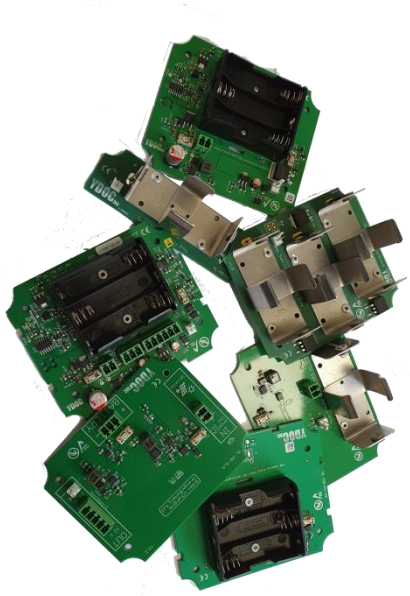
Your Data Our Care

ML-PB-XX (Power Board Series)
User Manual



Title	:	ML-PB-DC-XX User Manual	Date	:	Oct 2026
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Author	:	Hanko Milot			

WARNING

THE FOLLOWING OPERATING INSTRUCTIONS ARE FOR USE BY QUALIFIED PERSONNEL ONLY. TO AVOID DAMAGE OR MALFUNCTION, DO NOT PERFORM ANY OPERATING OTHER THAN THAT CONTAINED IN THIS MANUAL. ANY OPERATOR SHOULD BE SKILLED WITH A TECHNCAL BACKGROUND BEFORE OPERATING THE DEVICE.

1 ML-PB-XX (Power Board Series) User Manual

1 ML-PB-XX (Power Board Series) User Manual 3
1.1 Warranty 4
2 Battery and DC Powered Series 5
2.1 ML-PB-DC-LI 5
2.1.1 8 .. 28 Volts DC auxiliary input power (with Lithium Battery Backup) 5
2.1.2 Overview ML-PB-DC-LI 6
2.1.3 Connector Pin Configuration 7
2.1.4 Specifications ML-PB-DC-LI 7
2.2 ML-PB-LFP 8
2.2.1 Overview ML-PB-LFP 8
2.2.2 General 9
2.2.3 Charger 9
2.2.4 Protection 9
2.2.5 Charge indicator 10
2.2.6 Battery Full indicator 10
2.2.7 Maximum Power Point (MPP) 10
2.2.8 Connector Pin Configuration 11
2.2.9 Specifications ML-PB-LFP 11
3 Battery Powered Series 12
3.1 ML-PB-LI 12
3.1.1 Overview ML-PB-LI 12
3.1.2 Connector Pin Configuration 12
3.1.3 Specifications ML-PB-LI 13
3.2 ML-PB-3LI 14
3.2.1 Overview ML-PB-3LI 14
3.2.2 Connector Pin Configuration 15
3.2.3 Specifications ML-PB-3LI 15
4 Solar Powered Series 16
4.1.1 YDOC 1W solar cap 16
4.1.2 Example “12V solar panel” 16
4.2 ML-PB-DC-NIMH 17
4.2.1 Charger 17
4.2.2 Protection 17
4.2.3 LED indicators 18
4.2.4 Overview ML-PB-DC-NIMH 19
4.2.5 Connector Pin Configuration 20
4.2.6 Specifications ML-PB-DC-NIMH 20
4.3 ML-PB-PV12-LFP 21
4.3.1 Overview ML-PB-PV12-LFP 21
4.3.2 General 22
4.3.3 Charger 22
4.3.4 Protection 22
4.3.5 Charge indicator 23
4.3.6 Battery Full indicator 23
4.3.7 Maximum Power Point (MPP) 23
4.3.1 Connector Pin Configuration 23
4.3.2 Specifications ML-PB-PV12-LFP 24
4.4 ML-PB-PV-AA 25
4.4.1 Solar Charging of NiMh batteries (AA type) 25
4.4.2 Overview ML-PB-PV-AA 25
4.4.1 Connector Pin Configuration 26
4.4.2 Specifications ML-PB-PV-AA 27
4.5 ML-PB-SLA V2.0 28
4.5.1 Overview of the ML-PB-SLA V2.0 Board 28

4.5.2 General 29
4.5.3 Charger 29
4.5.4 Protection 29
4.5.5 Operation 30
4.5.6 Battery Full indicator 30
4.5.1 Battery Monitor output 30
4.5.2 Maximum Power Point (MPP) 30
4.5.3 Connector Pin Configuration 30
4.5.4 Specifications ML-PB-SLA V2.0 31
5 DC Power Board 32
5.1 ML-PB-DC 32
5.1.1 8 .. 30 Volts DC auxiliary input power 32
5.1.2 Overview ML-PB-DC 33
5.1.3 Connector Pin Configuration 33
5.1.4 Specifications ML-PB-DC (V1.3) 34
6 LiFePo4 Battery Empty Voltage 35

1.1 Warranty

All YDOC instruments are warranted against defective materials and workmanship. Any questions with respect to the warranty mentioned above should be taken up with your YDOC Distributor.

Check Available Editions on ML-525 and ML-417 data logger series.

2 Battery and DC Powered Series

2.1 ML-PB-DC-LI

The ML-PB-DC-LI Power Board is a multifunctional, high efficiency, low noise, power supply. It consists of a single PCB, to be mounted in YDOC ML-type Data Logger (It is delivered with a cover)

A D-Size 3.6V Lithium battery is best suitable for monitoring with longer log intervals >=1h and transfer intervals >=4h.

Equipped with D-size holder to host SAFT LSH20 battery safely, with a lossless capacity of 13000 mAh.

Features:

1) 8 .. 28 Volts DC auxiliary input power option
2) Lithium (Backup) Battery option

2.1.1 8 .. 28 Volts DC auxiliary input power (with Lithium Battery Backup)

The power supply is converting the input source to a, stable and clean, output voltage.
A special super-low-loss diode is mounted, to isolate the power supply from of the battery. The output voltage of the power supply is slightly higher than the unloaded voltage of the lithium battery, so no current is taken from the battery, when the board has input power.
A green LED indicates the presence of the input power.

So:

1) When both, Lithium Battery and Auxiliary Power are connected, the Power will be taken from the Auxiliary power only, saving the Battery.
2) When the Power board is connected, but NOT powered by a DC power source, the Data Logger will still continue to work, and draw it's power from the Lithium battery. No extra current is wasted back into the power supply, by means of the (protecting) diode.

To increase the availability of your system it is advised to use both battery and Auxiliary power together.

Protection

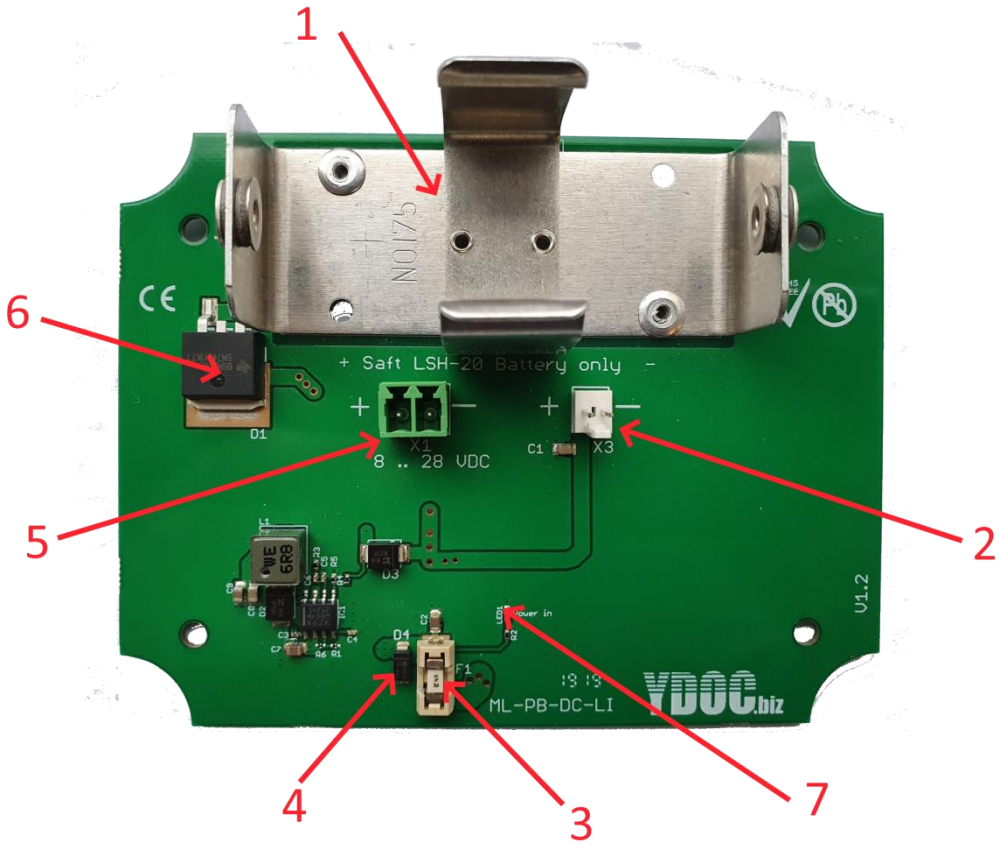
The power board input circuit is equipped with a transzorb of 30 Volts, and a fuse of 4 Amp. This protects the connected Data Logger from high input voltages.



