

MG SmartLink MX

- Manual EN-

MG Energy Systems B.V.





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1 GENERAL

Before continuing, read the instructions in this chapter carefully and be sure the instructions are fully understood. If there are questions after reading the instructions, please consult MG Energy Systems.

1.1 Document history

Revision	Date	Changes	Revision author
1.5	7-2-2024	<ul style="list-style-type: none"> - Added default settings. See chapter 10.13 - Updated setting names to match Diagnostic Tool - Fixed Figure 15 by adding correct terminators 	N.D. Yntema
1.4	13-11-2023	<ul style="list-style-type: none"> - Added extra mounting information including images(Figure 10Figure 11Figure 12) - Updated system setup example: chapter 11 - Added Table 8 - Start button functions - Added extra information to Table 6 - IO connector pinout - Redirected the links of 'AN1006' to our support site: https://docs.mgenergysystems.eu/ - Added additional charger types: Skylla and Delta-Q. See chapter 10.8 - Added extra CCU setting information 	N.D. Yntema
1.3	10-7-2023	<ul style="list-style-type: none"> - Changed MG SmartLink MX Tool links and text to MG Diagnostic Tool - Updated all chapters to match the new setting: 'Combine battery mode' - Updated setting names to match Diagnostic Tool - Added E-stop to status indication: Table 7 - Added chapter 8.6 Connect Energy Monitor - Added extra information how to wakeup BMSs: chapter 9.1 - Added chapter 10 SETTINGS for more information about the SmartLink MX settings 	N.D. Yntema
1.2	11-1-2023	<ul style="list-style-type: none"> - Updated status indication - Added power supply details. See 8.4 - Updated General purpose I/O name - Added extra settings changes for BMS - Updated Contact Details 	N.D. Yntema
1.1	30-11-2022	<ul style="list-style-type: none"> - Added CCU settings - Added commissioning procedure - Added extra settings change for Master LV - Updated status indication - Updated document design to the newest standard 	N.D. Yntema
1.0	26-8-2022	Initial document	N.D. Yntema

Table 1 - Document history

1.2 Terms, definitions, and abbreviations

Table 2 - List of terms, definitions, and abbreviations

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.
(Master) BMS	Shorthand for a <i>battery management controller</i> in a MG energy systems battery system. Could be a Master LV or Master HV.
Boundary limit	A boundary limit consists of two-level values, a set and a clear value, combined with a time condition.
DC-bus	Is the main DC-bus of the application where all user equipment is connected too, like generators, propulsion systems, 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.
HVIL	<i>High Voltage Interlock Loop</i> ; is a wire loop which is created for protection of disconnecting cables from the battery system while in operation. It isolates the electrical connections of the batteries from the system when loop is not closed.
NMEA 2000	<i>A plug-and-play communications standard used for connecting marine sensors and display units within ships and boats, standardised in the IEC 61162-1</i>
ATC	Allow-to-charge - A digital output used to control chargers.
ATD	Allow to discharge – A digital output used to control loads.
Failsafe	A condition of adequate level that causes an Alarm causing the battery pack to go into failsafe state.
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 fully discharged and 100% indicates fully charged.

2 SAFETY INSTRUCTIONS

Some safety instructions are needed when the SmartLink MX is used.

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 during when working on a battery system.
- Make sure the locale 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 data sheet may not be exceeded under any circumstances. If the identification tag is missing or wrong, 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 under all circumstances.



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.
- Store in the original packaging.

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 SmartLink MX – MGSLM48001
- 2x Connector Terminal Block Plug 1x6 5.08mm - MG5000230
- 1x RJ45 terminator (bag of 2) - MGRJ45000010

4 GENERAL DESCRIPTION

The SmartLink MX is the smart link between all MG products and third-party devices. It collects and combines all information in a MG battery system if needed. It transmits this data as a new device on the same CAN-bus and makes it in this way available for third party devices. It also makes this data available in such a way that parallel connected systems are shown as one battery bank. As a result, third party devices in a system no longer need to collect data from multiple BMSs.

The SmartLink MX supports interfacing to a list of common chargers and electric drives. The standard CAN-bus protocol is based on NMEA2000. No additional EMS or PMS is needed, because direct control is possible. The SmartLink MX is able to communicate with both the Master LV for low voltage systems and the Master HV for high voltage systems.

Besides collecting data, the SmartLink MX controls the MG Masters. It detects the state of the system, including warnings and errors. It can turn the BMS on or off, and restart the entire battery system.

SmartLink MX supports:

- NMEA2000
- Redundant and/or parallel system control
- Combined battery system data
- Control of third-party chargers and loads:
 - Victron Energy (fully supported by Victron GX devices);
 - TC-charger;
 - Powerfinn;
 - Delta-Q;
 - Tim Riester CCU;
- Bluetooth (MG Connect App)

