller recognises Modbus devices that can be detected via the RTU scan function. Modbus devices that are not capable of being detected must firstly be assigned a correct profile and then edit the names and the poll intervals.
6. Choose which devices to be inserted in the Modbus device list.

12.8.6 Add Modbus device

Manually add Modbus devices.

Path: Modbus tab → Add device button.

1. Click the Add device button.
2. Edit and save the following parameters:

Table 66: Modbus device parameters

<table>
<thead>
<tr>
<th>Name</th>
<th>Name of Modbus device</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connection type</td>
<td>RTU (RS-485)</td>
</tr>
<tr>
<td></td>
<td>TCP/IP</td>
</tr>
<tr>
<td>Profile</td>
<td>Select an installed profile</td>
</tr>
<tr>
<td>Device address</td>
<td>Select the Modbus device address. Note: It is mandatory to select this address on the Modbus device (e.g. via the display menu or the configuration software of the device).</td>
</tr>
<tr>
<td>Poll interval</td>
<td>Select an interval. Value 5 is the default (new values are read every 5 seconds).</td>
</tr>
<tr>
<td>IP address</td>
<td>If the TCP/IP connection type is selected, set the IP address. If the Modbus device (server) is directly connected to the Automation Controller (client), set the IP address of the Modbus device. If the Modbus device (slave) is connected via a RTU/TCP/IP gateway, set the IP address of the gateway (e.g. EGX300, Smartlink IP).</td>
</tr>
<tr>
<td>Port</td>
<td>(Optional) Set the Port for Modbus TCP communication. The standard Modbus default Port is 502.</td>
</tr>
</tbody>
</table>

12.8.7 Add Objects

It is recommended to prepare objects before the mapping procedure. New objects can be added in the Objects tab (see Add User parameters on page 102).

For each register in the Object mapping list, edit the following parameters:

Table 67: Object mapping parameters

<table>
<thead>
<tr>
<th>Name</th>
<th>Name of the register in the object mapping list.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Link to object</td>
<td>Select the object where the value read from the Modbus register will be saved. Only select existing objects from the drop down menu.</td>
</tr>
<tr>
<td>Value send delta</td>
<td>Set the value of delta. If the change of value read from Modbus register is bigger than this delta, the value is sent to the object.</td>
</tr>
<tr>
<td>Unit/suffix</td>
<td>If the User parameter application is selected, a unit is used from the profile or can be modified.</td>
</tr>
<tr>
<td>Keywords</td>
<td>Keywords are assigned to the object. Keywords can be used in scripts (optional).</td>
</tr>
<tr>
<td>Description</td>
<td>(Optional).</td>
</tr>
</tbody>
</table>
12.8.8 Modbus Mapping

When a Modbus device is added, bindings between Modbus registers and objects have to be created. This is done by setting the register mapping. The registers of the Modbus device can be mapped with objects of the application 250 - User Parameter. For each device in the Modbus device list, open a mapping list.

Path: Modbus tab → Modbus device list → Mapping column → Object mapping list.

Each row of the Mapping table represents one of the Modbus registers (defined in the device profile). Decide which registers to map, then check the data type of the selected registers. Link with objects of the C-Bus application 250 - User Parameter.

For the mapping, only select existing C-Bus objects with the correct application and data type.

Examples

- The register type of the Reactive Power is float32. In this case, link with the data type Floating point (32 bit). The application is 250 - User parameter.
- The register type of the PF Quadrant is internally converted from float32 to uint32 (float32=>uint32). In this case, link with data type Unsigned Integer (32 Bit). The application is 250 - User parameter.

12.8.9 RTU read test

RTU read test allows quick reading of values stored in Modbus registers with different parameters.

Path: Modbus tab → RTU read test button.

For testing, select a register address from the Object mapping list. This functionality is also very useful when creating and testing your own Modbus profiles.

12.8.10 Add and edit profiles

If your Modbus device profile is not in the list of preinstalled profiles, define your own profile.
Structure of a profile

Modbus device profiles are distributed in *.json files. Use any common text editor to create and edit your profile.

Consider using a text editor with enhanced support for .json files. These editors display .json file content with syntax colouring/formatting and this makes the file easier to edit and save.