Beware of exposing power board to high voltages, as it will damage the fuse. Also, when the polarity of the input-source is wrong, the fuse will blow. But your connected Data Logger is protected in both cases.

Note: *Remove the battery from the holder during data logger transportation and storage.*

2.1.2 Overview ML-PB-DC-LI



1) Battery holder for Lithium Battery (Saft LSH-20)
2) Power output for powering Data Logger
3) Main fuse
4) Transzorb for protection
5) 8 .. 28 VDC auxiliary power input connector
6) Super low loss diode
7) Input power LED

Note: *Remove the battery from the holder during data logger transportation and storage.*

Spare parts:

- Input fuse (F1): 2A Fast Acting Littlefuse 0453002.

2.1.3 Connector Pin Configuration

Connector	Pin	Function	Description	Value	Comments
X1	1	8 .. 28V power input (+)	Unregulated power (+)	8 .. 28V	DC power supply
X1	2	8 .. 28V power input (-)	Unregulated power (-)	0V /Gnd	Gnd
X3	1	Data Logger Power (+)	Power (+)	3.6V	Power (Molex)
X3	2	Data Logger Power (-)	Power (-) and Gnd	0V /Gnd	(Molex) /Gnd

2.1.4 Specifications ML-PB-DC-LI

Power Supply	
Protection	Fuse 4A
Input Power	8 .. 28 VDC
Power out	1 Amp (Rms)
General Enviroment	
Temperature	Operating: -30 .. +85 °C Storage: -40 .. +85 °C
Humidity	5 .. 60 % RH
Electrical	
Switch Frequency	1 Mhz typical
Quiesent Current	<1 mA @12V (3.6 Volts power supply active)
3.6 V output	
Output current	1 Amp Rms or 2 Amp when a battery is placed.
Connector	Molex 22-27-2021
Galvanic Isolation	No
Ripple & Noise	5% peak-peak, 20 MHz bandwidth
Overload Protection	Yes, Fuse
CE Compliant	Yes
Rohs Compliant	Yes
Dimensions	
W x D x H	106 x 82 x 40 mm
Weight	
Netto Weight	110 Grams

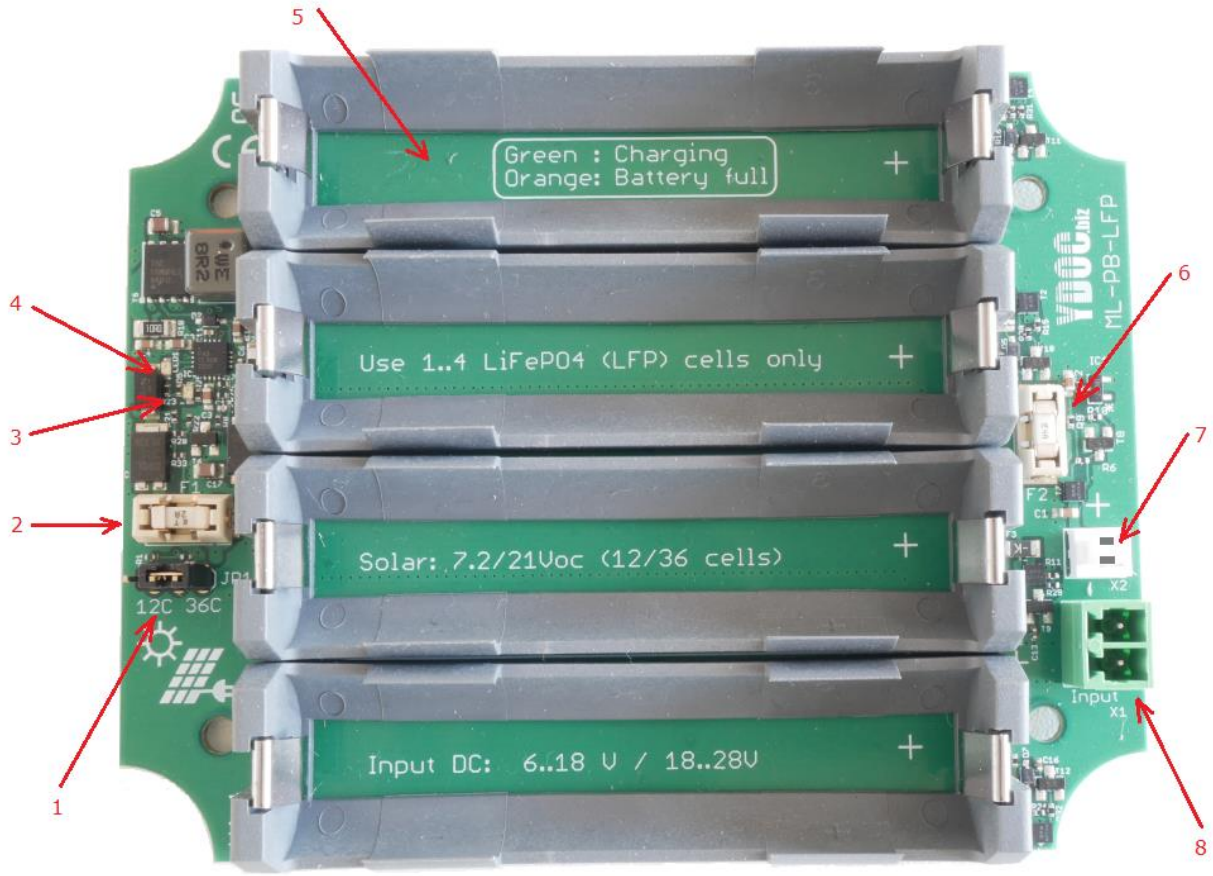
2.2 ML-PB-LFP

The YDOC ML-PB-LFP Charger-Power Board is an accessory for the ML-type low power Data Logger. It is designed to power the Data Logger from an auxiliary Solar or external DC power source. The batteries are used as backup during the night (when solar powered) or when DC power fails. It must be used in combination with 1 to 4 18650 LiFePO4 cells, depending on your data logger configuration power needs.

Features:

- Designed for operation with 12 or 36 Cells Solar system (12V or 21Vnom.) or a 6 .. 28 V DC power supply.
- Input voltage selector (6 ..18V /18 .. 28V)
- Power output 3.2 V to the data logger
- Supports 1 .. 4 LiFePO4 18650 batteries
- RoHs Compliant
- CE Compliant

2.2.1 Overview ML-PB-LFP



1) Solar Panel Type (12 /36 cells) or DC Input Voltage Selector (6 .. 18V /18 .. 28V)
2) Main fuse (2A fast acting)
3) Battery full indicator LED (Orange)
4) Charge indicator LED (Green)

5) Battery holder, up to 4 18650 cells
6) Battery Fuse (4 A fast acting)
7) 3.2Vnom output for Data Logger (Unregulated, directly from cells)
8) Input connector (From Solar Panel or DC power source). The arrow is pointing to the positive input terminal (pin #1)

Note: *Remove the batteries from the holder during data logger transportation and storage.*

2.2.2 General

The ML-PB-LFP Battery Charger is a, charger for 3.2 Volts, 18650 type, LFP Batteries (or LiFe-PO4). Batteries are charged by 12 /36 Solar Panel or can be used as a backup for a 6 .. 28V external DC power supply. It is a single PCB, to be mounted in a ML-type Casing.

2.2.3 Charger

The charger is optimized for solar power (36 cells, Vnom 12V Voc 21V). It automatically searches for the maximum power point of the solar panel, for high efficiency. The charge current is limited to 3.3 Amp.

2.2.4 Protection

The charger has different protection features to enable a high reliable, user-friendly and safe operation.

Battery under voltage protection

It has a Battery low detection which is triggered when the battery voltage gets below 2.5 Volts. When this happens, the batteries will be disconnected from the output (from the Data Logger), so, the batteries won't be damaged due to total discharge. There is a hysteresis which prevents the system from "flipping" on and of all the time. (see technical specification)
The batteries are re-connected to the power output when the battery-voltage gets above the threshold + hysteresis. So, the Data Logger will work again. The battery is switched off @ 2.5 V and switched back on @ 2.95 V.