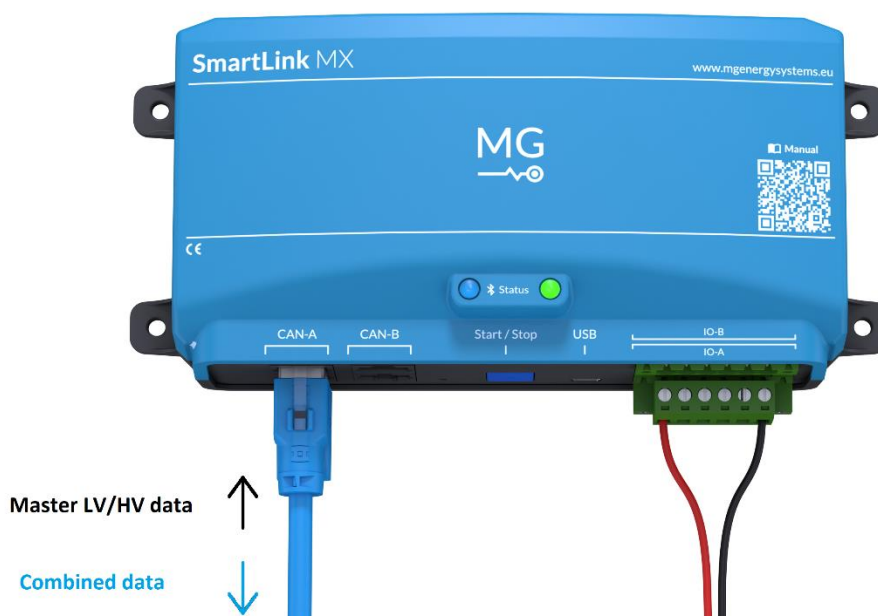


Figure 1 - Typical usage

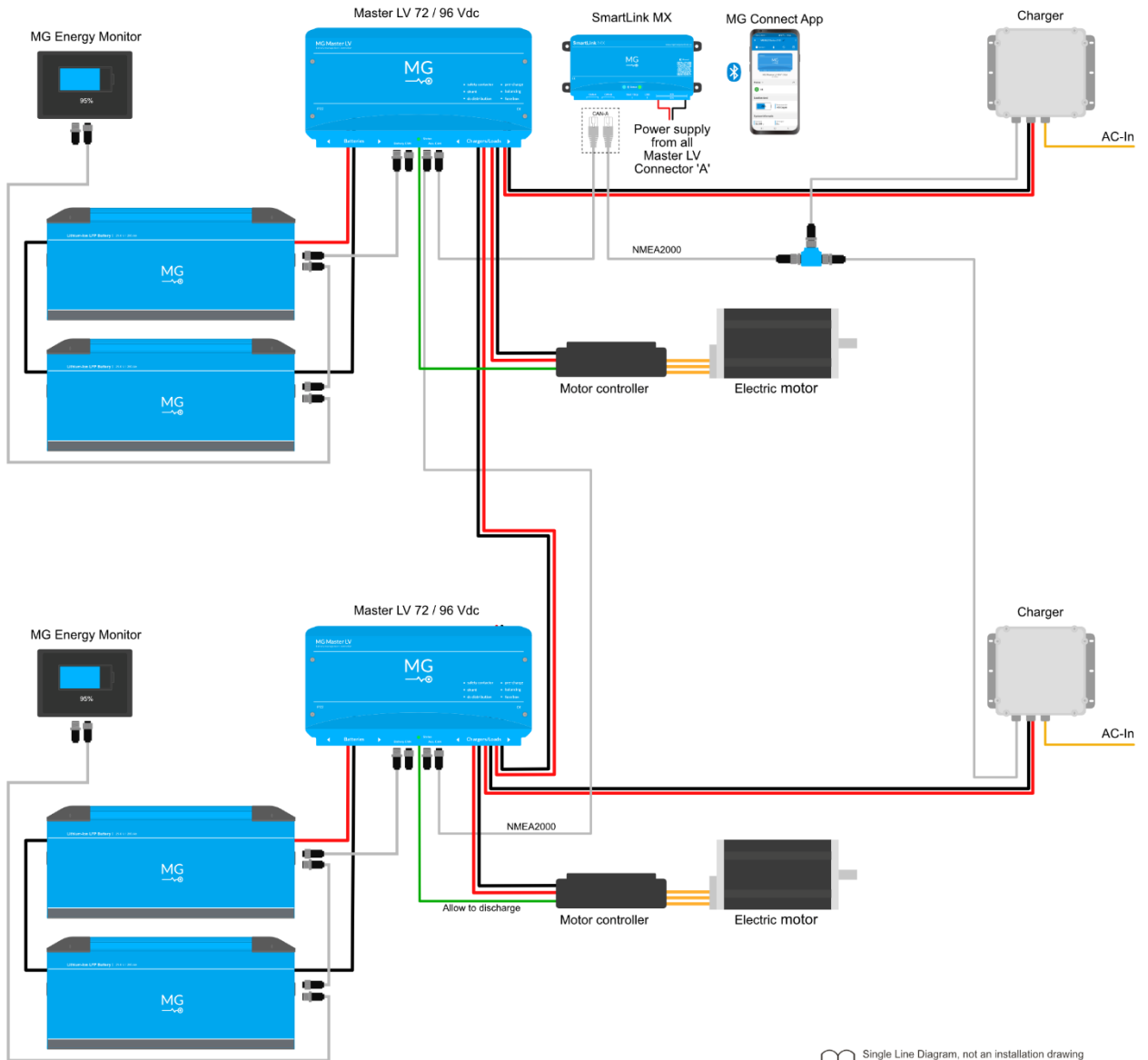
5 Installation examples

The SmartLink MX is a battery system combiner and controller. Different system configurations can be made, from a small 12 V system up to a parallel redundant propulsion or ESS system.

Contact MG Energy Systems B.V. for more information about possible configurations.

5.1 Basic propulsion system

See chapter 8.4 Connect to power supply to see how the SmartLink should be powered.



Single Line Diagram, not an installation drawing
 DC-cabling to batteries in parallel must have same length
 Refer to the manual for additional installation instructions

Figure 2 - System example 1

5.2 Basic ESS system

See chapter 8.4 Connect to power supply to see how the SmartLink should be powered.

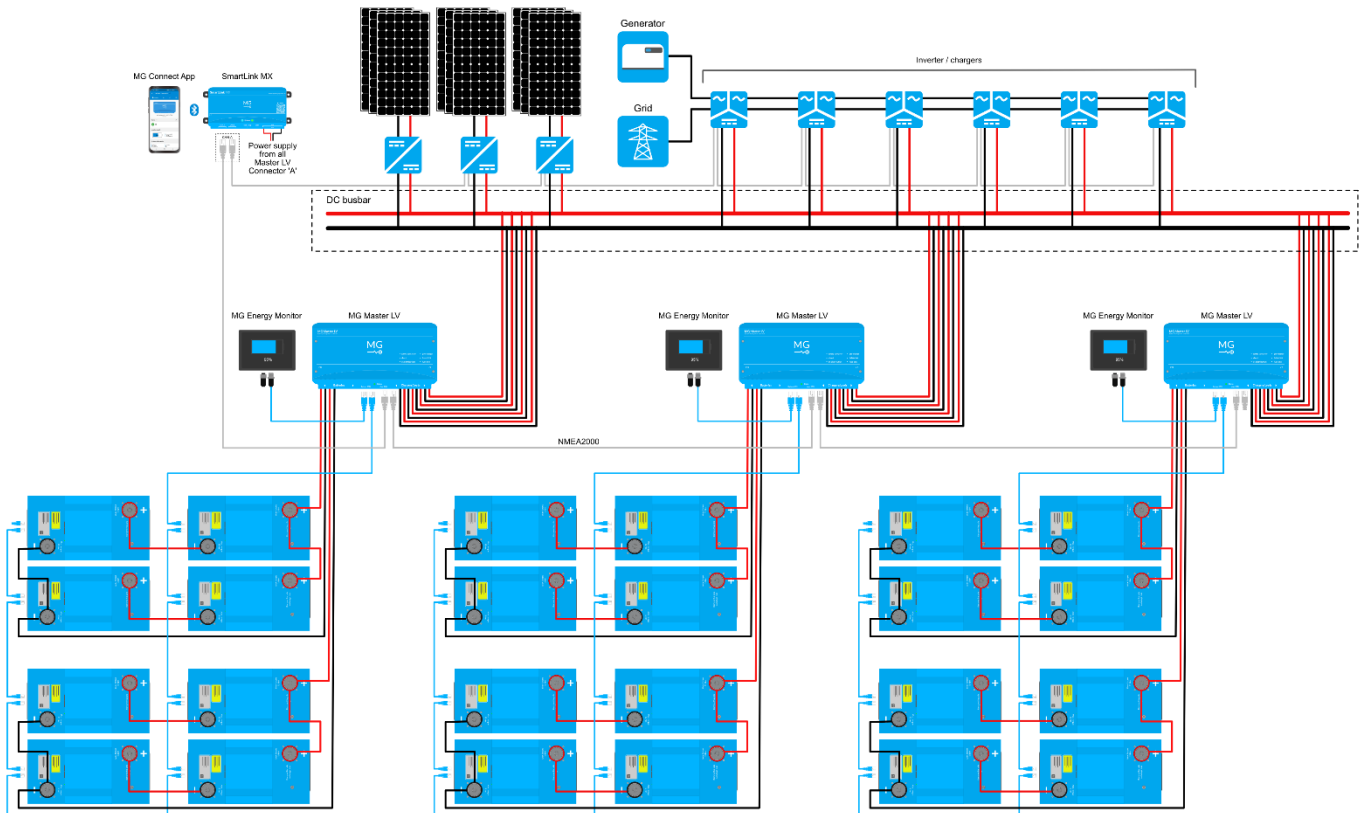


Figure 3 - System example 2

6 MODELS

This chapter shows the available models of the SmartLink MX.

