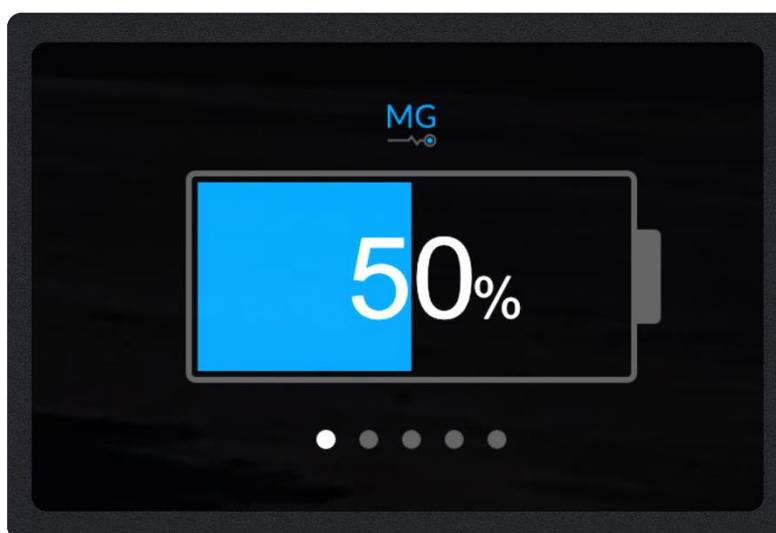


MG Energy Monitor Display

- Manual EN -

MG Energy Systems B.V.





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1 GENERAL

1.1 Document history

Table 1 - Document history

Revision	Date	Changes	Revision author
0.1	26-03-2020	Initial document.	Diederik Glashouwer
1.0	15-05-2020	Minor changes.	Mark Scholten
1.1	10-09-2021	Changed scope of delivery. Minor changes.	Diederik Glashouwer
1.2	20-01-2023	Added support for SmartLink MX. Updated images. General improvements	Diederik Glashouwer

1.2 Terms, definitions, and abbreviations

Table 2 - List of terms, definitions, and abbreviations

Name	Description
Battery module	An assembly of battery cells including BMS.
Battery pack	Consists of one or more battery modules in combination with a battery management controller (BMS).
Battery system	Consists of one or multiple battery packs connected to a common DC-bus.
Battery management controller	Controls, manages and protects one or multiple battery modules.
BMS	Battery Management System that is integrated in the battery pack.
Master BMS	Shorthand for a <i>battery management controller</i> in a MG energy systems battery system.
Slave BMS	The part of the BMS that is integrated in the battery module.
Redundancy BMS	The redundancy BMS that is integrated in the battery module.
DC-bus	The main DC-bus of the application where all user equipment is connected too, like generators, propulsion systems and other chargers and loads.
CAN-bus	<i>Controller Area Network bus</i> ; CAN-bus is a standard serial data bus that provides data communication between two or more devices.
NMEA 2000	National Marine Electronics Association’s NMEA 2000 is a plug-and play communications standard used for connecting marine sensors and display units within ships and boats, standardized in the IEC 61162-1.
SOC	State-of-Charge – reflects the level of charge of a battery pack or battery module relative to its capacity. The units of SOC are percentage points where 0% indicates discharged and 100% indicates charged.

2 SAFETY INSTRUCTIONS

Before continuing, read the manual in this chapter carefully and be sure the information, instructions and procedures are fully understood. If there are questions after reading then please consult MG Energy Systems or your dealer.

2.1 Safety message level definition

Table 3 - Safety message levels overview



WARNING:

A hazardous situation which, if not avoided, could result in death or serious injury.



ELECTRICAL HAZARD:

The possibility of electrical risks if instructions are not followed in a proper manner.



NOTICE:

- A potential situation which, if not avoided, could result in an undesirable result or state.
- A practice not related to personal injury.

2.2 User health and safety

2.2.1 General precautions

This product is designed and tested in accordance with international standards. The equipment should be used according the intended use only.



ELECTRICAL HAZARD:

The product is used in combination with a permanent energy source (battery). Even if the equipment is switched off.

- Wear applicable personal protective equipment when working on a battery system.
- Use insulated tools when working on a battery system.
- Make sure the local regulations for working on battery systems are followed.

2.2.2 Qualifications and training

The personnel responsible for the assembly, operation, inspection, and maintenance of the battery system must be appropriately qualified. The user company must do the following tasks:

- Define the responsibilities and competency of all personnel working on the battery system.
- Provide instruction and training.
- Ensure that the contents of the operating and safety instructions have been fully understood by the personnel.
- Check the local safety rules and guidelines they have higher priority over the manufacturer's specification in this manual in case of regulatory conflicts.

Instruction and training can be carried out by MG Energy Systems B.V. by order of the user company.

2.2.3 Non-compliance risks

Failure to comply with all safety precautions can result in the following conditions:

- Death or serious injury due to electrical, mechanical, and chemical influences.
- Environmental damage due to emission of hazardous substances.
- Product damage.
- Property damage.
- Loss of all claims for damages.