Due to this hysteresis, the system will not start, when connecting a battery with a voltage <2.95V. Normally, a unloaded, fully charged battery will have a voltage of > 3.6 V. An unloaded battery with a voltage < 2.95 V is pretty empty. After the solar panel has charged the battery above 2.95V it will work.

Temperature protection

The power board has built-in protection against loading under zero and high temperatures. For temperature measurement, a NTC resistor is mounted on the Gnd zone of the PCB. Batteries are charged above 0°C and below a board temperature of 60°C. Over temperature protection has two protection levels. The first level is set to 60 °C. If this level is reached, the loading process is stopped, and resumed, when the PCB has cooled down below 50°C. If the first protection, somehow fails, the second level (set to 145 °C) will shut down the board.

Note: When the data logger environment temperature is high, sometimes the over temperature protection gets activated once in a while during normal operation.

Overvoltage protection

The input is protected against too high voltage. When the input voltage raises above 34V, the (main) fuse will blow. The battery is protected against overcharging /high voltage by the management power board chip.

Wrong polarity protection

The input power is protected against wrong polarity. The main input fuse will blow if a source with enough power is connected wrongly. (A solar panel or external DC power supply must drive more than 2A to blow the fuse).

The battery is protected for wrong polarity by an electronic circuit. If the cell is installed backwards, the power board just doesn't work, without causing any damage to the data logger.

Operation

The ML-PB-LFP is used to charge 18650 type LiFe-PO4 batteries. You can build a system with just this Power board , a solar panel and a 18650-LFP battery. The Power board is optimized for solar power and has also a power output for the Data Logger.
The ML-PB-LFP power board manages the energy system stand alone. Two types of solar panels or DC power supplies are supported: 12 or 36 cells (7.2 - 21 Voc) or DC input 6 - 18 or 18 - 28V.
Selection is made by JP1.

2.2.5 Charge indicator

When the green LED is lit, the battery is charged. The charge current is defined by the internal management system and may vary upon, state of charge of the battery and the available power from the solar panel.

2.2.6 Battery Full indicator

When the orange LED is lit, the charge process is terminated, and the battery is fully charged. To prevent the device form "flipping" the system has a hysteresis. The battery will be charged again when the battery voltage drops below this hysteresis.

2.2.7 Maximum Power Point (MPP)

The device searches for the maximum power point of the solar panel. This point depends on the connected solar panel (The MPP is related to the Voc of the panel and that is a fixed property value of 18V) When the charger needs more current than the solar panel can provide, it limits the current at this point.
Of course, when a very big solar panel is connected, the maximum power point can't be reached because of the overcurrent limit of 3.3 A. So, the maximum power point tracking only works when the solar panel is properly dimensioned to the charger. (i.e., a 12 V, 15 Watt Panel). With the 36 cell panel, the MPP won't be reached, this works by designed.



When using DC power source: Check if the power board voltage range selector is matching the power supply voltage and batteries are charging (green led) when power is applied.

2.2.8 Connector Pin Configuration

Connector	Pin	Function	Description	Value	Comments
X1	1	Solar (+)		12 V nom	Solar Panel
X1	2	Solar (-) /GND		0V	Solar Panel
X2	1	Data Logger Power (+)		3.6V	Logger Power (Molex)
X2	2	Data Logger Power (-)		0V	0V and Gnd (Molex)
JP1	1	Voltage range selector	(Panel type selector)	12 V nom	Voltage selector (input)

2.2.9 Specifications ML-PB-LFP

Power Supply	
Protection	Internal fuse for Battery and main input
Input Power	Solar Panel or external DC power supply
Type of Power	Solar Panel 12 or 36 Cells (Voc 21 Volts, Vnom 12 Volts)
Charger Circuit	
Discharge protection	yes, @ 2.5 Volts
Charging Current	1.6 A max.
Battery Full Level	4.2 V
Battery Level Hysteresis	0.45 V (back on @ 2.95 V)
Battery Low Level	2.5 V
Temperature	Operating: 0 .. +60 °C (Limited to battery spec). Storage: -40 .. +85 °C
Humidity	5 .. 60 % RH
Electrical	
Type of charger	Solar optimized charger with mpp tracking
Switch Frequency	1 Mhz typical
Quiesent Current	50 uA (3.6 Volts power supply active)
3.6 V output	
Output current	4 Amp Rms
Connector	Molex 22-27-2021
Galvanic Isolation	No
Overload Protection	Yes, Fuse
CE Complient	Yes
Rohs Complient	Yes
Dimensions	
W x D x H	106 x 82 x 15 mm
Weight	
Netto Weight	110 Grams

Spareparts:

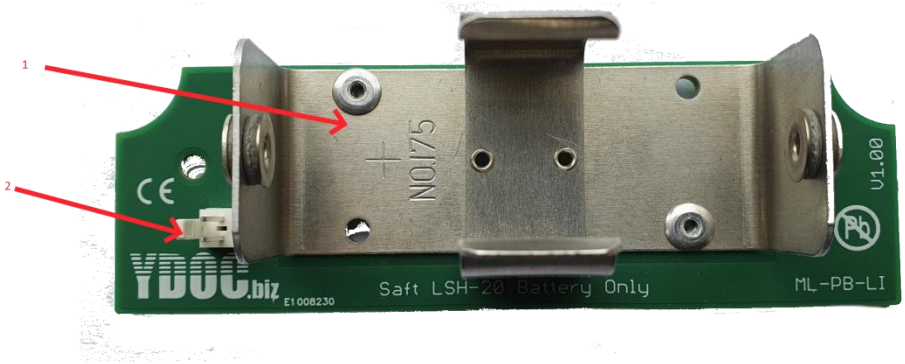
- Input fuse (F1): 2A Fast Acting Littlefuse 0453002.
- Battery fuse (F2): 4A Slow Blow Littlefuse 0454004.

3 Battery Powered Series

3.1 ML-PB-LI

The ML-PB-LI Power Board is a board to facilitate the housing of 1 single D-cell Li battery (Saft LSH-20)

3.1.1 Overview ML-PB-LI



1) Battery holder
2) 3.6V Power connector (Molex) to Data Logger

Note: *Remove the battery from the holder during data logger transportation and storage.*

3.1.2 Connector Pin Configuration

Connector	Pin	Function	Description	Value	Comments
POWER	1	Data Logger Power (+)	Power (+)	3.6V	Data Logger (Molex)
	2	Data Logger Power (-)	Power (-) and Gnd	0V /Gnd	(Molex)

3.1.3 Specifications ML-PB-LI

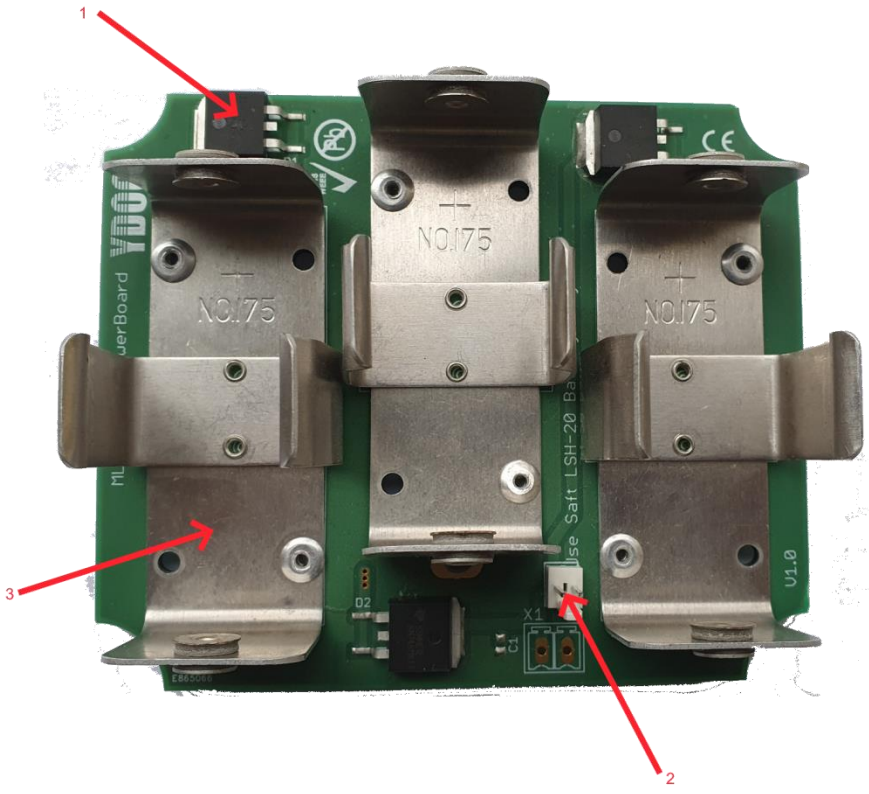
Power Supply	
Protection	None /Fuse inside battery
Input Power	none
General Enviroment	
Temperature	Operating: -30 .. +85 °C Storage: -40 .. +85 °C
Humidity	5 .. 60 % RH
Electrical	
Galvanic Isolation	No
Overload Protection	Yes, by means of fuse in battery
CE Compliant	Yes
Rohs Compliant	Yes
Dimensions	
W x D x H	106 x 33 x 40 mm
Weight	
Netto Weight	110 Grams

3.2 ML-PB-3LI

The ML-PB-3LI Power Board is a board to facilitate the housing of 3 D-cell Li batteries (Saft LSH-20) Combined the board holds 39Ah @ 3.6V.