6.1 Models and configurations

Product	Article number
MG SmartLink MX	MGSLM48001

Table 4 - Model number

6.2 Identification label

There are two identification labels located on the SmartLink MX.

One of the Identification labels is located at the left side of the device.

Example identification label:

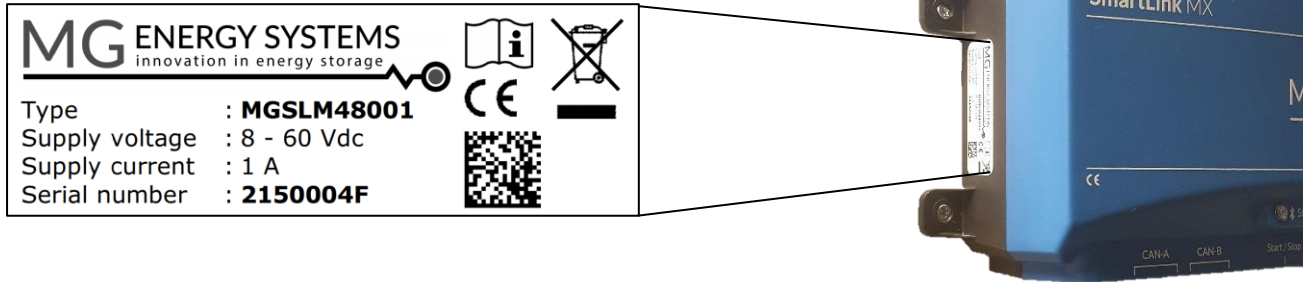


Figure 4 - Identification number example left side

The other identification label of the SmartLink MX is located at the bottom side of the device.

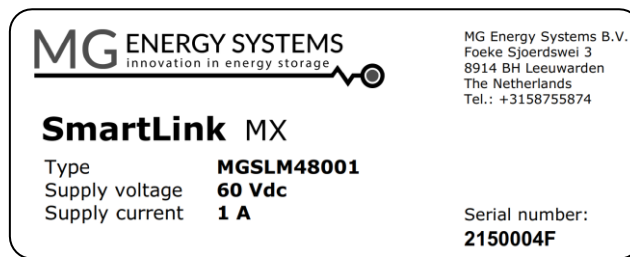


Figure 5 - Identification number example bottom side

The identifications label shown in Table 5 - Identification lable logo explanation. Contains written information about the product. The explanation of the symbols used on the identification label is stated in table 5.

Table 5 - Identification lable logo explanation

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

7 OVERVIEW

This chapter shows and overview of the SmartLink MX.

7.1 General overview



Figure 6 - SmartLink MX overview front

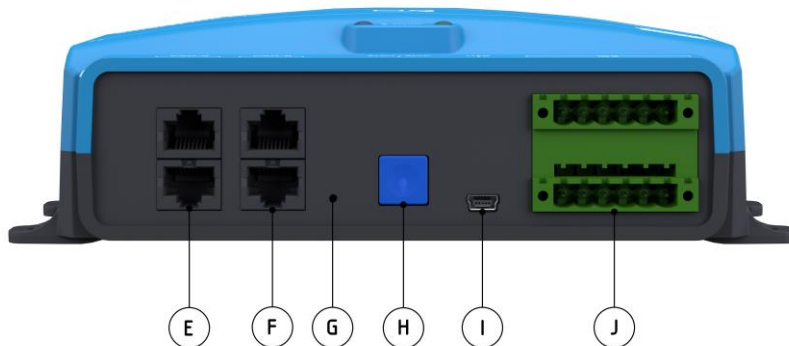


Figure 7 - SmartLink MX connection overview

Part	Description
A	Mounting points:
B	Bluetooth LED
C	Status LED
D	QR-code for Manual
E	CAN-A: 2x RJ45: Public CAN-bus (Isolated)
F	CAN-B: 2x RJ45: Private CAN-bus
G	Internal reset button
H	Start/Stop/Reset Button
I	USB interface: Mini USB
J	IO connector IO-A: Power supply and digital IOs IO-B: Digital relay contact outputs

7.2 Connection details

See chapter 8.4 Connect to power supply to see how the SmartLink should be powered in different systems.

7.2.1 I/O connectors

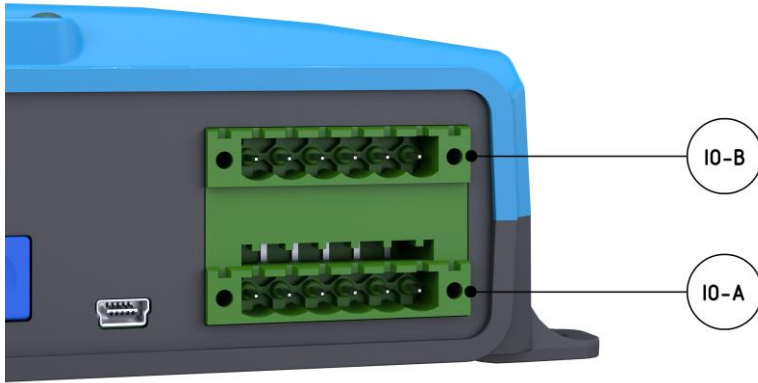


Figure 8 - IO connector pinout

Connector pins and specifications					
Conn.	Pin	I/O	Voltage	Current	Purpose
IO-A	1	In	Max. 60 VDC	1 A	Power input
	2	Out	'Power input' - 1V	0,5 A @ 12 VDC	Programmable output
	3	In	Max. 60 VDC		Programmable input 3-60VDC input for active detect.
	4	In	Active low		External start button Connect to ground for active detect
	5	Out	5 VDC	10 mA	External status output
	6	-			GND
IO-B	1	Out (NO)	Max. 60 VDC	0,8 A @ 60 VDC	Programmable relay output 1
	2				
	3	Out (NO)	Max. 60 VDC	0,8 A @ 60 VDC	Programmable relay output 2
	4				
	5	Out (NO)	Max. 60 VDC	0,8 A @ 60 VDC	Programmable relay output 3
6					

Table 6 - IO connector pinout

7.2.2 RJ45 Connector details

Typical cables that are used for the RJ45 CAN-bus connections are standard CAT 5 Ethernet network patch cables.