2.2.4 Unacceptable modes of operation

The operational reliability of this product is only guaranteed when it is used as intended. The operating limits on the identification tag and in the datasheet may not be exceeded under any circumstances. If the identification tag is missing or worn, contact MG Energy Systems B.V. for specific instructions.

3 TRANSPORT, STORAGE, AND UNPACKING

3.1 Transport

The Package and transport instructions provided by the manufacturer must be followed in all circumstances.

Notes on transport:

- Transport in original packaging.



NOTICE:

No liability can be accepted for damage during transport if the equipment is not transported in its original packaging or if the original packaging is opened before the destination is reached.

3.2 Storage

The storage instructions provided by the manufacturer must be followed in all circumstances.

Notes on storage:

- Store in a dry and clean location.

3.3 Unpacking

Follow these handling guidelines when handling the product to prevent damage during unpacking:

- Use care when handling the product.
- Leave protective caps and covers on the product until installation.

3.3.1 Scope of delivery

The scope of delivery is as following:

- MG Energy Monitor MGEMD010001
 - For additional equipment see chapter “12 ORDERING INFORMATION”

4 GENERAL DESCRIPTION

The MG Energy Monitor is an easy to use touchscreen display that shows the status of your MG Lithium-Ion battery system. The small size and high IP rating makes the MG Energy Monitor suitable for a wide range of applications. Scrolling through the status pages and changing settings is easily done by touch.

The Wi-Fi capabilities of the Energy Monitor allow it to communicate with the MG Energy Portal, an online portal that gives the user the possibility to remotely monitor their battery system. Data from multiple Energy Monitors can be combined on a single dashboard for an easy overview of more complex systems.

See the following link for more information: <https://energyportal.app/>

4.1 Battery system components

MG's Lithium-Ion battery system consists of the following components:

- One MG Master HV, LV or LV 12V battery management system.
- One or more Lithium-Ion battery modules, e.g. RS series, LFP series or HE series.
- (Optional) A MG Energy Monitor.

Multiple of these systems can be combined using a MG SmartLink MX, creating a combined system. If an Energy Monitor is used in combination with a SmartLink MX information about the combined system is available on the Energy Monitor.

Consult your local dealer or MG Energy Systems B.V. for a more in depth explanation of compatibility between device types.

4.2 Functional description

The main purpose of the Energy Monitor is to show battery system information and parameters. Additionally it can be used as a gateway to send all the live information to MG's Energy Portal to monitor the battery system remotely.

MG's system philosophy is to have one master BMS, e.g. a MG Master LV or MG Master HV, per string of battery modules which communicates with one or more slave BMSs integrated in the Lithium-Ion battery module(s). The slave BMSs are monitoring the battery cell parameters, for example: cell voltage, cell temperature.

The available parameters are sent to the MG Master via a dedicated CAN-bus which collects all the data and monitors them. When an MG Energy Monitor is connected to the system it will receive parameters from both the master and all the batteries in the system. This information is visible to the user of the Energy Monitor via a series of pages, some of which can be altered to precisely match the users specific use case.

Multiple of these battery systems can be combined using a MG SmartLink MX. The MX collects and combines all information in the battery system, this data is then made available as a new device. An Energy Monitor connected to a SmartLink MX will display information about the combined system as well as of the individual BMS's.

5 DEVICE MODELS

5.1 Models

There is one model of the MG Energy Monitor: **MGEMD010001**

5.2 Identification label

The identification label of the MG Energy Monitor is located at the bottom side of the device, as shown in figure 1.

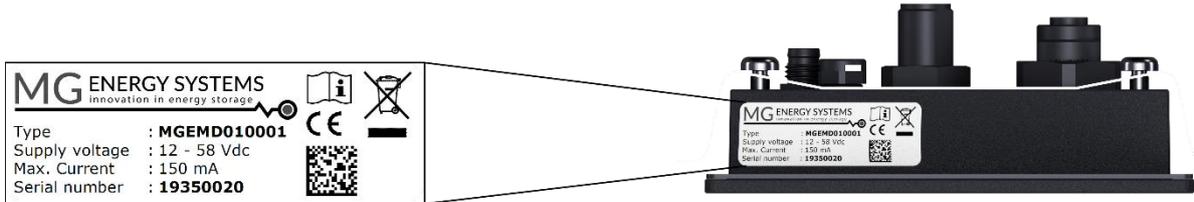


Figure 1 - Example identification label

The identifications label shown in figure 1 contains written information about the product. The explanation of the symbols used on the identification label is stated in Table 4.

Table 4 - Identification lable logo explanation

	Declaration of conformity with health, safety, and environmental protection standards for products sold within the European Economic Area as per directive 2014/35/EU.
	Symbol indication the manual must be red before installation and use of the device.
	Device is treated according the Waste Electrical and Electronic Equipment (WEEE) Directive 2012/19/EU.
	GS1 data matrix type barcode containing detailed product information.

6 CONNECTIONS

This chapter shows an overview of the connections and parts of the MG Energy Monitor.

