

MG LFP Battery 25.6V/230Ah/5800Wh IP

- Manual -

MGLFP243230 (LFP230 IP)

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

Table 1 - Document history

Rev.	Date	Changes	Revision author
1.1	11-03-2026	Updated unboxing sequence image	M. Scholten
1.0	09-02-2025	Initial release	M. Scholten

1.2 Terms, abbreviations, and definition

Table 2 - Terms, abbreviations, and definitions

Battery cell	<i>Battery cell</i> ; the smallest building block in a battery, a chemical unit. Cell is the bare Lithium-Ion battery cell.
Battery module	<i>Battery module</i> ; is an assembly of submodules, BMS and outer enclosure.
Battery stack	<i>Battery stack</i> ; is a set of multiple cells in cell cassettes constructed as one.
BMS	<i>Battery Management System</i> ; The BMS is the electronics that monitors the battery cell parameters to keep it within the operation specifications.
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.
C-rate	<i>C-Rate</i> ; the current (A) used to charge/discharge the battery system divided by the rated ampere-hours (Ah).
EMS	<i>Energy Management System</i> ; The EMS controls all power sources and consumers in a system.
HVIL	<i>High Voltage Interlock Loop</i> ; is a wire loop which is created for protection of pulling cables from the battery system while in operation. It shuts down the system when loop is not closed.
IC	<i>Integrated Circuit</i> ; is a chip containing an electronics circuit;
MSDS	<i>Material Safety Data Sheet</i> ; is a document that lists information relating to occupational safety and health for the use of various substances and products.
NMEA 2000	<i>National Marine Electronics Association's NMEA 2000</i> is a plug-and-play communications standard used for connecting marine sensors and display units within ships and boats, standardised in the IEC 61162-1.
PCB	<i>Printed Circuit Board</i> ; is a board containing an electronic circuit;
PCBA	<i>Printed Circuit Board Assembly</i> ; is a board containing an electronic circuit including passive and active components;
SoC	<i>State-of-Charge</i> ; is the remaining capacity in a battery cell or module in percent (%).
SoH	<i>State-of-Health</i> ; is a figure of merit of the condition of a battery (or a cell, or a battery pack), compared to its ideal conditions.



2 SAFETY INSTRUCTIONS

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.
	CAUTION: A hazardous situation which, if not avoided, could result in minor or moderate injury.
	LIMITATION: A limitation to use which must be considered for safe use of the equipment.
	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.

	WARNING: A battery is a permanent energy source which cannot be turned off.
	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. - There is a risk of electrocution and burns when working on higher voltage systems without proper protective gear and special training.

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 purchasing company is responsible for:

- Defining the responsibilities and competency of all personnel working with this product and all relevant systems.
- Providing instruction and training.
- Ensuring that the contents of the operating and safety instructions have been fully understood by the personnel.
- Ensuring that the system is installed in compliance to all local, federal codes or any other organism with jurisdiction over the system.

MG Energy System can, at the purchaser request provide all necessary training or instructions required for proper installation and usage of the system.

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 the leakage of dangerous materials.
- Product damage.
- Property damage.
- Loss of all claims for damages.

2.2.4 Risk assessment

For every integration of the battery system it might be applicable, depending on the application, to perform a risk assessment.

Goal of the risk assessment is to identify the hazards and determine the corresponding risks for the particular application.

The following topics need to be addressed:

- Fire hazards (fire from the batteries, fire from external source etc.)
- Environmental hazards (moisture, water ingress, vibration, heat etc.)
- Electrical hazards (short-circuit, cable specifications, cable routing etc.)
- Installation and operational hazards (lifting, communication, power loss etc.)

2.2.5 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 worn, contact MG Energy Systems B.V. for specific instructions.



WARNING:

The battery modules may only be used in combination with a MG Master BMS.
([MG Master LV](#) or [MG Master HV](#))

3 TRANSPORT, STORAGE, UNPACKING AND HANDLING

3.1 Transport

The package and transport instructions provided by the manufacturer must be followed under all circumstances.

Notes on transport:

- Use original packaging materials.
- Lithium-Ion batteries are dangerous goods and must be transported according to the applicable rules.
- Transportation company and shipper must be qualified to transport and package dangerous goods.
- The SoC during transport must be $\leq 30\%$.



For details on transport of this battery module see the [MSDS](#) and [general transport instructions](#).



CAUTION:

It is not allowed to transport, connect or operate a damaged battery.



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.



NOTICE:

The SoC of the battery as delivered from factory is $\leq 21\%$.

3.2 Storage

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

Notes on storage:

- Battery module must be stored in its original packaging.
- Store in a dry, clean, and conditioned location.
- Local regulations for storage of dangerous goods/Lithium-Ion batteries may be applicable.
- Recommended storage temperature of the battery module is between $+10\text{ }^{\circ}\text{C}$ to $+25\text{ }^{\circ}\text{C}$.
- It is recommended to limit the battery charge between 50% and 70% SoC. This will limit calendric aging.

The battery module's SoC is decreasing 6% per year when not connected to any equipment, including MG Master LV or MG Master HV. Recharging is required when the voltage is in the range of the under voltage voltage level.


NOTICE:

Check the MG Master LV or MG Master HV manual for storage of a connected system.


NOTICE:

Check the voltage of the stored battery module every year.
When the battery module voltage is < 24 VDC, recharging is required. Contact MG Energy Systems for specific instructions and tools.


NOTICE:

Local regulations for storage of dangerous goods/Lithium-Ion batteries may be applicable.

3.3 Unpacking and handling

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.

The battery module is shipped in a carton box. Figure 1 shows the unboxing sequence.

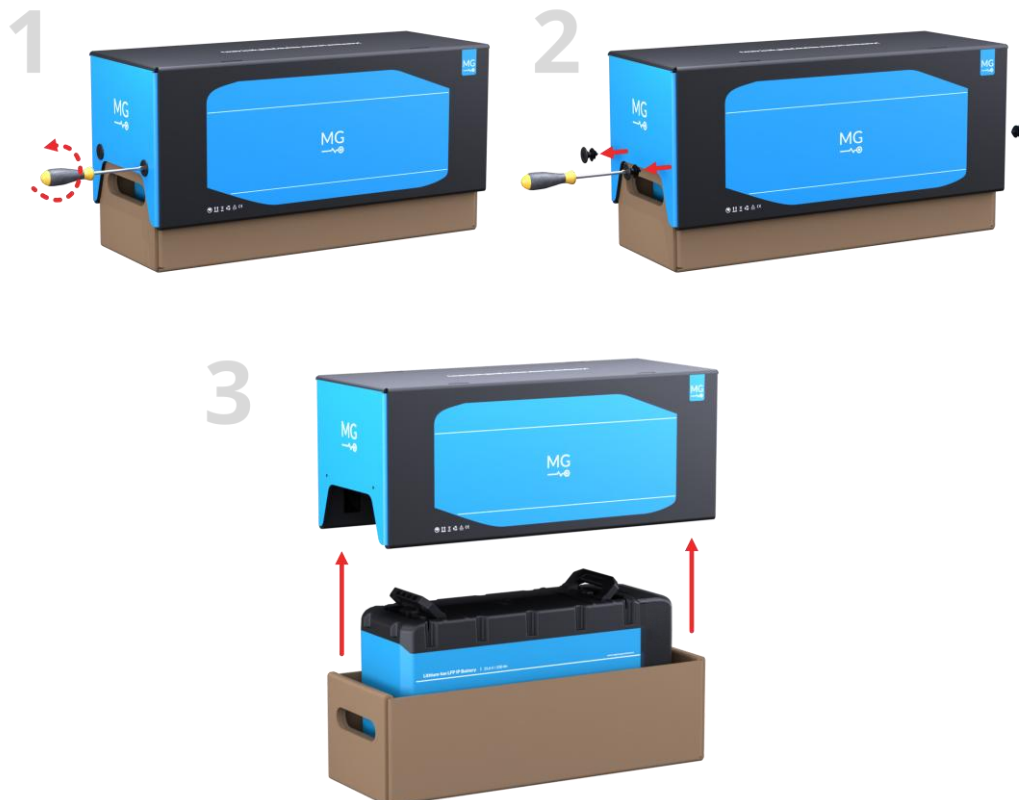


Figure 1 - Unboxing the LFP IP battery module

3.3.1 Lifting the battery module

Use the handles 'a' and 'b' on the top of the battery module for lifting.



Figure 2 - LFP IP Lifting handles



CAUTION:

Always take the local applicable standards and regulations regarding the prevention of accidents into account when handling the product.



CAUTION:

Be aware of the total mass of the product and do not lift heavy objects unassisted.

3.3.2 Scope of delivery

The scope of delivery is as follows:

- [1x MG LFP 24V 230 Ah IP battery module](#) of type as described in chapter 5.
- 2x LFP IP battery mounting kit - MG3000523.
- 1x Quick installation guide: [LFP 24V 230Ah IP](#)



NOTICE:

Not within the scope of delivery:

- Power cables and connectors (details can be found in chapter 6.2.2).
- Communication cables and connectors (details can be found in chapter 6.2).