3.2.1 Overview ML-PB-3LI

The board has triple good quality battery holders to hold the LSH-20 cells. The circuit is very straightforward: In series with each battery is a super low loss diode, which prevents the cells against revers current (which could be an issue when cells of different state of depletion are installed, or even minor differences in production) There is NO fuse on the board, because the battery itself is equipped with an internal fuse.



1) Super - Low Loss Diode (Smart diode)
2) 3.6V Power connector (Molex) to Data Logger
3) Battery holder

Note: *Remove the batteries from the holder during data logger transportation and storage.*

3.2.2 Connector Pin Configuration

Connector	Pin	Function	Description	Value	Comments
POWER	1	Data Logger Power (+)	Power (+)	3.6V	Data Logger (Molex)
	2	Data Logger Power (-)	Power (-) and Gnd	0V /Gnd	(Molex)

3.2.3 Specifications ML-PB-3LI

Power Supply	
Protection	None /Fuse inside battery
Input Power	none
General Enviroment	
Temperature	Operating: -30 .. +85 °C Storage: -40 .. +85 °C
Humidity	5 .. 60 % RH
Electrical	
Galvanic Isolation	No
Overload Protection	Yes, Fuse inside the battery
CE Complient	Yes
Rohs Complient	Yes
Dimensions	
W x D x H	106 x 82 x 40mm
Weight	
Netto Weight	110 Grams

4 Solar Powered Series

For solar charging, matching the YDOC data logger power needs, these panel types are applicable.

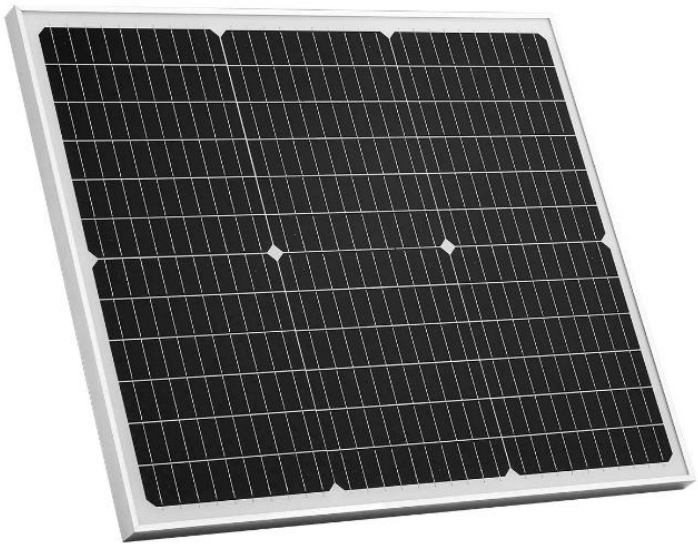
4.1.1 YDOC 1W solar cap

The YDOC solar cap, has a 12 cells /1 Wpeak, 4 Vnom /7 Vopen type panel.



The YDOC “1Watt” solar cap. (4Vnom /7Voc /1Wpeak).

4.1.2 Example “12V solar panel”



Example of an external “12V panel”. (12Vnom /21Voc /20Wpeak).

Note: *An 8 .. 30V power source can replace a “12V solar panel” occasionally.*

Check Available Editions on ML-525 and ML-417 data logger series (and a suitable ML-PB-XX power board in this manual).

4.2 ML-PB-DC-NIMH

The ML-PB-DC-NIMH NiMH Charger is a multifunctional, high efficiency, low noise, power supply and charger for AA type Rechargeable Batteries. It consists of a single PCB, to be mounted in a ML-xxx-type Data Logger

4.2.1 Charger

The charger is used to charge the rechargeable AA type batteries, and outputs the battery voltage.
It is converting the input power into the batteries. The Charger is developed to operate with various power sources, especially solar panels. It is very versatile and adapts automatically to the power source used. When there is very little power available, it will automatically reduce the charging current.
It can be used with 8 .. 30V Solar Panels or DC sources.

4.2.2 Protection

The charger has different protection features to enable a high reliable, user-friendly and safe operation. The features are implemented in both soft- and hardware to increase reliability.

Battery undervoltage protection

It has a Battery low detection which is triggered when the battery voltage gets below 2.9 Volts. When this happens, the batteries will be disconnected from the output (from the Data Logger), so, the batteries won't be damaged due to total discharge. There is a hysteresis which prevents the system from "flipping" on and of all the time.
The batteries are re-connected to the power output when the battery-voltage gets above the threshold + hysteresis. So, the Data Logger will work again.

Overtemperature protection

The temperature of the batteries is measured and if too high, the charging process is terminated.

Overvoltage protection

Both input and output are protected against too high voltage. The output protections ensures that the voltage of the output never exceeds 5.5 Volts, to guard your Data Logger. The input voltage is monitored, and in case of overvoltage, the charging-process is terminated. When the input voltage is above 43 Volts, the fuse will blow.

Battery out detection

This mechanism detects whether batteries are installed or not. If not, the charging process is terminated. This feature prevents the output voltage to rise above spec.

4.2.3 LED indicators

Red: Overtemperature (Red flashing)

When the temperature of the batteries reaches 65 °C, the red led is flashing. The charging process is terminated, until the temperature is normal again. This can happen when the enclosure is exposed to direct sunlight.

Red: Overvoltage Input (Red solid)

When the input voltage is higher than the spec of the device (>30 Volts) the red led will lit.

Orange: Battery Out (Orange solid)

The device detects if batteries are installed. If no batteries are present, the orange battery out led will be lit, and charging process is terminated. This prevents the output voltage to rise to an out-of-spec value.

Green: Charging (Solid, Flashing, Turned off)

A green led indicates the correct charging of the batteries. It shows different stages:

- Solid : Normal charging (200 mA)
- Flash: High speed charging (800 mA)
- Off: No charging (<200 mA or no charge)

When the led is off, it shows that the batteries are LOW CURRENT or NOT charging. This can indicate:

- Batteries are fully charged
- There is no input power available for charge
- The input power is not sufficient to charge @ normal, high current

Indication Led ‘’s	
Led	***Colour***
Battery Out	Orange
Overvoltage/	Red solid
Overtermperature	Red Flashing
Charge (high current)	Green flashing
Charge (normal current)	Green solid
Charge (low current /battery full)	Off

4.2.4 Overview ML-PB-DC-NIMH



1) Charge indicator LED
2) Battery out detection LED
3) Overvoltage /Overtemperature indicator LED
4) Battery holder, Use good Quality NiMH batteries only
5) Battery protection fuse
6) Output connector to Data Logger
7) Input Power connector (8 .. 30 Volts DC)
8) Main fuse

Note: *Remove the batteries from the holder during data logger transportation and storage.*

Spareparts:

- Input fuse (F1): 2A Fast Acting Littlefuse 0453002.
- Battery fuse (F2) 4A Slow Blow Littlefuse 0454004.

