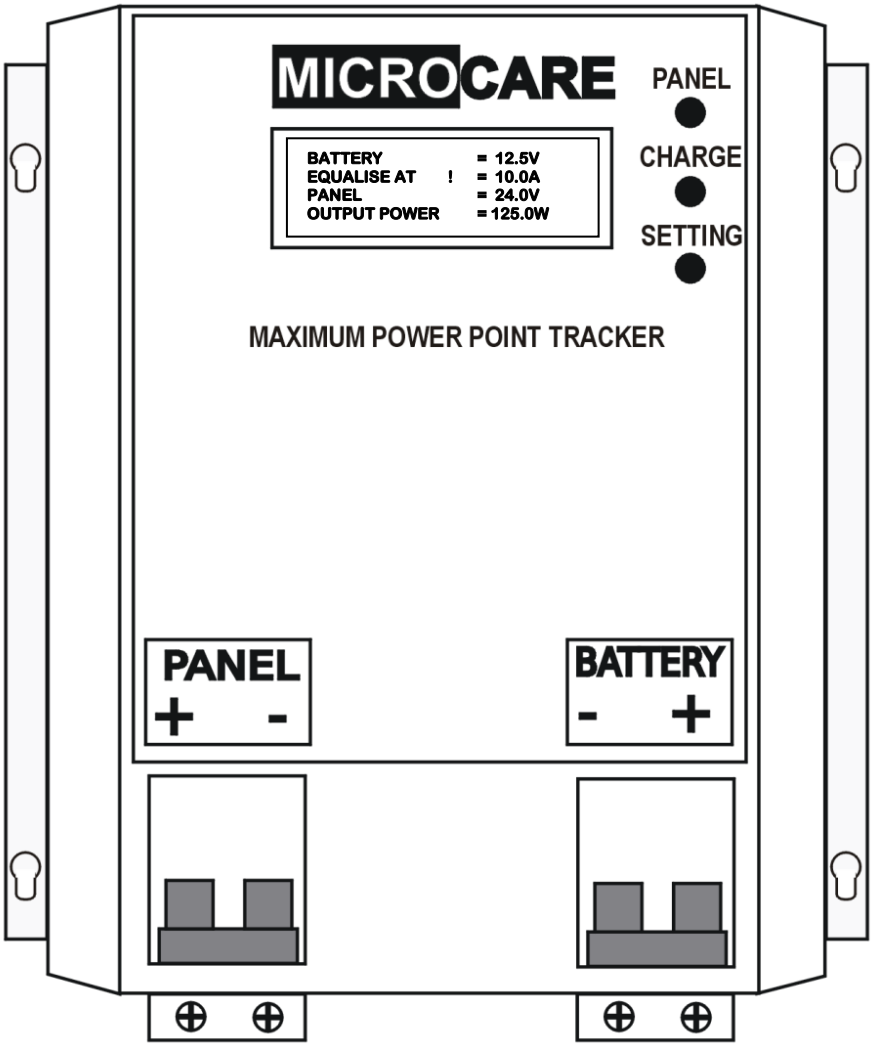
LCD MPPT
20 / 40 / 60 / 100A
User Manual



Manual Version: LCDMPPT-2016-4

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IMPORTANT INFORMATION AND SAFETY INSTRUCTIONS

- Installers should be qualified electricians or technicians.
- The installation information in the manual is for information purposes only.
- The monitoring and operation information in this manual is intended for anyone who needs to operate the MPPT.
- The MPPT input cannot be paralleled with another PV array.
- Read the instructions carefully before installing and operating the MPPT.
- MPPT connection and installation instructions must be followed.
- The unit should only be opened by skilled personal.
- Keep the MPPT clean and dry.
- The MPPT will not operate without batteries connected to the MPPT.
- The MPPT should be installed indoors, in a ventilated and dry area.
- Mount the MPPT vertically.
- Do not install the MPPT on a rugged or inclined surface.
- Do not install the MPPT near water or in damp environments.
- Do not install the MPPT where it would be exposed to direct sunlight.
- Do not remove the MPPT casing.
- Keep the MPPT away from heat emitting sources.
- Do not block the MPPT ventilation openings.
- Do not leave objects on top of the MPPT
- Do not expose the MPPT to corrosive gasses.
- Install the MPPT away from any explosive gasses.
- Ambient temperature: 0°C – 40°C.
- Use panels of the same type and size in an array.
- Sketches are intended for illustrative purposes only and are not intended to provide an electrical design.
- **Damage caused by reverse polarity is not covered by warranty**.
- **Do not exceed the MPPT 150 Volt** maximum input voltage (Voc) rating.
- Refer to your solar module documentation for the worst-case (coldest) module temperature voltage, it should provide the Voc vs. temperature data.
- **Contact the battery manufacturer or supplier for the correct charging specifications.**
- **Incorrect charging can damage or destroy batteries.**

WARNING
High DC voltage present and is capable of causing severe injury.

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PLEASE BE AWARE:

WARRANTY WILL BE NULL AND VOID IF PANEL SURGE PROTECTION IS NOT INSTALLED WITH ALL LCD MPPT INSTALLATIONS

Glossary of Terms & Abbreviations

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AC	Alternating Current
Ah	Rated battery capacity specified in Ampere-Hour
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DC	Direct Current
Flooded Battery	A lead acid battery with access caps for maintaining the electrolyte - replacing water lost during recharge operations. Hydrogen gas discharged during normal recharge
Impp	Maximum power point current
Isc	Short circuit current
LED	Light emitting diode.
Load	Electrical appliance or device to which an electrical voltage is fed
MPPT	Maximum Power Point Tracking
Off-Grid	A system not connected to the grid
PV	Photo Voltaic solar power
Sealed Battery	A lead acid battery with no access to the electrolyte - either valve regulated or gel. No hydrogen gas discharge during normal operation
Solar Array	A collection of Solar Panels.
SoC	State of Charge is the amount of charge in the battery bank expressed as a % of the battery capacity. When SoC = 100% the battery is fully charged. When the SoC is 50% then the battery is half charged
State of Charge	(SoC) Referring to the battery charge condition.
Voc	Open circuit voltage
Vmpp	Maximum power point voltage

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1. INTRODUCTION

1.1 General Description

The Microcare Maximum Power Point Tracker Charge Controller is designed to provide maximum power from the panels into the batteries. Using this system up to 30% more power can be extracted from the panels than using shunt or series pass PWM controllers. The Microcare MPPT is able to charge batteries of a lower voltage than the panel system.

A Liquid Crystal Display shows the status of the system and the data logging information. The unit has various programmable charge regimes which automatically adjust the charge levels when first starting up or if the battery falls below the minimum voltage.

The MPPT will read the battery voltage when first starting up and select whether it is a 12, 24, 36, or 48 volt battery system. It will then read the panel voltage and find the optimum power point. The charging, battery values and charge modes are then adjusted. This series features a durable and continuous 24 hour operation.

The compact and modular design makes installations easy and cost effective. It is a high quality product that offers the best price/performance ratio in the industry.

1.2 Key Features

- 4 X 20 LCD Display.
- Optional Input and Output circuit breaker protection.
- RS232 and Ethernet connectivity.
- Fully programmable.
- 63 Days logger.
- High efficiency design with greater than 96% conversion.
- Low heat dissipation.
- Variable Fan cooling.
- Suitable for any battery set between 12 and 48 Volt with 12V increments.
- Electronically limited charge current 20, 40, 60, 100 Amps. (Dependent on the
- MPPT type)
- Maximum open circuit PV Array voltage 135V_{OC} @ 25 ° C (Open Circuit Voltage).
- Manual or Auto Equalise selection.
- Wall mounted.

1.3 Clarification around the purpose and connection of the MPPT.

What is the main purpose of the MPPT?

The MPPT allows you to take advantage of the mathematics behind power conversion and allows maximum power delivery from the panel.

Let's look at a typical solar panel (the values will be adjusted to make reading/maths easier).

Open circuit voltage = 22 V (Voc)
Short Circuit current = 10.1 Amp (Isc)
Max Power = 170 W

Power point voltage = 17 V (Vmp)
Max Charge current = 10.0 Amp (Imp)

What do these values mean?

Open circuit voltage:
If the panel is exposed to sunlight while the panel is not connected to anything the voltage will be 22 volts.

Power point voltage:
If we connect the panel to the MPPT the panel will be kept around 17V (depending on the temperature of panel, angle of sun etc.) as long as the MPPT has a flat battery to charge.
This is the point at which the panel voltage multiplied by the panel current = max wattage (not max amps or max voltage but the combination of the two).

Short circuit current:
If the panel + and panel – touches, this current will flow.
The panel will be at 10amp when panel voltage is at 17V. If the panel voltage is forced lower, the current will increase.
As voltage decreases, when the panel voltage reaches 0 V then the current will = 10.1 amps.

Max charge current:
As long as the sun gives you 1000 W/m2 and the panel is kept at 25° C (P.S. panel temp rises when a current is flowing) and the panel voltage is kept at Vmp then the Imp will = 10 amps.

Max Power:
Vmp x Imp = 170 W

What Happens When You Charge a Battery?

- Power cannot be created out of nothing and cannot be destroyed, so input = output and Vbattery x Ibattery must = Vpanel x Ipanel
- With a MPPT regulator the panel voltage is controlled independently from the battery voltage and the panel voltage is kept at Vmp allowing Imp to flow. Refer to table 1.3
- With a PWM regulator the panel is connected to the Battery while charging, forcing Vpan to = Vbat, a current slightly higher than Imp will flow, because the panel is directly connected to battery the current must be equal in both, if the current is limited to Imp then the power is limited to Vpan (or Vbat) x Imp. Refer to table 1.4

Table 1.1

MPPT				
Vbat	Ibat	Vpan	Ipan	Power
10v	17 Amp	17v	10 Amp	170w
12v	14.2 Amp	17v	10 Amp	170w
14v	12.2 Amp	17v	10 Amp	170w

Table 1.2

PWM				
Vbat	Ibat	Vpan	Ipan	Power
10v	10.05 Amp	10v	10.05 Amp	100w
12v	10.05 Amp	12v	10.05 Amp	120w
14v	10.05 Amp	14v	10.05 Amp	140w

- PWM regulators can produce as low as 100w from a 170w panel under full sunlight condition and a max of about 140w in ideal conditions (battery V, temp, radiation …).

- MPPT regulators will always produce 170w in ideal conditions (temp, radiation …) no matter what the battery voltage is.

So now that you know the 1st and foremost importance of the MPPT we can discuss some added advantages.

It is true that a MPPT helps to improve system efficiency by allowing a higher panel voltage to be used, because power stays the same and power = V x I it means that the panel array current will decrease, resulting in less volt drop in the cable, resulting in less power loss in cable. What is important here is that this is only true if you keep the cable / conductor diameter the same when or as you increase the voltage, if you use thinner cable because the current is less then you're only saving on system installation cost and **not gaining any efficiency**.

This gain in efficiency is normally almost insignificant when compared to the 1st most important reason for using a MPPT gain of up to 70% increase in power (normally around 30% because battery voltage does not always stay at 10v).

Do not use the MPPT to increase panel voltage, increase panel voltage to make your installation easier and more economical. W**hat is very important to note** is that there is a limit to how much you can increase the panel voltage on the MPPT.

Why is this so?

- The MPPT (all step down MPPT battery chargers) uses a Buck regulator circuit to do the power conversion.
- These circuits do not operate at max efficiency when the input output voltage ratio is very high.
- Try to not exceed a ratio of 1:4, this is especially true on 12v systems

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For example:

If you charge a 12v battery do not connect 120v of panels to the MPPT the ratio = 1:10.

The MPPT display a "High Panel voltage" Warning meaning that the MPPT is now operating out of speck.