4 GENERAL DESCRIPTION

The LFP battery series is based on LiFePO_4 chemistry. The next generation battery cells of this chemistry gives this battery module a high energy density and long cycle life. A modular and compact design makes system integration more flexible, especially in refit applications. The passive cooling concept keeps integration simple and straight forward. Specifically this IP version has some additional safety features like the touch proof power connectors which add safety during installation of the modules, even on higher system voltages. But also the integrated exhaust system which will, in the unlikely event of a thermal runaway, open under pressure, providing a secure release of the gasses to a safe area. The battery module design has a true IP65 rated design which makes it easier for installation in more demanding applications.

These features makes it an ideal choice for demanding applications where reliability and durability are paramount.

4.1 Battery system components

A MG Energy Systems Lithium-Ion battery system consists of the following components:

- One or more [MG LFP IP battery modules](#) of the same type;
- One [MG Master LV](#) or [MG Master HV](#) battery management system; Details of these battery management controllers can be found in their separate description documents;
- [MG Energy Monitor](#) (optional);
- [MG SmartLink MX](#) for parallel redundant control (optional);

4.2 Functional description

MG's system philosophy is to have one Master BMS, e.g. a MG Master LV or MG Master HV, per bank 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 like cell voltage and cell temperature. Besides monitoring, the slave BMS also controls balancing of cells based on the input of the Master BMS.

All these parameters are sent to the MG Master LV or MG Master HV via a dedicated CAN-bus which collects all the data and monitors these parameters with different thresholds. When a parameter exceeds the threshold this will first be communicated to the user via the, separated, auxiliary CAN-bus or the I/O connections. If the exceeded threshold stays, the master BMS has the possibility to disconnect the batteries from the system by opening the main contactors.

Functional and safety features of the MG LFP IP battery module are:

- Robust chemistry with a modular design;
- True IP rated;
- Exhaust system;
- Plug and Play installation: Automatic configuration;
- Low voltage solutions;
- High voltage solutions;
- Fast and safe installation;
- M12 CAN Bus connector;

4.3 Example systems

The modular design makes it possible to create different kind of battery system configurations. Battery modules can be placed in series and parallel to create higher voltages and larger capacities.

4.3.1 Low voltage systems

Low voltage systems up to 96 VDC are setup with the MG Master LV series. For more information about the [MG Master LV](#), please refer to the data sheet and manual. The example in Figure 3 is a simplified schematic that is not showing all the details.

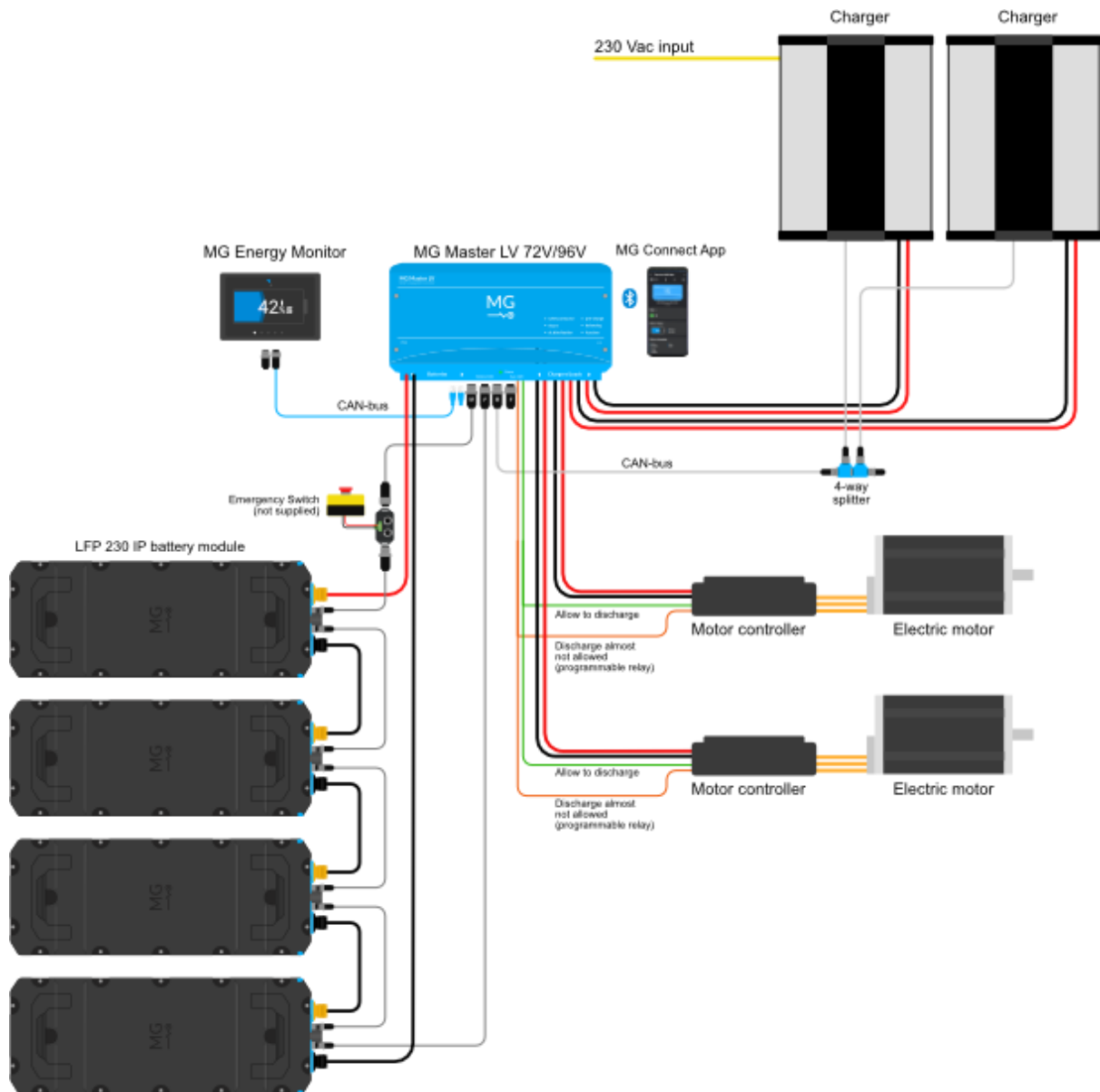


Figure 3 - 96 VDC propulsion system for industrial and marine applications

4.3.2 High voltage systems

High voltage systems up to 144 VDC are setup with the MG Master HV series. For more information about the [MG Master HV](#), please refer to the data sheet and manual. The example in Figure 4 is a simplified schematic which is not showing all the details.