4.2.5 Connector Pin Configuration

Connector	Pin	Function	Description	Value	Comments
X3	1	Data Logger Power (+)	Power output for ML-type Data Logger	3.6V	Power (Molex)
X3	2	Data Logger Power (-)		0 V	Gnd (Molex)
X1	1	External Power Input (+)	DC source or Solar panel	8 .. 30V	Power Input
X1	2	External Power Input (-)		0V	Gnd

4.2.6 Specifications ML-PB-DC-NIMH

Power Supply			
Protection	Internal fuse: 2A Battery: 4A		
Input Range	8 .. 30 VDC | Solar | Optional use of 3 NimH batteries		
Type of Power	External DC | NiMH battery | Solar Panel		
Power	Output Voltage	Output Current	Output power
	4.8 V	500 mA	2.4 W
Charger Circuit			
Discharge protection	yes, @ 2.9 Volts		
Bypass Diode	yes		
General Enviroment			
Temperature	Operating: -30 .. +45 °C Storage: -40 .. +75 °C		
Humidity	5 .. 60 % RH		
Electrical			
SMPS	yes		
Switch Frequency	80 kHz		
Quiesent Current	500 uA		
Peak Current	1.8 A		
Max. Input Voltage	40 V		
Min. Input Voltage	8V		
Connector	Molex 22-27-2021		
Galvanic Isolation	No		
Ripple & Noise	1% peak-peak, 20 MHz Bandwidth		
Overload Protection	Yes, Fuse		
CE Complient	Yes		
Rohs Complient	Yes		

Dimensions	
W x D x H	107 x 109 x 35 mm
Weight	
Netto Weight	110 Grams

4.3 ML-PB-PV12-LFP

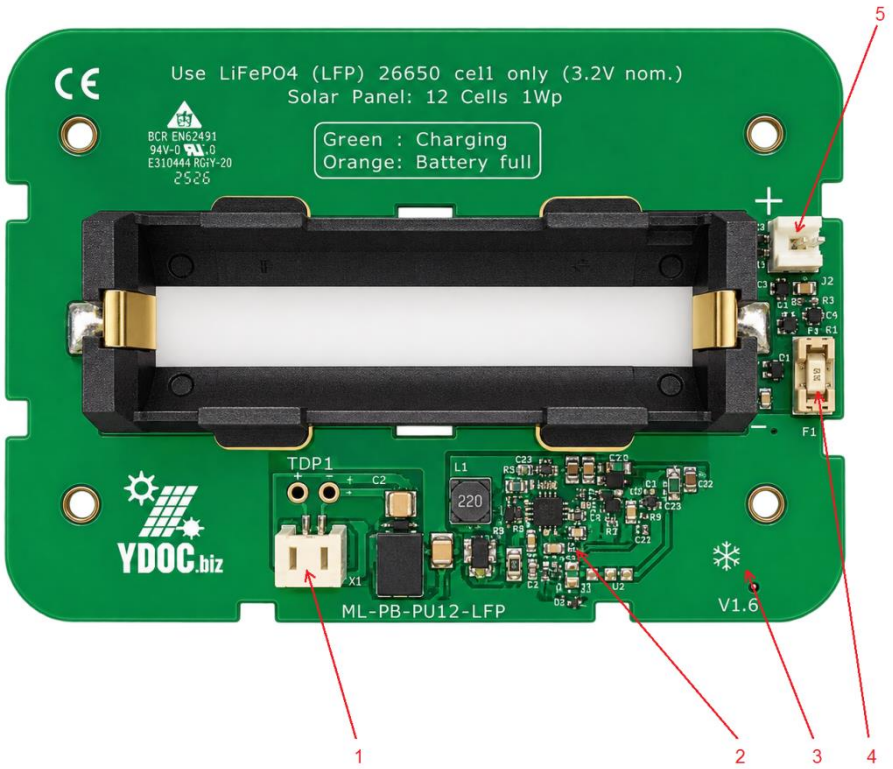
The YDOC ML-PB-PV12-LFP Power Board is designed for use with a type ML-type low power Data Logger. It is designed to power the Data Logger from an 12 cells 1Wpeak solar cell. It must be used together with a 26650 LiFePiO4 battery and a solar panel.

Features:

- Designed for operation with solar cell 1Wp 12 Cells (4 Vnom.)
- Power output 3.2 V nominal (Cell voltage)
- LiFePO4 26650 battery
- RoHs Compliant
- CE Compliant

4.3.1 Overview ML-PB-PV12-LFP

The picture is showing the latest HW revision, the V1.6 board layout.



1) Input connector (solar panel)
2) Battery full (orange) and charge indicator (green)
3) PCB is suitable for “cold charging” with this indicator
4) Battery Fuse (4 A)
5) Output connector 3.2 Vnom for Data Logger (Unregulated, directly from battery cell)

Note: *Remove the battery from the holder during data logger transportation and storage.*

4.3.2 General

The ML-PB-PV12-LFP Battery Charger is a, charger for 3.2 Volts, 26650 type, LiFe-PO4 Battery. It consists of a single PCB, to be mounted in a ML-COVER-PV-type Casing

4.3.3 Charger

The charger is optimized for the YDOC solar cap. (12 cells, 1Wpeak, 4Vnom, 7Voc). It automatically searches for the maximum power point of the solar panel, for high efficiency. The charge current is limited to 200 mA.

4.3.4 Protection

The charger has different protection features to enable a high reliable, user-friendly and safe operation.

Battery under voltage protection

It has a Battery low detection which is triggered when the battery voltage gets below 2.5 Volts. When this happens, the battery will be disconnected from the output (from the Data Logger), so, the battery won't be damaged due to total discharge. There is a hysteresis which prevents the system from "flipping" on and of all the time. (see technical specification)
The battery is re-connected to the power output when the battery-voltage gets above the threshold + hysteresis. So, the Data Logger will work again. The battery is switched off @ 2.5 V and switched back on @ 2.95 V.



Due to this hysteresis, the system will not start, when connecting a battery with a voltage <2.95V. Normally, a unloaded, fully charged battery will have a voltage of > 3.6 V. An unloaded battery with a voltage < 2.95 V is pretty empty. After the solar panel has charged the battery above 2.95V it will work.

Temperature protection

The power board has built-in protection against loading under zero and high temperatures. For temperature measurement, a NTC resistor is mounted on the Gnd zone of the PCB. Batteries are charged between a board temperature of -20 /0°C and 60°C.

Note: *The latest ML-PB-PV12-LFP board version (V1.6) can charge special "cold LFP batteries" to a temperature of -20°C.*

Over temperature protection has two protection levels. The first level is set to 60 °C. If this level is reached, the loading process is stopped, and resumed, when the PCB has cooled down below 50°C. If the first protection, somehow fails, the second level (set to 145 °C) will shut down the board.

Note: *When the data logger environment temperature is high, sometimes the over temperature protection gets activated once in a while during normal operation.*

Wrong polarity protection

The battery is protected for wrong polarity by an electronic circuit. If the cell is installed backwards, the power board just doesn't work, without causing any damage to the data logger.

Operation
The ML-PB-PV12-LFP is used to charge a 26650 type LiFe-PO4 battery. You can build a solar system with just this Power board, inside the ML-COVER-PV , 26650-LFP battery. The Power board also has a power output for the Data Logger.
The ML-PB-PV12-LFP is optimized, and only intended for solar power. (12 Cells 1Wp)

The ML-PB-PV12-LFP power board manages the energy system stand alone. There are no jumpers, no settings are needed. It just works straight from the box. There are 2 indicators that are useful for the user.

4.3.5 Charge indicator

This is the green LED, it is lid, when the battery is charging. The charge current is defined by the internal management system and may vary upon, state of charge of the battery and the available power from the solar panel.

4.3.6 Battery Full indicator

This is the orange LED, it is lid when the charge process is terminated and the battery is fully charged. To prevent the device form “flipping” the system has a hysteresis. The battery will be charged again when the battery voltage drops below this hysteresis.

4.3.7 Maximum Power Point (MPP)

The device searches for the maximum power point of the solar panel. This fixed point lies at 5.5 Volts. (The MPP is related to the Voc of the panel, and that is a fixed property) When the charger needs more current than the solar panel can provide, it limits the current at this point.
A bypass circuit will continue to work, in low light conditions, where the conditions of the MPP are not met.

4.3.1 Connector Pin Configuration

Connector	Pin	Function	Description	Value	Comments
X1	1	Solar (-) /Gnd	Black wire (Solar Panel)	0V	Solar Panel
X1	2	Solar (+)	Red wire (Solar Panel)	4V nom	Solar Panel
X2	1	Data Logger Power (+)		3.6V	Data Logger (Molex)
X2	2	Data Logger Power (-)	0V /Gnd	0V	Gnd (Molex)

4.3.2 Specifications ML-PB-PV12-LFP

Power Supply	
Protection	Internal fuse for Battery
Input Power	Solar Panel
Type of Power	Solar Panel 12 Cells (Voc 7 Volts, Vnom 4 Volts)
Charger Circuit	
Discharge protection	Yes, @ 2.5 Volts
Charging Current	200 mA max
Battery Full Level	3.8 V
Battery Level Hysteresis	0.45 V (back on @ 2.95 V)
Battery Low Level	2.5 V
Temperature	Operating: 0* or -20* .. +60 °C (*Limited to battery spec) Storage: -40 .. +85 °C
Humidity	5 .. 60 % RH
Electrical	
Type of charger	Solar optimized charger with MPP tracking
Switch Frequency	1 Mhz typical
Quiesent Current	<100 uA (output available, but not loaded)
3.6 V output	
Output current	4A RMS
Connector	Molex 22-27-2021
Galvanic Isolation	No
Overload Protection	Yes, Fuse
CE Compliant	Yes
Rohs Compliant	Yes
Dimensions	
W x D x H	106 x 82 x 15 mm
Weight	
Netto Weight	110 Grams

Spareparts:

- Battery fuse (F2): 4A Slow Blow Littlefuse 0454004.