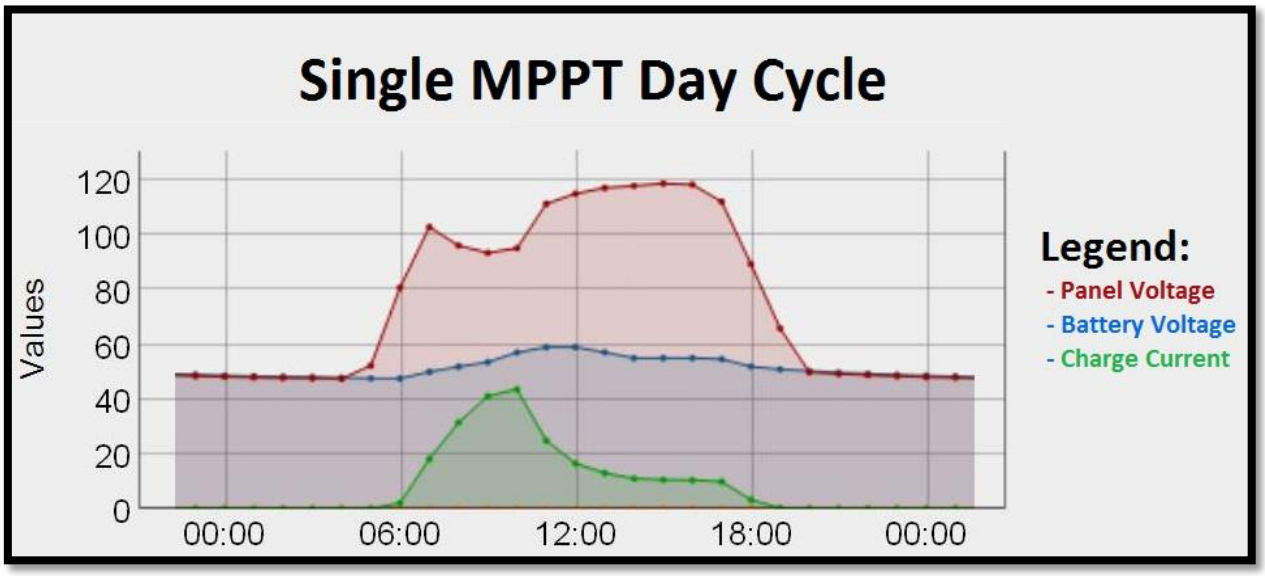
For a 12v system your max Charge voltage is 15v, so use a panel array with a power point voltage (Vmp not Voc) between 15v and 60v (1:4 = 15v x 4 = 60v), then the MPPT will be efficient and you will get maximum power transfer efficiency from your MPPT.

In essence your MPPT has 2 paths where the power flow, 1 path steps down and divides the voltage and the other increases and multiplies the current.

If the ratio is 1:10, then each circuit has to work 10 times harder then what it would have worked if the ratio was 1:1.

Having to divide the voltage by 10 and boosting the current 10 fold (turn 1 amp from panel into 10 amps into the battery), the difference in efficiency between 1:1 and 1:4 is minuscule and not worth stressing about but when the ratio becomes greater than 1:6 then the efficiency is notably lower.

1.4 MPPT Operation Description



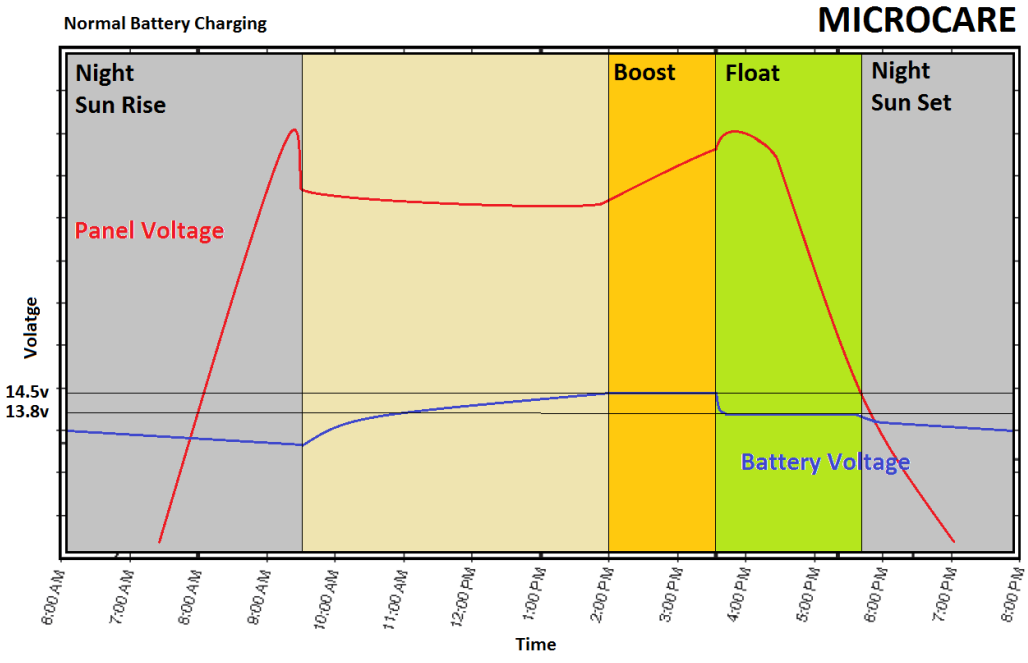
This simple real world illustration (above) shows how the MPPT functions during the course of a day as well as a simple schematic (below). In the morning, as soon as the MPPT detects that the Panel Voltage is at a useable level (MPPT charge entry voltage);

Boost Mode – The MPPT starts to charge the batteries at maximum efficiency in a BOOST mode at an adjustable nominal voltage of 14.5V per 12V battery bank.

Equalise Mode - If however the batteries are detected to not be uniformly discharged, the MPPT will go into EQUALISE mode to restore battery bank balance before switching to BOOST mode as its primary charge mode. The MPPT maintains this mode until the batteries reach the boost voltage and the charge current decreases to a level below an adjustable nominal change level of 6 Amps.

Float Mode - The MPPT then steps down the charge voltage to an adjustable nominal voltage of 13.8V per 12V battery bank in FLOAT mode. The MPPT will attempt to maintain FLOAT mode for as long as the panel voltage is present.

Sleep Mode - If no panel voltage is present, the MPPT goes into a sleep state until it detects a rise in panel voltage indicating a new day for charging.



2. MPPT OVERVIEW

Fig 2.1: MPPT Front View

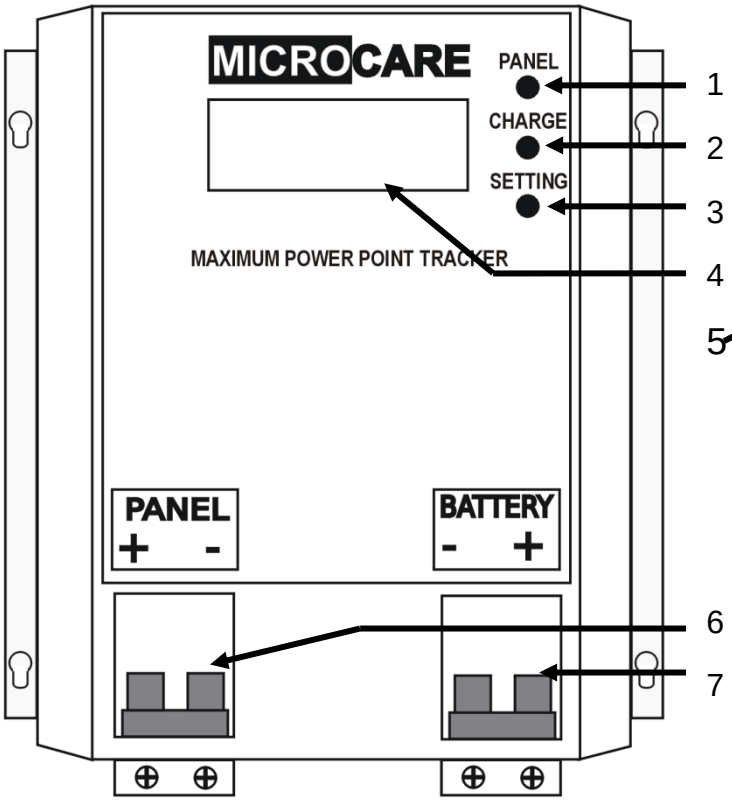


Fig 2.2: MPPT Side View

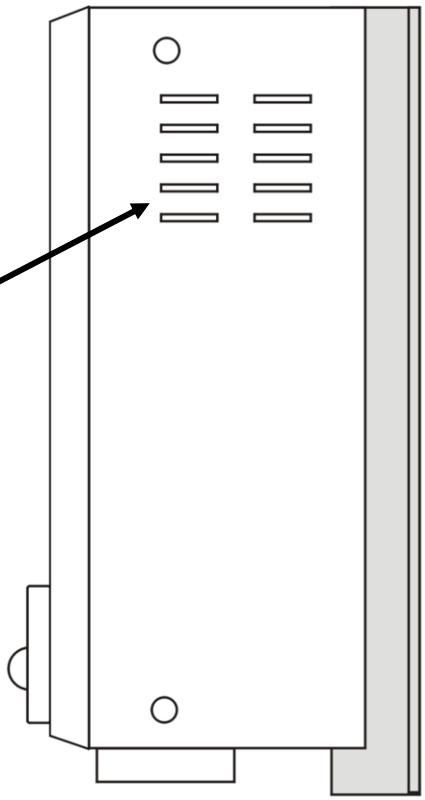


Fig 2.3: MPPT Top View

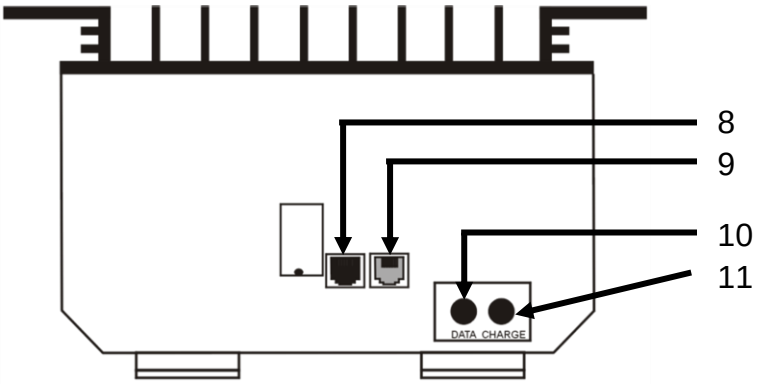
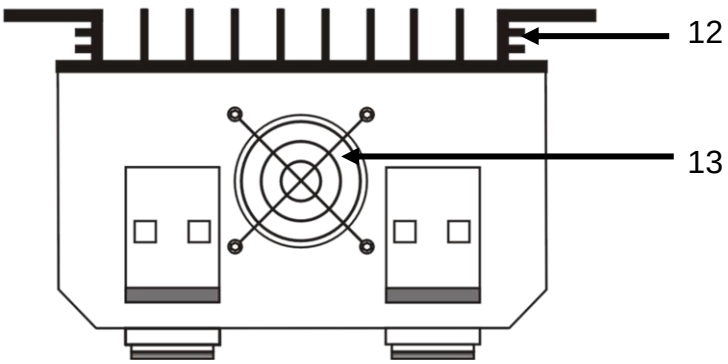