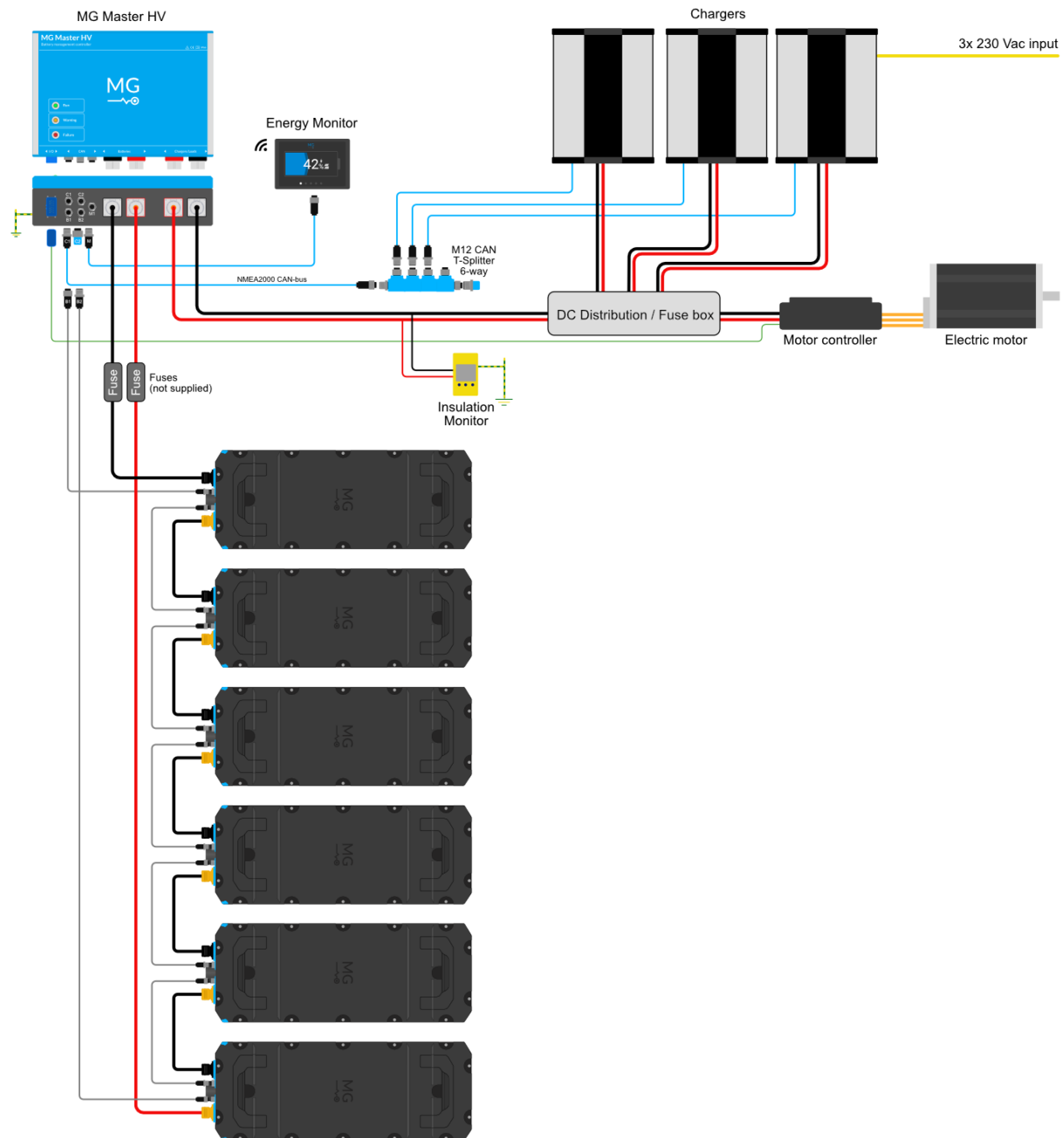


Figure 4 - 144 VDC propulsion system for industrial or marine applications

5 MODELS

The LFP Series has different models and configurations available. The main differences are battery module capacity, maximum system voltage and CAN Bus connector types.

5.1 Models and configurations

Table 4 lists the available battery module configurations.

Table 4 - Battery module configurations

Article number	Description	Remarks
MGLFP243230	MG LFP Battery 25.6V/230Ah/5800Wh	24 V up to 563 V, M12 connectors

5.1.1 Battery designation

As per IEC 62620 it is required to state a standard designation per battery module configuration. For the LFP series lithium-ion battery these are given in table 5.

Table 5 - Battery module designation as per IEC 62620

Article number	Designation
MGLFP243230	IFpP/55/174/205/[1P8S]E/-10NA/90

5.2 Labels

The identification label and the warning labels of the MG LFP battery module are located at the front of the enclosure.



Figure 5 - Example identifications label LFP 230 IP

The identifications label shown in figure 5 contains written information about the product. The explanation of the symbols used on the identification label is stated in table 6.

Table 6 - 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 indicating the manual must be read 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.

5.3 Approvals and standards

The LFP IP battery conforms to an extensive list of standards and tests.

IEC 62619
EN 62620

- [Declaration of Conformity LFP 230 IP](#)
- [List of tests and standards LFP 230 IP](#)
- [LFP cell propagation test](#)
- [Material safety datasheet](#)
- [UN38.3](#)

5.3.1 Safety integrity level

The LFP 230 IP battery in combination with the MG Master HV hold a Functional Safety Certificate with SIL-2 (Safety Integrity Level 2) approval under IEC 61508. This certification verifies its compliance with rigorous safety standards, ensuring reliable risk mitigation, fault tolerance, and system integrity in critical applications. Validated through independent testing, it guarantees reduced hazards and seamless integration into safety-critical systems globally.



NOTICE:

The IEC-EN62619 standard is applying to a battery in combination with the BMS such as the MG Master LV or MG Master HV. Always check for compliance with this combination.

6 OVERVIEW

This chapter shows an overview of parts of the LFP IP battery.

6.1 General overview

Figure 6 shows an overview of parts and connections of the LFP IP battery module.

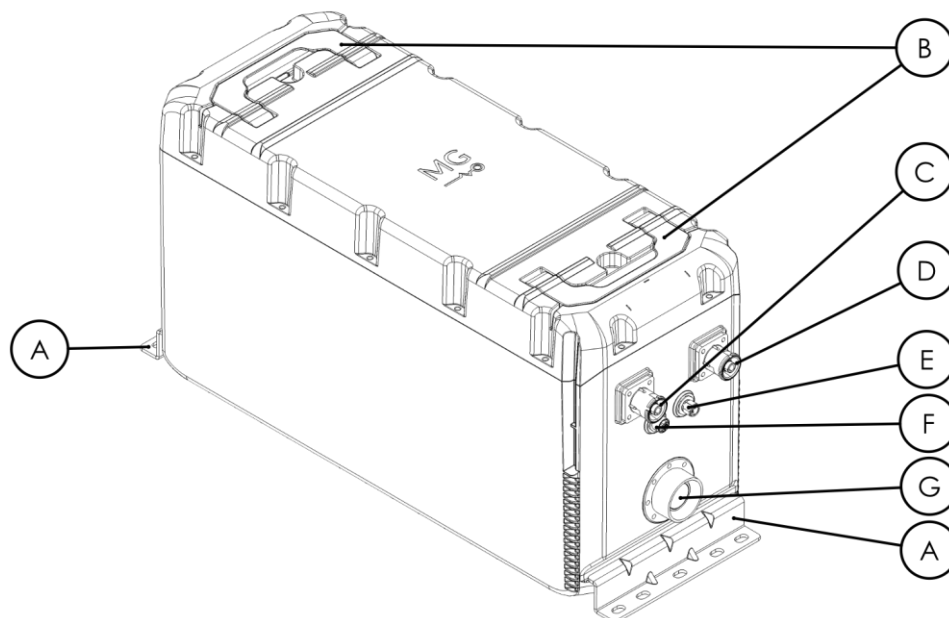


Figure 6 – LFP 230 IP module overview

Table 7 - Module overview

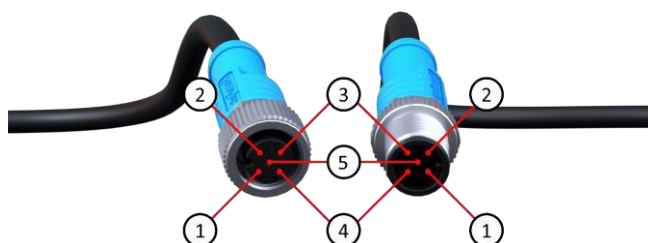
Part	Description
A	Mounting points and brackets.
B	Lifting handles.
C	Negative power connector.
D	Positive power connector.
E and F	M12 CAN-Bus communication.
G	Exhaust connection.

6.2 Connections details

6.2.1 CAN bus connections

Each battery module contains two CAN-Bus connectors to connect to the MG Master BMS and to the next battery, if any.

The connectors used for connecting the CAN bus are all of the same type, namely a circular M12 connector with 5 positions and A-coded keying.



Connector pins and specifications			
Name/Purpose	Pin	Voltage	Current
Shield	1		
CAN VCC	2	≤ 18 VDC	≤ 1 A
CAN GND	3		≤ 1 A
CAN-H	4		
CAN-L	5		

Cables to be used for the system 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).
- Cable with braided shielding connected to pin 1.



NOTICE:

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

6.2.2 Power connections

The MGLFP243230 battery model is equipped with Amphenol SurLok Plus power connectors. This provides a safe, easy and fast installation. Especially in systems at higher voltages.

Table 8 show the available connector plugs that fit the battery terminals.

Table 8 - Power terminal overview

Terminal Plug	Color	Cable size	Brand	MPN	MG part
Positive	Orange	50 mm ²	Amphenol	SLPPC50BSO0	MG5001172
Negative	Black	50 mm ²	Amphenol	SLPPC50BSB2	MG5001171
Positive	Orange	70 mm ²	Amphenol	SLPPC70BSO0	MG5001170
Negative	Black	70 mm ²	Amphenol	SLPPC70BSB2	MG5001169
Positive	Orange	95 mm ²	Amphenol	SLPPC85BSO0	MG5001061
Negative	Black	95 mm ²	Amphenol	SLPPC85BSB2	MG5001060

The keying that is used on the connector are as follows:

Table 9 - Connector keying overview

Connector	Key
Negative 	60°
Positive 	90°

6.2.3 Exhaust connection

The LFP IP battery is provided with a gas exhaust connection. This connection has the function of extracting the released gasses during an emergency situation. The released gasses are toxic, corrosive and might be explosive. Extracting these gasses to a safe and open area will add additional safety to the complete battery installation. Figure 7 shows the exhaust connection marked in red.

Exhaust	
Material	Aluminium
Outside diameter	40 mm



Figure 7 - Exhaust connection marked in red

7 BATTERY MODULE PROPERTIES

This chapter describes detailed information about the properties and behaviour of the LFP battery modules.

7.1 Internal resistance

The internal resistance of LFP modules depends on different factors. The main factor(s) influencing the resistance is temperature, and SOC (state of charge) and SOH (state of health). More extensive values can be found in Table 4.

