**MAIN FEATURES**

- CubeSat and CubeSat Kit compatible.
- 3.3V, 5V and Raw Battery buses are provided.
- Flexible design: different solar cell types/string lengths.
- Can interface to up to 6 solar arrays; one per spacecraft facet.
- Active Maximum Power Point Tracking of solar arrays.
- Compatible with Lithium Ion and Lithium Polymer batteries. (We also supply Cubesat batteries).
- Telemetry and telecommand via I2C interface.
- Bus over-current and battery under-voltage protection.
- USB battery charger.
- Compatible with dead launch via separation switches.
- 1U, 2U and 3U CubeSat versions available.
- 3U Deployed solar panel version (3U DEPS) available (>40W instantaneous solar power capable).
- 1U Deployed solar panel version (1U DEPS) in development (>15W input power capable).

**APPLICATIONS**

- CubeSat and CubeSat Kit satellites.
- Nanosatellites with a power requirement from 1W to 20W orbit average power.

**Technical Description** ('Block Diagram' on next page). For more info see www.clyde-space.com.

**BCR**

There are 3 Battery Charge Regulators (BCRs). Each BCR connects to solar panels on opposing sides of the spacecraft (only one of these panels can be in sunlight). Each BCR has a dedicated active Maximum Power Point tracker.

Each BCR uses a high efficiency power stage and is rated to 3W/8W scaled to match the connected solar array. A simple charge pump powers the low level electronics from input voltages as low as 3.5V.

A centralised End of Charge Voltage controller provides ‘constant current/constant voltage’ charge regime suitable for lithium ion and lithium polymer batteries. (A simple modification adapts this for NiCd and NiMH).

BCR 3 has the ability to interface to the 5V USB line from the main connector. This allows battery charge via USB and EGSE power to the spacecraft during test.

**BATTERY**

A Clyde Space lithium polymer battery can be integrated as a daughter board (battery can be purchased separately).

**TLM/TC**

Telemetry and telecommand functionality is handled by a dedicated I2C compatible microcontroller. Telemetry channels include array and battery currents, voltages and temperatures. Telecommands provide reset/run capability on each power bus.

**PCU**

Synchronous rectifiers provide high efficiency dc-dc converters to regulate to 5V and 3.3V from the raw battery voltage.

An automatic light mode of operation provides seamless operation from zero load.

**PROTECTIONS**

An over-current on any of the 3 buses triggers the timed disconnection of the power bus in question.

An unloading function disables the outputs when the battery voltage is less than 6.5V, re-activating once the battery recovers to 7.5V.
### Performance Specifications (Performances can be adapted to mission specific needs)

<table>
<thead>
<tr>
<th>System Unit</th>
<th>Performances</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>3W BCR</strong></td>
<td><strong>1U EPS &amp; 1U DEPS</strong></td>
</tr>
<tr>
<td></td>
<td>Input voltage: 3.5V to 8V.</td>
</tr>
<tr>
<td></td>
<td>Output voltage: 10V max. Output current: 0.5A max.</td>
</tr>
<tr>
<td></td>
<td>Efficiency: ~90%</td>
</tr>
</tbody>
</table>

| **8W BCR**  | **1U EPS & 1U DEPS**  | **3U EPS & 3U DEPS**  |
|             | Input voltage: 9V maximum Efficiency: >90% | Input voltage: 9V maximum Efficiency: >90% |
|             | Output voltage: 5V and 3.3V +/- 1% over lifetime and temperature | Output voltage: 5V and 3.3V +/- 1% over lifetime and temperature |
|             | Output current: 20mA to 1.2A (3.3V) and 1.2A (5V) (1.5A available on request) | Output current: 20mA to 1.2A (3.3V) and 1.2A (5V) (1.5A available on request) |
|             | Light mode: zero to 20mA output current with a 2.4% output voltage ripple | Light mode: zero to 20mA output current with a 2.4% output voltage ripple |

| **PCU**     | **1U EPS & 1U DEPS**  | **3U EPS & 3U DEPS**  |
|             | Mass: 73g without battery stand-offs; 82g with battery stand-offs (1U EPS) | Mass: 86g (3U EPS) |
|             | Typical dimensions: 95mm (l) x 90mm (w) x (15mm from top PCB 3mm from bottom of PCB; PCB thickness 1.6mm) (d) | Volume: typical dimensions (for above spec): 95mm (l) x 90mm (w) x (15mm from top PCB 3mm from bottom of PCB; PCB thickness 1.6mm) (d). |

### Mechanical Details

**Power System**

**System Mass**

- 73g without battery stand-offs; 82g with battery stand-offs (1U EPS)
- 86g (3U EPS)

**System Dimensions**

- 95mm (l) x 90mm (w) x (15mm from top PCB 3mm from bottom of PCB; PCB thickness 1.6mm) (d)
- 95mm (l) x 90mm (w) x (15mm from top PCB 3mm from bottom of PCB; PCB thickness 1.6mm) (d).

### Connectors

- Two 52 PIN SMATEC ESQ-126-39-G-D connectors, to the CubeSat Kit specification.
- Three 6 PIN HIROSE H3324-ND connectors for Solar Array connections.
- For Pin outs, please see www.clyde-space.com.

Please contact us with your specific requirements (enquiries@clyde-space.com).
For more information on this product and configurations, please go to www.clyde-space.com.