The structure of a profile is shown here:

```json
{
    "manufacturer": "Schneider Electric",
    "description": "Example device",
    "mapping": [
        { "name": "Output 1", "bus_datatype": "bool", "type": "coil", "address": 0,"writable": 1 },
        { "name": "Input 1", "bus_datatype": "float16", "type": "inputregister", "address": 0, "value_multiplier": 0.001, "units": "V" }
    ]
}
```

Mapping parameters

Each “mapping” line in the .json file contains mapping information for one Modbus register or coil. All the possible mapping parameters are listed in the table below.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Type</th>
<th>Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Object name, e.g. Output 2.</td>
<td>String</td>
<td>Yes</td>
</tr>
<tr>
<td>bus_datatype</td>
<td>C-Bus object data type, key from dt table, e.g. float32.</td>
<td>String/Number</td>
<td>Yes</td>
</tr>
<tr>
<td>type</td>
<td>Modbus register type. Possible values: coil, discreteinput, register, inputregister.</td>
<td>String</td>
<td>Yes</td>
</tr>
<tr>
<td>address</td>
<td>Register address (0-based).</td>
<td>Number</td>
<td>Yes</td>
</tr>
<tr>
<td>writable</td>
<td>Set to true to enable writing to the register if type is either coil or register.</td>
<td>Boolean</td>
<td>No</td>
</tr>
<tr>
<td>write_only</td>
<td>Set to true to disable reading coil or register value when &quot;writable&quot; is enabled.</td>
<td>Boolean</td>
<td>No</td>
</tr>
<tr>
<td>datatype</td>
<td>Modbus value data type. If set, conversion will be done automatically. Possible values: bool, uint16, int16, float16, uint32, int32, float32, uint64, int64, quad10k, s10k.</td>
<td>String</td>
<td>No</td>
</tr>
<tr>
<td>value_delta</td>
<td>New value is sent when the difference between previously sent value and current value is larger than delta. Defaults to 0 (send after each read).</td>
<td>Number</td>
<td>No</td>
</tr>
<tr>
<td>value_base</td>
<td>Add specified number to the resulting value.</td>
<td>Number</td>
<td>No</td>
</tr>
<tr>
<td>value_multiplier</td>
<td>Multiply resulting value by the specified number.</td>
<td>Number</td>
<td>No</td>
</tr>
<tr>
<td>value_bitmask</td>
<td>Bit mask to apply. Shifting is done automatically based on the least significant '1' found in the mask.</td>
<td>Number</td>
<td>No</td>
</tr>
<tr>
<td>value_nan</td>
<td>Array of 16-bit integers. If specified and the read operation returns the same array, no further processing of the value is done.</td>
<td>Array</td>
<td>No</td>
</tr>
<tr>
<td>value_conv</td>
<td>Apply one of the inbuilt conversion functions.</td>
<td>String (Int)</td>
<td>No</td>
</tr>
<tr>
<td>value_custom</td>
<td>Name of an inbuilt enumeration or a list of key → value mapping. Resulting value will be 0 if key is not found.</td>
<td>String/Object</td>
<td>No</td>
</tr>
<tr>
<td>internal</td>
<td>Not visible to the user when set to true. Must be used for scale registers.</td>
<td>Boolean</td>
<td>No</td>
</tr>
<tr>
<td>units</td>
<td>Object units/suffix.</td>
<td>String</td>
<td>No</td>
</tr>
</tbody>
</table>
Inputs and Outputs

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Type</th>
<th>Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>address_scale</td>
<td>Address of the register containing value scale. Value = value * 10 ^ scale</td>
<td>Number</td>
<td>No</td>
</tr>
<tr>
<td>read_count</td>
<td>Number of registers to read at once (for devices that only support reading of a specific block of registers).</td>
<td>Number</td>
<td>No</td>
</tr>
<tr>
<td>read_swap</td>
<td>Swap register order during conversion (endianness).</td>
<td>Boolean</td>
<td>No</td>
</tr>
<tr>
<td>read_offset</td>
<td>Position of first register of data from the block of registers (0-based).</td>
<td>Number</td>
<td>No</td>
</tr>
<tr>
<td>timeout</td>
<td>Specify device timeout in seconds. If the slave device does not reply within specified time, it is treated as a timeout error. Default values: 0.5 s for Modbus RTU, 3 s for Modbus TCP.</td>
<td>Number</td>
<td>No</td>
</tr>
<tr>
<td>write_multiple</td>
<td>This parameter sets the multiple writing function (function 15 or 16 is used instead of function 5 or 6). If “Type” is set to “register” and “Write_multiple” is set to “true”, Modbus function 16 is used for writing to the register. If “Type” is set to “coil” and “Write_multiple” is set to “true”, Modbus function 15 is used for writing to the coil. Default value is “false”, which means that Modbus function 5 or 6 (depending on register type) is used for writing.</td>
<td>String</td>
<td>No</td>
</tr>
</tbody>
</table>

When the Modbus devices are physically connected, use the RTU read test. This allows quick reading of values stored in Modbus registers (See RTU read test on page 183).

