SOLAR ENERGY STORAGE SYSTEMS

ISS4E ERC Lab

E-Bike Charging Station
ISS4E ERC Lab Layout

NOTES:
ENERGIZED 100 UNIT WILL NOT BE FEEDING INTO THE GRID.
S&I NEW LAMINOID LABEL FOR PANELS AS PER SPECIFICATIONS

30A BREAKER S&I BY CONTRACTOR

#12 CONNECTED TO BUILDING GROUND
HANWHA HSL60 Solar Panel

Five Key Features

1. Guaranteed quality: 12 year product warranty, 25 year linear performance warranty *
2. Predictable output: Positive power sorting of 0 to + 5 W
3. Innovative solution: Anti-reflective coating for high sunlight absorption
4. Robust design: certified to withstand up to 4000 Pa wind load and up to 7000 Pa snow load**
5. Anti-PID: Modules are qualified to withstand PID(Potential Induced Degradation)***

* Please refer to Hanwha Solar Product Warranty for details
** Please refer to Hanwha Solar Module Installation Guide
*** PID test conditions: module charged -1000V with Al-foil covered surface, 25°C, 168h

Electrical Characteristics

Electrical Characteristics at Standard Test Conditions (STC)

<table>
<thead>
<tr>
<th>Power Class</th>
<th>255 W*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Power (P_{max})</td>
<td>255 W</td>
</tr>
<tr>
<td>Open Circuit Voltage (V_{oc})</td>
<td>38.0 V</td>
</tr>
<tr>
<td>Short Circuit Current (I_{sc})</td>
<td>8.89 A</td>
</tr>
<tr>
<td>Voltage at Maximum Power (V_{mp})</td>
<td>30.8 V</td>
</tr>
<tr>
<td>Current at Maximum Power (I_{mp})</td>
<td>8.29 A</td>
</tr>
<tr>
<td>Module Efficiency (%)</td>
<td>15.8 %</td>
</tr>
</tbody>
</table>

P_{max}, V_{oc}, I_{sc}, V_{mp}, and I_{mp} tested at Standard Testing Conditions (STC) defined as irradiance of 1000W/m² at AM 1.5 solar spectrum and a temperature of 25±2°C. Module power class have positive power sorting: 0 to +5W. Measurement tolerance: +/- 3% (P_{max})

* 255W is only applicable for the module with white back sheet

Electrical Characteristics at Normal Operating Cell Temperature (NOCT)

<table>
<thead>
<tr>
<th>Power Class</th>
<th>255 W*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Power (P_{max})</td>
<td>186 W</td>
</tr>
<tr>
<td>Open Circuit Voltage (V_{oc})</td>
<td>35.2 V</td>
</tr>
<tr>
<td>Short Circuit Current (I_{sc})</td>
<td>7.22 A</td>
</tr>
<tr>
<td>Voltage at Maximum Power (V_{mp})</td>
<td>27.9 V</td>
</tr>
<tr>
<td>Current at Maximum Power (I_{mp})</td>
<td>6.67 A</td>
</tr>
<tr>
<td>Module Efficiency (%)</td>
<td>14.4 %</td>
</tr>
</tbody>
</table>

P_{max}, V_{oc}, I_{sc}, V_{mp}, and I_{mp} tested at Normal Operating Cell Temperature (NOCT) defined as irradiance of 800W/m²; 20°C; Wind speed 1m/s; Measurement tolerance: +/- 3% (P_{max})

*255W is only applicable for the module with white back sheet
**Renusol CS60** Ballasted Mounted System for Flat Roof and Ground Applications

The **Renusol CS60** is a one piece PV mounting system for flat roof and ground mount applications, available in 10 and 15 degree tilts. The universal design accommodates all common PV modules. The simplicity of the Renusol CS60 saves installation time and reduces overall project costs.

**Features**

- Complete kit in 1 box
- Installs quickly with minimal parts
- PV panel mounts directly to Renusol CS60
- Evenly distributes weight across roof surface
- Enclosed ballast tray
- Durable, non-conductive material (no grounding required)
- Impact and UV resistant
- Wind tunnel testing up to 170 mph
APSystem YC500A Micro inverter

The **APSystem YC500 Micro inverter** is a grid-tied micro inverter with intelligent networking and monitoring systems. It is used in utility-interactive grid-tied or off-grid applications, and is made up of three key elements: APS Micro inverter, APS Energy Communication Unit (ECU), APS Energy Monitor and Analysis (EMA) web-based monitoring and analysis system.