Table 10 - Average module internal resistance LFP modules (new condition)

Model	Total pack resistance [mΩ] @ 25 °C	Heat rejection at 0.5C [W]	Heat rejection at 1C [W]
MGLFP24x230 (230Ah)	6	80	318

7.2 Internal resistance change towards EOL

All Lithium-Ion cells will age and lose some performance during use. This aging will affect different factors but mainly the internal resistance and capacity. Temperature and DOD (depth-of-discharge) are leading factors in the aging process. In general, the higher the temperature of the module during use, the faster the aging. Same is true for DoD, cell aging is worse if full cycles (100% DoD) occur on a regular base.

As a guideline for the change of internal resistance of the module, it can be expected to increase by 50% during its life (EOL is defined here at 70% SOH). This practically means that the heat generated by each module could increase over its lifetime.

Table 11 - Expected module internal resistance RS modules (EOL condition)

Model	Total pack resistance [mΩ] @ 25 °C	Heat rejection at 0.5C [W]	Heat rejection at 1C [W]
MGLFP24x230 (230Ah)	9	119	476

7.2.1 Important note on heat rejection (air-cooling)

The values given in table 1 and 2 can be used to make an approximation on the heat rejection of a system, but it has to be used with caution. Due to the specific heat of the system (due to the module mass) most energy that is generated is “stored” in the mass of the system. This means that high load peaks don’t directly lead to a significant increase in temperature. This will take some time to build-up and dissipated to the environment.

7.3 Short-circuit currents

The short-circuit currents are highly dependent on the temperature of the module. Second (less significant) factor is SOC, but due to the flat voltage charge/discharge curve. Worst-case scenario should be around the nominal voltage range of the LFP module (3.1Vdc - 3.3Vdc).

High and low values of SoC will lead to an increase of internal resistance, hereby limiting the short-circuit currents.

Calculations in Table 1 are based on a 26.4V module voltage and a 0 mΩ short-circuit load.

Table 12 - Detailed specifications of LFP modules (internal resistance & short circuit current)

Module temperature	Configuration	Module internal resistance [mΩ]	Module peak short-circuit current [kA]
10 °C	MGLFP24x230 (230Ah)	8.5	3.1
25 °C	MGLFP24x230 (230Ah)	6	4.4
45 °C	MGLFP24x230 (230Ah)	4	6.6

8 INTEGRATION

This chapter describes the necessary requirements, instructions and advice for integration of the battery module into the application.

8.1 Risk assessment

Performing a risk assessment for the integration of the battery system is depending on the application for which specific rules might apply. For example in a Marine application, class register rules might apply or on other cases standard CE-marking might apply.

MG Energy Systems can supply the necessary basic documentation for risk assessment.



NOTICE:

Before integration design check the applicable rules for the application where the battery system will be integrated in.

8.2 Location

The location of the battery system needs special attention, since some regulatory body categorize Lithium-Ion battery systems as hazardous. Check for the local rules for the requirements of the battery system location in the used application.

General recommendations and requirements for the battery space with respect to the battery module are as following:

- Make sure the battery space is in accordance with the applicable rules.
- Ensure the battery space complies with the operating conditions of the batteries.
- Do not place the batteries next to a heat source.
- Accessibility for commissioning and service of battery modules must be maintained.
- Take into account the placement requirements in chapter 8.3.

8.2.1 Environment

The battery modules have an IP rating of IP65. Placement of the battery modules must be in a dry space that is moisture and dust free, non-condensing and protected against fluid ingress (water, oil etc.) from top and bottom.



WARNING:

Moisture or water can damage the battery and its electronics. This might lead to dangerous situations.



To protect the battery modules from both mechanical abuse and external environmental elements (such as water, moisture or fire), a solution could be to place the battery modules in a steel box or sealed compartment. The design and the requirement of applying a battery box may depend on the type of application, the outcome of a risk assessment, local regulations or additional safety measures prescribed by insurance companies.

For the implementation of a battery compartment the following additional measures could be included in the design:

- Isolated for 60 minutes fire retardant (A60).
- Fluid and gas tight.
- Gas exhaust connection to outside (safe area).
- Manual or automatic flooding option of the battery compartment.
- Temperature and/or smoke sensor.
- No electrical switching equipment or junction boxes inside.
- Place the battery modules with at least 10 mm clearance from the floor/bottom.
- Accessibility for commissioning and service of battery modules must be maintained.



NOTICE:

Respect the thermal management notes of the battery module in 8.2.2 and 8.2.3 when used in sealed spaces or compartments.



NOTICE:

Also find the guidelines for placement of batteries in a battery compartment on the [MG Download Center](#)

8.2.2 Thermal management

The LFP IP Series battery modules are passive cooled. Therefore ambient temperature needs to be taken into account when selecting a space for the installation of the batteries.

- Make sure there is sufficient air flow in the battery space to dispose the heat rejected by the batteries and/or other equipment.
- The most optimized ambient temperature for the batteries is around 25 °C.



NOTICE:

Take into account the heat rejection of other equipment in the same space of the batteries.



NOTICE:

A significant decrease of cycle life will occur when the battery modules are used at high ambient temperatures.

If forced air ventilation is used for the battery room please make sure the environmental specifications are met. Temperature difference should in no way cause condensation on the battery module nor on other parts of the battery room.

8.2.3 Heat rejection

The heat rejection can be calculated from the internal resistance of the battery module. For detailed information refer to chapter 7.1 and 7.2.

8.3 Placement

This chapter will explain the design requirements for placement of the battery modules.

8.3.1 Positioning the battery

The battery module may be placed upwards only.



Figure 8 - Mounting positions of the LFP models



NOTICE:

Other mounting positions might be allowed on request. Contact MG Energy Systems B.V. to discuss the possibilities.

8.3.2 Mounting considerations

Mounting of the battery modules can be either done with the included brackets. Mounting using straps is also an option, but not included in the scope of delivery.

8.3.2.1 Mounting using the mounting brackets

Place the mounting brackets on the battery enclosure and use screws or bolts to fasten them.



Figure 9 - Brackets mounting example

8.3.2.2 Example for strap mounting

Figure 10 shows an example of strap mounting of the batteries.



Figure 10 - Strap mounting example

8.4 Electrical

This chapter describes the installation and connections of the electrical wiring.

8.4.1 Power cables

Cable lengths and diameters need to be taken into account when designing a battery system. Batteries can be placed in parallel, for example in 24 VDC systems, or in series up to 560 VDC.



NOTICE:

- Use the correct cable type for the applicable system voltage.
- Use the correct fuses for the applicable cable cross-section and voltage.
- We recommend to size the cables to limit voltage drop to 1% or less.

8.4.2 Fuses

In the Lithium-Ion battery system, fusing is an important part of the electrical system design. Lithium-Ion batteries have a very low internal resistance and this results in a high short-circuit currents. Always select fuses that can handle the system voltage and the short-circuit current of the battery. The fuse will protect the battery and also the connected power cables. Therefore the sizing of the fuse must match the cable diameter that is used.

Always take into account the regulation applied for the specific application when designing an electrical system with batteries.

See this [link](#) for a detailed explanation about Lithium-ion batteries and fuses.



WARNING:

- The breaking capacity of the selected fuse must be higher than the short-circuit current the battery can generate.
- The maximum voltage of the fuse must be higher than the highest system voltage.

- The current rating must match the current rating of the cable diameter.

8.4.3 Parallel configuration

The battery module can be set in parallel to create a larger system capacity. The MG Master BMS can handle up to 96 LFP battery modules.



CAUTION:

Make sure the voltage of each battery module is equal when connecting them in parallel. Excessive high uncontrolled currents can flow between battery modules when the voltage is not equal. This can damage the batteries and might lead to other damage or injury.



NOTICE:

The power cables of each battery module need to have matching lengths as good as possible when connecting battery modules in parallel.

Battery modules can be connected separately in parallel to a Master LV. It has four power connection positions where four batteries can be connected. Refer to the [Master LV manual](#) for more information.

Figure 11 shows the most basic parallel connection that is possible. The power connection of each battery is directly connected to a Master LV.