Export profiles

When creating a new profile, use an existing profile as an example. If a preinstalled profile must be modified, e.g. to add registers, it can be exported, modified in Notepad and imported again. If required to keep both versions, rename the new json file.

Path: Modbus tab → Profiles button → Profiles list → Export icon.

1. Click the Profiles button.
2. Click the Export icon in the profiles list and select where to save the .json file.

Editing of the file with a text editor is now possible.

Import profiles

Import new or changed .json files in the Profiles list.

Path: Modbus tab → Profiles button → Profiles list → Add profile button.

1. Click the Add Profiles button and select the .json file.
   If something is wrong, e.g. the characters ",, [], {} are missing or in the wrong place, this error message appears: Invalid profile selected. If a parameter is not recognised, it will just be skipped.
2. After successful import, the profile becomes available in the Profiles list.

Delete profiles

Path: Modbus tab → Profiles button → Profiles list → Delete icon.

Click the Delete icon to delete a profile.
12.9 Modbus settings using scripts

Function codes and corresponding master functions, MODBUS RTU configuration commands, and, Modbus slave functions can be set up to required specifications.

12.9.1 Function Codes and corresponding Master Functions

All the possible Modbus function codes that can be used in the Automation Controller are listed below. There is an LUA function in the Automation Controller for each function code.

All of these functions can be used for both Modbus TCP and Modbus RTU.

FC#01 Read Coils

<table>
<thead>
<tr>
<th>Name</th>
<th>Read single coil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Command</td>
<td>coil = mb:readcoils(address)</td>
</tr>
<tr>
<td>Arguments</td>
<td>[address]: address of the coils</td>
</tr>
<tr>
<td>Returned values</td>
<td>1: ON, 0: OFF</td>
</tr>
<tr>
<td>Exception codes:</td>
<td>01 or 02 or 03 or 04</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name</th>
<th>Read multiple coil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Command</td>
<td>coil = mb:readcoils(start, count)</td>
</tr>
</tbody>
</table>
| Arguments  | [start]: address of the first coil to read  
|            | [count]: number of coils to read (max. 2000) |
| Returned values | 1: ON, 0: OFF                     |
| Exception codes: | 01 or 02 or 03 or 04              |
| Script example | coil1, coil2, coil3 = mb:readcoils(1000, 3) |
|              | Value read from coil address 1000 is returned into variable coil1. |
|              | Value read from coil address 1001 is returned into variable coil2. |
|              | Value read from coil address 1002 is returned into variable coil3. |
**FC#02 Read Discrete Inputs**

Name | Read discrete input  
---|---
Command | value = mb:readdiscreteinputs(address)  
Arguments | [address]: address of the input  
Returned values | 1: ON, 0: OFF  
Exception codes: 01 or 02 or 03 or 04

Name | Read discrete inputs  
---|---
Command | value = mb:readdiscreteinputs(address, count)  
Arguments | [address]: address of first input to read  
[count]: number of inputs to read (max. 2000)  
Returned values | 1: ON, 0: OFF  
Exception codes: 01 or 02 or 03 or 04

Script example  
```plaintext
bool1, bool2 = mb:readdiscreteinputs(10, 2)
```
Value read from discrete input address 10 is returned into variable bool1.  
Value read from discrete input address 11 is returned into variable bool2.

**FC#03 Read Holding Registers**

Name | Read registers  
---|---
Command | value = mb:readregisters(address, count)  
Arguments | [address]: address of the first register to read  
[count]: number of registers to read (max 125)  
Returned values | 2 byte values  
Exception codes: 01 or 02 or 03 or 04

Script example  
```plaintext
value1, value2 = mb:readregisters(1100, 2)
```
Value read from register address 1100 is returned into variable value1.  
Value read from register address 1101 is returned into variable value2.