NOTICE:

Connector **CAN-A** is an **Isolated CAN-bus**. This means it is not connected electrically to all other connections of the SmartLink MX.



NOTICE:

Always use standard prefabricated Ethernet network patch cables (straight).

RJ45 Connector pinout (T-568B)



Figure 9 - RJ45 connector pinout

CAN-A: Public connector pins and specifications (ISOLATED)				
Pin	I/O	Voltage	Current	Purpose
1	-			
2	-			
3	-			GND
4	-			
5	-			
6	-			
7	CAN			CAN-H
8	CAN			CAN-L

CAN-B: Private connector pins and specifications				
Pin	I/O	Voltage	Current	Purpose
1	-			
2	-			
3	-			GND
4	IN	Max. 10 VDC		SP-Input (Do not use)
5	OUT	Max. 10 VDC	100mA	SP-Feedback (Do not use)
6	IN	Max. 60 VDC	1A	Optional power supply
7	CAN			CAN-H
8	CAN			CAN-L

7.3 Status indication

Table shows the status LED indication states and their meaning.

Status LED state	Description
Off	System off and is not powered.
Short flash green	Searching for BMSs on the CAN-bus network.
Blinking green slow	Waiting for start command.
Inverted Short flash green	System is pre-charging.
On	Running.
Red/ no beep	In Primary bootloader.
Blinking red / no beep	In Secondary bootloader.
Flashing/beeping 2 times	All connected BMSs are in failsafe.
Flashing/beeping 7 times	Hardware configuration failure (check BMSs and batteries: number of cells per battery and number of batteries in series should match each other).
Flashing/beeping 8 times	E-stop has been activated. A reset is needed to restart the system.
Flashing/beeping 12 times	System instability problem detected (contact manufacturer).

Table 7 - Status indication

8 INSTALLATION

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



WARNING:

Before continuing make sure the following instructions are met:

- Ensure that the connection cables are provided with fuses and circuit breakers.
 - Never replace a protective device by a component of a different type. Refer to the ordering information sections of this manual or contact manufacturer for a correct replacement.
 - Before switching the device on, check whether the available DC bus voltage range conforms to the configuration of the product as described in the manual.
 - Ensure that the equipment is used under the correct operating conditions. Never operate it in a wet or dusty environment.
 - Ensure that there is always sufficient free space around the product.
 - Install the product in an environment that can sustain some heat. Ensure therefore that there are no chemicals, plastic parts, curtains or other textiles, etc. in the immediate vicinity of the equipment.
-



ELECTRICAL HAZARD:

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



NOTICE:

During installation a check form needs to be used to log the installation procedure. This log will be checked during commissioning.

8.1 Mounting

Mount the SmartLink MX to a flat surface with the 4 mounting holes on the side of the device. Make sure there is enough space to connect all interfaces and the Start-Button is reachable.



Figure 10 - Mounting the SmartLink MX



WARNING:

Countersunk screws should not be used. This can damage the mounting feet.

The SmartLink MX must be mounted vertically (recommended) or horizontally against a flat surface.

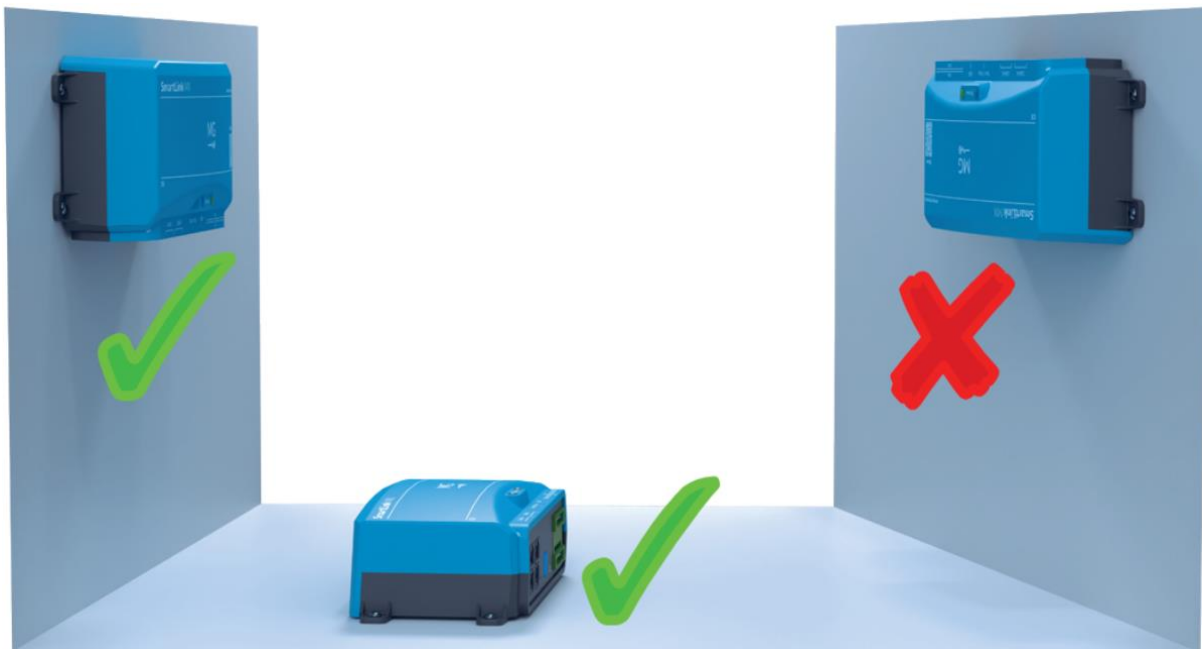


Figure 11 - Mounting direction

8.2 Setting up the BMSs

8.2.1 Combined system

When a BMS (Master LV/HV) needs to be controlled and combined by the SmartLink MX, some settings need to be changed in the BMS first. Before changing the settings, make sure the BMS is up to date. The following settings need to be changed:

- External CAN-bus protocol: '**MG NMEA2000**'
- External control '**ENABLE**'
- Wake up on charger detect: '**NO**' (only available for MG Master LV)
- External CAN-bus SOC Sync. group: **same number for every BMS.**
- If combining based on the **device instance** is preferred, every BMS must have the same device instanced number. How to change this number using a Victron device can be found here: <https://docs.mgenergysystems.eu/en/installation-guides/mg-victron-energy#change-device-instance>.

Make sure that the SmartLink MX **Selection method** is set to '**Device instance**'.

When these settings have been changed, a restart of the BMS(s) is needed first.