Fig 2.4: MPPT Bottom View



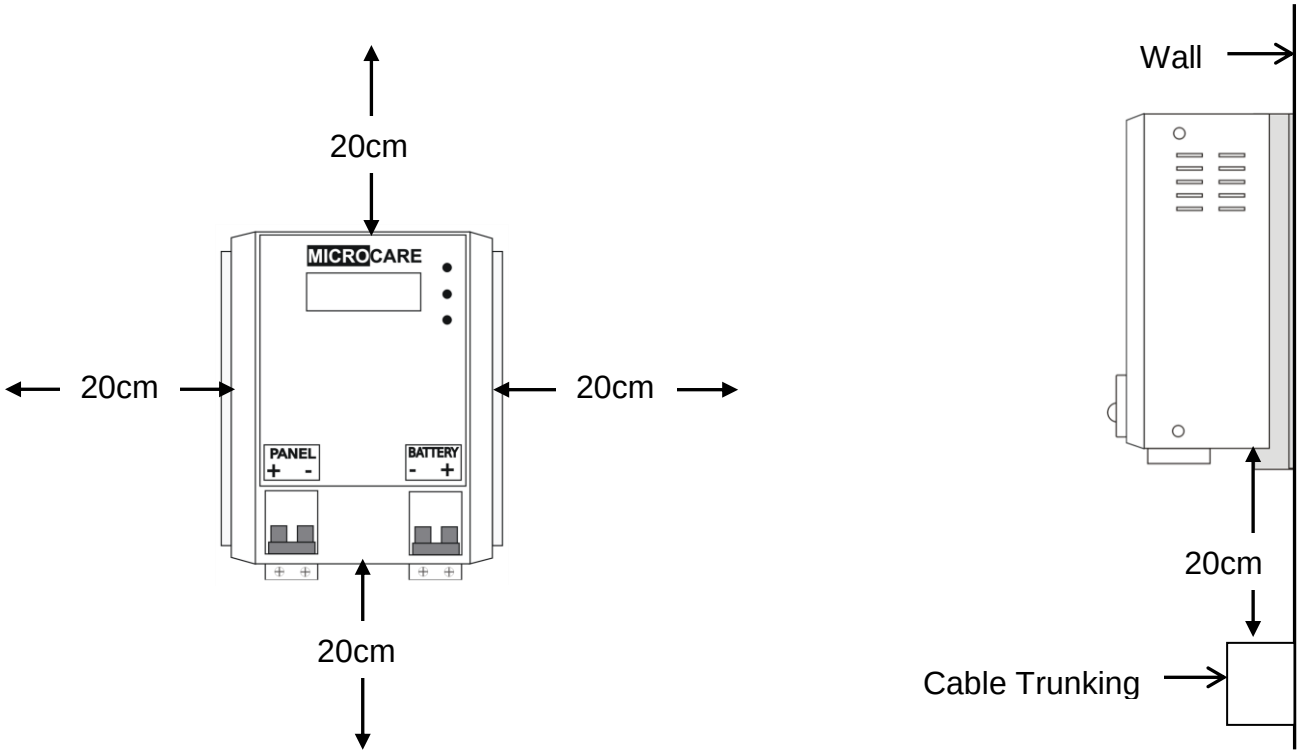
No	Description
1	Green Panel LED
2	Green Charge LED
3	Green Setting LED
4	LCD Display
5	Ventilation Holes
6	Panel Circuit Breaker
7	Battery Circuit Breaker
8	RJ12 Programming Port For Factory Programming Only
9	Communications Port
10	Data Button
11	Charge Button
12	Heatsink
13	Fan

(Isolators Installed on 100A MPPT Unit's)

3. MPPT INSTALLATION

3.1 MPPT minimum installation clearance distance

Fig 3.1: Minimum clearance distance



Maintain a minimum clearance of 20cm below and around the MPPT to ensure unhindered air circulation. Mount the solar charge controller as close as possible to the batteries.

3.2 MPPT Installation Instructions:

- Read the installation instructions before installing the MPPT.
- The MPPT is designed for indoor applications only.
- The mounting position should allow for sufficient ventilation and the minimum clearance distance between MPPT's and other objects, trunking as above.
- Mount the MPPT at eye level in order to allow the user to read the LCD Screen
- The MPPT must be mounted in a vertical position against a solid wall.
- Do not install the MPPT in a sealed container.
- Do not install the MPPT near water or in damp environments.
- Do not install the MPPT where it would be exposed to direct sunlight or near heat.
- Do not install the MPPT on a wooden surface. Only install the MPPT on flat concrete, stone or metal surfaces.
- Do not block off the aluminium heat sink and don't leave objects on top of the MPPT.
- Do not expose the MPPT to corrosive battery gases. Corrosion is not covered by warranty.
- MPPT operating environment temperature should not exceed: 0˚C - 40˚C.
- Ensure that connecting cables are of adequate thickness. Consult the reference table for recommended thicknesses in Cable Connections. Refer to the cable design sheet for correct PV cable thickness.

3.3 LCD MPPT Installation Diagram

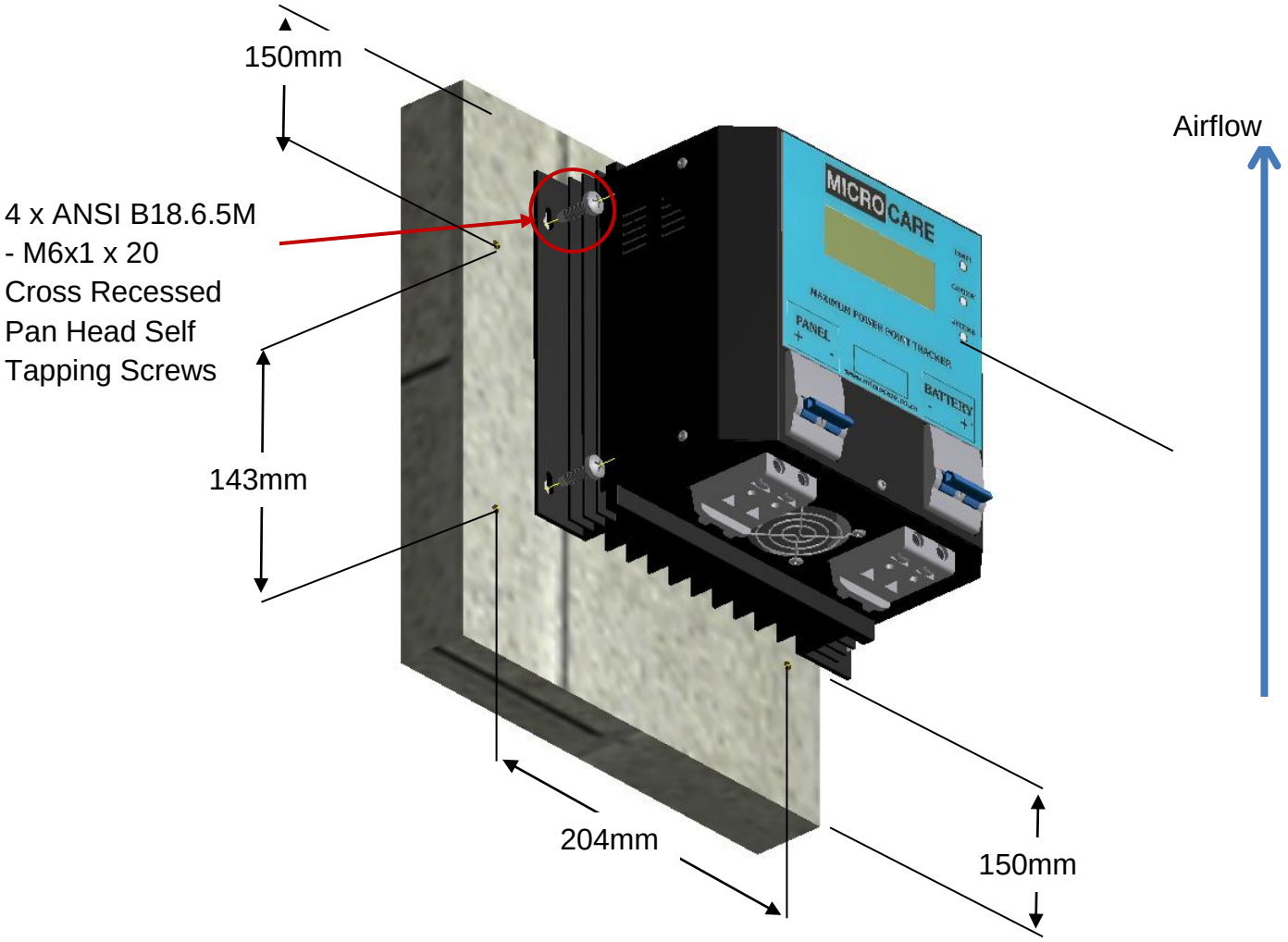


Table 3.1: MPPT Mounting Hole Dimensions		
MPPT	Height	Width
20 Amp LCD MPPT	143 mm	204 mm
40 Amp LCD MPPT	143 mm	204 mm
60 Amp LCD MPPT	227 mm	204 mm
100 Amp LCD MPPT	278 mm	204 mm

3.4 Recommended Array Sizes

The following should be used as a guide to the maximum array size that can be connected to the MPPT. The current limits to the specified level of the MPPT model so any array larger than these will simply waste power:

Table 3.2: Recommended Photovoltaic Array Sizes in Watts				
Battery Set	20 Amp MPPT	40 Amp MPPT	60 Amp MPPT	100 Amp MPPT
12V	250W	500W	750W	1300W
24V	500W	1000W	1500W	2500W
36V	750W	1500W	2200W	3600W
48V	1000W	2000W	3000W	5000W

3.5 Maximum Panel Voltage (Voc) Per Battery Bank

Table 3.3: Maximum Panel Voltage per battery bank

Battery Bank Size	PV Panel Voltage (Voc)
12V	48V
24V	96V
36V	135V
48V	135V
Please remember that the Standard MPPT will only support 150Voc per PV Panel String.	

150Voc is the absolute maximum. Systems should be designed for a max of 135Voc due to the increase in panel voltage due to colder Panel Temperatures. Refer to your solar module documentation for the worst-case (coldest) module temperature voltage, should provide Voc vs. temperature data.

The voltage of the PV array may not exceed 150V and depending on the MPPT model, a specified current strength.

The Battery Set array is however unlimited in size although an increase in Battery Set array capacity will increase the amount of time needed to fully charge the batteries.

This complex setup diagram of a PV-MPPT System illustrates two 120V DC PV Arrays connected in parallel and two 48V DC Battery Sets connected in parallel

This setup may be extended to suit the needs of the user.

150V is the maximum voltage the MPPT may accept, therefore, PV arrays may not have an open circuit voltage greater than 150V else the MPPT will be damaged.

Battery Sets may not exceed a nominal voltage of 48V. Ensure that the current strength leading into the MPPT from the PV Array does not exceed that of the maximum allowed by the specific MPPT model that is installed.

4. WIRING INFORMATION

4.1 Cable Sizes

The PV (Photo Voltaic) panels should always be connected in the highest voltage configuration. The advantage of this is that panel current will always be at its minimum so that thinner connecting wires may be used which reduces voltage drops with loading and improves cost efficiency.

The cable length from the batteries to the MPPT should not exceed 3m. The cable lengths connecting the PV panels to the MPPT should not exceed 30m.

As an example, if there are two 40 volt panels rated at 5 amps each and they are connected in parallel, then the output voltage would be 40 volts at 10 amps. If they were connected in series the output would be 80 volts at 5 amps. In both cases the power would be the same but in the parallel configuration a thicker power cable must be used to reduce the volt drop from the array to the MPPT as well as from the MPPT to the batteries.

Cable thicknesses listed are recommended thicknesses that have voltage drops accounted for up to a distance of 3m for connecting the MPPT and the batteries together and the bottom table lists recommender cable thicknesses for cables connecting the MPPT to the panels up to a distance of 30m.