**FC#04 Read Input Registers**

Name | Read input registers  
---|---
Command | value = mb:readinputregisters(address, count)  
Arguments | [address]: address of the first input register to read  
[count]: number of input registers to read (max. 125)  
Returned values | 2 byte values  
Exception codes: 01 or 02 or 03 or 04

Script example  
```plaintext
value1, value2 = mb:readinputregisters(1015, 2)
```
Value read from input register address 1015 is returned into variable value1.  
Value read from input register address 1016 is returned into variable value2.
FC#05 Write Single Coil

<table>
<thead>
<tr>
<th>Name</th>
<th>Write single bit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Command</td>
<td>mb:writebits(address, value)</td>
</tr>
</tbody>
</table>
| Arguments     | [address]: address of the coil  
|               |  [value]: true or false |

FC#06 Write Single Register

<table>
<thead>
<tr>
<th>Name</th>
<th>Write single register</th>
</tr>
</thead>
<tbody>
<tr>
<td>Command</td>
<td>mb:writeresisters(addresss, value)</td>
</tr>
</tbody>
</table>
| Arguments     | [address]: address of the register  
|               |  [value]: value of the register |

FC#0F Write Multiple Coils

<table>
<thead>
<tr>
<th>Name</th>
<th>Write multiple bits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Command</td>
<td>mb:writebits(address, value1, value2, value3,...)</td>
</tr>
</tbody>
</table>
| Arguments     | [address]: start address of the coils  
|               |  [value1]: true or false , [value2]: true or false, ... (max. 1968 bits) |
| Script example| mb:writebits(1000, true, false)  
|               |  Write bit at address 1000 to true (on)  
|               |  Write bit at address 1001 to false (off) |

FC#0F Write Multiple Registers

<table>
<thead>
<tr>
<th>Name</th>
<th>Write multiple registers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Command</td>
<td>mb:writeresisters(address, value1, value2, value3, ...)</td>
</tr>
</tbody>
</table>
| Arguments     | [address]: start address of the registers  
|               |  [value1]: number, [value2]: number, ... (max. 123 registers) |

Exception codes

mb:readcoils(start, count)  
mb:readdiscreteinputs(start, count)  
mb:readregisters(start, count)  
mb:readinputregisters(start, count)

These commands read one or more registers/coils from the start address and return all values when successful. When an error occurs, three variables are sent back:
- Nil
- Exception code description
- Exception code (see Table 69).
### Table 69: Modbus function exception codes

<table>
<thead>
<tr>
<th>Code</th>
<th>Name</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Illegal Function</td>
<td>The Function Code received in the query is not an allowable action for the server (or slave). This may be because the function code is only applicable to newer devices, and was not implemented in the unit selected. It may also indicate that the server (or slave) is in the wrong state to process a request of this type, for example because it is not configured and is being asked to return register values.</td>
</tr>
<tr>
<td>02</td>
<td>Illegal Data Address</td>
<td>The data address received in the query is not an allowable address for the server (or slave). More specifically, the combination of reference number and transfer length is invalid. For a controller with 100 registers, a request of offset 96 and a length of 5 will generate exception 02.</td>
</tr>
<tr>
<td>03</td>
<td>Illegal Data Value</td>
<td>The value contained in the query data field is not an allowable value for the server (or slave). This indicates a fault in the structure of the remainder of a complex request, such as the implied length is incorrect. It specifically does NOT mean that a data item submitted for storage in a register has a value outside the expectation of the application program, since the Modbus protocol is unaware of the significance of any value of any register.</td>
</tr>
<tr>
<td>04</td>
<td>Failure in Associated Device</td>
<td>An unrecoverable error occurred while the server (or slave) was attempting to perform the requested action.</td>
</tr>
<tr>
<td>05</td>
<td>Acknowledge</td>
<td>Specialized in conjunction with programming commands. The server (or slave) has accepted the request and is processing it, but a long duration of time will be required. This response is returned to prevent a timeout error from occurring in the client (or master). The client (or master) can next issue a poll program complete message to determine if processing is completed.</td>
</tr>
<tr>
<td>06</td>
<td>Busy, Rejected Message</td>
<td>Specialized use in conjunction with programming commands. The server (or slave) is engaged in processing a long-duration program command. The client (or master) will retransmit the message later when the server (or slave) is free.</td>
</tr>
<tr>
<td>07</td>
<td>NAK – Negative Acknowledgement</td>
<td>Specialized use in conjunction with programming commands. The server (or slave) is engaged in processing a long-duration program command. The client (or master) will retransmit the message later when the server (or slave) is free.</td>
</tr>
<tr>
<td>08</td>
<td>Memory Parity Error</td>
<td>Specialized use in conjunction with function codes 20 and 21 and reference type 6, indicates the extended file area failed to pass a consistency check. The server (or slave) attempted to read a record file, but detected a parity error in the memory. The client (or master) can retry the request, but service may be required on the server (or slave) device.</td>
</tr>
<tr>
<td>0A</td>
<td>Gateway Path Unavailable</td>
<td>Specialized use in conjunction with gateways. Indicates that the gateway was unable to allocate an internal communication path from the input port to the output port for processing the request.</td>
</tr>
<tr>
<td>0B</td>
<td>Gateway Target Device Failed to respond</td>
<td>Specialized use in conjunction with gateways. Indicates that no response was obtained from the target device. Usually means that the device is not present on the network.</td>
</tr>
</tbody>
</table>