6.1 General overview



Figure 2 – Front and rear view



Figure 3 - Bottom view

6.2 Detailed connection overview

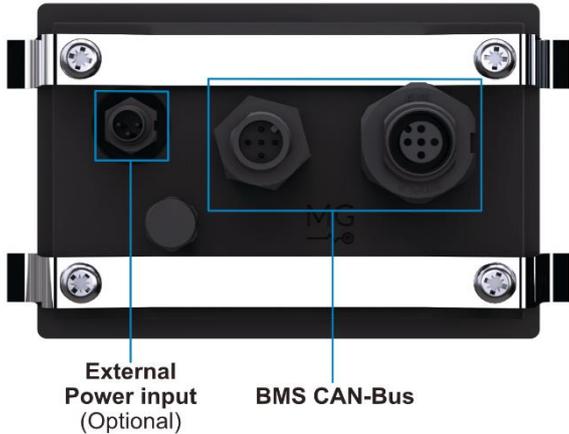


Figure 4 - Energy Monitor rear view

Please see section “8.2 Electrical connection procedure” for usage.

6.2.1 CAN-bus connectors details

The MG Energy Monitor communicates with and is powered by the connected system via CAN-bus. This is a dedicated CAN-bus where only MG devices may be connected.

The CAN-bus connectors of the Energy Monitor are circular M12 connectors with 5 positions and A-coded keying.

Table 5 - Circular M12 connector with 5 positions A-coded details

Pin	Description	Connector view
1	Shield	<div style="display: flex; justify-content: space-around; margin-top: 10px;"> Male Female </div>
2	V+	
3	GND	
4	CAN-H	
5	CAN-L	

Cables to be used are typically referred to as NMEA 2000 or DeviceNet compatible cables. The minimum requirements for cables are:

- Twisted pair connected to pins 4 and 5 for communication with a minimum wire cross sectional area of 0.2 mm² (24 AWG).
- Pair of conductors connected to pin 2 and 3 for power and HVIL with a minimum wire cross sectional area of 0.34 mm² (22 AWG).



NOTICE:

Do not use sensor / actuator cables. They often don't have twisted pairs and are therefore not suitable for this application.

6.2.2 External power connector

The external power connector is used to provide additional power to the Energy Monitor.

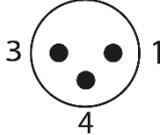
Please see chapter “12.1 Accessories” for ordering information



NOTICE:

- The external power input and CAN-bus grounds are not electrically isolated.

Table 6 - MGEMD010001 power connectors

Pin	Name	Description	Specifications	Wire color (If using MG sourced cable [MG5000663])	Connector view (Male)
1	VCC	Power supply input	12 ... 58 V	Brown	
2	-	Not fitted		-	
3	GND	Power supply return connection		Blue	
4	N/C	No connection		Black	

7 OPERATION

This chapter describes the operation of the Energy Monitor and its capabilities.

7.1 User interface

The Energy Monitor has user interface that allows the user to view a number of parameters about the system and make changes to the settings of the connected devices. The interface can be navigated using the capacitive touchscreen.

The user interface is split in to multiple sections called pages, each page has its own target functionality. There are “main” pages focused on a group of functions, beneath these there are a number of pages that go in to more detail on specific functionality.

Generally, there are a number of default colors used to indicate certain states or properties of a value or button, namely:

- White: variable or active item
- Grey: description or inactive item
- Blue: highlight, description or active button
- Orange: warning
- Red: error / alarm

To get a detailed description of all possible interactions please refer to the User Guide.

<https://downloads.mgennergysystems.eu/energymonitor/documents/user-guide-en>

A number of common interactions are demonstrated in video clips available on the MG download center.

<https://downloads.mgennergysystems.eu/energymonitor/videos>

7.1.1 Status icons

A number of status icons can appear in the top right of each of the main pages. These gives the user a quick indication about the status of the Energy Monitor.

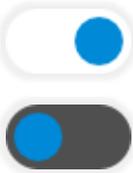
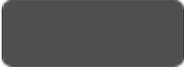
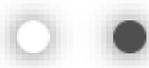
Table 7 - Status icons

Icon	Function
	Wi-Fi connected
	Establishing Wi-Fi connection
	Wi-Fi connection failed
	Portal connected
	Establishing connection to portal
	Portal connection failed
	Full synchronization used
	Connected device not fully supported or not fully up-to-date
	Connected device not supported or not up-to-date or CAN bus violated
	System settings not as saved
	Main contactor closed, system is connected to the DC-bus
	Device is part of a combined system and is actively participating
	System has been set up to participate in a combined system but is waiting for a start command
	System is part of a combined system but is currently monitoring the DC-bus, ready to join as soon as it is safe to do so.
	System is not setup to join a combined system
	Demonstration mode is enabled

7.1.2 Common interface elements

Using the touchscreen, the user can swipe left and right to switch between the different main pages described in section “7.1.4 Main pages”. Swiping up or down will scroll through lists. In “Table 8 - Common buttons” a number of common buttons are shown, these are used across the user interface of the Energy Monitor and are used for most of the user interactions.