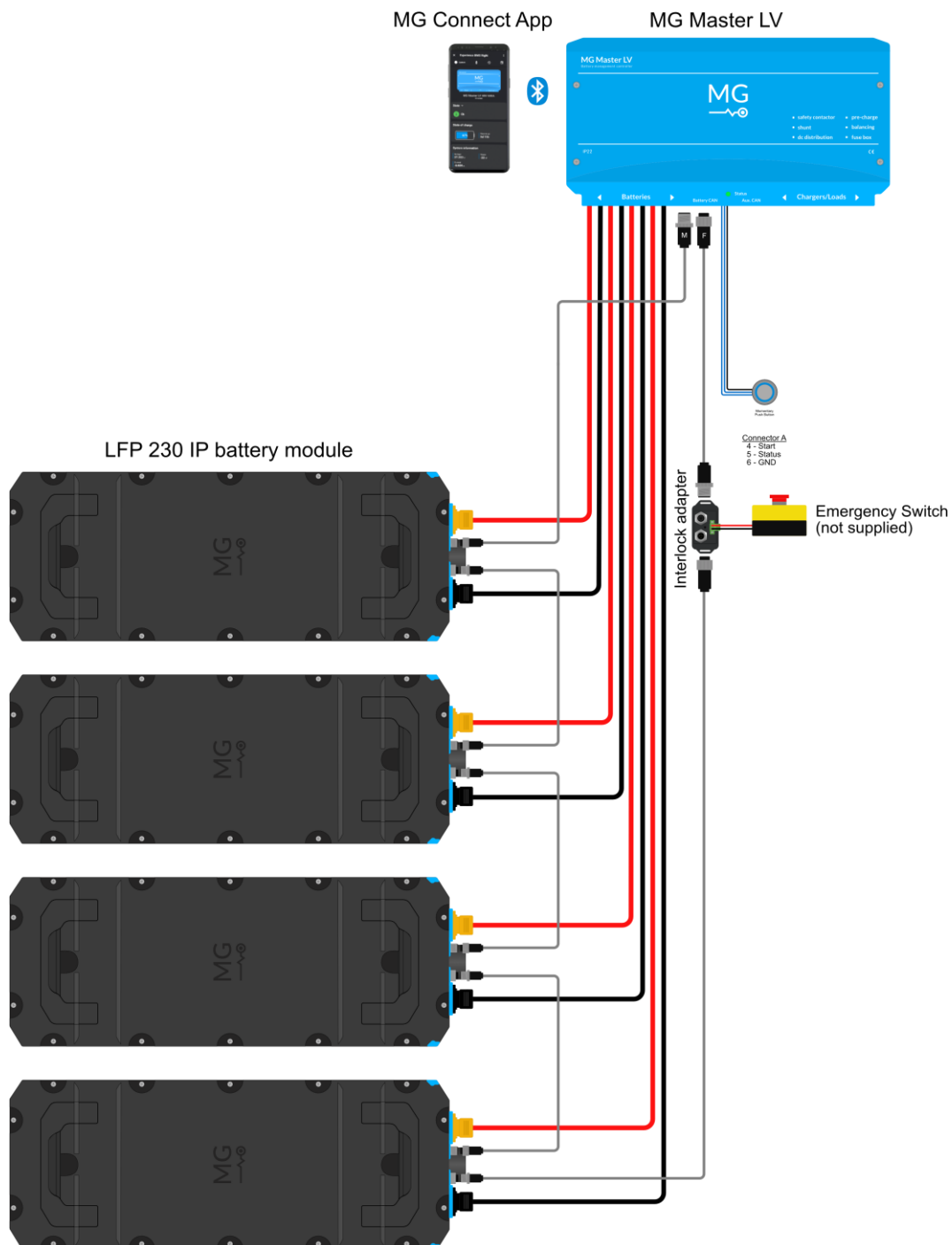


Figure 11 - Four battery module connected in parallel on a single Master LV. Cables must have matching lengths.

There are multiple options when connecting more than four batteries in parallel.

1. Paralleling using the Distributor LV.
2. Paralleling using a custom bus bar connection system.

8.4.4 Paralleling using the Distributor LV

One of the options is to parallel battery modules using the MG Distributor LV (MGLVDIST01001). Basically this DC distribution box has a positive and negative bus bar with the possibility to place fuses. Refer to the manual of the MG Distributor LV for more details.

Figure 12 shows an example of paralleling battery modules using the MG Distributor LV's.

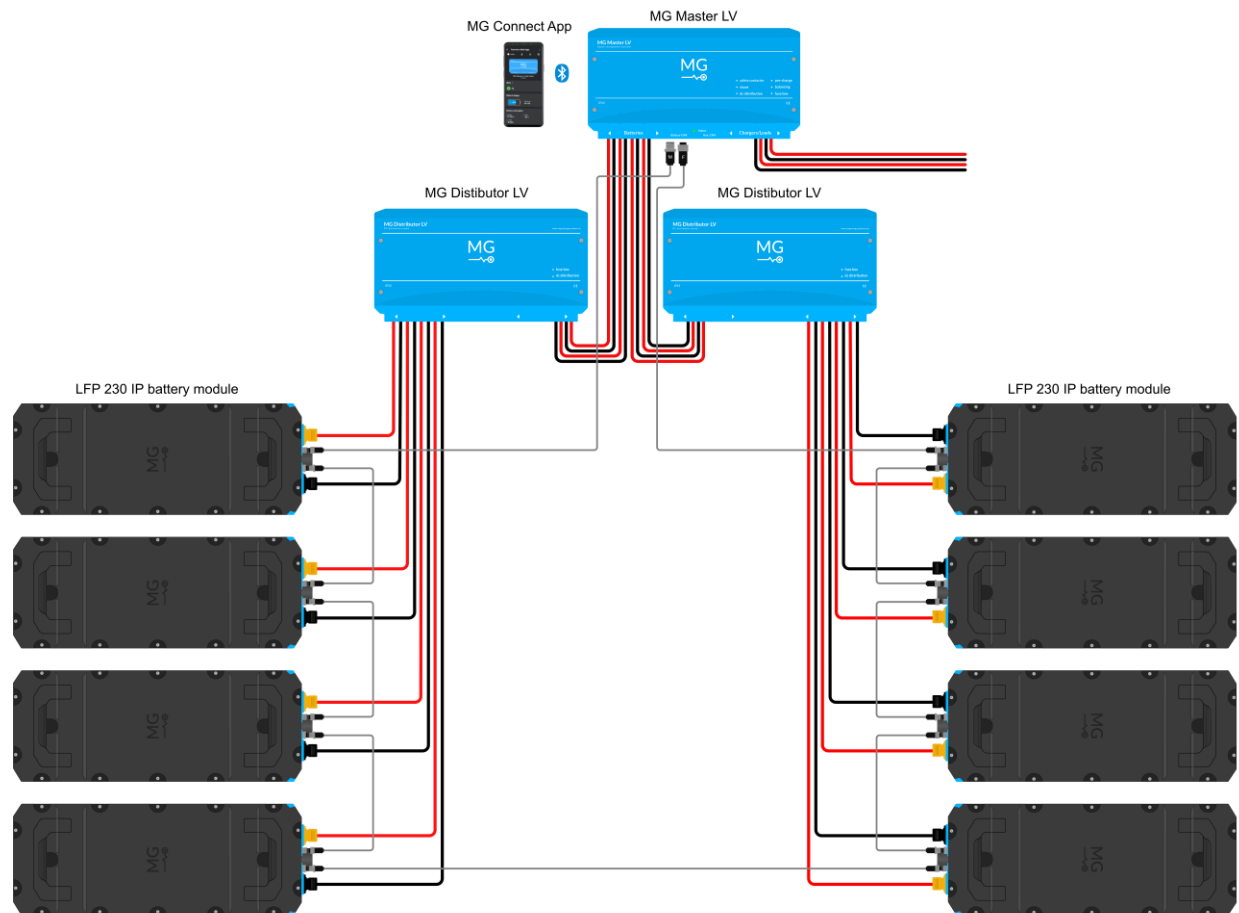


Figure 12 - Example of parallel connection with MG Distributor LV's



CAUTION:

When batteries are connected in parallel. Make sure each battery or battery string is fused.

8.4.5 Paralleling using a custom bus bar connection system

Designing a custom DC-busbar system is beyond the scope of this manual.

8.4.6 Series configuration

The battery modules can be connected in series. Table 13 shows the maximum number of battery modules in series per battery type.

Table 13 - Maximum number of modules in series per battery type.

Article number	Voltage range	Maximum number of modules in series
MGLFP243230	24 V up to 563 V	22

WARNING:



- Make sure high voltage battery systems cannot be accessed by non-authorized people or personnel.
- Mark the space of the high voltage battery installation with warning signs of **ELECTRICAL SHOCK** and the applicable signs according to the local rules and regulation.



NOTICE:

Some regulations require a manual service disconnect.

Figure 13 shows an example system of 6 battery modules in series connected to a MG Master HV.