Table 4.1: Recommended cable size connecting Cables up to 3m between MPPT and batteries. (Single Stranded Copper Specifications)

MPPT Type	Cable Core Area	Overall Core Diameter
20 Amp	6mm²-10mm²	5.4mm-6.3mm
40 Amp	10mm²-16mm²	6.3mm-7.5mm
60 Amp	20mm²-30mm²	8mm-9.5mm
100 Amp	40mm²-55mm²	10mm-13mm

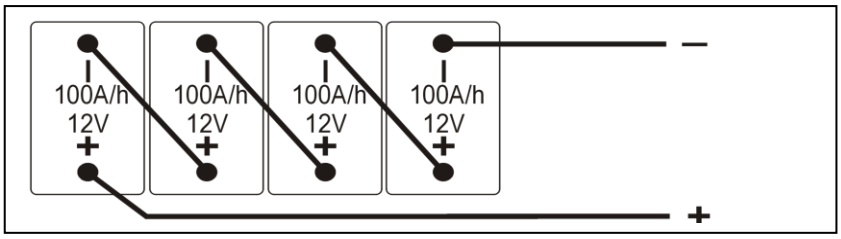
Table 4.2: Recommended cable size connecting Cables up to 30m between MPPT and PV panels (Single Stranded Copper Specifications)

MPPT Type	Cable Core Area	Cable Core Diameter
20 Amp	3mm²-4mm²	1.8mm-2.2mm
40 Amp	6.8mm²-9mm²	2.8mm-3.2mm
60 Amp	16mm²-21mm²	4.4mm-5mm
100 Amp	25mm²-32mm²	6mm-6.8mm

4.2 Battery Connection Methods

4.2.1 Series Connection

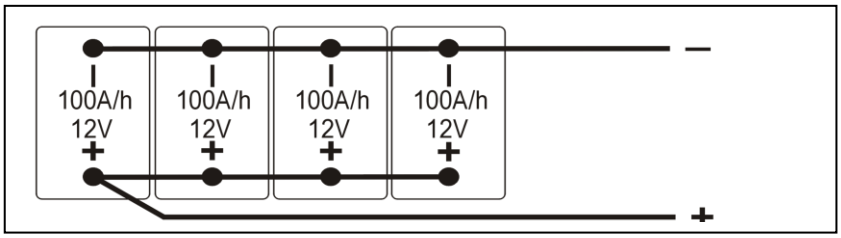
12V + 12V + 12V + 12V = 48V Ah remain at 100 Ah



Series Connection (Voltage increases, amperage stays the same as a single battery)

4.2.2 Parallel Connection

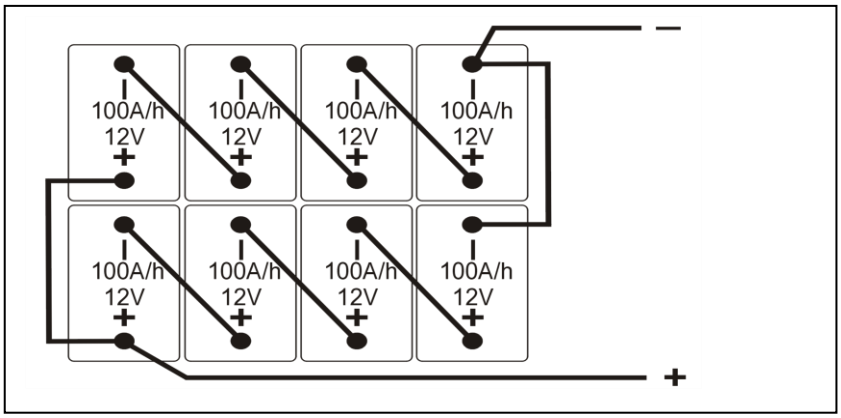
Voltage remains at 12V 100 Ah + 100 Ah + 100 Ah + 100 Ah = 400 Ah



Parallel Connection (Voltage stays the same as a single battery, amperage increases)

4.2.3 Series and Parallel Connection

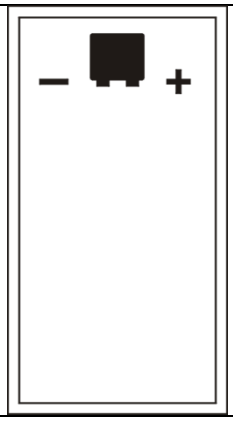
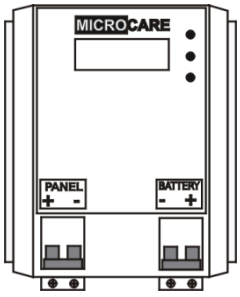
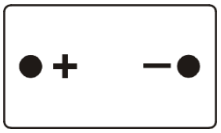
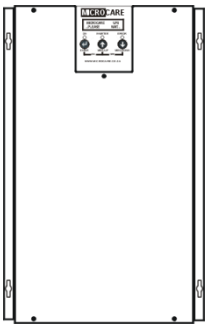
Voltage increases to 48 V Ah increases to 200 Ah



2 Strings of batteries in series, connected in parallel
Series/Parallel Connection (both voltage and amperage increase)

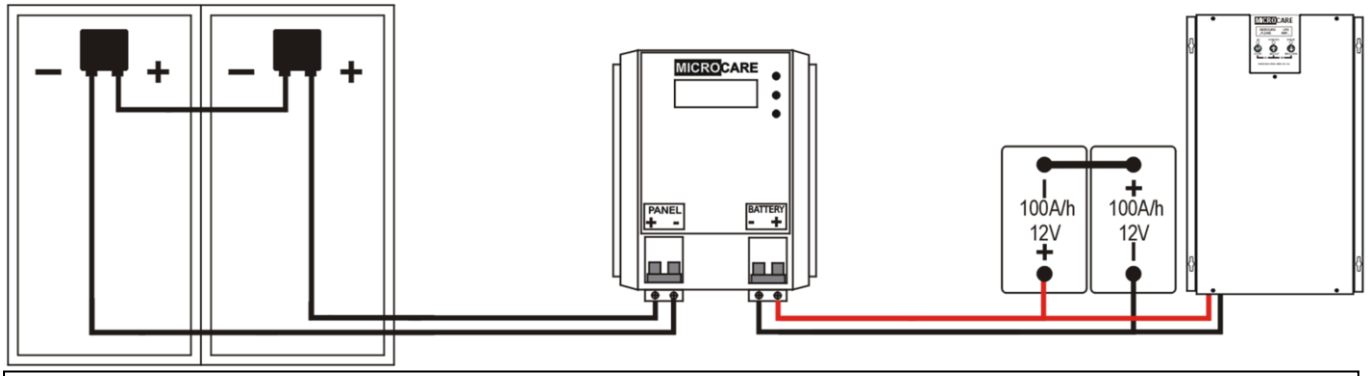
Refer to table 4.1 for the correct cabling sizing.

4.3 Basic MPPT Wiring Diagram Examples

PV Panel	MPPT Charge Controller	Battery	Inverter
			

The total array power is the sum of the power of all the panels connected in series and parallel.

4.3.1 2 x Panels Connected in Series



For the example above:
PV Panel specifications

Maximum power:100W
Maximum power voltage (Vmp): 17.4V
Maximum power current (Imp): 5.74A
Open circuit voltage (Voc): 20.8V
Short circuit current (Isc): 6.49A

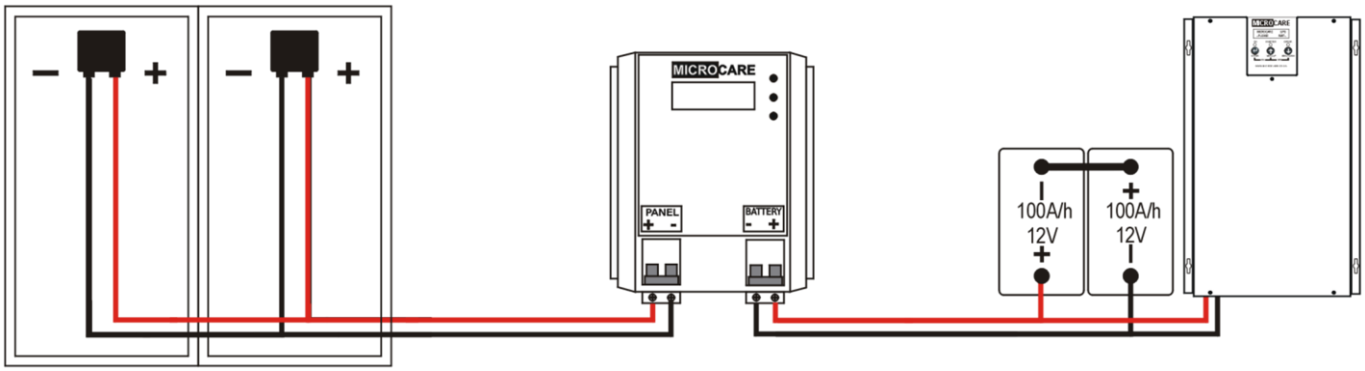
2 x 100 W panels connected in series = 200W
2 x 12V 100Ah batteries in series = 24V 100Ah

Recommended MPPT as per table 3.2 = 20A MPPT charge controller

Series connection the voltage is equal to the sum of all the panels in series
Array max Voc = 2 x 17,4V = 34,8V :
This is within the max operating voltage of the MPPT and the max operating volts per battery bank as per table 3.3

For series connection the total current remains the same
Total Isc = 6,49A
Use this current to calculate the minimum cable diameter between the panels and the MPPT.

4.3.2 2 x Panels Connected In Parallel



For the example above:
PV Panel specifications

Maximum power: 310W
Maximum power voltage (Vmp): 37V
Maximum power current (Imp): 8,38A
Open circuit voltage (Voc): 45V
Short circuit current (Isc): 8,80A

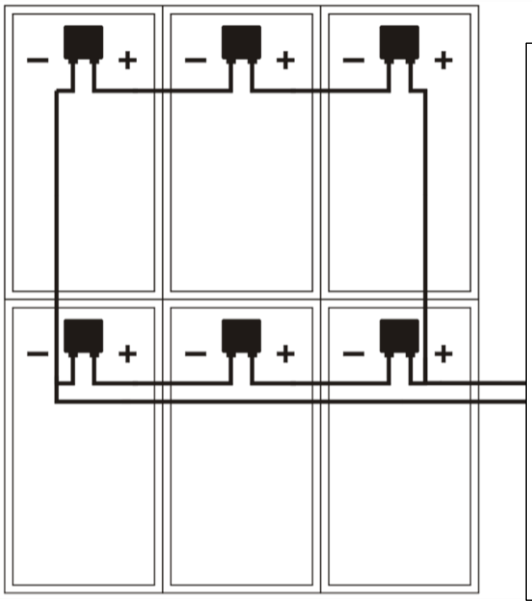
2 x 310 W panels connected in parallel = 620W
2 x 12V 100Ah batteries in series = 24V 100Ah

Recommended MPPT as per table 3.2 = 40A MPPT charge controller

For the PV Parallel connection the voltage remains the same
Array max Voc = 45V :
This is within the max operating voltage of the MPPT and the max operating volts per battery bank as per Table 3.3

For parallel connection the total current is the sum of all the panels in parallel
Total Isc = 8,8 x 2 = 17,6A
Use this current to calculate the minimum cable diameter from the PV array to the MPPT.

