

# PPU FOR HIGH VOLTAGE CHARGING

Power Processing Unit For Modern Lithium Battery Module

Company logo: Hang Xu 1856033



The power processing unit can be the power supporting unit for Modern Lithium Battery Module which is consist of 18650/2170 rechargeable battery cells or any other rechargeable battery cells. This type of Lithium Battery Module is generally used in Electric Cars, Backup Power Source, Solar or Wind Power Storage. The eco-friendly feature of the Li-ion battery makes it one of the most popular type of batteries. After Tesla Motors, the electric vehicle company’s release of Model S all-electric car in 2014, the method of building battery pack by rechargeable cells become much more general in industry and design. This unit can be the best partner of most of these battery packs.

This unit has been developed especially for the Integrated Design Project 2 Challenge, which have a main purpose to supply the battery source of the umbrella shaping retractable roof for Nelson Mandela Bay Stadium. The umbrella membrane roof with 16 rails on the support structure is controlled by servo DC motors on each rail. Because of the special design, the calculated data is different with regular stadium roofs.

The 80-ton roof is light enough so that the power rate of each servo DC motor can be 200W, which is able to be driven directly by 16 packs of Lithium Battery Module which contains 16 2170 Li-ion batteries each providing 60V output for each servo motor.

Considering the position for the placement of the PPU is in the central pin at the midair of 70-meter-high, the high frequency circulation of air allows high voltage charging which usually have a heating problem. The PPU provides two type of DC voltage for both fast charging and middle speed charging. Also, the low speed charging is provided by the solar power collecting feature which is default open when the high speed charging is switched off. The Power Processing Unit is also considered to provide the 220V AC power for regular house holding devices, so that the consumers will not need to obtain another one.

The control of the PPU is achieved by an CPU which can be powered by the build in battery source. The control unit will judge which mode of charging need to be enable depend on the device temperature and battery level.

### Key Feature

- Generate and monitor the voltages and currents to the battery component; provide a hardware start up and force off.
- Convert the industrial three phase AC power for use and be able to provide low voltage DC power from build-in solar cells and capable with third part solar panel.
- Three levels of charging which can be manually switched from slow to fast.
- Smart Control, judge the situation and choose a proper charge speed. Capability with electric vehicle.
- Emergency energy battery source and direct 220V AC output for building and stadium.

### Main application field

- Buildings and stadiums which use rechargeable battery as the main power supply
- New Energy Research and Implementation
- Commercial product(Electric vehicle) accessory

### Customers/Application

- Integrated Design Project 2 Challenge Group C 12
- New Energy Research Facility(Maybe)
- Electric vehicle owner

### Budgets

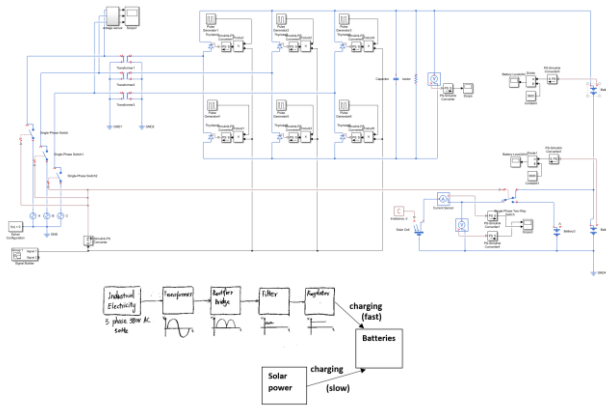
- Mass3-Phase Transformer 31kg  
3-phase Controlled Bridge Rectifier 1.18kg  
Build-in 2170(66g) Battery Pack 18.48kg  
Build-in Solar cells 3.02kg  
total (with other chips) 55kg
- Volume660mm x 570mm x 260mm
- Efficiencyhigh speed 80.8% middle speed 42.5

### Interfaces

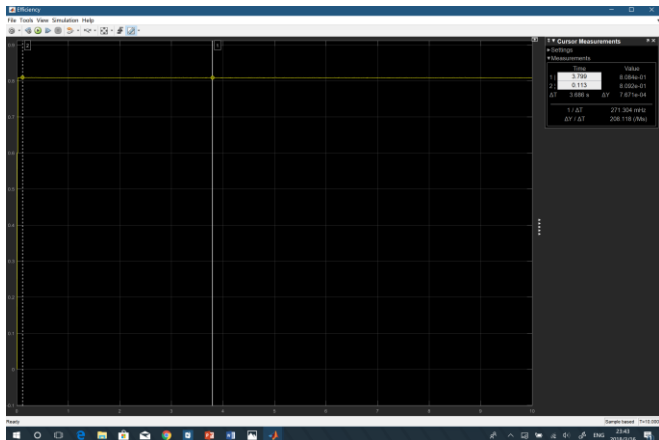
- Power Input:  
Input Voltage 3-phase industrial electricity 380V 50Hz  
Maximum input current: 1000A
- Power Output:  
Maximum output power: 378V/198V  
Voltage supply range:380V three phase AC  
Solar Power Current: 10A  
logical control signal voltage: 1V
- Production:  
OEM: Foxconn Technology  
Packaging: Polycarbonate alloy  
Production cycle: 1 month  
Delivery date: June 21st