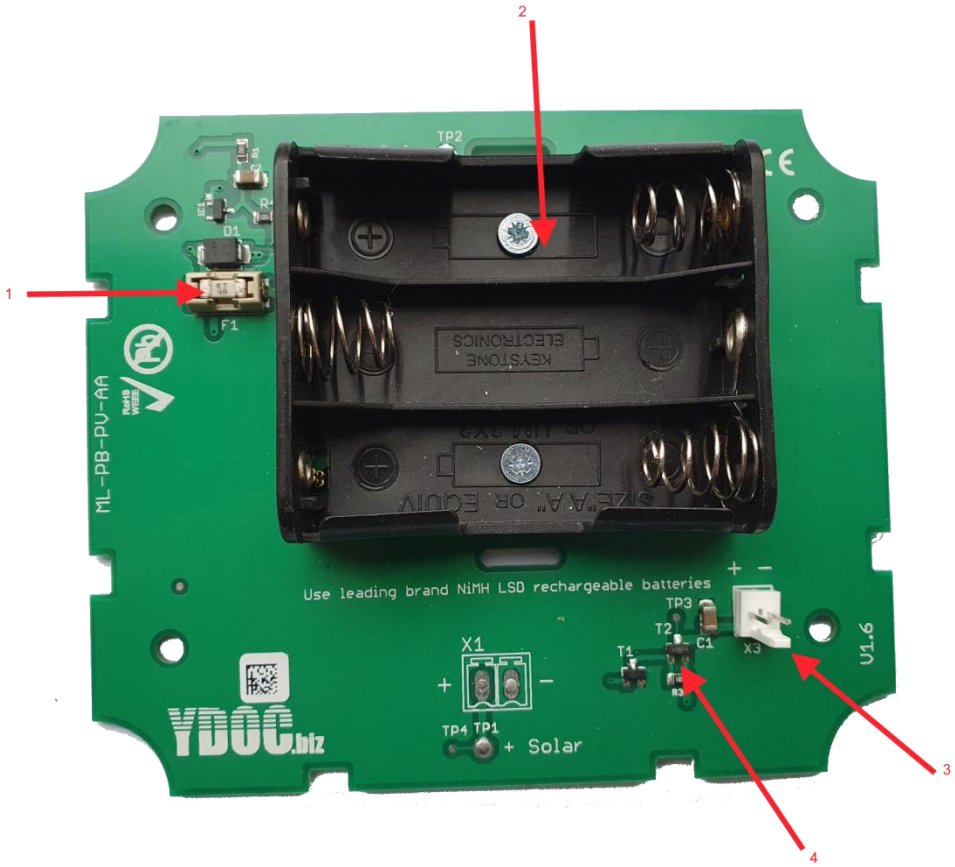
4.4 ML-PB-PV-AA

The ML-PB-PV-AA Power Board is a power board to use with the YDOC 1 Wpeak solar cap, charging 3 NiMh -AA cells. It provides overload protection-by dimensioning and battery discharge protection.

4.4.1 Solar Charging of NiMh batteries (AA type)

The design is very straightforward: a 1 Wp solar panel, that is mounted in the special cover, is directly charging the batteries. The output is switched off when the batteries are depleted (@2.9 Volts). A diode prevents the solar panel from dawning the batteries at night.
A 4 Amp fuse protects the batteries/device in case of a short-circuit.

4.4.2 Overview ML-PB-PV-AA



1) 4 Amp Battery fuse
2) Battery holder for 3 AA type NINH LSD cells (low self-discharge)
3) Output connector (to Data Logger)
4) Undervoltage protection
5) Solar panel connector or wires (X1)

Note: *Remove the batteries from the holder during data logger transportation and storage.*

Spare parts:

- Battery fuse (F2): 4A Slow Blow Littlefuse 0454004.

4.4.1 Connector Pin Configuration

Connector	Pin	Function	Description	Value	Comments
X1	1	Solar (-) /Gnd	Black wire (Solar Panel)	0V	Solar Panel
X1	2	Solar (+)	Red wire (Solar Panel)	4V nom	Solar Panel
X2	1	Data Logger Power (+)		3.6V	Data Logger (Molex)
X2	2	Data Logger Power (-)	0V /Gnd	0V	Gnd (Molex)

4.4.2 Specifications ML-PB-PV-AA

Power Supply	
Protection	Fuse
Input Power	Solar Panel
Type of Power	YDOC Solar Panel (12 cells, 1 Wpeak)
Charger Circuit	
Discharge protection	Yes, @ 2.9 Volts
Charging Current	200 mA max
Battery Empty Level	2.9 V
Battery Empty Hysteresis	0.45 V (back on @ 3.35 V)
General Enviroment	
Temperature	Operating: -30 .. +85 °C Storage: -40 .. +85 °C
Humidity	5 .. 60 % RH
Electrical	
Type of charger	Solar
Switch Frequency	DC
Quiesent Current	Not applicable
Galvanic Isolation	No
Overload Protection	Yes, Fuse
CE Compliant	Yes
Rohs Compliant	Yes
Dimensions	
W x D x H	106 x 82 x 20 mm
Weight	
Netto Weight	110 Grams

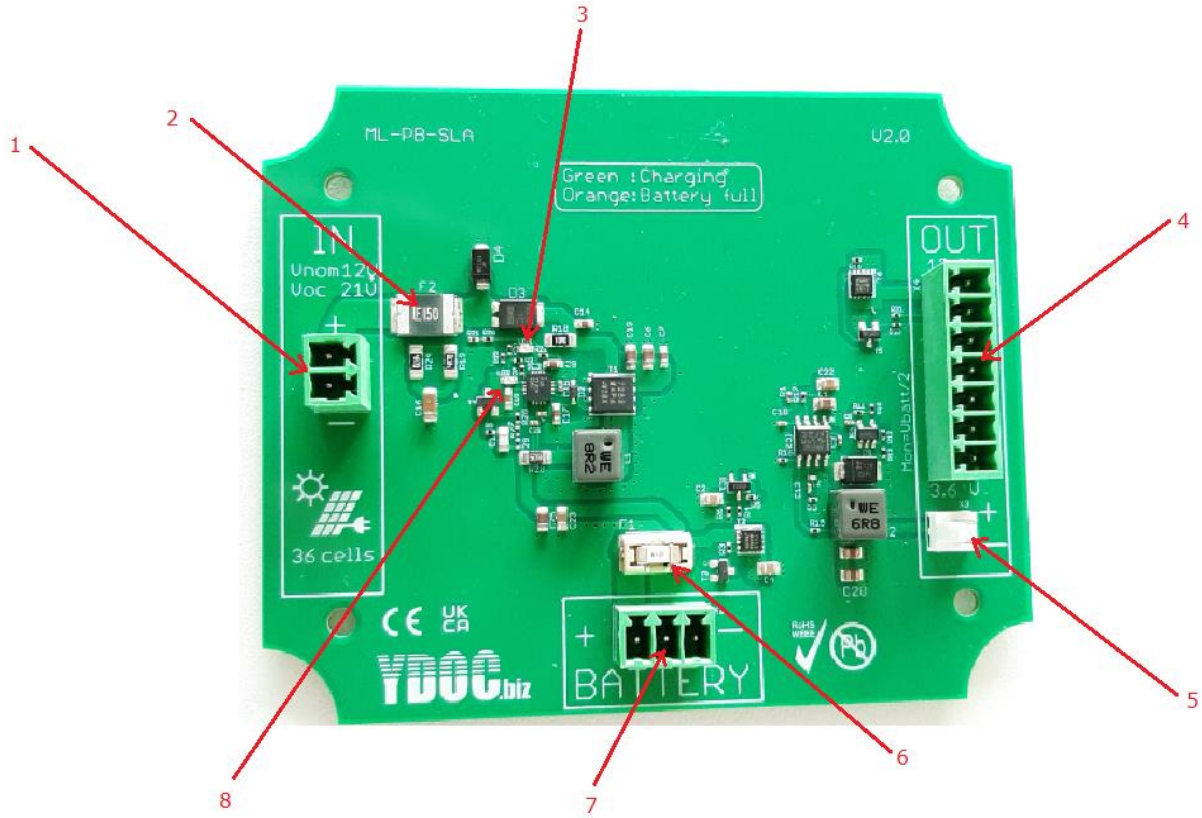
4.5 ML-PB-SLA V2.0

The YDOC ML-PB-SLA V2.0 SLA Charger-Power Board is an accessory for the type ML-xx low power Data Logger. It is designed to power the ML-xx Data Logger from an auxiliary solar power source. It must be used together with a 12 V Sealed Lead Acid Battery (SLA) or a LiFe-PO4 battery and a solar panel or DC power supply.