WARNING:

Before continuing make sure that:

- All other BMSs which do not need to be combined, and which are connected to the same CAN-bus, need to be disconnected or the following setting have to be applied:
 - External control: DISABLE
 - It is not possible to run two separate combined systems on a single CAN-bus network.
-

8.2.2 Single BMS

When the SmartLink MX is used to control chargers for a single BMS system (No start/stop control is possible in this mode) the following settings must be used:

- External CAN-bus protocol: '**MG NMEA2000**'
- External control: '**DISABLE**'
- If selecting a BMS based on the **device instance** is preferred, the BMS must have the same device instanced number as the SmartLink MX setting. How to change this number using a Victron device can be found here: <https://docs.mgenergysystems.eu/en/installation-guides/mg-victron-energy#change-device-instance>.

Make sure that the SmartLink MX **Selection method** is set to '**Device instance**'. Also make sure that **no** other BMSs on the CAN-Bus have the same device instance.

When these settings have been changed, a restart of the BMS(s) is needed first.

8.3 Connect to CAN-bus

The SmartLink MX should be connected to the same CAN-bus network as the BMSs are connected to (Aux. CAN). This NMEA2000 CAN-bus should be connected to the CAN-A connector using a RJ45 network cable. If it is the last device in the bus, make sure to use a RJ45 terminator to end the bus.

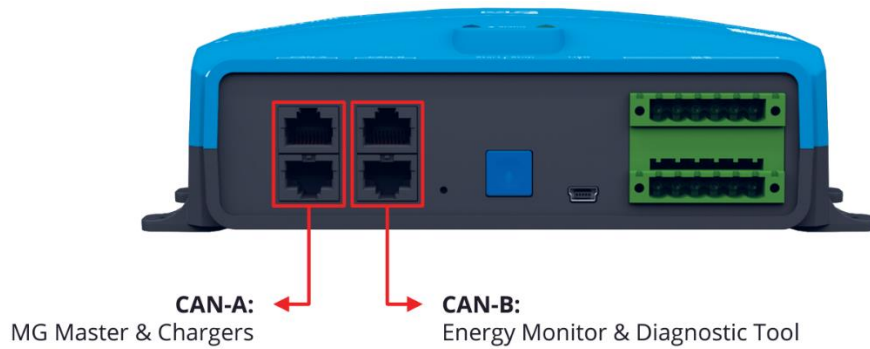


Figure 12 - CAN-bus connections

8.4 Connect to power supply

The SmartLink MX can be powered Via IO-A connector with wires connected to ground (pin 6) and Power input (pin 1). There are different ways to power the SmartLink MX in a system. Do never connect the SmartLink MX directly to a battery.

NOTICE:



- The SmartLink MX power supply connection should never be connected directly to a battery in the system. This can drain the batteries to a voltage that is lower than allowed.

8.4.1 Powered by one BMS

When the SmartLink MX is powered via the IO-A connector, it is recommended to power the device from the IO-A connector of the BMS.

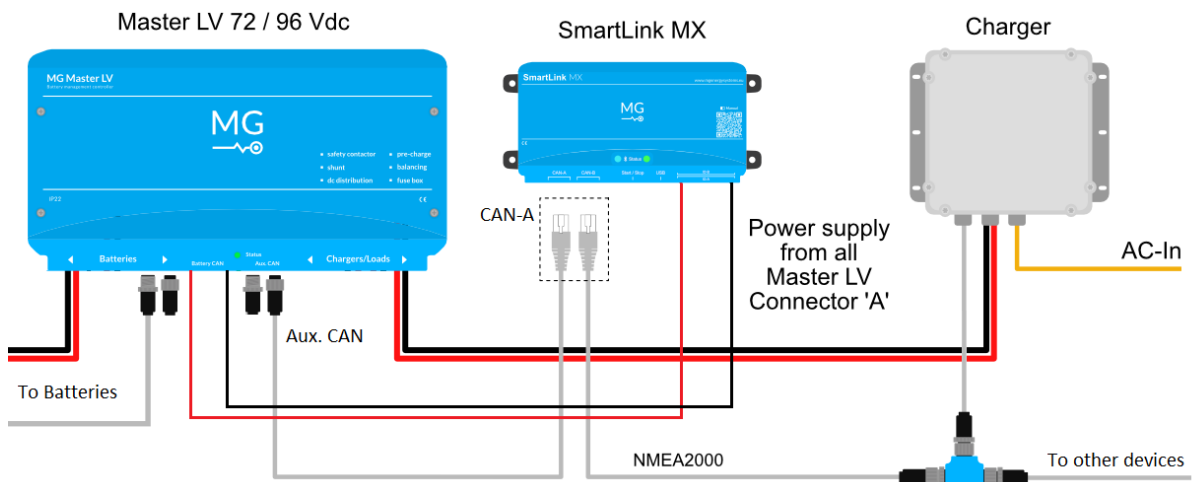


Figure 13 – System connection example

8.4.2 Powered by multiple BMSs

When multiple Master are connected, it is recommended to connect the power supply of the SmartLink MX to all of the Masters as it is shown in Figure 14. The SmartLink MX is now powered when at least one of the BMSs is active.



NOTICE:

- Once the SmartLink is powered by multiple Masters, the power supply ground wire should only be connected to one of the BMSs. This must be done to prevent ground loops.

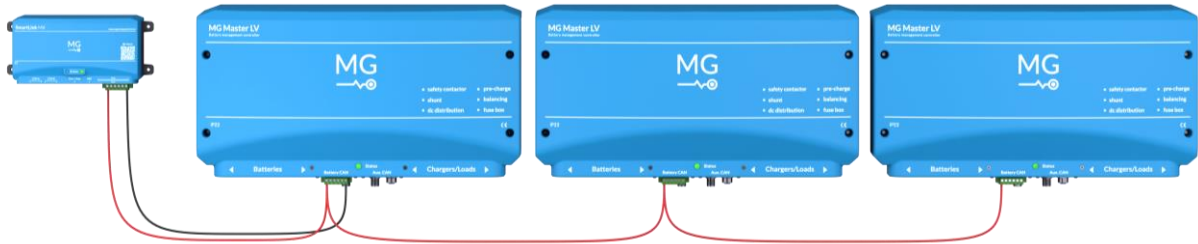


Figure 14 - Power supply connection with multiple BMSs

8.5 Setting up the SmartLink MX

Every system setup is different and requires different specifications. Therefore some settings have been implemented in the SmartLink MX. To set the proper settings for each individual system, the SmartLink MX can be set up with the “MG Diagnostic Tool”:

<https://downloads.mgenergysystems.eu/diagnostic-tool/applications/setup-64bit>

8.6 Connect Energy Monitor

An Energy Monitor should be connected to the “CAN-B” ports of the 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. Both ends of the CAN-bus must be supplied with terminators.



Figure 15 - SmartLink MX with MG Energy Monitor



NOTICE:

- The MG Energy monitor needs to be powered externally. It is not powered via CAN-Bus.