For more information, see: [http://modbus.org](http://modbus.org).
12.9.2 Modbus RTU configuration commands

Create Modbus RTU object

```lua
require('luamodbus')
mb = luamodbus.rtu()
```

Open Modbus RTU connection

```lua
-- 19200 baud rate, even parity, 8 data bits, 1 stop bit,
-- half duplex
mb:open('/dev/RS485', 19200, 'E', 8, 1, 'H')
mb:connect()
```

Terminal name

`'/dev/RS485'`

Parity

- "N" None choose between one and two stop bits
- "E" Even one stop bit is set
- "O" Odd one stop bit is set

The default parity mode of Modbus is "even" parity.

Data bits and stop bits

Data bits: [Number of data bits = 5, 6, 7, 8]
Stop bits: [Number of stop bits 1, 2]

Duplex

- "H" Half duplex
- "F" Full duplex (not supported in RS-485)

Delay Between Frames

```lua
-- Wait for 1.5 seconds
os.sleep(1.5)
```

Some devices require considerable time after the end of response until they are ready to receive the following request from the master. If the behaviour of the device is not known, select (1.5).

Set slave address

```lua
-- Set slave address to 123
mb:setslave(123)
```

Address range is [1..247].

Read registers

```lua
-- Read from address 1000 and write it to value
value = mb:readregisters(1000)
```

Close modbus connection

```lua
mb:close()
```
Example 1
-- init modbus on first script execution
if not mb then
  require('Luamodbus')
  mb = Luamodbus.rtu()
  mb:open('/dev/RS485', 38400, 'E', 8, 1, 'H')
  mb:connect()
end
mb:setslave(30)
mb:flush()

Example 2
-- Timeout interval between two consecutive bytes of the same
-- message
  mb:getbytetimeout()
  mb:setbytetimeout(timeout)

Example 3
-- Timeout interval used to wait for a response:
  mb:getresponsetimeout()
  mb:setresponsetimeout(timeout)

Example 4
-- Timeout interval used for an incoming indication from
-- master (Slave mode only)
  mb:getreceivetimeout()
  mb:setreceivetimeout(timeout)
12.9.3 Modbus master functions

mb:setslave(slaveid)
Sets slave id to read/write data from/to.

mb:readcoils(start, count)
start – address of first coil to read.

count – number of coils to read.

mb:readdiscreteinputs(start, count)
start – address of first discrete input to read.

count – number of discrete inputs to read.

mb:readregisters(start, count)
start – address of first holding register to read.

count – number of holding registers to read.

mb:readinputregisters(start, count)
start – address of input register to read.

count – number of input registers to read.

Returns all values on success and nil, error description on error.

mb:writebits(start, v1, [v2, [v3, ...]])
Writes values to coils from start address.

mb:writerregisters(start, v1, [v2, [v3, ...]])
Writes values to registers/coils from the start address.

Single write will be used when only one value is supplied, multiple write otherwise returns all of values written on success and nil, error description on error.

mb:reportslaveid()
Reads slave internal data.

Returns values on success.

Returns nil, error description on error.
12.9.4 Modbus slave functions

Receive data from master
mb:receive()

- Receives data from master with 1 minute timeout.
- Returns data as a binary string on success.
- Returns nil, error description on error.

Set Modbus mapping of slave device
mb:setmapping(coils, inputs, holding_regs, input_regs)

- Creates memory mapping for the registers with size specified for each type.

Handle slave
mb:handleslave()

- Waits for an incoming indication from master and sends a reply when necessary.

Get functions
mb:getcoils(start, count)
mb:getdiscreteinputs(start, count)
mb:getinputregisters(start, count)
mb:getregisters(start, count)

- Gets one or many register/coil/input values from mapping from the start address.
- Returns all values on success.
- Returns nil, error description on error, exception code if applicable.