Features:

- Solar system 36 Cells (12Vnom)
- Power output 12V /0 .. 4A max.
- Switchable output 12V /0 .. 4A max.
- 12V Power output and switched output can deliver 4A max. *(Together)*
- Stabilized 3.6V (Molex) to power the Data Logger
- SLA Charger
- RoHs Compliant
- CE Compliant

4.5.1 Overview of the ML-PB-SLA V2.0 Board



1) Solar power in. Use 36 cells solar panel
2) Automatic main fuse (Non replaceable)
3) Charge indicator LED (Green)
4) 12V Output connector
5) 3.6V power connector (Molex) for Data Logger
6) Battery Fuse (4A fast acting)
7) Battery connector
8) Battery full indicator LED (Orange)

Spareparts:

- Battery fuse (F1): 4A Slow Blow or fast acting Littlefuse 0454004.

4.5.2 General

The ML-PB-SLA Sealed Lead Acid Battery Charger is a, high efficiency, low noise, power supply and charger for 12V type SLA Batteries (or LiFe-PO4). It consists of a single PCB, to be mounted in a ML-type data logger casing.

4.5.3 Charger

The charger is optimized for solar power (36 cells, Vnom 12V /Voc 21V). It automatically searches for the maximum power point of the solar panel, for high efficiency. The charge current is limited to 1.6 Amp, for small battery-support.

4.5.4 Protection

The charger has different protection features to enable a high reliable, user-friendly, and safe operation.

Battery undervoltage protection

It has a Battery low detection which is triggered when the battery voltage gets below 10.8 Volts. When this happens, the batteries will be disconnected from the output (from the Data Logger), so, the batteries won't be damaged due to total discharge. There is a hysteresis which prevents the system from "flipping" on and of all the time. (See technical specification)
The batteries are re-connected to the power output when the battery-voltage gets above the threshold + hysteresis. So, the Data Logger will work again. Because of the chemistry of a battery, the hysteresis is relatively high. The battery is switched off @ 10.8V and switched back on @ 12.0V.



Due to this hysteresis, the system will not start, when connecting a battery with a voltage <12 V. Normally, a unloaded charged battery will have a voltage of > 12 V. An unloaded battery with a voltage < 12 V is pretty empty. After the solar panel has charged the battery above 12V it will work.

Overtemperature protection

The system is protected against Too high temperature (>145 degrees Celsius), it will shut down. This temperature is measured inside the charge controller, which is connected to the Gnd plane of the PCB Because the batteries are charged externally, the battery temperature is NOT measured

Overvoltage protection

The input is protected against too high voltage When the input voltage is above 34 Volts, the (main) fuse will blow. The battery is protected against overvoltage (overcharge) by the management chip.

Wrong polarity protection

The input is protected against wrong polarity. If the polarity is wrong, the system won't work and there is no damage to the system.

The battery in/output is protected by means of a fuse. If connected wrong, the fuse will blow. Although the electronic circuits on the main board are not damaged by this, it is NOT favorable to do.

4.5.5 Operation

The ML-PB-SLA is used to charge SLA & LiFe-PO4 batteries. You can build a system with just this Power board , a solar panel and a battery. The Power board also has a power output for the Data Logger. This way, the user won't have to buy a separate solar charger, and 3.6 volts power supply.The ML-PB-SLA is optimized for solar power. It is not practical to use it as a power adapter for 12 ->3.6 Volt conversion. Use other products, like ML-PC-DC instead. The ML-PB-SLA power board manages the energy system stand alone. There are no jumpers, no settings are needed. It just works straight from the box. There are 2 indicators that are useful for the user. Charge indicator
This is the green LED.
When this LED is lid, the battery is charged. The charge current is defined by the internal management system and may vary upon, state of charge of the battery and the available power from the solar panel.

4.5.6 Battery Full indicator

This is the orange LED. When this LED is lid, the charge process is terminated, and the battery is fully charged. To prevent the device form "flippering" the system has a hysteresis. The battery will be charged again when the battery voltage drops below this hysteresis.

4.5.1 Battery Monitor output

This output enables the monitoring of the battery voltage. It outputs half of the real battery voltage. This is convenient, because it enables the user to connect it to a standard analog (voltage) 0 - 10V input. By multiplying the measurement by 2, it shows the real battery value. This output is buffered by an OpAmp, so the user doesn't have to worry about input impedance.

4.5.2 Maximum Power Point (MPP)

The device searches for the maximum power point of the solar panel. This fixed point lies at 18V. (The MMP is related to the Voc of the panel, and that is a fixed property) When the charger needs more current than the solar panel can provide, it limits the current at this point.
Of course, when a very big solar panel is connected, the maximum power point can't be reached because of the overcurrent limit of 1A. So, the maximum power point tracking only works when the solar panel is properly dimensioned to the charger. (i.e., a 12V, 15W Panel). A bigger panel is supported also, only the MPP won't be reached. (The user will not notice, because it will operate perfectly)

4.5.3 Connector Pin Configuration

Connector	Pin	Function	Description	Value	Comments
OUT	1	Switched output (Battery)	Switched output (+)	12 .. 14V	Switched Battery output (4A Fuse)
X4	2	Control input	Control input	5 ..12V	Switch input
	3	Battery (-) Gnd	Gnd /Battery 0V		
	4	Battery (-) Gnd	Gnd /Battery 0V		
	5	Battery (+)	Unregulated battery	12 .. 14V	Raw battery voltage (4A fuse)
	6	Battery (+)	Unregulated battery	12 .. 14V	Raw battery voltage (4A fuse)
	7	Monitor output (Vbatt /2)	Battery (voltage/2) monitor	0 .. 7V	Usable on Analog input 0 .. 10V
IN	1	Solar panel +		3.6V	Data Logger
X1	2	Solar panel -		0V	Data Logger
BATTERY	1	Battery connection (+)	Battery positive pole	12 ..14V	Battery input power 12 .. 14V
X2	2	NC			
	3	Battery connection (-)	Battery negative pole (Gnd)	0V /Gnd	System GND /Battery 0V
POWER	1	Regulated power +		3.6V	Data Logger power (Molex)
X3	2	Regulated power - /GND		0V	0V /Gnd (Molex)

4.5.4 Specifications ML-PB-SLA V2.0

Power Supply	
Protection	Internal fuse
Input Power	Solar Panel
Type of Power	Solar Panel 36 Cells (Voc 21 Volts, Vnom 12 Volts)
Auxilary Output	
Protection	Yes, by fuse
Output Voltage	12 Volts unregulated (Battery voltage)
Output Current	4 A max. (Continue and Switched together)
Charger Circuit	
Discharge protection	Yes, @ 10.8 Volt
Charging Current	1 Amp max.
Battery Full Level	14.4 Volt
Battery Full Hysteresis	1.8 V (Back on @ 12.6 V)
Battery Low Level	10.8 Volt
Battery Low hysteresis	1.2 V (Back on 12.0 V)
General Environment	
Temperature	Operating: -30 .. +85 °C Storage: -40 .. +85 °C
Humidity	5 .. 60 % RH
Electrical	
Type of charger	Solar optimized charger with MPP tracking
Switch Frequency	1 Mhz topicaal
Quiesent Current	1 mA (3.6 Volts power supply active)
Quiesent Current	500 uA (SLA Battery low) (3.6 volts power supply not active)
3.6 V output	
Output current	2A Rms
Connector	Molex 22-27-2021
Galvanic Isolation	No
Ripple & Noise	5% peak-peak, 20 MHz bandwidth
Overload Protection	Yes, Fuse
CE Complient	Yes
Rohs Complient	Yes
Dimensions	
W x D x H	106 x 82 x 15 mm
Weight	
Netto Weight	110 Grams

5 DC Power Board

5.1 ML-PB-DC

The ML-PB-DC (V1.3) power board is a high efficiency, low noise, power supply. It consists of a single PCB, to be mounted in YDOC ML-type Data Logger (It's delivered with a cover).