Table 8 - Common buttons

Icon	Function
	Go back to previous page
	Scroll up or down on a list. Greyed out icons indicate the end of a list.
	Toggle button. Enables or disables a particular setting or function.
	Increment or decrement the value. When not available the icon will turn grey.
	Touch to show keyboard.
	Show or hide variable, used for fields like passwords.
	Menu button
	General purpose button, will have text indicating its function.
	Clicking this button will show a page where more information will be available.
	Icons indicating which one of the main pages the user is looking at.
	Show QR code containing a link, used to refer the user to online resources like the latest version of this manual

7.1.3 Page map

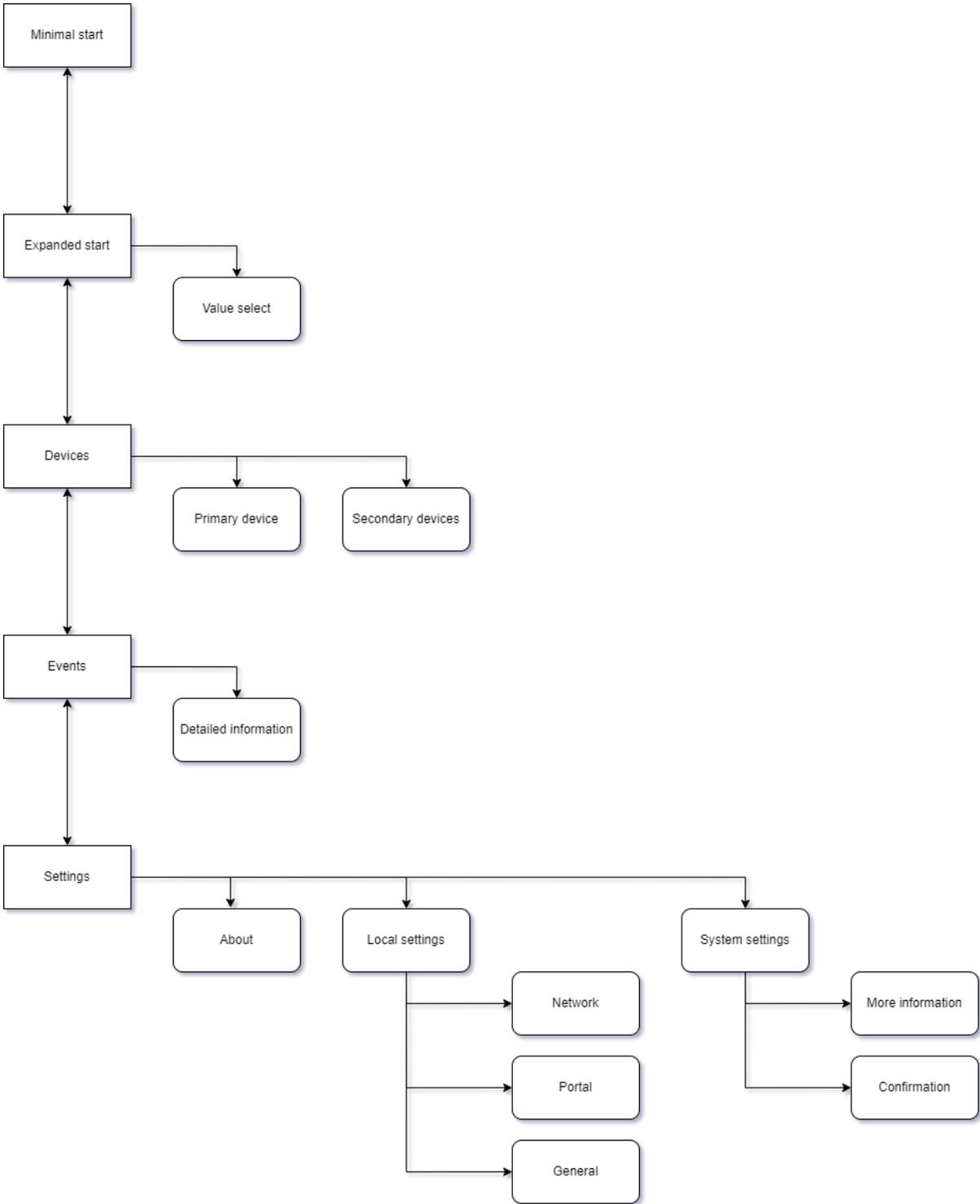


Figure 5 - User interface page map

7.1.4 Main pages

The Energy Monitor has a number of main pages the user can switch between, each page has a different function suited for a specific purpose.

On both of the start screens (see 7.1.4.2 and 7.1.4.3) an orange warning or red error icon can be shown, touching this icon will take the user to the relevant page.

7.1.4.1 Main page indication

There are five main pages. These pages are indicated at the bottom of the screen with five dots. The white dot is the current page. Swiping to the left or right will change the active page.