4.3.3 2 Series Strings Connected in Parallel

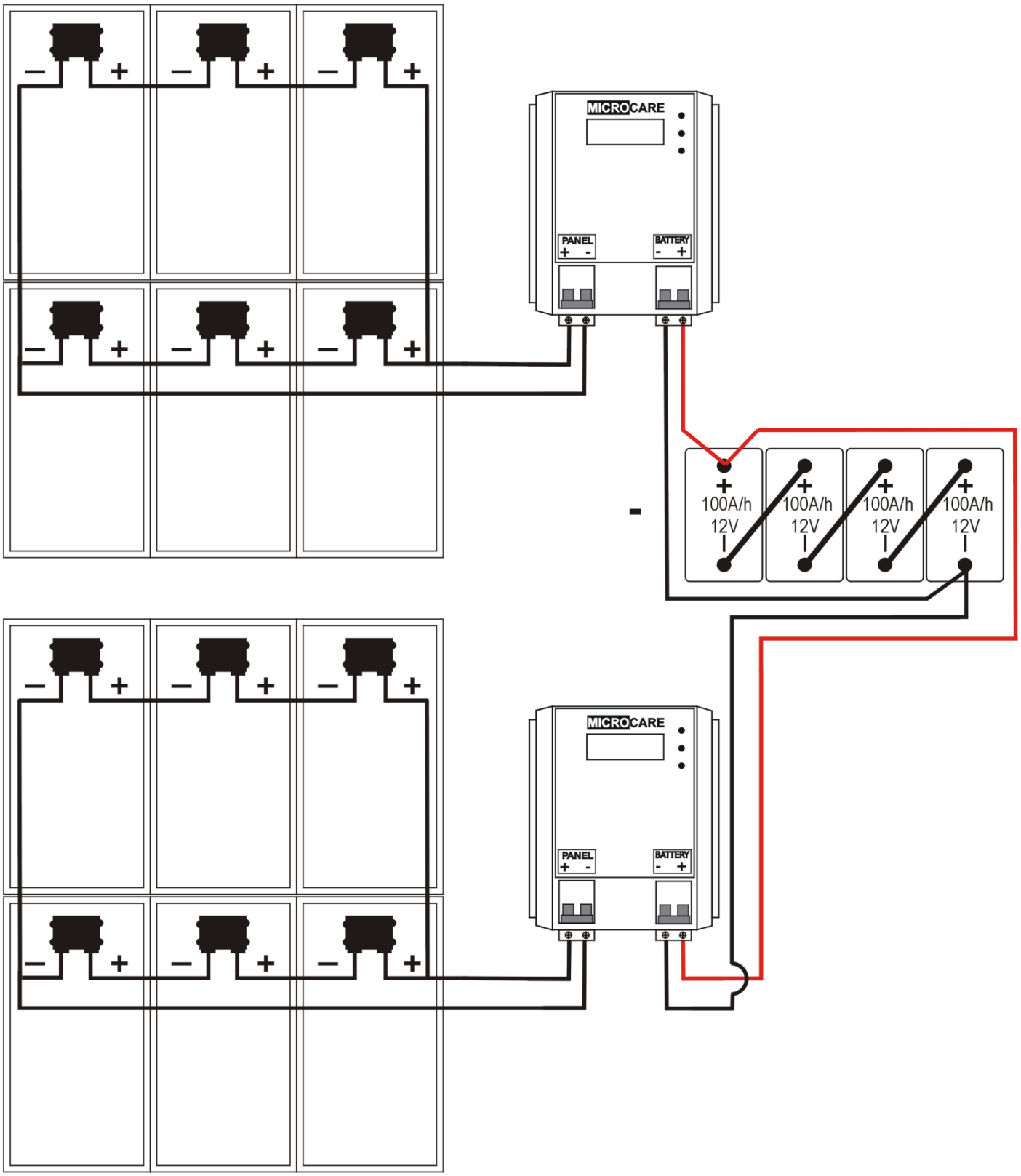


PV Panel specifications
Maximum power:200W
Maximum power voltage (Vmp): 24,6V
Maximum power current (Imp): 8,13A
Open circuit voltage (Voc): 30V
Short circuit current (Isc): 8,56A

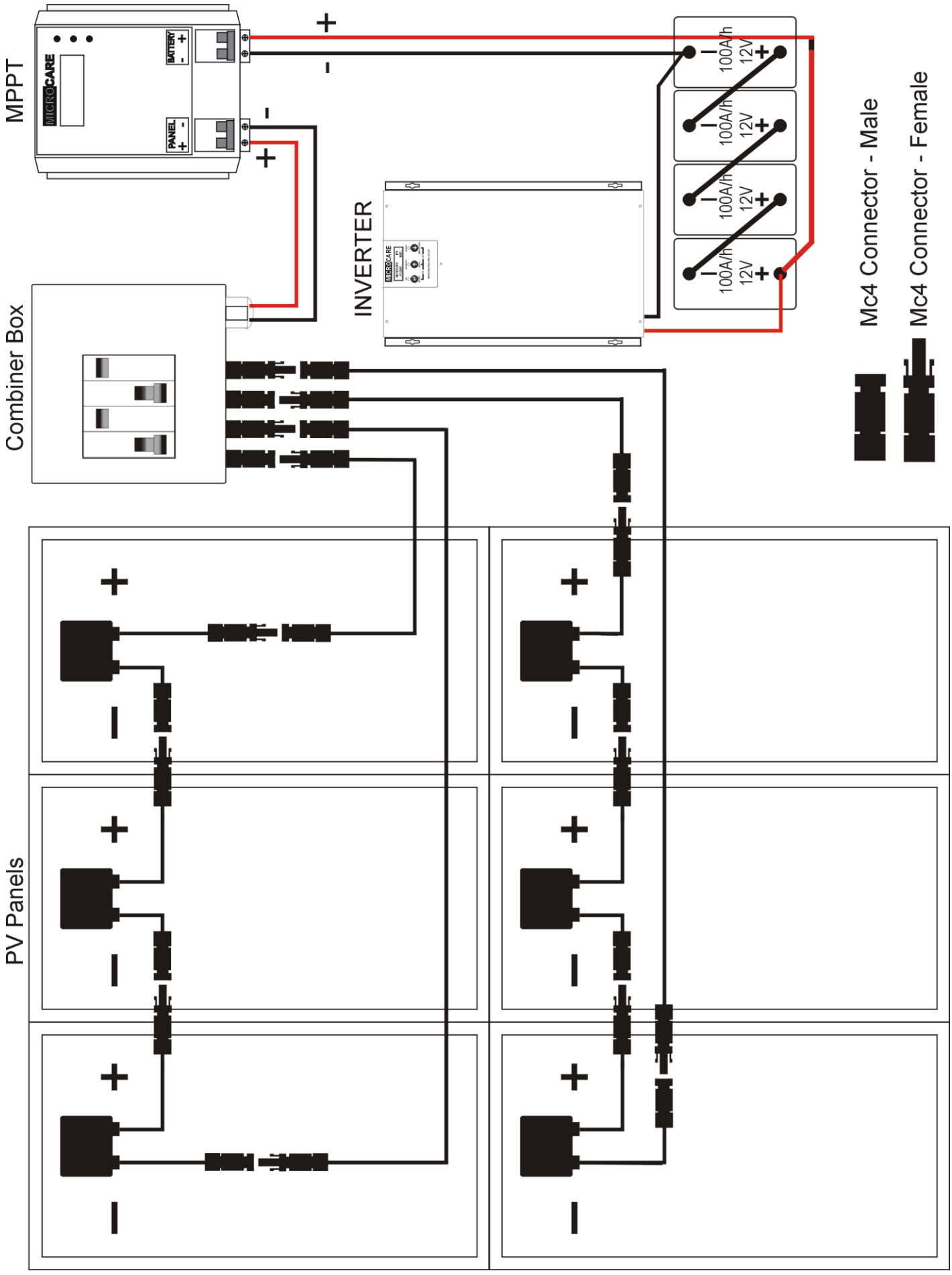
Total Array Wattage = 6 x 200W = 1200W
Series string current per string = 8,13A
Total Array current (Imp) = 16,26A
Total Array (Vmp) = 73,8V
Total Array (Voc) = 90V

4.3.4 Connecting 2 x MPPT's in Parallel

This configuration can be used when connecting 2 arrays to one battery bank.

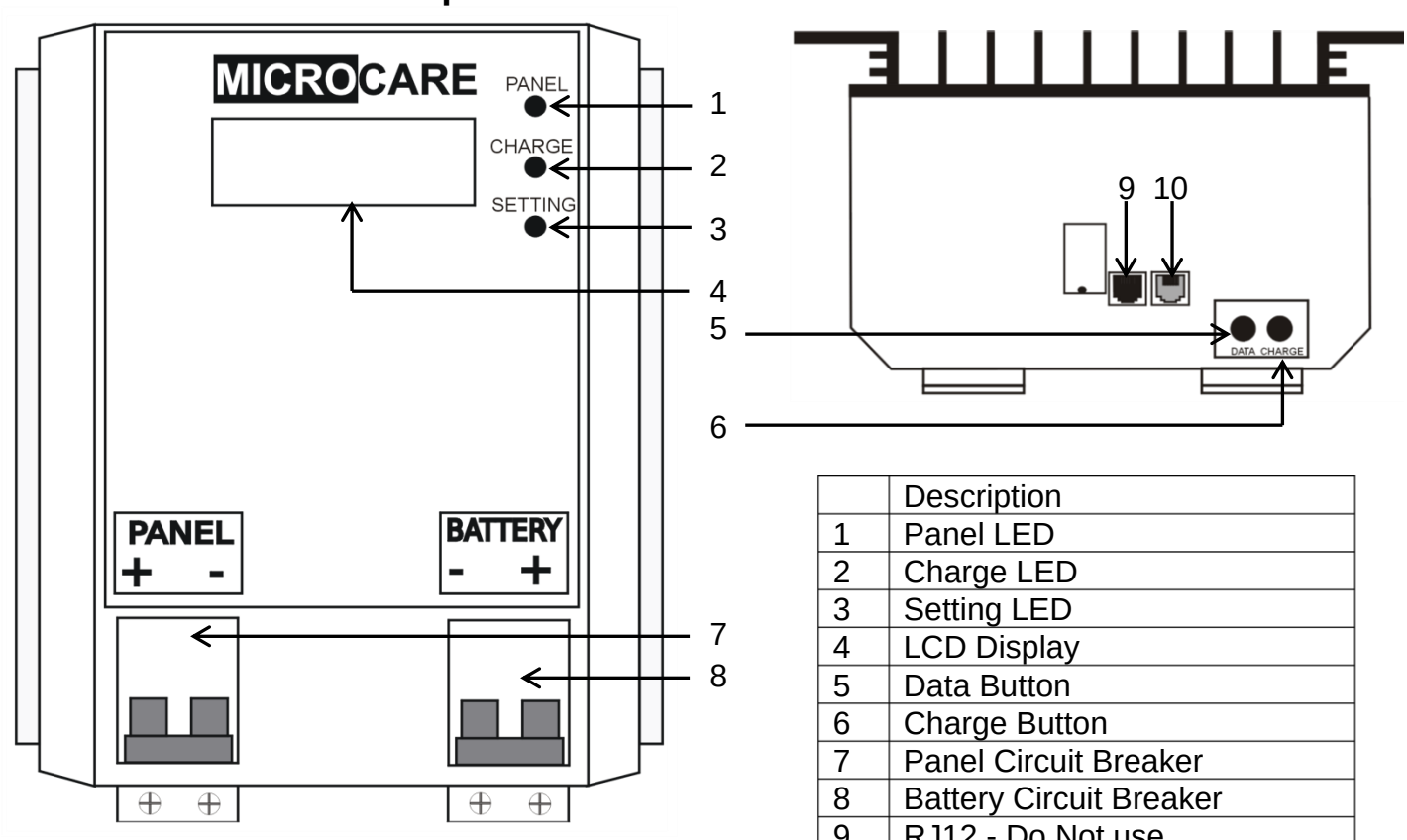


4.4 Basic System Diagram



5. MPPT OPERATION

5.1 Front Panel Description



	Description
1	Panel LED
2	Charge LED
3	Setting LED
4	LCD Display
5	Data Button
6	Charge Button
7	Panel Circuit Breaker
8	Battery Circuit Breaker
9	RJ12 - Do Not use
10	RJ12 – External Connection

Button Function Description

Button Name	Function description
Data	Increments programming values,
Charge	.Stores selected programming values, selects charging modes

MPPT Status LED's

Indicator	Indicator Name	LED Status	Description
	Panel	Steady ON	Indicates that the solar panels are producing power
	Charge	Flashes	Indicates that the MPPT is charging
	Setting	Steady ON	Indicates that the batteries are in float mode

RJ12 Connections

No	Description
9	RJ12 Connection – For factory programming only. " Do not use"
10	RJ12 Connection – RS232 External connection output

5.2 Checks Prior To Start-Up

- Ensure the MPPT is mounted vertically.
- Check input output cables are secured.
- Check the polarity of the panel and battery and they are correct.
- Check if the Panel Voltage meets the MPPT rating required.