### Environments

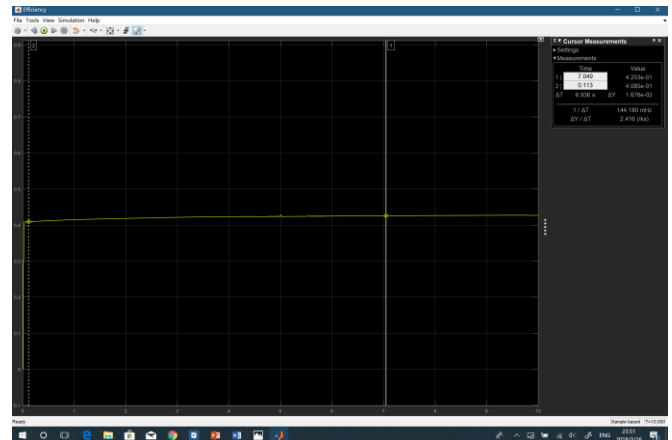
- Operating Temperature: 2°C(Battery) to 50°C  
3-phase Rectifier will heat to 150°C(Cooling Fans needed)
- Reliability: Fit for Port Elizabeth (7°C to 40°C)



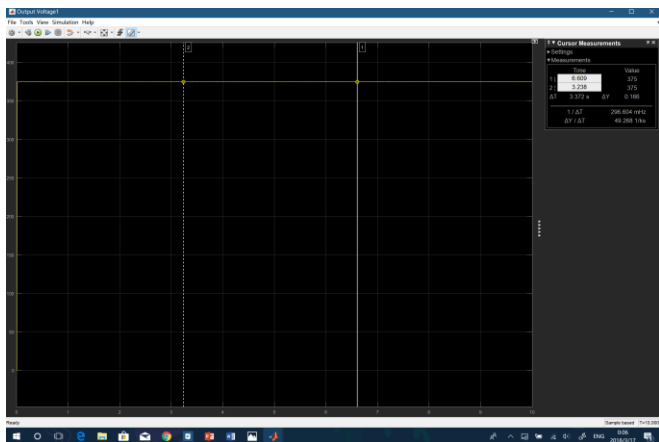
This is a simple version of the circuit, the main procedure is that the three phase AC power go through a RLC filter and here get a three phase source with out low frequency noise, Then a transformer with ratio 1:1 purpose to separate the industrial power system with the PPU System. Three phase full controlled thyristor rectifier is chosen to both rectify and adjust the output voltage by control the delay. Finally a capacitor is used to filter the high frequency part.



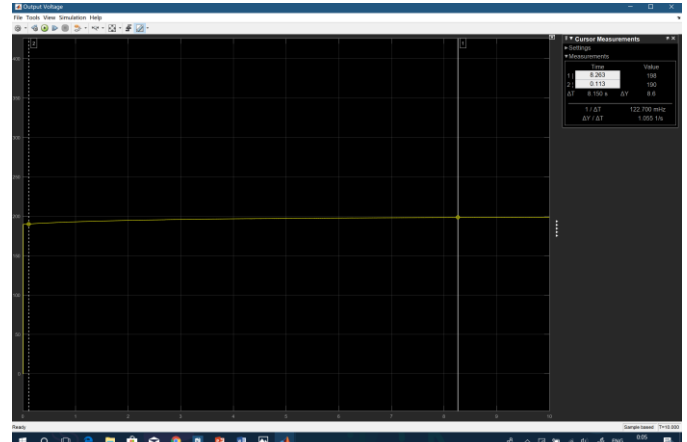
### High speed charge efficiency curve



### Middle speed charge efficiency curve



### High Speed Charge output voltage



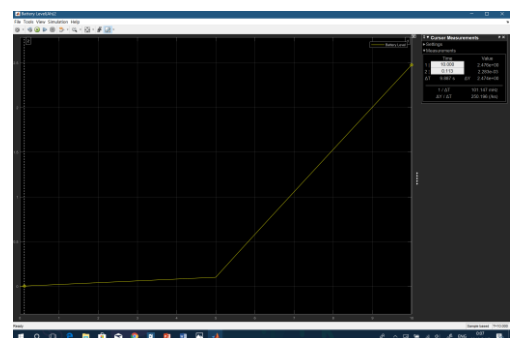
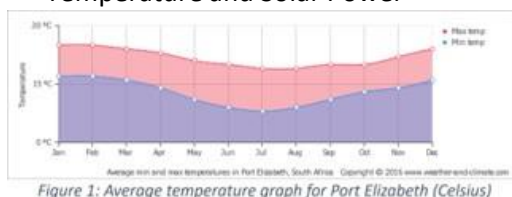
### Middle Speed Charge output voltage

## Render Parts



## Environment Situation

### Temperature and Solar Power



## Solar Charging switch to High Speed Charge