Figure 6 - Main page indication

7.1.4.2 Minimal start

This page shows a graphical representation of the state of charge of the system, as indicated by the amount of the battery icon that is filled in. In front of this icon is the current state of charge as a percentage.

The minimal start page is one of the two options for the default start up screen of the Energy Monitor. By default, the monitor will use minimal start as the start screen.

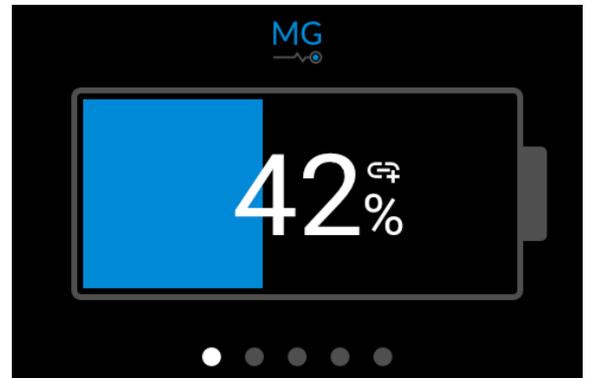


Figure 7 - Minimal start page

7.1.4.3 Expanded start

Expanded start shows 4 customizable parameters in an easy to read way. To change one of the parameters, all the user has to do is touch and hold down any of the 4 values for a short while. This will show a list from where the new parameter can be selected. Possible options include: state of charge, time to go, system voltage, system current and highest cell voltage in the system.

The expanded start page is the second of the two options for the default start up screen of the Energy Monitor.

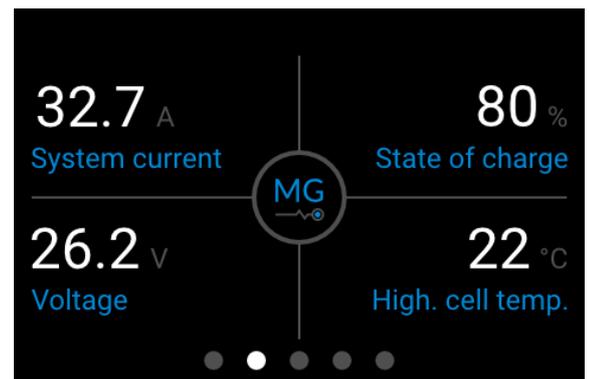


Figure 8 - Extended start page

7.1.4.4 Devices

The Devices page shows an overview of all the devices in the connected system. By using the arrow buttons or swiping up or down it is possible to scroll through the devices. Clicking on any of the buttons will show specific information about the selected device.

There are multiple subpages for each device type depending on the available information. For example: Master and SmartLink MX devices have pages where they display the highest and lowest cell variables in the system, battery pages list all individual cell voltages and BMS pages show their current combined status. Page selection for a given device is done either via the menu or by swiping horizontally.

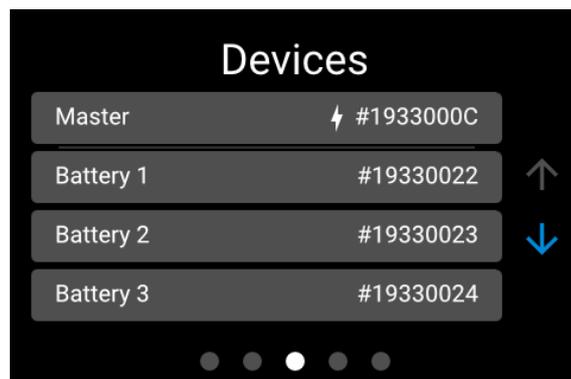


Figure 9 - Devices page

7.1.4.5 Events

The Events page shows a list of all the events that were reported by the connected device (MG Master BMS variant or MG SmartLink MX). It is possible to scroll through the list by either using the buttons to the side or swiping up and down. Clicking on an event will show more info about that particular event, like what device or sensor triggered it as well as the time it occurred.

By default the page will only display alarms or warnings. Information events can be listed as well, this is done by changing the local device settings.

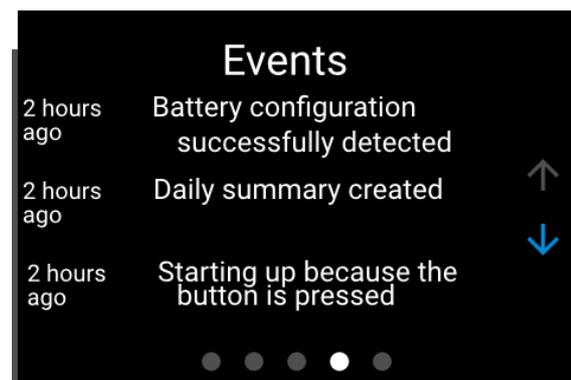


Figure 10 - Events page

7.1.4.6 Settings

The Settings page offers the user the option to jump to 3 specific pages: About, Device settings and System settings.

About page

The About page shows information about the MG Energy Monitor being used. The information that can be seen includes the device type, serial number, the status messages and the version numbers of the device. It also allows the user to name the device to allow for easy identification if multiple monitors and systems are used side by side. It also shows a tab where the user can reboot the monitor or change the permissions level. Changing this level will lock some settings behind a password to prevent unintended changes to the device and system configuration.