5.3 MPPT Start-up Procedure

- Always turn on battery breaker first.
- Wait until MPPT Display states that the MPPT is sleeping.
- Turn on Panel Breaker.
- MPPT will track the PV Panels.
- MPPT will start charging the batteries.

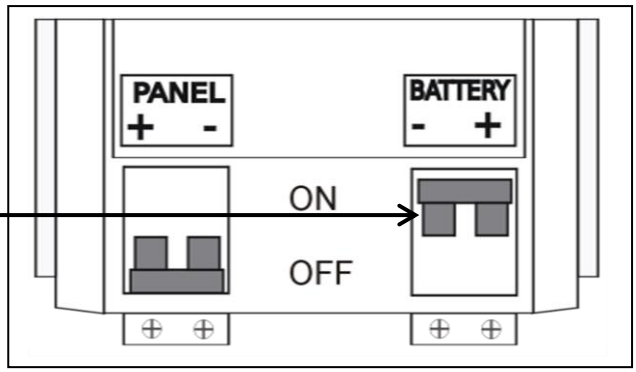
PLEASE BE AWARE:

WARRANTY WILL BE NULL AND VOID IF PANEL SURGE PROTECTION IS NOT INSTALLED WITH ALL LCD MPPT INSTALLATIONS

6. LCD MPPT OPERATION

Please follow the instructions below for basic MPPT operation.

Turn ON the battery circuit breaker.



The following screen should appear:

This shows the name of the supplier, contact number and serial number

The screen changes to

Supplied by
Supplier Details
Supplier Tel Number
Serial No = MC *****

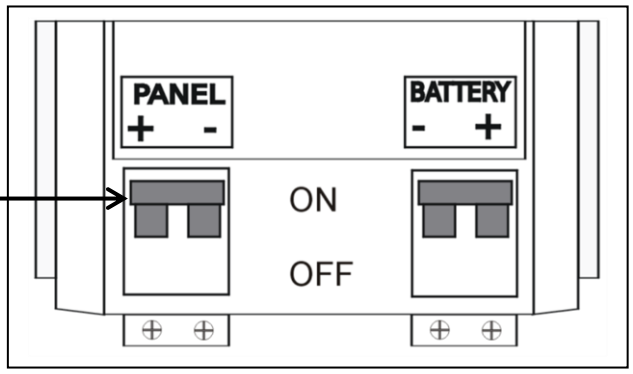
This shows the unit automatically measuring the batteries and displaying the result. Should the battery voltage shown be incorrect it is possible to force the MPPT to accept a new battery value.

. . . Start up . . .
Checking Batteries
12 volt system
.....

The screen changes to

MICROCARE MPPT 40Amp
Panel is LOW
. . . MPPT sleeping . . .
Battery = 13.5.0V

Turn ON the Panel Circuit Breaker.



Start Up Screen

The following screen should appear:

This shows the MPPT measuring the open circuit panel voltage and calculating the initial power point voltage

The screen then changes to:

TRACKING
MAXIMUM POWER POINT
V power point...xxxV

This is the screen that will normally be displayed showing the system operating correctly.

BATTERY	**= 12.0V**
BOOST at *	**= 10.0A**
PANEL	**= 24.0V**
OUTPUT POWER	**= 120W**

There are other details that will appear on the screen that will assist the user to read at what point the MPPT and batteries are

6.1 Float Mode

The * flashing next to the **BATTERY** indicates that the **MPPT is in FLOAT mode** and the batteries are full.

```
BATTERY      * =  13.8 V
FLOAT AT       =  1.0 A
PANEL          =  24.0 V
OUTPUT POWER.. = 13.8 W
```

6.2 Panels Limiting Energy

The * flashing next to the **PANEL** indicates that the PV panels are limiting the amount of energy delivered to the MPPT to charge the batteries

```
BATTERY        = 12.0 V
BOOST at       = 10.0 A
PANEL        * = 24.0 V
OUTPUT POWER.. = 120.0W
```

6.3 Equalise Mode

The **!** sign next to the **EQUALISE AT** line indicates that the batteries are being charged in the Equalise mode and the batteries have not reached the "**Equalise Voltage**", for every 12volt in the battery pack, system this would be 15 volts

```
BATTERY        =  12.5V
EQUALISE AT  ! =  10.0A
PANEL          =  24.0V
OUTPUT POWER.. = 125.0W
```

Once the batteries have reached the EQUALISE VOLTAGE then the display will change to
This shows that the battery is at the **EQUALISE Voltage** and that the MPPT is in the 1 hour bulk charge mode.

```
BATTERY      ! = 15.0V
EQUALISE at.   = 10.0A
PANEL          = 24.0V
OUTPUT POWER.. =150.0W
```

6.4 Boost Charge Mode

When this is complete the charger switches to the **BOOST** mode and will hold the voltage at the programmable value say 14.5 volts until the charge current has fallen below the programmable BOOST amps, say 5.0 amps
When the charge current falls below the programmed value of say 5.0 amps,

```
BATTERY      * = 14.5V
BOOST at       =  5.0A
PANEL          = 24.0V
OUTPUT POWER.. = 72.5W
```

The screen changes to

6.5 Float Mode

This shows that the **battery is in FLOAT mode** and is Indicated by the flashing **'*'**at the end of the BATTERY line

```
BATTERY      * = 13.8 V
FLOAT at       = 1.0 A
PANEL          = 28.0 V
OUTPUT POWER...= 13.8 W
```

6.6 Checking the MPPT Firmware

To determine the MPPT's firmware, make sure the LCD display is at the main screen:

Now hold in the **<CHARGE>** button for 3 seconds and the following screen will appear for 2 seconds and then automatically revert to the main screen:

Check the Microcare website for the latest firmware available for your specific MPPT. To request a firmware upgrade for the MPPT, visit Microcare at **www.microcare.co.za** and contact them via the online email.

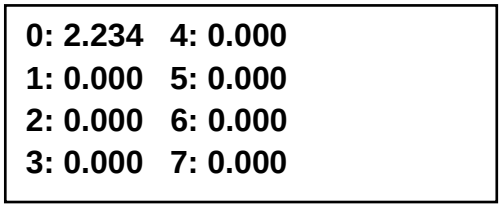
6.7 Turning the MPPT OFF.

- Turn off the **panel breaker** first. (Never Turn Off The Battery Breaker First.)
- Wait until MPPT Display states that the MPPT is sleeping.
- Turn off the **battery breaker**.
- This will allow the MPPT to discharge any remaining power in the coil into the batteries and will eliminate the possibility of damage to the MPPT.

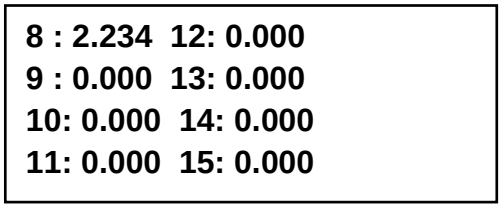
6.8 Data Logging Operation

By Pressing the **DATA** button the following screen will appear:

This shows the energy accumulated since the charger started.
The 24Hr is the daily average for the no of days shown.
Should you wish to CLEAR the DATA hold the **<CHARGE>** button for 6 seconds and the values will reset to **0**



To view the next 8 days of DATA LOGGING Press the **<DATA>** button and the screen will change to
Day 0 shows the power accumulated for the current day.
Up to 31 days of data is stored and may be viewed by Pressing the **<DATA>** button.
To clear the screen, hold in the **<CHARGE>** button in for 10 seconds or until the data has been cleared.

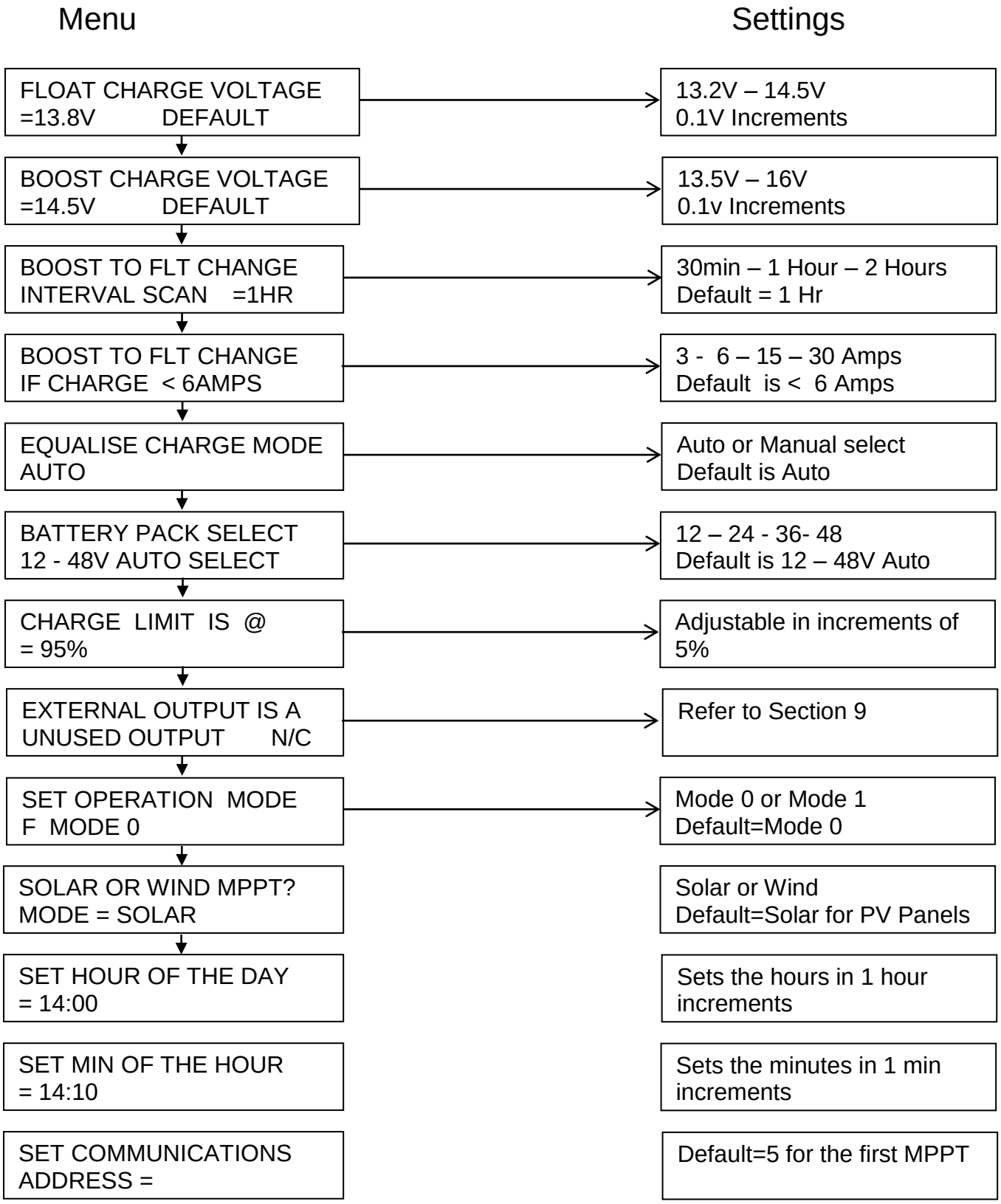


To return to the main screen, the **<DATA>** button must be pressed until the end of the Data Log Menu has been reached. Alternatively, the MPPT will automatically revert to the normal charge display after 1minute.