5.1.1 8 .. 30 Volts DC auxiliary input power

The power supply is converting the input source to a, stable and clean, output voltage.
A green LED indicates the presence of the input power.

Protection

The power board input circuit is equipped with a tranzorp of 30 Volts, and a fuse of 4A. This protects the connected Data Logger from high input voltages.

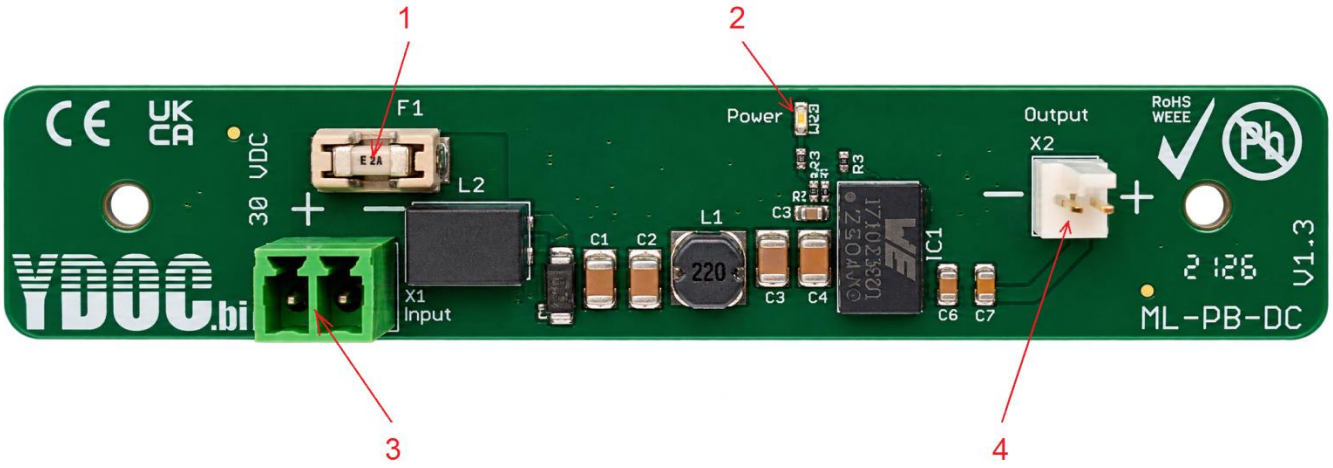


Beware of exposing power board to high voltages, as it will damage the fuse. Also, when the polarity of the input-source is wrong, the fuse will blow. But, your connected Data Logger is protected in both cases.

Note: *Normally the fuse will never blow, during the lifetime of the instrument.*

5.1.2 Overview ML-PB-DC

The ML-PB-DC board converts 8 .. 30V input voltage to a stabilized 4.2V power source for a data logger.



1) Input Fuse (2A)
2) Power LED (green)
3) 8 .. 30V DC input
4) 4.2V data logger power (Molex connector for use of the red and black cable)

Spare parts:

- Input fuse (F1): 2A Fast Acting Littlefuse 0453002.

5.1.3 Connector Pin Configuration

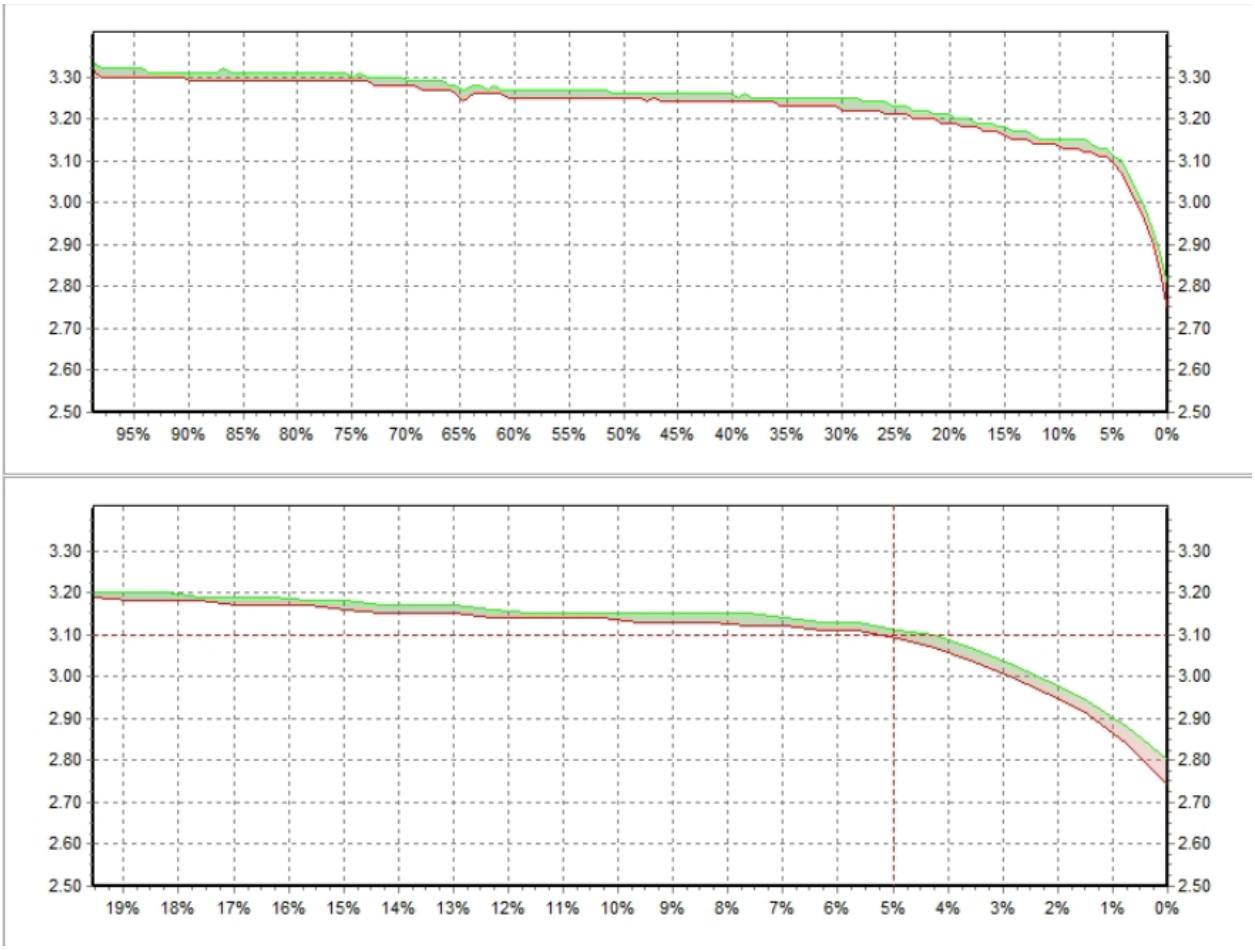
Connector	Pin	Function	Description	Value	Comments
X1	1	DC Power input (+)	DC power supply	8 .. 30V	1A cont. (2A peak)
X1	2	DC Power input (-)		0V /Gnd	
X2	1	Data Logger Power (+)	Data logger power	4.2V	Data Logger (Molex)
X2	2	Data Logger Power (-)	0V /Gnd	0V /Gnd	Gnd (Molex)

5.1.4 Specifications ML-PB-DC (V1.3)

Power Supply	
Protection	Fuse 2A
Input Power	8 .. 30 V (DC)
Power out	4.2V, 1 Amp (Rms), 2A (Peak)
General Enviroment	
Temperature	Operating: -30 .. +85 °C Storage: -40 .. +85 °C
Humidity	5 .. 60 % RH
Electrical	
Switch Frequency	700 kHz typical
Quiescent Current	<0.5 mA, input @12V
Output	
Output current	1 Amp Rms, 2A peak.
Connector	Molex 22-27-2021
Galvanic Isolation	No
Ripple & Noise	2% peak-peak, 20 MHz bandwidth
Overload Protection	Yes, Fuse
CE Compliant	Yes
Rohs Compliant	Yes
Dimensions	
W x D x H	106 x 21 x 15 mm
Weight	
Netto Weight	12 Grams

6 LiFePo4 Battery Empty Voltage

According to manufacturer discharge curves the state of charge at 3.1 V of a LiFePo4 cell is about 15%, but this is always with a high load. With low loads like with our data loggers, a battery can maintain a higher voltage much longer, which means that the capacity left at 3.1 V is way lower and about 5%. However, with 5% of 3600 mAh is still 180 mAh left and enough to keep data logging going on for weeks. Please find below a realistic discharge curve base on a typical Data Logger load.



Note: *Check this FAQ on deep-discharged LiFePo4 batteries.*