Set functions
mb:setcoils(start, v1, [v2, [v3, ...]])
mb:setdiscreteinputs(start, v1, [v2, [v3, ...]])
mb:setinputregisters(start, v1, [v2, [v3, ...]])
mb:setregisters(start, v1, [v2, [v3, ...]])

- Sets values to register/coil mapping from the start address.
- Returns true on success.
- Returns nil, error description on error, exception code if applicable.

Callback functions
mb:setwritecoilcb(fn)
mb:setwriteregistercb(fn)

- Sets a callback function for coil/register write event.
- Callback will accept two parameters: coil/register address and value (boolean or number).
- For multiple writes callback is executed for each coil/register separately.
- Use nil to remove a callback.
13 BACnet

BACnet is designed to allow communication of building automation and control systems for applications such as heating, ventilation, air conditioning control, lighting control, access control, fire detection systems and their associated equipment. The BACnet protocol provides exchange information for building automation devices, regardless of the particular building service they perform.

There are two formats for BACnet: BACnet Ethernet and BACnet IP. Both formats use Ethernet media for communications. The Automation Controller only supports BACnet IP format via the RJ45 Ethernet connector.

The Automation Controller can act as a BACnet server only (not as a client). The Automation Controller serves data which can be read by BACnet client devices (like Building Management Systems). BACnet client devices can write data to the server. This allows for a wide functional integration. For example, the Automation Controller gets Modbus master measurement data from a Modbus RTU and delivers the data via BACnet to a BMS (Building Management System).

BACnet IP is a protocol that complies with the following standards:
- ASHRAE American Society of Heating, Refrigerating and Air-Conditioning Engineers
- ANSI American National Standards Institute
- ISO International Organization for Standardization

The Automation Controller has been certified by BACnet Testing Laboratories (BTL) as a BACnet Application Specific Controller (B – ASC).

The Automation Controller complies with all the necessary interoperability requirements.

13.1 List of all BACnet Interoperability Building Blocks (BIBBs) supported

Table 70: BACnet supported interoperability building blocks

<table>
<thead>
<tr>
<th>Data Sharing</th>
<th>Device and Network Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>ReadProperty-B</td>
<td>Dynamic Device Binding-B</td>
</tr>
<tr>
<td>ReadPropertyMultiple-B</td>
<td>Dynamic Object Binding-B</td>
</tr>
<tr>
<td>WriteProperty-B</td>
<td>DeviceCommunicationsControl-B</td>
</tr>
<tr>
<td>COV-B</td>
<td>TimeSynchronization-B</td>
</tr>
<tr>
<td></td>
<td>UTCTimeSynchronization-B</td>
</tr>
<tr>
<td></td>
<td>ReinitializeDevice-B</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Data Link Layer Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Media: BACnet IP</td>
</tr>
<tr>
<td>Option: Register as a Foreign Device</td>
</tr>
</tbody>
</table>
13.2 Schneider Electric Building Management System

Schneider Electric offers StruxureWare as a BACnet certified Building Management System. Building Operation WorkStation is software used to configure and commission Enterprise Server (software) and the Automation Server (hardware) which can retrieve and send data to the C-Bus Automation Controller.

The following image shows a list of BACnet data points in the StruxureWare Building Operation WorkStation software (SBO).

The configuration of the C-Bus Automation Controller is done in three steps:
1. Select objects in the objects list and activate the Export function.
2. Configure BACnet communication (BACnet Settings).
3. Check the view of BACnet objects and optionally save as a .csv file that can be used for documentation.

13.3 Object export

Use the following applications for exporting to BACnet:

<table>
<thead>
<tr>
<th>Number</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>56 (48-127)</td>
<td>Lighting</td>
</tr>
<tr>
<td>203</td>
<td>Enable</td>
</tr>
<tr>
<td>202</td>
<td>Trigger control</td>
</tr>
<tr>
<td>228</td>
<td>Measurement</td>
</tr>
<tr>
<td>250</td>
<td>User Parameter</td>
</tr>
<tr>
<td>255</td>
<td>Unit Parameter</td>
</tr>
</tbody>
</table>

Path: Configurator → Objects tab → Export column.

Select the objects which are to be made available for BACnet in the Export column.
Most C-Bus applications deliver, or are controlled by (AV) analogue numeric values 0-255 as well as status indication. These can be used as on/off/dim commands or scene triggers to C-Bus units, depending upon the C-Bus application being used.