9 OPERATION

To get the system operational, the BMSs need to be woken up first. If one of the **Combined Control modes** is chosen, the SmartLink MX can control the BMSs with the following actions:

- Start system
- Stop system
- Reset system

If combine battery mode of the SmartLink MX has been disabled or the combined control mode has been turned off, the system cannot be controlled via the SmartLink MX. Only a restart can be done of the device itself: 9.4.3 Restart the SmartLink MX

9.1 Wakeup BMSs

After applying the correct setting to all the BMSs that need to be combined and the SmartLink MX, each of the BMSs needs to be awakened so the SmartLink MX can detect and control all the BMSs. The SmartLink MX will automatically detect the state of the system.

- If Master LV is off, then it can be awakened by pushing the start/stop button for 3 seconds until the status led will blink.
- Master HV's can be awakened by supplying them with 24 volts on the 24V_IN pin.

9.2 Start system

To start the system, the start/stop button should be pressed for 2 seconds. The system will pre-charge the DC bus and all BMSs will close their contactor when they are in a safe voltage window of 0.6% of the system voltage for 10 seconds.



NOTICE:

The system can only be started under the following conditions

- The Status indication of the SmartLink MX is "Waiting for start command"
 - The minimum number of BMSs are able to start.
 - The digital input must allow the start of the system if such a setting is chosen.
-

9.3 Stop system

To stop a running system, the start/stop button should be pressed for 2 seconds. All connected BMSs will open their contactor at the same time, and will automatically go to standby.

9.4 Reset system

9.4.1 One or more BMSs in failsafe

When there is one or more BMSs in failsafe, they can be restarted with the SmartLink MX by a short push on the start/stop button.

9.4.2 SmartLink MX in failsafe

When the SmartLink MX is in failsafe, it can be reset in the same way as when BMSs are in failsafe. A short push on the start/stop button is needed to reset the device.

9.4.3 Restart the SmartLink MX

The start/stop button should be pressed for more than 5 seconds to restart the device.



NOTICE:

When pressing the button longer than 2 seconds, the system will start or stop, instead of resetting the failsafe BMSs.

9.4.4 Start button functions

Function	Press time	Feedback
Restart BMSs in failsafe	0.2 - 1 second	None
Start or stop battery system	2 - 5 seconds	Single blink and beep
Reset SmartLink MX	After 5 seconds the device will reset automatically	Device is restarting
Activate or deactivate Bluetooth.	3 short presses (each press 0.2 – 1 second)	3x blinks and beeps. Blue led on: Bluetooth enabled Blue led off: Bluetooth disabled

Table 8 - Start button functions

10 SETTINGS

The following settings are available for the SmartLink MX with software version 1.8 or higher. More information about specific settings or available options can be found in that specific chapter.

Settings can be changed by using the following method's:

- Using the [MG Diagnostic Tool](#)
- Via Bluetooth using the Connect App on [Apple](#) or [Android](#)
- With a [MG Energy Monitor](#)

10.1 CAN-bus protocol CAN-A

This is "MG NMEA 2000". It cannot be changed in this version.

10.2 CAN-bus protocol CAN-B

This is "MG CoffeeCAN". It cannot be changed in this version.

10.3 Combine BMSs

Enables/disables the combine battery mode for the SmartLink MX. It must be enabled to be able to control and connect an combined system. If disabled, it can only connect to a single BMS. Controlling a BMS is also not possible if this setting has been disabled.



NOTICE:

- This setting must always be the same as the "External control" setting of the BMS. Otherwise the SmartLink MX will not work properly.
-

10.4 Control mode

The Control mode must be used when the SmartLink MX also control's the system. Therefor the setting "Combine BMSs" must be enabled. Changing this mode will change the BMS which needs to start up first.

- Off: only combining data, no control.
- Start BMS with highest serial number first.
- Start BMS with lowest serial number first.
- Start BMS with highest voltage first.
- Start BMS with lowest voltage first.
- Start random BMS first.

10.5 Required number of BMSs

This setting represents the minimum number of BMSs that the system needs to stay running. In other words, a parallel or parallel redundant system can be configured with this setting. This number effect the following:

- System won't start when there are not enough BMSs detected on the CAN-bus.
- Once the system is running with enough BMSs, and the number of running BMSs falls below the minimum (this can be caused by failsafe for example) the system will shut down.

10.6 Selection method

The selection method has two different options:

- **Serial numbers:**
This mode will select BMSs based on their unique identifiers. BMSs can be added or removed in the devices tab or via manual input.
- **Device instance:**
This mode will select BMSs based on their device instance number. In most systems, all BMSs will already have the same device instance. To change the device instance of an BMS with a Victron device, See: <https://docs.mgennergysystems.eu/en/installation-guides/mg-victron-energy#change-device-instance>.



NOTICE:

- If **“Serial numbers”** is chosen and the setting **“Combine BMSs”** is disabled, only the first serial number will be selected by the SmartLink MX, because only one BMS can be connected in this mode.
 - If **“Device instance”** is chosen and the setting **“Combine BMSs”** is disabled, make sure that there is only one BMS with the chosen Device instance number on the CAN-Bus.
-

10.7 Current limits

These settings represents a manual current limit. This can be enabled to limit the current if needed. If disabled, the limit will be limited by other devices.

Note: The current will always be limited by the lowest allowed current by the system.

10.8 Additional CAN-Bus chargers

Choose an additional CAN bus chargers if connected. The setting **“Number of connected chargers”** must also be changed into the number of chargers connected. This number is used to distribute the current over the chargers. Supported chargers are:

- TC chargers
- Powerfinn Chargers
- Skylla chargers
- Delta-Q (CAN-open protocol)

10.9 Charging controller unit

Choose an additional charging controller unit if connected. If setting **“AC charge current limit”** gets enabled by choosing a connected charging controller unit, it must also be changed. It can be set between 6 and 80A(80 = unlimited). The supported Charging control units are:

- Tim Riestler TR-LS2 CCU



NOTICE: Only the chargers of the setting: ‘Additional CAN-Bus chargers’ can be controlled by the charging controller unit. It will **NOT** affect the DVCC value’s.

10.10 Bluetooth

This setting can disable or enable the Bluetooth connection of the SmartLink MX. Once the setting is disabled, a reboot is needed first.

10.11 Programmable outputs

This setting can change the behavior of the programmable outputs. When available, information icons will be available in the MG Diagnostic Tool.

There are 2 different output types:

- Programmable relay
 - Programmable relay 1: Connector IO-B pin 1 and 2
 - Programmable relay 2: Connector IO-B pin 3 and 4.
 - Programmable relay 3: Connector IO-B pin 5 and 6
- Programmable output
 - Programmable output: Connector IO-A pin 2.

List of programmable contact behavior:

- Warning: Switch relay when warning is present.
- Failure: Switch relay when system is in fail safe mode due to failure.
- Status flag
 - Required BMSs are running
 - All BMSs are running
 - Any BMS has a warning
 - All BMSs have a warning
 - Any BMS has a failure
 - All BMSs have a failure
 - Required BMSs have activated programmable output
 - All BMSs have activated programmable output
 - Allowed to charge
 - Allowed to discharge
 - Combined control is running
 - E-stop activated (**Can only be used as indication. Not for emergency purposes**)
- Current: Switch relay by programmed current for programmed threshold times.
- Battery temperature: Switch relay by programmed battery temperature for programmed threshold times.
- Battery cell voltage: Switch relay by programmed battery cell voltage for programmed threshold times.
- State of charge: Switch relay by state of charge for programmed threshold times.
- Discharge almost not allowed: Switch relay when discharging is almost not allowed.
- Disabled: disable programmed relay feature.