**Features**

- Single unit connects two solar modules or one solar module and one wind turbine
- Individual MPPT for each module
- Rated up to 310W modules
- Maximum output power 500W (250W AC per module)
- Up to 14 solar modules (7x YC500s) in a string with a 20A breaker
APS Energy Monitor and Analysis (EMA) - web-based monitoring and analysis system

Features

• Collects individual module and micro inverter statistics
• Communicates in real time
• Requires no additional wiring (it uses **PLC** or **Power-line communication**: data carried on a conductor, that is also used simultaneously for AC transmission or distribution)

Diagram of a typical residential system
Zefr Wind Turbine

Z-100 Micro Wind Turbine

- 250 Watts at 35 MPH
- UV Stable ABS Injection Molded Blades
- 36" (91.44m) Rotor Diameter
- Constant DC Voltage Output of 30V
- Simple Aesthetics
- Blades Optimized for Performance and Low Acoustic-Profile
- Cut-in speed of 5MPH
- Chargrhz-compatible for Battery Charging
- Invertrz-compatible for Grid-tied applications

Zefr is the first wind turbine that can be installed in an array. Utilizing JLM’s Invertrz technology, Zefr and PV panels can be configured on the same electrical branch to create a true hybrid wind and solar PV System. Additionally, the whole system can be monitored by JLM Energy’s online monitoring software called Measurz through our AC-SGB Module.

For battery charging applications, Zefr is compatible with JLM’s Chargrhz module.

Zefr Z-100 Micro Wind Turbine Data Sheet

OUTPUT DATA [DC]
- Nominal Output Voltage Rating: 30Vols
- Maximum Output Power (at 3.5 MPH): 250W
- Output Current Rating: Up to 8 Amps
- Generator: 3 Phase Rated at 300W

MECHANICAL DATA
- Nacelle Housing: NEMA-4 (IP65)
- Bearings: Fully Sealed and Rated at 100,000 Hours
- Rotor Diameter: 36" (91.44m)
- Weight: 45 lbs (20.4kg)
- Weight (Extended Height): 35 lbs (15.9kg)
- Cooling: Natural Convection — No Fan
- Finish: Epoxy Primer and Powder Coat
- AutoFurlz Speed: 35MPH
- Hub Height: 31" (78cm)
- Hub Height (Extended): 67" (170cm)
- Blade Material: Foamed ABS with UV Stabilizer Package

TESTS
- 24 Hours: 30°C (86°F)
- One Hour: 90°C (194°F)
- Five-minute Intervals of G-150W: 25°C (77°F)

FEATURES
- High Wind Speed Safety Mechanisms
- AutoFurlz and Resistive Electromagnetic Braking
- Warranty: 5-Year Limited Warranty

Specifications subject to change without notice - please ensure you are using the most recent update found at www.jlmei.com
IPC-2MPSR50 SURVEILLANCE CAMERA

PRO-Series 2-MegaPixel All-Weather Network Dome Camera featuring a **2.8-12.0mm varifocal lens** and **infrared night-vision up to 50 Feet**. Perfect for day & night surveillance applications including: Parking lots, offices, schools, hospitals and other high-risk areas.

**ADVANTAGES**

- High-Definition H.264 2-MegaPixels (1920 x 1080) @ 30fps
- High-Intensity IR Night-Vision Range up to 50 Feet
- Dynamic 2.8mm-12.0mm Zoom Lens
- Vandal-Resistant IP-66 Rated All-Weather Design
- ONVIF Compliant & PoE Ready for Easy Installation
- Includes License-Free 64 Channel Client Management Software
- Perfect for Parking lots, offices, schools, hospitals and other high-risk areas
- 100% Performance Guarantee & World Class Technical Support

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EPack - Compact SCR Power Controller

Features

• Nominal load current from 1 amp to 63 amps
• Voltage up to 500V
• Compact DIN Rail and bulkhead Mounting Format
• Configurable via iTools (PC software) or front panel
• Plug and play Ethernet communications
• V2, I2 or True power control
• Controls comprehensive range of loads: resistive, infra-red, transformer primary, etc.
• Energy usage measurement
PHASE ANGLE CONTROL

This mode of firing controls power by varying the amount of each cycle which is applied to the load, by switching the controlling thyristor on part-way through the cycle.