If a **Battery Temperature and Battery Voltage Sensor** is connected to the MPPT, the **<DATA>**button needs to be repeatedly pressed to return to the main screen.

7. SETUP MENU SETTINGS

Setup Menu - Quick Reference Guide



8. Programming the MPPT

All settings are for 12 Volt nominal systems.
Divide the required settings:
/ 2 for 24 Volt Systems. / 3 for 36 Volt Systems. / 4 for 48 Volt systems.

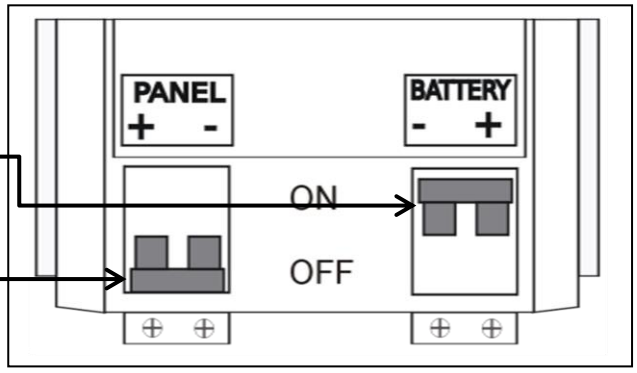
Eg: If the float voltage for a 48V system is 54,2V, the setting on the MPPT = (54,2/4) =13,8V
Set the float voltage on the MPPT to 13,8V
Please consult your battery supplier for the correct battery charging specifications before commencing with the MPPT programming. Incorrect charging can damage batteries. Make note of the following:
Battery float voltage, boost voltage and equalisation voltage. Note that some battery types cannot be equalised.

Programming mode

To enter the programming mode the MPPT must be

connected to the batteries:

The **Battery Circuit Breaker** must be turned **ON**
The **Panel Circuit Breaker** must be turned **OFF**
.

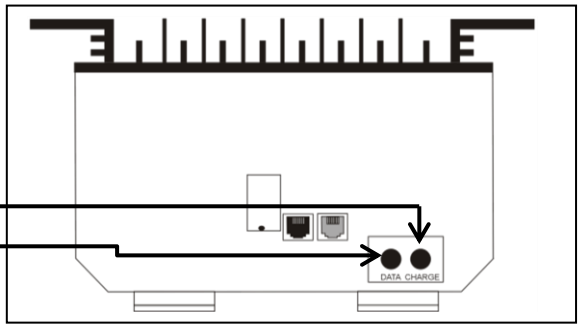


When the Panel circuit breaker is turned off the MPPT will enter the sleep mode and the MPPT must be in SLEEP MODE to enter the programming mode

MICROCARE MPPT 40Amp
Panel is LOW
. . . MPPT sleeping . . .
Battery = 25.0V

Press and hold the <**CHARGE>** button for 6 seconds

The Screen in section 8.1 will be displayed



8.1 Float Voltage

The Float voltage can be changed from 13.2 to 14.5 volts in 0.1 volt increments.
Default Value is 13.8V.
Obtain the correct float charge voltage from your battery supplier
For a 48V battery bank with a float voltage of 54V the setting on the MPPT must be set at 13,8V

FLOAT CHARGE VOLTAGE
= 13.8v DEFAULT
press CHRG to save
press DATA to change

- Press the **<DATA>** button to change the battery FLOAT VOLTAGE
- Press **<CHARGE>** to save the selected FLOAT VOLTAGE

The screen changes to: BOOST CHARGE VOLTAGE

8.2 Boost Voltage

BOOST CHARGE VOLTAGE
= 14.5v DEFAULT
press CHRG to save
press DATA to change

The Boost voltage can be changed between 13.5 and 16.0 volts in 0.1 volt increments.
Default Value is 14.5V.
Obtain the correct boost charge voltage from your battery supplier

- Press the **<DATA>** button to change the battery BOOST VOLTAGE
- Press **<CHARGE>** to save the setting

The screen changes to: BOOST TO FLOAT CHANGE

8.3 Boost to Float Voltage

BOOST TO FLT CHANGE
INTERVAL SCAN = 1Hr
press CHRG to save
press DATA to change

This screen changes the time that the BOOST mode takes to switch to FLOAT mode, once the batteries have reached the BOOST voltage level.

- The time can be set to 30minutes – 1 hour – 2 hours.
- Default Value is 1 Hr.

- Press the **<DATA>** button to change the battery BOOST VOLTAGE
- Press **<CHARGE>** to save

The screen changes to: BOOST TO FLOAT CURRENT

8.4 Boost to Float Current

BOOST TO FLT CHANGE
IF CHARGE < 3 AMPS
press CHRG to save
press DATA to change

This changes the charge current at which the BOOST mode after timing out, changes to FLOAT.

- This can be <**3 – <6 – <15 - <30** amps or Disabled.
- Default Value is < 6 Amps

- Press the **<DATA>** button to change the battery BOOST TO FLOAT CURRENT VOLTAGE
- Press the **<CHARGE> button** to save the setting

The screen changes to EQUALISE CHARGE MODE

8.5 Equalise Charge Mode

EQUALISE CHARGE MODE
AUTO ENABLED
press CHRG to save
press DATA to change

In this mode the Regulator will automatically go into EQUALISE mode if the battery pack voltage falls below 10.8V.
This enables or disables the EQUALISE Charge mode.

- Auto= 1 Every forth-night (+- 2 weeks)
- Manual = Disable) Selected by Pressing the charge button)
- Default Value is AUTO.

The MPPT will automatically set the Equalisation voltage

- EQ: = 15V if boost voltage setting is 14,7V or lower
- EQ: = 16V if boost voltage setting is 14,8V or higher

- To change the battery EQUALISE CHARGE MODE press the **<DATA>** button
- To save the setting press the **<CHARGE> button**

PLEASE NOTE: Some battery types cannot undergo an equalisation charge. Contact you battery supplier for the correct charging information.

The display changes to: BATTERY PACK SELECT

8.6 Battery Set Voltage

BATTERY PACK SELECT
12 – 48 AUTO SELECT
press CHRG to save
press DATA to change

This allows the MPPT to auto select the battery system or the MPPT can be PRESET.

- AUTO
- 6 cells 12 volts through to 24 cell 48 volt battery pack.
- Default Value is 12 – 48 AUTO SELECT.

- Press the **<DATA>** button to change the BATTERY PACK SELECT
- Press the **<CHARGE> button** to save the setting

The screen changes to: CHARGE LIMIT

8.7 Charge Limit

CHARGE LIMIT IS @ = 95%
press CHRG to save
press DATA to change

This allows the user to limit the MPPT current.
100 % will be 20 amps or if the limit must be 18 amps then set the % to 90 % for a 20Amp MPPT as an example.
The charge limit can be set in 5% increments. 0% - 100%.
This can be extended to any LCD MPPT type accordingly.
Default Value is 95%.

- Press the **<DATA>** button to change the battery CHARGE LIMIT
- Press **<CHARGE>** to save the setting.

The screen changes to: EXTERNAL OUTPUT

8.8 External Output Connections:

EXTERNAL OUTPUT IS A UNUSED OUTPUT N/C
press CHARGE to save
press DATA to change

Please refer to Section 9 : External Output Connections.

The screen changes to: SET OPERATION MODE

8.9 Set Operation Mode

SET OPERATION MODE
F MODE0
press CHRG to save
press DATA to change

MODE 0 is the Low Frequency Setting – 34MHz.
MODE 1 is the High Frequency Setting – 77MHz.
MODE 2 – 5 Is Currently Not Used.

- Default Value is MODE 0.

- Press the **<DATA>** button to change the OPERATION MODE
- Press the **<CHARGE> button** to save the setting

The screen changes to: SOLAR OR WIND

8.10 Solar or Wind Settings

SOLAR OR WIND MPPT ?
MODE = SOLAR
press CHRG to save
press DATA to change

This Setting allows the MPPT to be changed between a solar MPPT and a Wind Turbine MPPT.
Please confirm that these settings are not adjusted as a standard.
Confirm with support before adjusting these settings.
Default Value is SOLAR

- Press the **<DATA>** button to change the SOLAR OR WIND SETTINGS
- Press the **<CHARGE> button** to save the setting

The screen changes to: SET HOUR OF THE DAY

8.11 Change time settings

This allows the user to change the time settings of the MPPT. The Hour of the day is changed in this screen through a 24hour time format with 1 hour increments.

SET HOUR OF THE DAY
= 14: 40
press CHRG to save
press DATA to change

- Press the **<DATA>** button to change the HOUR OF THE DAY SETTINGS
- Press the **<CHARGE> button** to save the setting

The screen changes to: SET MIN OF THE HOUR

In this screen, the clock's minutes are adjusted in a similar way to that of the hour settings.

SET MIN OF THE HOUR
= 14: 40
press CHRG to save
press DATA to change

- Press **<DATA>** button to change the MIN OF THE HOUR SETTINGS
- Press the **<CHARGE> button** to save the setting

Note: Time settings do not affect any MPPT operations and are purely for user convenience. Time settings are lost when the batteries are disconnected from the MPPT

The screen changes to: SET COMMUNICATIONS ADRESS

8.12 Communication Setting

Only to be adjusted when communicating to a Web Logger or our Battery Monitor system and using more than 1 x MPPT for communication.

SET COMMUNICATIONS
ADDRESS = 5
press CHRG to save
press DATA to change

- Default Address:= 5

5 for the 1st MPPT, 6 = 2nd MPPT, 7= 3rd MPPT etc. "**Max of 20 x MPPT's**",
Do not use Address 0 – 5, Address "5" will be the default for the 1st MPPT.

- Press the **<DATA>** button to Communication Address
- Press the **<CHARGE> button** to save the setting

The screen changes to: EXTERNAL CONNECTIONS

---

9. EXTERNAL CONNECTIONS

This allows the user to program the external output to operate a MICROACRE PROGRAMABLE RELAY INTERFACE. This is plugged into the RJ12 port.

Pressing the **<DATA>** button will change the external output from an UNUSED output to a:

EXTERNAL OUTPUT IS A
UNUSED OUTPUT N/C
press CHARGE to save
press DATA to change

1. SOLAR ASSIST SIGNAL
2. DAY NIGHT no L-S SIGNAL (L-S = Load Shed) Load switches on at dawn with no load shed
3. LOAD SHED SIGNAL also known as a (Low Battery Disconnect)
4. SOLAR ASSIST SIGNAL V2
5. SOLAR AST UPS CNTR1
6. WIND TURBINE BRAKE (Contact our Support team regarding this option)

7. DAY + L-S SIGNAL (L-S = Load Shed) “Day Switch”

- Connects a load when the Panel Voltage is high enough for the MPPT to track the PV voltage and switches off when MPPT is sleeping.
- It also disconnects the load at the set low battery disconnect voltage and reconnects the load at the set reconnect voltage.

8. NIGHT + L-S SIGNAL (L-S = Load Shed) “Night Switch”

- Switches a load when the MPPT is sleeping and switches off when the Panel Voltage is high enough for the MPPT to track the PV voltage.
- It also disconnects the load at the set low battery disconnect voltage and reconnects the load at the set reconnect voltage.
- **Note**:The external output is **only** to be used with MICROCARE MPPT CHARGER accessories such as the Microcare Programmable Relay.

9.1 Solar Assist signal

The **SOLAR ASSIST SIGNAL** switches the relay for 10 seconds when the MPPT switches from BOOST to FLOAT.

9.2 Day Night Signal

If **DAY NIGHT SIGNAL** mode is selected, it switches the relay when the panel power is LOW and stays ON until the panel reconnects.