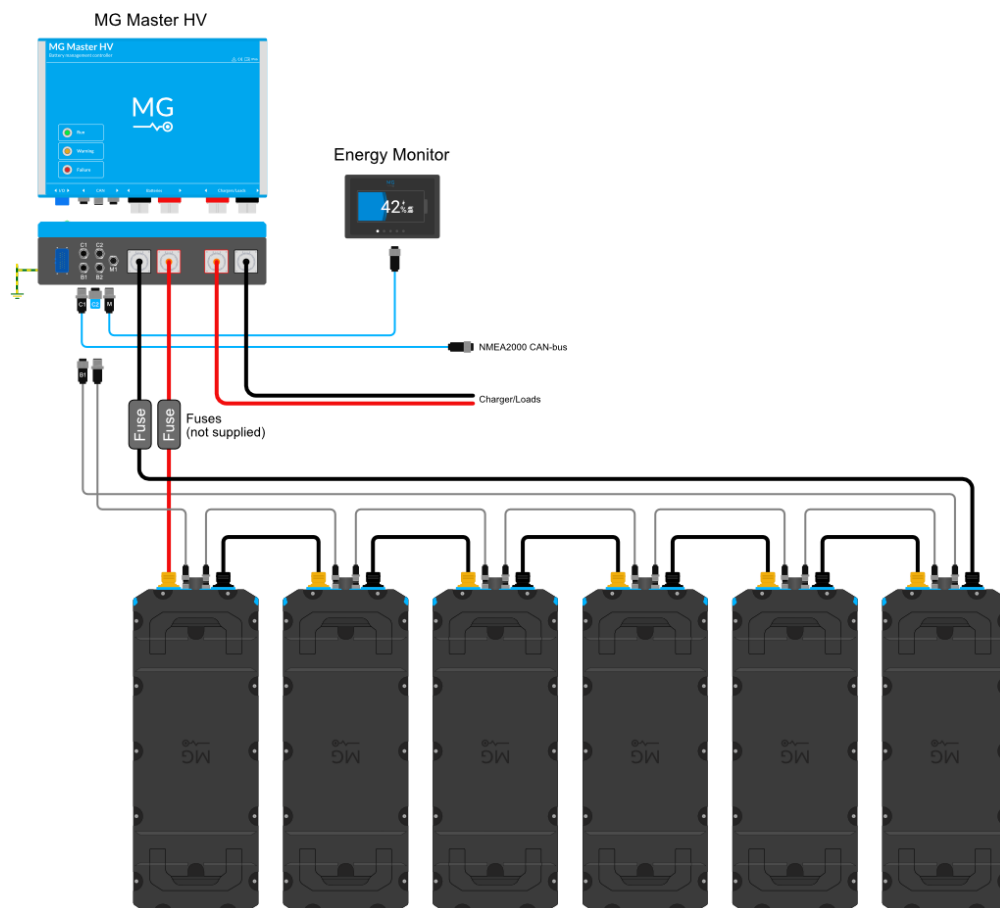


Figure 13 – Series configuration example


WARNING:

In systems with voltages > 58 V an insulation monitor is required.


NOTICE:

- Use the correct cable type for the applicable system voltage.
- Use the correct fuses for the applicable cable cross-section and voltage.

8.4.7 Charging

Any charger with constant voltage (CV) constant current (CC) charging can be connected to the MG battery system. Important is that the charger can be stopped by the MG Master BMS when the batteries are fully charged. Therefore the charger needs to have the ability to stop and start it remotely with a dry contact. There are also a number of chargers available that are digitally controlled by the MG Master BMS. Refer to the MG Master LV or MG Master HV manual for more details.

8.4.7.1 Periodic charging

It is important to charge the batteries regularly to 100%. This is necessary to recalibrate the State-of-Charge. The time of this period depends on the application and usage. Typically once a week should be sufficient.


NOTICE:

Recalibration of the SOC is performed at the end of the charge cycle. This means that sometimes the SOC is already at 100%, but the charger is still charging. It is important to let it charge until the Master BMS stops the charging.

8.4.7.2 Charger settings

Chargers that are controlled with on/off need to use the following voltage settings.

Absorption voltage	28,2 VDC
Float voltage	26,4 VDC

This is the voltage setting for one battery. Multiply this by the number of batteries in series for system voltages > 24 VDC.

9 INSTALLATION

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

Additional information for installation:

- Quick installation guide: [LFP 24V 230 IP](#)
- [Technical drawings](#)



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 local health and safety regulations for working on battery systems are followed.
-

9.1 Tooling

For the installation of this product are no specific tools required. Make sure you have tools to mount the brackets to the surface. This can be done with different methods like screws or bolts. The power cables have SLP connectors on the battery side, but the MG Master LV side has M8 bolt connections therefore a torque wrench M8 (13 mm) (insulated) is required.

9.2 Installation procedures

Below the basic installation procedures at battery module level.

1. Mount the battery module: Mounting procedure;
2. Connect the battery module electrically: Electrical connection procedure;
 - a. Power connections.
 - b. CAN bus connections.



NOTICE:

During installation the commissioning chapter 10 for check list.

9.3 Mounting procedure

The battery module has specific mounting brackets to fixate the battery module onto a surface. Figure 14 shows an example of mounting the batteries on a wooden surface using the brackets.



Figure 14 - Example installation method using the mounting brackets

9.4 Electrical connection procedure

Before any electrical connection can be performed, remove the front cover from the battery module.



ELECTRICAL HAZARD:

The battery modules can be placed in series up to 563 V. Make sure to wear proper insulation gloves and safety goggles/mask.



ELECTRICAL HAZARD:

Before connecting the DC cables, make sure the other ends are protected or connected to the MG Master BMS or a DC-distribution system.



NOTICE:

The red protection caps protect the battery connectors from dust, moisture and particles during installation. Remove these caps only right before connecting the power cables.

Before connecting any power cable make sure the other end of the cable is connected to the MG Master BMS or a DC-distribution system.

Below the procedure for connecting the power and CAN bus cables to the battery.

1. Connect the SurLok connectors until it clicks. Pull each connector to make sure it is locked.



2. Connect the M12 CAN-Bus cables and terminators. When a front cover is installed then use 90 deg. CAN bus connectors. Place a terminator at the end of the CAN bus.



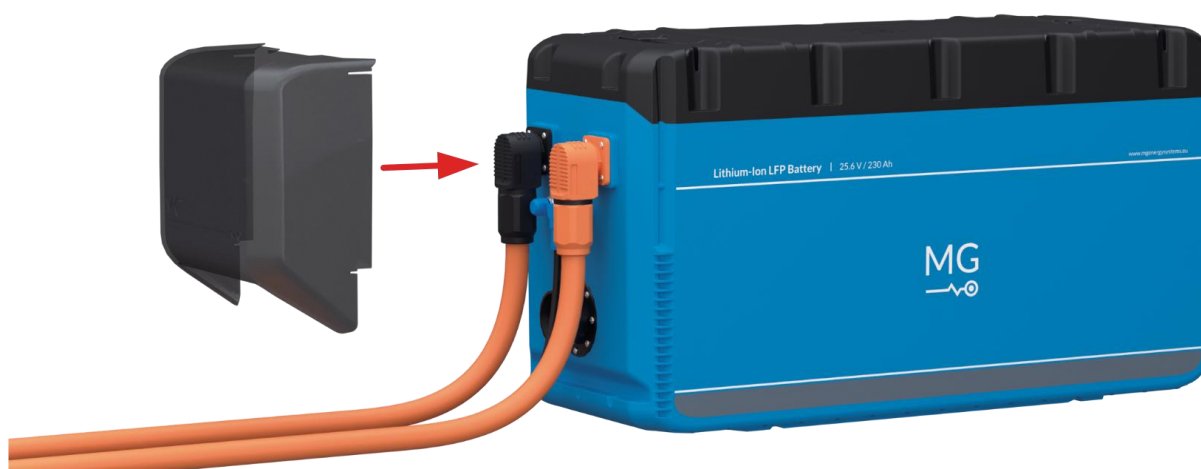
3. Do not obstruct the front flange to ensure smooth air flow.



4. Optional: Mount the exhaust system. The exhaust pipe needs to have an inner diameter of 42 mm. Use a hose clamp for fixation.



5. Optional: Install the front cover for protection of the cables and connections.



NOTICE:

The cover can be clicked on the front of the battery or by sliding it in from the top.