The application 250 - User Parameter with the Boolean data type will appear as binary values (BV) with a range of 0-1. On C-Bus, this translates to 0=Off and 1=On.

### 13.4 BACnet configuration

The Automation Controller can be configured as a BACnet server in the BACnet Settings of the Automation Controller. The BACnet Building Management System on the client site will then discover the selected data.

#### 13.4.1 BACnet settings

Configure the Automation Controller as a BACnet server in the BACnet Settings.

Path: Configurator → Utilities button → System button → Network tab → BACnet Settings.

<table>
<thead>
<tr>
<th><strong>Server enabled</strong></th>
<th>Enable/disable Automation Controller as a BACnet server.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Device ID</strong></td>
<td>BACnet device ID which must be unique on the BACnet network.</td>
</tr>
<tr>
<td><strong>Password</strong></td>
<td>BACnet password.</td>
</tr>
<tr>
<td><strong>Objects priority</strong></td>
<td>Define the priority array to which the Automation Controller writes. The default value of the object property is 16.</td>
</tr>
<tr>
<td></td>
<td>The Automation Controller writes to the Relinquish Default (RD) property by first reading (Upload from BMS) and takes the current value of the object.</td>
</tr>
<tr>
<td></td>
<td>It is not possible to change the value of the Relinquish Default property afterwards. If the object read from the Automation Controller has a higher value than the RD property, it raises the Overwritten flag.</td>
</tr>
<tr>
<td><strong>Add group address to object name</strong></td>
<td>Names of BACnet objects contain information about group address (see BACnet objects on page 197).</td>
</tr>
<tr>
<td><strong>Use comment as object description</strong></td>
<td>Comments in objects are visible in the SBO (StruxureWare Building Operation WorkStation software) as a description.</td>
</tr>
<tr>
<td><strong>Port</strong></td>
<td>BACnet port, default 47808.</td>
</tr>
<tr>
<td><em><em>BBMD</em> IP</em>*</td>
<td>Router IP.</td>
</tr>
<tr>
<td><em><em>BBMD</em> port</em>*</td>
<td>Router port.</td>
</tr>
<tr>
<td><em><em>BBMD</em> lease time (seconds)</em>*</td>
<td>Registration resend interval.</td>
</tr>
</tbody>
</table>
13.4.2  BACnet objects

Open a list of BACnet objects with the selected parameters.

Path: Configurator → Utilities button → System button → Network tab → BACnet objects.

In the Type column of the above screen shot, there are five analogue (AV) and one binary value (BV).

BACnet objects can optionally be downloaded to a .csv file via the Download CSV button. This list can be used for documentation.

13.4.3  BACnet COV setting

The first 256 objects exported to BACnet can use the change of value (COV) subscription on the client side. This parameter defines the minimum change of value (delta) which implies a change of the value on the client side.

The default value is 1.

Path: Configurator → Utilities button → System button → Network tab → BACnet COV settings.
14 Advanced network functions

Advanced network functions allow views of network settings, routes, utilities, access settings and remote diagnostics

14.1 Network Settings

Path: Configurator → Utilities button → System button → Network tab.

14.1.1 Interfaces

Click Interfaces in the Network tab and then click eth0 to configure the IP address (see Change IP settings of the Ethernet interface on page 27). Click the Show network usage button to check the network traffic.

14.1.2 Routes

The routing table shows the network routes associated with the Automation Controller.

Click Routes in the Network tab.

<table>
<thead>
<tr>
<th>Interface</th>
<th>Destination</th>
<th>Gateway</th>
<th>Network mask</th>
<th>Flags</th>
</tr>
</thead>
<tbody>
<tr>
<td>eth0</td>
<td>0.0.0.0</td>
<td>192.168.5.5</td>
<td>0.0.0.0</td>
<td>UG</td>
</tr>
<tr>
<td>eth0</td>
<td>192.168.5.0</td>
<td>0.0.0.0</td>
<td>255.255.255.0</td>
<td>U</td>
</tr>
<tr>
<td>usb0</td>
<td>192.168.254.0</td>
<td>0.0.0.0</td>
<td>255.255.255.0</td>
<td>U</td>
</tr>
</tbody>
</table>

eth0 network adapter
196.168.5.5 is the address of the gateway (router), i.e. access to Internet.
192.168.5.0 is the address of the local network (default is 192.168.0.0).

usb0 network adapter
192.168.254.0 is the address of the USB-B network connection. The IP address of the Automation Controller on this network is 192.168.254.10.
14.2 Network utilities

Use network utilities to check the connection to other network devices via *Ping* and *Trace route*. For example, check the connection between the Automation Controller and a Modbus IP gateway or a IP camera, locally or via the public address.