10.12 Programmable input

Connections:

- Programmable input: Connector IO-A pin 3.

List of programmable input behavior:

- Off (only visible in the status flag of the device)
- Safety key: When input is active, the system will be turned off. Threshold times can be set. Once it is active, the system can also not be started.
- Allowed to charge: Threshold times can be set.
- Allowed to discharge: Threshold times can be set.
- Current limiter: When input is active, the (dis)charge current will be limited by chosen current limits if enabled. Note that the current will always be limited by the lowest allowed current in the system. When the input is inactive, the lowest allowed current limit of the system will be used again.
- E-stop: when input is activated, the (dis)charge current limits will go to 0A. For example the DVCC value's. If this input is triggered, the SmartLink MX must be restarted for full functionality.



NOTICE:

- Activation of the “**E- stop**” input will not shutdown any BMSs. An E-stop must be implemented to the BMS itself also if needed.
-

All programmable input modes can be inverted.

10.13 Default settings

The SmartLink MX is set with default settings from the moment it has left the factory. Below a table with the default settings (factory settings):

Setting	Default value
CAN-bus protocol CAN-A	MG NMEA2000 (cannot be changed)
CAN-bus protocol CAN-B	MG CoffeeCAN (cannot be changed)
Combine BMSs	Enabled
Control mode	First BMS
Required number of BMSs	1
Selection method	Device instance
Serial numbers to combine	empty
Device instance to combine	0
Charge current limit	Disabled
Discharge current limit	Disabled
Additional CAN-bus charger	None
Number of CAN-bus chargers	0
Charging controller unit	None
AC charge current limit	6A
Bluetooth enabled	Disabled
Programmable relay 1	Mode: Status Activated state: Close Activation status: Allowed to charge
Programmable relay 2	Mode: Status Activated state: Close Activation status: Allowed to discharge
Programmable relay 3	Mode: Discharge almost not allowed Activated state: Close
Programmable input	Mode: Off Input signal: Default
Programmable output	Mode: Discharge almost not allowed Activated state: Close

Table 9 - Default settings

11 SYSTEM SETUP EXAMPLE

The following chapter will describe an example how to setup a system with 3 TC chargers.

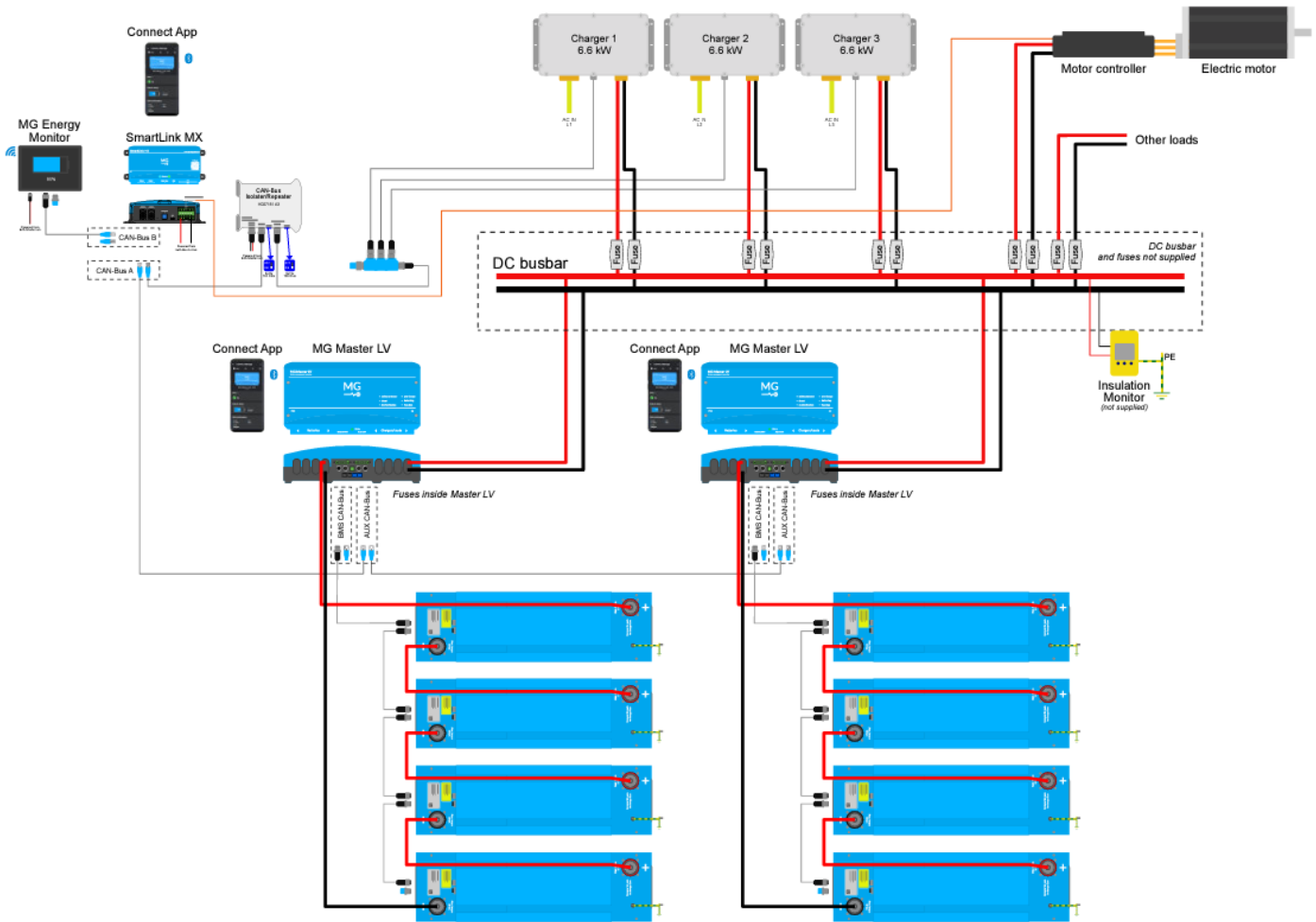


Figure 16 - System installation example

11.1 System specifications

A system example with the following specifications:

- 2 BMSs in parallel redundant (each BMS has the same number of batteries in series with the same voltage (also the same number of cells per battery))
- System is able to run on a single BMS.
- 3 TC chargers that communicate via CAN-bus
- Combined and controlled based on BMS serial numbers.
- Allowed to discharge output relay contact for the motor controller.