50% shown. Power is proportional to the area under the curve.
Energizr – Energy Storage and Management System

Energizr is a complete energy storage and energy management solution for on-grid and off-grid residential applications.
Energizr – Energy Storage and Management System

Features
• Stores solar energy during the day to power a home at night
• Reduces or eliminates the need to purchase energy from utility company
• Provides electricity during power outages by keeping solar systems operational
• Provides whole-house emergency backup power during power outages
• Operates independently or seamlessly integrates with solar systems and backup generators
• Protects sensitive electrical equipment during power outages
• Cloud based interface for real-time energy monitoring using Measurz software
ISS4E Charging Station Layout

PV

Charge Controller

Inverter

Raspberry Pi

Phidget Board

Bike Battery

Battery

I1 - PV Charging Current Sensor
I2 - Battery Bank Charging Current Sensor
I3 - Discharging Current Sensor
V1 - PV #1 Voltage Sensor
V2 - Battery #2 Voltage Sensor
V3 - Battery #3 Voltage sensor
V4 - Battery #4 Voltage Sensor
T - Temperature Sensor
Chargrz – Battery Charge Controller

Chargrz is a battery charger specifically designed to work directly with solar or wind energy. The energy output of each solar panel varies depending on shading, manufacturing parameters of the solar panels in the system, temperature variations and the general health of the panels. Chargrz is designed to connect to a single solar panel. As such its maximum power point tracking (MPPT) system optimizes the battery charging capabilities of the individual solar panel. Multiple chargers can be connected in a daisy chain configuration.

Features

- Increases PV Array Output by up to 30%
- PV Panel level Continuous Maximum Power Point Tracking (MPPT)
- Full Power Output in Ambient Temperature (up to 40°C)
- Battery Voltages from 12 to 75 VDC
- Works with PV Panels up to 300W
- Convenience (not available in the first production units):
  - Measurz-Compatible
  - Programmable using wireless radio connectivity
  - Built-in 365 Days of Data Logging
Cotek – Pure Sine Wave Inverter

Cotek s600-148 is a 600Watt 48Volts Pure Sine Wave inverter. It turns DC current into AC current, used for powering a multitude of devices, such as office equipment, household devices, power tools, etc.

Features

- Pure sine wave output
- Output frequency: 50 / 60Hz switch selectable
- Input & output fully isolation design
- High efficiency 88~94%
- Capable of driving highly reactive & capacitive loads at start moment.
- Tri-Color indicators display input voltage & output load level
- Loading controlled cooling fan
- Advanced microprocessor
- Protection: Input low voltage, Overload Short circuit, Low battery alarm, Input over voltage, Over temperature
Raspberry Pi Model B+

Raspberry Pi is a low cost, credit-card sized computer. It’s capable of doing many things a desktop computer would do, from browsing the internet to making spreadsheets and word-processing. Most importantly, Raspberry Pi has the ability to interact with the outside world, and has been used in a wide array of projects.

Features

- Chip: Broadcom BCM2835 SoC
- Core architecture: ARM11
- CPU: 700 MHz Low Power ARM1176JZFS Applications Processor
- GPU: Dual Core VideoCore IV® Multimedia Co-Processor
- Memory: 512MB SDRAM
- Operating System: Boots from Micro SD card, running a version of the Linux operating system
- Dimensions: 85 x 56 x 17mm
- Power: Micro USB socket 5V, 2A
- Connectors: 10/100 BaseT Ethernet socket, HDMI, Composite RCA (PAL & NTSC), Audio Output, GPIO Connector, 15-pin MIPI Camera Serial Interface (CSI-2)
Phidget Interface Kit 8/8/8 - 1018_2

The Phidget Interface Board is a flexible I/O (input/output) board which can record and control analog sensors and digital inputs and outputs.

Features

- Number of Analog Inputs: 8
- Analog Input Resolution: 10 bit
- Number of Digital Inputs: 8
- Number of Digital Outputs: 8
- USB 5VDC powered
- Max Current Consumption: 500mA
Phidget Precision Voltage Sensor – 1135_0

The **Voltage Sensor** measures the differential voltage between the input terminals and outputs the difference proportionally. The maximum differential voltage that can be measured accurately is ±30V.

**Features**

- Sensor Type: Voltage DC
- Voltage Difference Max: +/- 30 VDC
- Supply Voltage: 5VDC
- Max current Consumption: 3.6 mA
- Sensor Input Impedance: 1 MΩ
- Operating temperature: -40 to +85 °C
ACS710 Current Sensor

The Allegro™ ACS710 is a current sensor which consists of a precision linear Hall sensor integrated circuit. It provides economical and precise means for current sensing applications in industrial, commercial, and communications systems. The device is offered in a small footprint surface-mount package that allows easy implementation.

Features

- Sensor Type: Hall Effect, Open Loop
- Measuring Type: AC/DC
- Linear sensing Range: -14 to 14 Amps
- Sensitivity: 151mV/A
- Polarization: Bidirectional
- Voltage Supply: 3 to 5VDC
- Number of Channels: 1