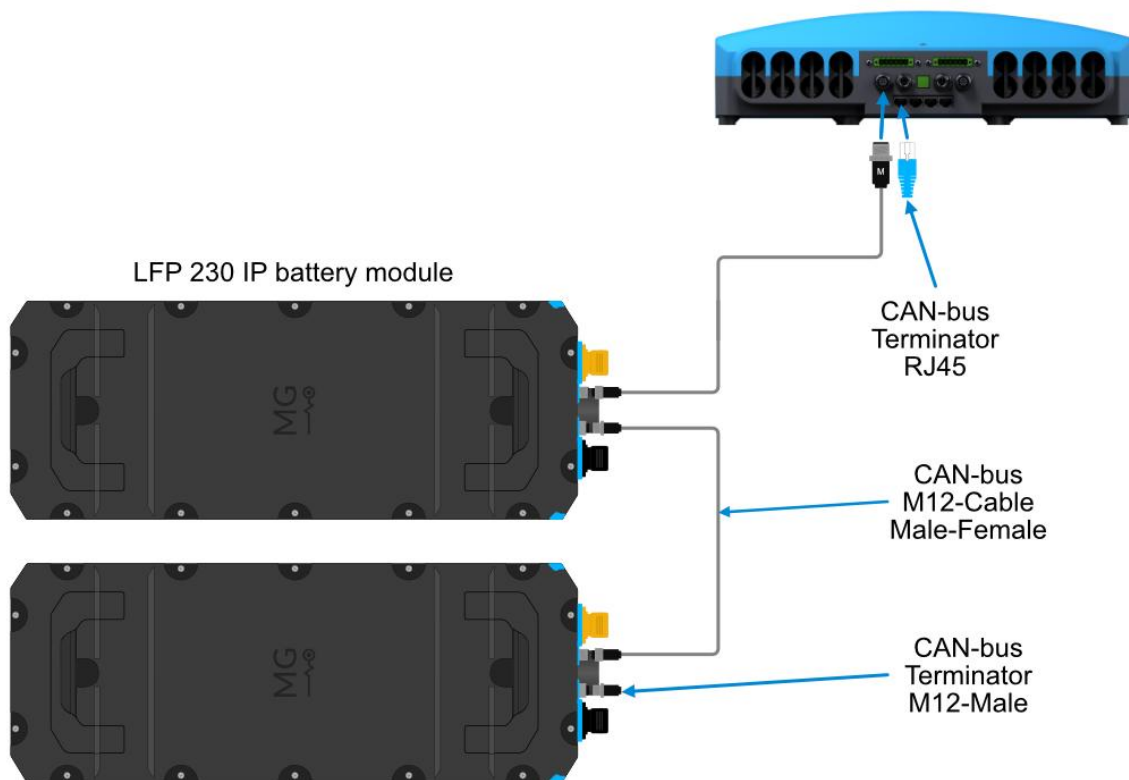
9.4.1 CAN-bus connection procedure

The battery modules communicate with a CAN-bus system to the MG Master BMS. This connection is with M12 connectors. However, the MG Master LV and MG Master HV can have different connection configurations. For more information about the CAN-bus communication connection possibilities, refer to the MG Master LV, MG Master HV manual.

9.4.1.1 Basic connection

The most basic connection is as follows:

1. Start with a CAN-bus cable at the MG Master BMS, the Battery CAN-Bus, and go to the first battery. (For the Master LV start at the most left M12 connector).
2. Connect from the first to the second battery. Repeat this until the last battery module.
3. Place a termination resistor at the end and begin of the CAN-bus network.



WARNING:

Use the termination resistors delivered with the MG Master BMS. 3rd party termination resistors could damage the devices, because pinning could be different.

10 COMMISSIONING

Table 14 shows a list of points that need to be checked after installation.

Table 14 - Commissioning steps procedure

	Description
☐	Is a risk assessment performed?
☐	Are the location and placement requirements in chapter 8.2 and 8.3 met?
☐	Are the battery modules clean from any dust, metal pieces and loose wires?
☐	Are the batteries secured?
☐	Are all battery terminal connectors plugged in until clicked?
☐	Are all CAN-bus cables connected?
☐	Are CAN-bus termination resistors installed in the correct way?
☐	Make sure there is not any equipment connected directly to the batteries.
☐	Perform a partial charge/discharge test run and measure the temperature of the battery terminals during the test. Is there excessive heat generation in the system or system components?
☐	Make a "Support Request". This can either be done with the MG Diagnostic Tool or MG Connect App. See following links for details: - MG Diagnostic Tool - MG Connect App
☐	Make pictures of the installation.
☐	Send the pictures and this form together with the system commissioning form to support@mgennergysystem.eu with the subject: <project name> - Commissioning.



NOTICE:

For the system commissioning procedure, refer to the manual of the MG Master LV or MG Master HV. If no commissioning procedure is available in the manual, contact MG Energy Systems.

11 DECOMMISSIONING PROCEDURES

This chapter describes procedures to decommission the battery system or module in several situations.

11.1 Procedure: removing a malfunctioning battery module

This chapter describes the procedure to follow if a malfunction in a battery module has occurred.



WARNING:

- Use the correct personal safety gear.
 - The released gasses during a thermal runaway are explosive and toxic.
 - Always consult the local safety protocols before performing any procedures.
-



NOTICE:

The procedures in this chapter are indicative and can differ depending on the situation, (local) regulations and standards. Therefore MG Energy Systems B.V. cannot accept responsibility for damage, injury, or expenses resulting thereof.

11.1.1 Detecting malfunctioning

A malfunctioning battery module can lead to a number of different situations that takes the complete battery system out of operation. The list below shows the most plausible alarms that can occur on the MG Master BMS.

- High temperature alarm;
- Damaged temperature sensors alarm (at least 2);
- Damaged BMS: no communication, no temperatures, voltages etc;

Other signs of a malfunctioning battery module:

- Low insulation resistance;
- Leakage detection alarm;
- Smoke/gas released from the battery module enclosure;
- Enclosure of battery module has a higher temperature comparing to the other battery modules;
- A battery module emits an unusual smell.
- A battery module such a high temperature that it cannot be touched.
- A battery module changes colour and/or shape.

These alarms and signs, but not limited to, are an indication for a malfunctioning battery module.



NOTICE:

In case of the suspicion of a malfunctioning battery module or any anomalies pointing towards this. It is mandatory to stop the battery system from operating and contact MG Energy Systems B.V. for specific instructions.

11.1.2 Monitoring the battery module

Depending on the situation and damage, several actions may be taken.

11.1.2.1 Example situation 1

One of the battery modules in a system is malfunctioning and is still communicating with the MG Master BMS. In that case the temperature of the particular battery module can be monitored by the MG Diagnostic Tool or any other monitoring system which is digitally connected to the MG Master BMS.

11.1.2.2 Example situation 2

One of the battery modules in a system is malfunctioning and is not communicating anymore with the MG Master BMS. In that case it is advised to monitor the temperature of the battery module in another way, for example a thermal imaging camera or external temperature sensor(s).

11.1.3 Remove and secure the battery module

The following procedure is only applicable when the battery module has cooled down, and thermally stable to ensure a safe removal of the battery module.

1. Take the system out of operation. Contactors of the MG Master BMS open.
2. Disconnect the main power connectors or remove the fuses from the MG Master BMS and in other location of the battery system.
3. Find and inspect the particular battery module.
4. Before removing the battery module, verify whether the temperature has cooled down within safety levels. This can be checked with either a thermal imaging camera or using the MG Diagnostic Tool if possible.



WARNING:

Wear protective clothing and gloves to avoid injuries through heat.

5. Disconnect the power and communication cables from the particular battery module.



ELECTRICAL HAZARD:

When there is a low insulation resistance in the battery system or battery module, make sure using proper insulation gloves before touching any parts of the battery system.

6. Remove the battery module.
7. Place the battery module in a water filled container at a safe location, for example outside or in a special container. The temperature of the battery module will be kept low and the module is secured from a new event.



NOTICE:

In some cases it is not possible to remove and secure the battery module immediately. In those situations it is mandatory to constantly monitor the temperature of the battery module to be prepared for any emergency situation.

11.2 Procedure: removing a battery module from a functioning system

In some cases batteries need to be removed from a correct functioning system to be stored for a longer period of time and reinstalled later. This chapter describes the procedures for removing the batteries and prepare them for storage. Before starting the removal procedure make sure the battery bank is charged between 50 % and 70 % SoC.

11.2.1 Removing battery modules

The following procedure is only applicable when the battery module has cooled down, and thermally stable to ensure a safe removal of the battery modules.

1. Take the system out of operation. Contactors of the MG Master BMS open.
2. Disconnect the main power cables and/or fuses from the MG Master BMS.



ELECTRICAL HAZARD:

Use proper insulation gloves before removing any parts of the battery system.

3. Disconnect all power cables from the batteries.
4. Disconnect all communication cables from all batteries.
5. Remove each battery module one by one.
6. Prepare the modules for a long storage period.

11.2.2 Prepare the battery module for a longer storage period

Additional preparations are required when the battery modules are stored for a longer period of time and are removed from a correct operating system.

- Make sure the battery modules are charged between 50 % and 70 % SoC.
- Make sure the storage requirements from chapter 3.2 are met.

12 SERVICE

12.1 Maintenance

For maintenance it will be sufficient to inspect the following points once a year:

- Check if the batteries are secured.
- Check the electrical connections on torque.
- Check if all communication connections are mated.
- Check for traces of water, oil, moisture, any other fluids or dust.
- Check for signs of corrosion.
- Clean the device.
- Check status with the [MG Diagnostic Tool](#), [MG Connect App](#) or [MG Energy Portal](#).



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.

12.1.1 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 of 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.

12.2 End-of-life

The battery module is considered end-of-life if the SoH is decreased to 70 %. After this period it is strongly advised to replace the battery module to ensure safety.

12.3 Disposal

Batteries marked with the recycling symbol must be processed locally via a recognized recycling agency. By agreement, they may be returned to the manufacturer. Batteries must not be mixed with domestic or industrial waste. Before disposal it is recommended to discharge the battery module to 0 VDC.

13 BOUNDARY LIMITS

The boundary limits that are used by the master for the battery modules are listed in this chapter. A level will be triggered when a boundary condition is true for a defined period of time.