Device settings page

The Device settings page allows the user to change a range of parameters of the Energy Monitor, including the brightness or what wireless network it should connect to. Please refer to the User Guide for more in-depth information about all the possible settings.

System settings page

The System settings will show the user a list of settings of the connected MG Master or SmartLink MX device. Where available a more information button is shown on the individual settings pages, clicking this will bring up a page where the user can learn more about the setting in question. Please refer to the manual of the MG product being used before making any changes to any of the available settings. A full rundown of all the available settings and their effects can be found there as well.

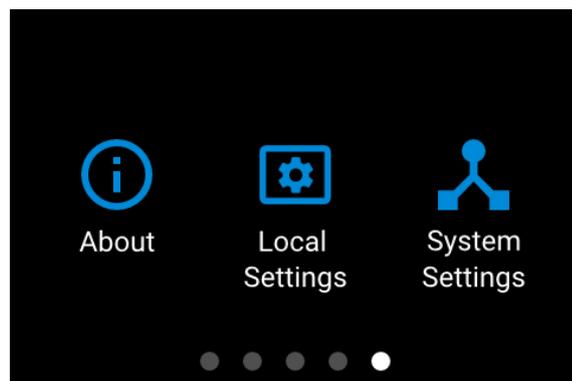


Figure 11 - Settings page

7.1.4.7 Pop-ups

A pop-up will appear if an issue is encountered by either the Energy Monitor or the connected MG device. This pop-up will show the user what kind of issue occurred and it will give a description of what caused the issue or what can be done to solve it. If an issue is resolved by itself the pop-up will automatically clear. If the issue is still active when the user has clicked the dismiss button an icon on the start screens will indicate that an issue is ongoing.

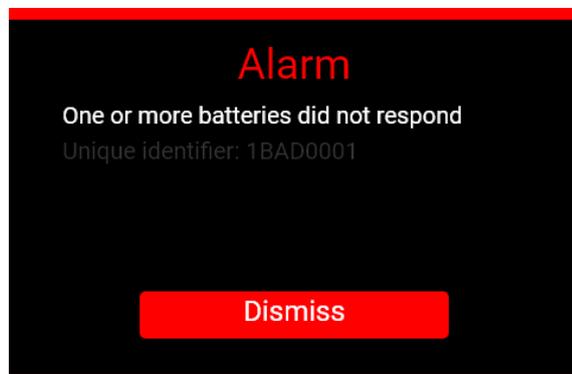


Figure 12 - Pop-up page

8 INSTALLATION

Read the installation instructions in this chapter before commencing installation activities.

WARNING:



Before continuing make sure the following instructions are met:

- Before switching the system ON check whether the available voltage source conforms to the configuration settings of the product as described in the manual.
- Ensure that the equipment is used under the correct operating conditions.

8.1 Mounting procedure

This procedure describes how to mount the Energy Monitor.

Mounting is done in the following steps:

- 1 Make a cut-out in the panel were the Energy Monitor is to be mounted. Included in the packaging of the Energy Monitor is an insert with a template.
The size of the cut-out should be 94.5 mm wide and 61.5 mm high.
See MG Energy Systems website for a printable panel mount cut-out.
<https://downloads.mgenergysystems.eu/energymonitor/drawings/panel-cutout>
- 2 Remove the mounting screws and mounting strips from the back of the device.
- 3 Place the device in the cut-out.
- 4 Place the mounting strips back on the rear of the device and tighten each set of screws till the mounting strips are just flexing slightly. Do not over tighten.