9.3 Load Shed Disconnect

If the load shed disconnect is selected the screen on the right appears
(by pressing **<CHARGE>**to save)

The screen changes to: LOAD DISCONNECTING @

EXTERNAL OUTPUT IS A
LOAD SHED DISCONNECT
press CHARGE to save
press DATA to change

9.3.1 Load Shed Disconnect Voltage

The user can program the Voltage at which the RELAY operates.
This is between 10-12 volts per pack and increments in steps of
0.1 volts. If the system is 48 volts, multiply the settings by 4.

LOAD DISCONNECTING @
= 11.0V PER BAT PACK
press CHARGE to save
press DATA to change

- Press the **<DATA>** button to change the LOAD DISCONNECT VOLTAGE
- Press the **<CHARGE> button** to save the setting

The following screen will appear:

LOAD RECONNECTING @
= 13.0V PER BAT PACK
press CHARGE to save
press DATA to change

9.3.2 Load Reconnect Voltage

If this is complete then the LOAD SHED RECONNECT voltage can be programmed which can be between 12-14 volts per pack:

- Press the **<DATA>** button to change the LOAD RECONNECT VOLTAGE
- Press the **<CHARGE> button** to save the setting

The **SOLAR ASSIST SIGNAL V2** switches the relay for 10 seconds when the battery voltage is limiting the current into the system. This is when the * is flashing next to the Battery display.

If **SOLAR AST UPS CNTR1** is selected

(by pressing **<CHARGE>** to save).

EXTERNAL OUTPUT IS A
LOAD SHED DISCONNECT
press CHARGE to save
press DATA to change

The following screen will appear:

The user can program the Voltage at which the RELAY operates.
This is between 10-12 volts per pack, in 0.1 volt steps. If the system is 48 volts multiply the settings by 4.

LOAD DISCONNECTING @
= 11.0V PER BAT PACK
press CHARGE to save
press DATA to change

If this is complete then the **LOAD RELAY RECONNECT** voltage may be programmed which can be between 12-14 volts per pack.

LOAD RECONNECTING @
= 13.0V PER BAT PACK
press CHARGE to save
press DATA to change

9.4 Battery Temp and Battery Voltage Sensor

REMOTE BVT CONNECTED
VOLTAGE MPPT = xx.xV
BV= 0.00V ADJ- xx.xV
BT=25.0'C ADJ+ xx.xV

When the sensor is plugged into the RJ12 connector then the following screen will show:
This shows the battery temperature and voltage.
Should there be a problem with the cable or a poor connection then the screen will flash ERROR.

Voltage MPPT shows the battery voltage at the output of the MPPT.
The BV shows the voltage at the battery terminals. The correction is shown as either +/-.
The Battery Temperature (BT) is then shown with the ADJ compensation.
If the Battery Voltage Temperature is disconnected, the MPPT will revert back to stand alone readings.

9.5 To reset the MPPT to factory defaults

To reset the MPPT to factory defaults you need to make sure the MPPT Battery and Panel Breaker is off.

Press and hold the DATA and CHARGE Button and turn on the battery breaker.

The following screen will appear
Once the countdown completes then the MPPT will have been reset to the default values.
Switch off the battery breaker and restart the MPPT.

DO NOT PREES BOTH
DATA and MODE buttons
AT THE SAME TIME
MPPT WILL STOP IN 100

10. TROUBLESHOOTING

When Problems are experienced with the MPPT's please refer to this section to confirm the procedure to follow in order to correct the fault.

10.1 Panel Output Power Low

This would be the general error experienced when connecting the MPPT.

BATTERY	**= 13.8V**
BOOST at	**= LOW**
PANEL	**= 28.0V**
OUTPUT POWER	**= LOW**

This fault can be checked through any of the following tests on the MPPT:

- Turn off the MPPT Panel breaker and measure the voltage using a multi-meter.
- Turn on the Panel circuit breaker and confirm if the voltage is immediately dropping to the battery voltage or if the voltage is slowly decreasing
- If the voltage is immediately dropping to the battery voltage then the MPPT needs to be sent to Microcare for repair.
- If the voltage is not adjusting then you need to open up the MPPT and check the internal cables to confirm if the circuit breaker attachments are tight.
- Tighten the circuit breaker internally and externally.
- If this does not solve the error then you would be required to test your PV Panels independently to confirm if you have a Panel short circuit that is causing the PV voltage to be low.

10.2 High Panel Voltage

This error will display when the PV Voltage is exceeding The ratio between the battery voltage and the PV Panel Voltage used to charge the batteries. (Refer to List Below)

. . . WARNING . . .
HIGH PANEL VOLTAGE
V POWER POINT = xV

Battery Bank Size	PV Panel Voltage (VOC)
12V	48V
24V	96V
36V	135V
48V	135V
Remember that the MPPT will only support a max of 150VOC per PV array.	

10.3 Open Circuit Voltage Higher Than 150 VDC

Your PV Panel array is connected in series and is exceeding the 150Voc capacity of the MPPT

ERR DETECTED! PANEL
OPEN CIRCUIT VOLTAGE
GREATER THAN 150 VDC
MPPT CHARGE DISABLED

10.4 Battery Voltage Higher Than 60Vdc

The Battery Voltage is exceeding the supported Voltage range of the MPPT.

ERR DETECTED! BATTERY
OPEN CIRCUIT VOLTAGE
GREATER THAN 60vDC
MPPT CHARGE DISABLED

10.5 Output Short Circuit

This error message will be displayed if the load being drawn from the batteries is exceeding the amount of power that the MPPT is capable of supplying.

ERR DETECTED!
MPPT OUTPUT
SHORT CIRCUIT
MPPT CHARGE DISABLED

If the load being drawn from the batteries is eg: 70A and you only
have a 40A MPPT then this error will display on the MPPT.

If this error is detected, open up the MPPT and check the left ribbon cable and confirm that the ribbon cable is securely fastened between the Display and the power card.

If the Ribbon Cable is secure then reduce the Load being drawn from the battery bank to clear the error. (Restart the MPPT once the load has been reduced.)

11. Maintenance and service

Caution – Risk of Electric Shock.
Batteries may cause electric shock and have a high short-circuit current.
Please take the precautionary measures specified below and any other measures necessary when working with batteries.
Remove wristwatches, rings and other metal objects.
Use only tools with insulated grips and handles.
Only authorized personnel should perform maintenance, inspection, and replacement operations.
All wiring connections should be checked on a regular basis

PLEASE BE AWARE:

WARRANTY WILL BE NULL AND VOID IF PANEL SURGE PROTECTION IS NOT INSTALLED WITH ALL LCD MPPT INSTALLATIONS

12. LCD MPPT SPECIFICATIONS

Nominal Battery Voltage	Multi-Voltage (Automatic/Manual selection of voltage - 12/24/36/48V battery set)
PV Input Voltage	Open Circuit Absolute Maximum 150VDC
Charge Algorithm	5-stage, 3-level Equalize/Boost/Float
Equalize Voltage	Charges12V to 15V per 12V DC battery pack for 1hour
Boost Voltage	Charges to 14.5V and switches when charge current is < 10Amps for 1hour
Float Voltage	13.8v per battery
Power Conversion	DC/DC Switch Mode
Output Efficiency	Peak greater than 96% conversion efficiency
Voltage Step down Capability	Can charge a lower voltage battery from a higher voltage PV array.
Status display	4 Line LCD Screen with Backlight • Battery Voltage • Charge mode-charge current (Equalize/Boost/Float) and Charge current • Panel Voltage • Output Power • State of charge of battery
Data Logger	• 24hr Average • 63 day history
Power Consumption	Less than 1 Watt
Environmental Rating	0 – 40˚C
Protection System	Lightning Protection, Reverse polarity on Panel/Battery

Recommended MPPT Sizes Per Array and Battery Set				
Battery Set	20 Amp MPPT	40 Amp MPPT	60 Amp MPPT	100 Amp MPPT
12V	250W	500W	750W	1300W
24V	500W	1000W	1500W	2500W
36V	750W	1500W	2200W	3600W
48V	1000W	2000W	3000W	5000W

13. LCD MPPT ACCESSORIES

13.1 Data acquisition software

13.2 Battery Monitor

13.3 Battery Monitor Accessories

13.3.1 100 A Battery Sensor
13.3.2 200 A Battery Sensor
13.3.3 400 A Battery Sensor
13.3.4 Web-Logger
13.3.5 232-485 Converter

13.4 Programmable Relay

13.5 PV String Combiner and Surge Protection Box

Available in multiple configurations

14. DESTRIER ELECTRONICS LIMITED CARRY- IN WARRANTY

Destrier Electronics warrants the full range of LCD MPPT's against defects in workmanship and materials, fair wear and tear accepted, for a period of 3 (three) years from the date of delivery/collection for all equipment and is based on a carry-in basis. Where the installation of the product makes it impractical to carry-in to our workshops, Destrier Electronics reserves the right to charge for travel time and kilometres travelled to and from the site where the product is installed.

During this warranty period, Destrier Electronics will, at its own discretion, repair or replace the defective product free of charge. This warranty will be considered void if the unit has suffered any physical damage or alteration, either internally or externally, and does not cover damages arising from improper use such as, but not exclusive to:

- Reverse of battery polarity.
- Inadequate or incorrect connection of the product and/or of its accessories.
- Mechanical shock or deformation.
- Contact with liquid or oxidation by condensation.
- Use in an inappropriate environment (dust, corrosive vapour, humidity, high temperature, biological infestation.)
- Breakage or damage due to lightning, surges, spikes or other electrical events.
- Connection terminals and screws destroyed or other damage such as overheating due to insufficient tightening of terminals.
- When considering any electronic breakage except due to lightning, reverse polarity, over-voltage, etc. the state of the internal control circuitry determines the warranty.

This warranty will not apply where the product has been misused, neglected, improperly installed, or repaired by anyone else than Destrier Electronics or one of its authorised Qualified Service Partners. In order to qualify for the warranty, the product must not be disassembled or modified. Repair or replacement is our sole remedy. Destrier Electronics shall not be liable for damages, whether direct, incidental, special, or consequential, even caused by negligence or fault. Destrier Electronics owns all parts removed from repaired products. Destrier Electronics uses new or re-conditioned parts made by various manufacturers in performing warranty repairs and building replacement products. If Destrier Electronics repairs or replaces a part of a product, its warranty term is not extended. Removal of serial nos. may void the warranty.

All remedies and the measure for damages are limited to the above. Destrier Electronics shall in no event be liable for consequential, incidental, contingent or special damages, even if having been advised of the probability of such damages. Any and all other warranties expressed or implied arising by law, course of dealing, course of performance, usage of trade or otherwise, including but not limited to implied warranties of merchantability and fitness for a particular purpose, are limited in duration to a period of 3 (three) years from the date of purchase.

Life Support Policy:
As a general policy, Destrier Electronics does not recommend the use of any of its products in life support applications where failure or malfunction of the Destrier Electronics product can be reasonably expected to cause failure of the life support device or to significantly affect its safety or effectiveness.

Destrier Electronics does not recommend the use of any of its products in direct patient care. Destrier Electronics will not knowingly sell its products for use in such applications unless it receives in writing assurances satisfactory to Destrier Electronics that the risks of injury or damage have been minimised, the customer assumes all such risks, and the Liability of Destrier Electronics is adequately protected under the circumstances.

Caution:
Our products are sensitive. While all care is taken by us to dispatch goods with adequate packaging, Destrier Electronics is not responsible for any damages caused to products after they have left our premises.

15. REGISTRATION OF MY MICROCARE PRODUCT

Please register your product online at www.microcare/register-my-product

Also complete the form below as a hardcopy reference for technical support.

Product Serial Number: _____

Product Description: _____

Date Purchased _____

Where was the product was purchased.

Company Name _____

Contact Person _____

Contact Number _____

E-mail Address _____

Installation Company Information:

Company Name _____

Contact Person _____

Contact Number _____

E-mail Address _____

Details of Product Owner

Name & Surname _____

Address _____

City & Province _____

Contact Number _____

E-mail Address _____

Date Installed _____

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