Path: *Configurator* → *Utility* tab → *System* button → *Status* tab → *Network utilities*.

Depending on your network settings, the response to a ping command may be blocked.

**Example of pinging a network time protocol server (NTP)**

Traceroute displays the path and delay times to a destination on the Internet.

14.3 Access via HTTP, HTTPS or VPN

Port forwarding is used to get remote access to an IP device in a local network. Settings must be made in the network router. See the manual for the particular router for instructions on how to set and use port forwarding.

If there is no static address on the public side of your router, a dynamic DNS service is needed to reach the your router. DNS service providers can supply information about configuring a dynamic DNS service.

14.3.1 HTTP or HTTPS

**NOTICE**

HTTP IS NOT A SECURE MEANS OF COMMUNICATION

- Information transmitted via HTTP is not encrypted and therefore insecure.
- Only use HTTPS for port forwarding and remote access.

Failure to follow these instructions may result in network security breaches.
14.3.2 VPN

Many network solution providers offer a way to set up a virtual private network (VPN) connection to get direct secure access via Internet to a local network. Usually a VPN solution requires VPN server and VPN client software.

Depending on the security standards used, VPN access can provide a high level of security.

14.3.3 HTTP Server

On the System page, set an additional HTTP and HTTPS port. By default, HTTP port 80 and HTTP port 443 are already set.

Path: Configurator → Utilities button → Services button → Http Server.

14.4 Remote services

Use remote services (XML/JSON) to remotely activate functions or control objects.

Path: Configurator → Utilities button → System button → Services tab → Remote services.

14.4.1 Parameters

Service stats
Enable/disable the function.

Username
The username is remote.

Password
The default password is remote.

Allow only exported objects
Only control objects with the activated export function can be checked. This function is set in the Objects tab (see Additional parameters for all applications on page 103).

14.4.2 Examples

Show alerts

Alerts are displayed in the Alerts tab and can be shown in XML format in the browser.

Example of browser command:
http://remote:remote@192.168.0.10/scada-remote/?m=rss&r=alerts
Example of browser response:

```
...<item>
  <title>System start</title>
  <pubDate>Mon, 06 Feb 2017 09:22:35 +1030</pubDate>
...```

14.4.3 Set value

In this example, the value of an object (light) with the composed address 0/56/1 is set to 255.

Example of browser command:

http://remote:remote@192.168.0.10/scada-remote/?m=json&r=grp&fn=write&alias=0/56/1&value=255

Example of browser response:

true

The new value of 0/56/1 is 255 and the light is switched on remotely.

14.5 FTP server

The Automation Controller includes an FTP server. By default, the FTP server is disabled.

Path: Configurator → Utilities button → System button → Services tab → FTP server.

**NOTICE**

**USE OF THE FTP SERVER CAN AFFECT AUTOMATION CONTROLLER OPERATING FILES.**

The FTP server can expose files that are necessary for the Automation Controller to work properly.

- Exercise care when working with files via the FTP server.
- Do not move or delete any files that are necessary for Automation Controller operation.

Failure to follow these instructions may result in the Automation Controller becoming inoperative.

14.5.1 Parameters

**Server status**

Enable/disable the function.

**Port**

The default port is 22.

**Username**

The username is `ftp`. 
Passive mode min port
Minimum port for passive mode.

Passive mode max port
Maximum port for passive mode.

14.6 Remote diagnostic
Remote diagnostic allows access to the controller via SSH (Secure Shell), a network protocol for secure services. By default, remote diagnostic is disabled.

Path: Configurator → Utilities button → System button → Services tab → Remote diagnostic.

NOTICE
USE OF THE REMOTE DIAGNOSTIC FUNCTION CAN AFFECT AUTOMATION CONTROLLER OPERATING FILES
Remote diagnostic can expose files that are necessary for the Automation Controller to work properly.

- Only use the Remote diagnostic function when recommended by Schneider technical support.
- Exercise care when using the Remote diagnostic function.
- Do not move or delete any files that are necessary for Automation Controller operation.

Failure to follow these instructions may result in the Automation Controller becoming inoperative.

By default, remote diagnostic is disabled. When enabled, Port 22 must be forwarded on the router.
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