Battery thresholds are compatible with the following master BMS firmware versions or higher:

- Master HV 1.31 or higher
- Master LV 1.40 or higher

13.1 Limits

Boundary limits are defined to keep the battery within manufacturer's specifications.

The tables with the boundary limits consist of:

- *Description*; Description of the boundary limit;
- *Trigger action*; Action response of the boundary limit;
- *Condition*; Contains a required condition of a value triggering the action in combination with the time delay;
- *Delay*; The amount time a condition must be met before an indication will be activated or deactivated. A delay time with "+" starts counting when the previous condition is reached.

13.1.1 Trigger actions

Different actions are triggered for the parameters and conditions in the boundary limit tables followed by this paragraph. The list below gives all the possible trigger actions and their description. When the tables shows a trigger action that sets a particular flag, it will set the flag of the description in the corresponding flag register. For example. If an "Over voltage warning" condition is true, it will set the "Over voltage" flag in the warning register.

- *Status flag*; This flag is in a general purpose status register. Depending on the configuration of the connected Master BMS it might also trigger digital outputs. For example the Allow-to-Charge relay or the Allow-to-discharge relay.
- *Warning flag*; This flag is in the warning register. Depending on the configuration of the connected Master BMS it might also trigger digital outputs. For example the Programmable relay.
- *Fail-safe flag*; This flag is in the fail-safe register. When a corresponding parameter flag is set then this will trigger the Master BMS to open its main safety contactor.
- *Safely lock flag*; This is a single flag. When this is set, it will open the main safety contactor of the Master BMS and lock it to prevent start-up. It can be unlocked after a check-up by a certified dealer. Contact MG Energy Systems B.V..

13.1.2 Cell voltage

Table 15 Cell voltage boundary limits slave BMS

Charging				
Description	Trigger action		Condition	Delay
Almost charged	Set	Status flag	$\geq 3440 \text{ mV}$	10 sec.
	Clear		$< 3390 \text{ mV}$	10 sec.
Charged	Set	Status flag	$\geq 3520 \text{ mV}$	+10 sec.
	Clear		$< 3440 \text{ mV}$	10 sec.
Over voltage warning	Set	Warning flag	$\geq 3600 \text{ mV}$	+20 sec.
	Clear		$< 3520 \text{ mV}$	20 sec.
Over voltage critical	Set	Fail-safe flag	$\geq 3650 \text{ mV}$	+5 sec.
Over voltage safety lock	Set	Lock flag	$\geq 3850 \text{ mV}$	-

Discharging				
Description	Trigger action		Condition	Delay
Almost discharged	Set	Status flag	$\leq 3100 \text{ mV}$	10 sec.
	Clear		$> 3150 \text{ mV}$	10 sec.
Discharged	Set	Status flag	$\leq 3000 \text{ mV}$	+10 sec.
	Clear		$> 3100 \text{ mV}$	10 sec.
Under voltage warning	Set	Warning flag	$\leq 2900 \text{ mV}$	+20 sec.
	Clear		$> 3000 \text{ mV}$	20 sec.
Under voltage critical	Set	Fail-safe flag	$\leq 2850 \text{ mV}$	+5 sec.
Under voltage safety lock	Set	Lock flag	$\leq 1850 \text{ mV}$	-

13.1.3 Cell temperature charging

Table 16 Cell temperature charging boundary limits slave BMS

Over temperature				
Description	Trigger action		Condition	Delay
Over temperature alert	Set	Status flag	$\geq 43 \text{ }^{\circ}\text{C}$	5 sec.
	Clear		$< 42 \text{ }^{\circ}\text{C}$	5 sec.
Over temperature	Set	Warning flag	$\geq 45 \text{ }^{\circ}\text{C}$	+20 sec.
	Clear		$< 43 \text{ }^{\circ}\text{C}$	20 sec.
Over temperature critical	Set	Fail-safe flag	$\geq 50 \text{ }^{\circ}\text{C}$ and charge current > 5% battery capacity	+60 sec.
Over temperature safety lock	Set	Lock flag	$\geq 65 \text{ }^{\circ}\text{C}$	-

Under temperature				
Description	Trigger action		Condition	Delay
Under temperature alert	Set	Status flag	$\leq 1 \text{ }^{\circ}\text{C}$	5 sec.
	Clear		$> 2 \text{ }^{\circ}\text{C}$	5 sec.
Under temperature	Set	Warning flag	$\leq 0 \text{ }^{\circ}\text{C}$	+20 sec.
	Clear		$> 1 \text{ }^{\circ}\text{C}$	20 sec.

Under temperature critical	Set	Fail-safe flag	$\leq -5\text{ }^{\circ}\text{C}$ and charge current > 5% battery capacity	+60 sec.
Under temperature safety lock	Set	Lock flag	$< -35\text{ }^{\circ}\text{C}$	-

13.1.4 Cell temperature discharging

Table 17 Cell temperature discharging boundary limits slave BMS

Over temperature				
Description	Trigger action		Condition	Delay
Over temperature alert	Set	Status flag	$\geq 53\text{ }^{\circ}\text{C}$	5 sec.
	Clear		$< 52\text{ }^{\circ}\text{C}$	5 sec.
Over temperature	Set	Warning flag	$\geq 55\text{ }^{\circ}\text{C}$	+20 sec.
	Clear		$< 53\text{ }^{\circ}\text{C}$	20 sec.
Over temperature critical	Set	Fail-safe flag	$\geq 60\text{ }^{\circ}\text{C}$	+60 sec.
Over temperature safety lock	Set	Lock flag	$\geq 65\text{ }^{\circ}\text{C}$	-

Under temperature				
Description	Trigger action		Condition	Delay
Under temperature alert	Set	Status flag	$\leq -19\text{ }^{\circ}\text{C}$	5 sec.
	Clear		$> -18\text{ }^{\circ}\text{C}$	5 sec.
Under temperature	Set	Warning flag	$\leq -20\text{ }^{\circ}\text{C}$	+20 sec.
	Clear		$> -19\text{ }^{\circ}\text{C}$	20 sec.
Under temperature critical	Set	Fail-safe flag	$\leq -25\text{ }^{\circ}\text{C}$ and discharge current > 10% battery capacity	+60 sec.
Under temperature safety lock	Set	Lock flag	$< -35\text{ }^{\circ}\text{C}$	-

13.1.5 Power terminal temperature

Table 18 Power terminal temperature boundary limits slave BMS

Description	Trigger action		Condition	Delay
Over temperature alert	Set	Status flag	$\geq 60\text{ }^{\circ}\text{C}$	5 sec.
	Clear		$< 59\text{ }^{\circ}\text{C}$	5 sec.
Over temperature	Set	Warning flag	$\geq 70\text{ }^{\circ}\text{C}$	+20 sec.
	Clear		$< 60\text{ }^{\circ}\text{C}$	20 sec.
Over temperature critical	Set	Fail-safe flag	$\geq 80\text{ }^{\circ}\text{C}$	+60 sec.

13.1.6 Current

Table 19 Current boundary limits slave BMS

Charging				
Description	Trigger action		Condition	Delay
Charging over current warning	Set	Warning flag	> 1.0C	10 sec.
	Clear		<= 1.0C	10 sec.
Charging over current critical	Set	Fail-safe flag	> 1.2C	+20 sec.

Discharging				
Description	Trigger action		Condition	Delay
Discharging over current warning	Set	Warning flag	> 1.0C	10 sec.
	Clear		<= 1.0C	10 sec.
Discharging over current critical	Set	Fail-safe flag	> 1.65C	+20 sec.

13.1.7 Balancing

Table 20 Balancing boundary limits slave BMS

Description		Condition	Delay
Offset cell voltage		> 25 mV	1 min.
Balancing cell voltage		>= 3350 mV	1 min.
Battery pack current		current within $\pm 5\%$ battery capacity	1 min.

14 TECHNICAL SPECIFICATIONS

The technical specifications of this product can be downloaded from the MG Download Center.

<https://downloads.mgenergysystems.eu/lfp24v/data-sheets/mglfp243230>

15 DIMENSIONS

The dimensions of this product can be downloaded from the MG Download Center.

<https://downloads.mgenergysystems.eu/lfp24v/drawings/total-assembly-230-ip>

16 CONTACT DETAILS

For specific questions please feel free to contact us.

16.1 Sales

For sales related questions, please contact a [local dealer](#).

For specific sales questions, please contact our sales team:

MG Sales team

sales@mgennergysystems.eu

16.2 Technical support

For technical support, please follow the steps below:

1. Consult the Manual.
Manual can be found on the [MG Download Center](#).
2. Consult the [MG Support Center](#).
3. Watch the Installation Videos.
Videos can be found on [MG's You Tube channel](#).
4. Check Your Software Version.
Check and update the products software version to latest using the MG Connect App ([Apple](#) or [Android](#)) or [MG Diagnostic Tool](#).
5. Contact [MG Service Point](#).
6. Contact MG technical support.
Send an email with your technical questions to support@mgennergysystems.eu.