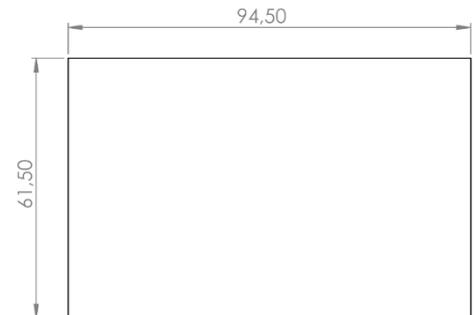


Figure 13 - Panel cut-out dimensions

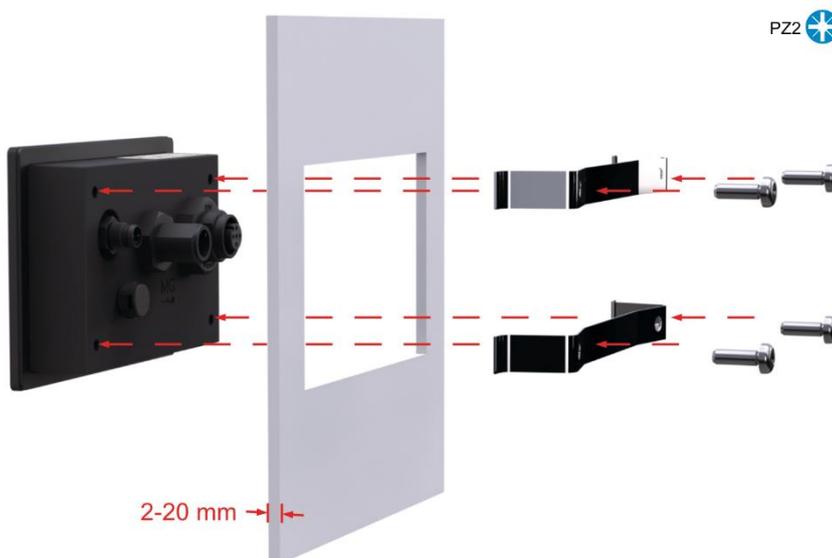


Figure 14 - Mounting procedure

8.2 Electrical connection procedure

The MG Energy monitor has options for electrical connections, one set for communication and another for external power. Refer to chapter 6 CONNECTIONS for information about the available connections.

8.2.1 CAN-bus connection procedure

The display needs to be connected to the BMS CAN-bus of the battery system, please refer to the section describing the MG device the Display will be connected to.

See section “12.3 M12 CAN-Bus cables and accessories” for information about available connection cables.

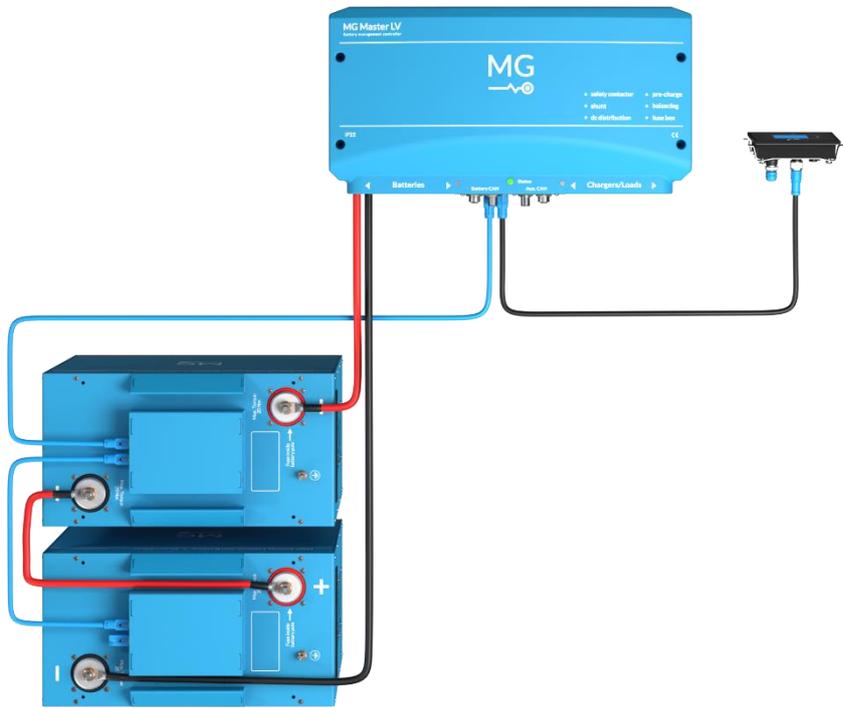


Figure 15 - Example system

8.2.1.1 SmartLink MX

An Energy Monitor should be connected to the “CAN-B” ports of a SmartLink MX. Please note that there is no power provided on these ports by the MX device itself, the display will need to be powered externally.



Figure 16 - MG SmartLink MX

8.2.1.2 Master LV

An Energy Monitor should be connected to the Master used as seen in “Figure 17 - MG Master LV – RJ45” and “Figure 18 - MG Master LV –M12”. There should always be two termination resistors on a CAN-bus system, with the Energy Monitor at the end of a chain a termination resistor should be connected at to the available M12 connector.



Figure 17 - MG Master LV –RJ45



Figure 18 - MG Master LV –M12

8.2.1.3 Master HV

An Energy Monitor should be connected to the Master HV used as seen in “Figure 19 - MG Master HV”. The Energy Monitor should be connected directly to the diagnostic port of the Master HV. The termination of the diagnostics CAN-bus port is handled internally by the Master HV, there should not be a termination resistor installed on the Energy Monitor.



Figure 19 - MG Master HV

WARNING:



Termination is handled internally for the Master HV. No additional termination should be installed on the Energy Monitor.

WARNING:



If the CAN-bus cable connected to the Master HV CAN-bus diagnostics port is longer than 5 meters, a CAN-bus isolator is required.

8.2.2 External power supply connection

For pinout of connector please see section 6.2.2 External power connector.

The external power connector is used to provide additional power to the Energy Monitor. In systems with a MG Master device this is typically optional and would only be required in the following situations:

- Multiple Energy Monitors are used in one system.
- Long CAN-bus cable lengths are used.
- Larger battery system i.e. more than 8 batteries in a system.

In situations where the Energy Monitor is connected to a SmartLink MX is likely to be required as the MX does not supply power on the private CAN-bus.