11.2 Setup system hardware

The following steps must be made:

- Make sure the BMSs and the TC chargers are connected correctly, and they are connected on the same CAN-bus

- Make sure if the BMSs have the latest firmware.
- Connect the SmartLink MX as described in chapter 8 INSTALLATION

11.3 Configure BMS settings

The following settings must be changed to all BMSs

- **External CAN-bus protocol:** MG NMEA2000
- **External control:** Enable
- **Start up when charger is detected:** No (only for MG master LV).
- **External CAN-bus SOC Sync. group:** same number for both BMSs.

Save the settings by clicking on “Apply” Note that the BMSs need to be restarted to use the changed settings

11.4 Configure SmartLink MX settings

Change the settings in the SmartLink MX using the “MG Diagnostic Tool”.

- **Combine BMSs:** Enable
- **Control mode:** choose which BMS should start first.
- **Required number of BMSs:** select 1 (because it is a redundant system).
- **Selection method:** choose “serial number” to add the BMSs by serial number.
- **Serial numbers to combine:** click on a BMS if it is already connected to the system. Then select ‘Add to settings’ to add the BMS to the combining group. (Note: the BMSs need to be running or in standby mode to see them in the Diagnostic Tool) **Check the SmartLink MX settings in the MG Diagnostic Tool to see how BMSs can be added manually.**
- **Charge/ discharge limit current:** Check if the system does need a specific charge/ discharge limit current. When the charge/discharge current is disabled, the SmartLink MX will automatically pick the lowest current limit set by the BMSs.



NOTICE:

Make sure that the total current limit divided by the number of chargers is not higher than the chargers rated max current.

- **Additional CAN-Bus charger:** select “TC charger”
- **Number of CAN-Bus chargers:** select the number of TC chargers connected on the CAN-bus. In this example this will be 3.
- **Charging control unit:** None
- **Programmable relay 2 behaviour:**

This relay is chosen, because the default setting is already “allowed to discharge”.

 - Mode: Status.
 - Output activated state: Choose close or open.
 - Status flag: Allowed to charge.

Save the settings by clicking on “Apply”

11.5 Start the system

Make sure that the BMSs are in standby.

When the settings are set correctly, the Status LED of the SmartLink MX will now blink for: 0.5 seconds on, 0.5 seconds off (just like the BMSs). This means the system is ready to start.

By a push on the SmartLink MX button for 2 seconds, the system will start. It will first start the BMS with the chosen setting, followed by all other BMSs. Once running the blinking will stop, and will the status led will burn continuously.

If the systems allowed to charge, and the input pin are both valid, the SmartLink MX will control the TC chargers with the maximum allowed charge current by the system.

11.6 Stop the system

When the system is running, it can be turned off by pushing the button on the SmartLink MX for 2 seconds. It will restart all BMSs at the same time and charging will be stopped. After some time, all BMSs including the SmartLink MX will go to standby state again ready to be started again.

12 COMMISSIONING

Below describes the procedure for commissioning for the SmartLink MX.



NOTICE:

Only commissioning of the SmartLink MX is handled in this document. Make sure that the commissioning of the MG Master LV/HV is finished before starting this one.

12.1 Procedure

Use the following procedure to verify the systems functionality:

Check the firmware version of the MG Master LV or HV:

- The connected MG Master LV or HV firmware version is updated to the latest release.

Check MG Master LV or HV CAN-bus connections:

- All MG Master LV or HV AUX. CAN, chargers and charging controller units have to be connected to the NMEA2000 CAN-bus.

Check if the settings of the Master LV or HV are set correct:

- External CAN bus protocol** is set to **MG NMEA2000**.
- External control** is set to **Enable** if a combined system is required.
- Start up when charger is detected** is set to **No**, only for MG master LV in a combined system.
- Set the External CAN-bus SOC Sync. group** for each master to the same number.
- A restart of all Master LV or HV's is done so the settings are activated.

Check SmartLink MX connections:

- The SmartLink MX is connected to the NMEA2000 CAN-bus using the **CAN-A** connection.
- The SmartLink MX is powered via the IO-A connector (See chapter 8.4 Connect to power supply to see how the SmartLink should be powered).

Check the firmware version of the SmartLink MX:

- The SmartLink MX firmware version is updated to the latest release.

Check if the settings of the SmartLink MX are set correct:

- All system specific settings are checked and set correctly (e.g. the current limit etc.)
- All BMSs, those who need to be added to the system, are visible in the MG Diagnostic Tool (Devices tab).
- Make sure these BMSs are configured to participate the system by clicking on it.

Check for all chargers in the system that it is controlled by the wired allow-to-charge contact, IO-B connector:

- Check the programmable relay 1 settings are set to allow-to-charge, this is the default setting.
- For the next steps use the “MG Connect App” or the “MG Diagnostic Tool”.
- Check status: Programmable relay 1 active.
- Make sure the charger is charging by reading a positive battery current.
- Unplug the IO-B connector from the SmartLink-MX.
- Check if chargers have stopped charging by reading the current.
- Plug the IO-B connector back into the SmartLink-MX and charging should start again.

Check for all loads in the system that it is controlled by the wired allow-to-discharge contact, IO-B connector:

- Check the programmable relay 2 settings are set to allow-to-discharge, this is the default setting.
- For the next steps use the “MG Connect App” or the “MG Diagnostic Tool”.
- Check status: Programmable relay 2 active.
- Make sure the load is active by reading a negative battery current.
- Unplug the IO-B connector from the SmartLink-MX.
- Check if load has stopped discharging by reading the current.
- Plug the IO-B connector back into the SmartLink-MX and the load should start again.

13 SERVICE

13.1 Maintenance

The device does not require specific maintenance. When any maintenance or user intervention is required, the user will be notified via status information received by the auxiliary CAN-bus.



ELECTRICAL HAZARD:

Do not pour or spray water directly onto the device. When cleaning the device be aware that the connected battery string is a permanent energy source. Even when the device is turned off, the battery power connections might carry dangerous voltage levels.

13.1.1 Connections

It will suffice to check all connections once a year. Check if all connectors are mated correctly according the instructions given in sections of this manual.

13.1.2 Cleaning

Cleaning of the device is best done using a dry or slightly damp cloth. Limit the use of cleaning agents. If a cleaning agent is to be used, use an electrically non-conductive cleaning agent is advised.

It is important to keep the battery spaces clean and tidy in order to minimise the need for cleaning. Prevent the use of moisture, vaporizing agents, oil, grease, etc. in the vicinity of the device.

13.2 Disposal

Batteries marked with the recycling symbol must be processed via a recognized recycling agency. By agreement, they may be returned to the manufacturer. Batteries must not be mixed with domestic or industrial waste.

14 TECHNICAL SPECIFICATIONS

<https://downloads.mgenerysystems.eu/smartlinkmx/documents/technical-specification-en>

15 DIMENSIONS

<https://downloads.mgenerysystems.eu/smartlinkmx/drawings/total-assembly-smartlinkmx>

16 CONTACT DETAILS

For specific questions please feel free to contact us.



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