Power is not passed on through to the CAN-bus of the Energy Monitor, if multiple Energy Monitors are used in a system all monitors should be provided with external power.



WARNING:

Make sure the voltage applied to the external power connector is in the range listed in section 10 TECHNICAL SPECIFICATIONS



NOTICE:

The external power input and CAN-bus grounds are not electrically isolated. Ground loops should be avoided.

9 SERVICE

9.1 Maintenance

The device does not require maintenance. There are no user serviceable parts inside.

If an issue is encountered check if all connections are still correctly mated (see section 6.2). If this does not solve the issue please try updating the Energy Monitor (see section 9.2) as well as the connected MG device (see device specific manual)

9.1.1 Cleaning

Cleaning of the device is best done using a dry or moist cloth. Limit the use of cleaning agents. If a cleaning agent is to be used, use of an electrically non-conductive cleaning agent is advised. When cleaning the touchscreen be aware that this might cause some unwanted interactions with the display. The working of the touchscreen will be impaired if the screen is wet, please dry before usage.

9.2 Updating

The firmware of the MG Energy Monitor can be updated using the MG Diagnostic Tool. Contact your supplier for more information.

<https://downloads.mgenersystems.eu/diagnostic-tool/applications>

A compatible USB to CAN interface can be purchased from MG, see: 12 ORDERING INFORMATION



WARNING:

Updating the Energy Monitor will take some time. Do not disconnect the device from the system or turn the system off while the update is in progress.



NOTICE:

The instructions in this section assumes the MG Diagnostics Tool software is already installed and configured on a computer. If in this section a reference is made to “computer”, the computer running the MG Diagnostics Tool software is meant with it.

Updating procedure

1. Make sure the system is powered on and remains on during the update. If stable power cannot be guaranteed, please connect external power to the monitor.
2. Connect a compatible USB to CAN transceiver to the same CAN-Bus as the monitor.
3. Connect the USB-connector of the USB to CAN transceiver to the computer.
4. Start the MG Diagnostic Tool software on the computer.
5. Select the USB-CAN interface of your choice.
6. Click the button for the preferred Energy Monitor. If an update is available a notification will be shown.
7. Click on the “Update to” button.
8. The MG Diagnostic Tool will ask for confirmation to update to the new firmware version. Press the “Update” button to start the update process.
9. The Energy Monitor will shut-down and perform the firmware update.
10. When the update is completed, the monitor will start-up automatically.

10 TECHNICAL SPECIFICATIONS

<https://downloads.mgennergysystems.eu/energymonitor/documents/technical-specification-en>

11 DIMENSIONS

<https://downloads.mgennergysystems.eu/energymonitor/drawings/total-assembly>

12 ORDERING INFORMATION

This chapter describes the MG order numbers for spare-, service-, and replacement-parts for the MG Energy Monitor.

12.1 Accessories

Article number	Name
MG5000663	External power supply cable for MG Energy Monitor

12.2 CAN-Bus interfaces

Article number	Name
MGUSBCAN001	MG USB CAN Interface
MG5000568	Kvaser Leaf Light 2 M12

12.3 M12 CAN-Bus cables and accessories

Article number	Name
MGM12001035	M12 CAN T-Splitter 3-way
MGM12001036	M12 CAN T-Splitter 4-way
MGM12001037	M12 CAN T-Splitter 6-way
MGM12001032	M12 CANOpen Female 0 deg to RJ45 2.5m
MGM12001033	M12 CANOpen Female 90 deg to RJ45 2.5m
MGM12001031	M12 CANOpen Male 0 deg to RJ45 2.5m
MGM12001034	M12 CANOpen Male 90 deg rot -90 deg to RJ45 1m
MGM12000020	M12 CANOpen Terminator Female
MGM12000010	M12 CANOpen Terminator Male
MGM12005002	M12 CANOpen cable 0 to 0 deg 0.5m
MGM12100002	M12 CANOpen cable 0 to 0 deg 10m
MGM12150002	M12 CANOpen cable 0 to 0 deg 15m
MGM12010002	M12 CANOpen cable 0 to 0 deg 1m
MGM12020002	M12 CANOpen cable 0 to 0 deg 2m
MGM12030002	M12 CANOpen cable 0 to 0 deg 3m
MGM12050002	M12 CANOpen cable 0 to 0 deg 5m
MGM12020003	M12 CANOpen cable 0 to 90 deg 2m
MGM12020004	M12 CANOpen cable 90 to 0 deg 2m
MGM12006001	M12 CANOpen cable 90 to 90 deg 0.6m
MGM12010001	M12 CANOpen cable 90 to 90 deg 1m
MGM12020001	M12 CANOpen cable 90 to 90 deg 2m
MGM12030001	M12 CANOpen cable 90 to 90 deg 3m
MGM12050001	M12 CANOpen cable 90 to 90 deg 5m

13 CONTACT DETAILS

For specific questions please feel free to contact us.



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The Netherlands

For support contact your local dealer:

<https://www.points.mgenergysystems.eu/>