The White Rabbit Switch Low Jitter is a new version of the White Rabbit Switch which counts with a series of improvements that enable its use in more demanding time and frequency distribution applications.

The WRS-LJ distributes Time and Frequency within sub-nanosecond accuracy to thousands of nodes through standard optical fiber, providing very low noise and accurate timing outputs.

The WRS-LJ provides deterministic delivery and a reliable communication. Currently, highly demanding industrial and scientific facilities in more than fourteen countries are already using WR Switches for time-critical applications.
### Technical Specifications / WRS-LJ

#### HIGHLIGHTS
- Sub-nanosecond time accuracy
- 18 SFP 1GbE ports
- Time and frequency distribution
- Distance range over 100km in 1-hop
- Remote monitoring
- Improved clocking design in HW and FPGA
- Cleaner and more accurate 1PPS output.
- Improved clock jitter and phase noise.
- Lower power consumption and better thermic dissipation
- High reliability and improved MTFB

#### Physical Specification

<table>
<thead>
<tr>
<th>Dimension</th>
<th>447 mm x 44 mm x 223 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color</td>
<td>White (metallic)</td>
</tr>
</tbody>
</table>

#### System On-Chip

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>FPGA</td>
<td>Xilinx Virtex-6</td>
</tr>
<tr>
<td>CPU</td>
<td>ARM Atmel AT91 SAM9G45</td>
</tr>
<tr>
<td>Core</td>
<td>400MHz (ARM926E)</td>
</tr>
<tr>
<td>Memories</td>
<td>64MB DDR2 (16-bit bus chip) 256MB NAND flash chip</td>
</tr>
</tbody>
</table>

#### Timing protocols

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>White Rabbit</td>
<td>Supported on 18xSFP ports</td>
</tr>
<tr>
<td>IEEE1588-2008 (PTP)</td>
<td>Default profile (layer 2) supported on 18xSFP ports</td>
</tr>
<tr>
<td>NTP</td>
<td>NTP v2, v3 &amp; v4 supported in Ethernet interfaces. ToD supported via NTP.</td>
</tr>
</tbody>
</table>

#### Front Panel

#### Clocks I/O

- 5 SMC coaxial connectors (male):
  - 10 MHz reference clock input (GPS/Cesium), 50 ohm
  - 10MHz & 62.5 MHz output reference clock, 50 ohm
  - 1xPPS Input & 1xPPS Output, 50 ohm

#### Ports

- 18 x SFP cages*
  *SFP transceivers are not included in all packages. Seven Solutions recommends 1.25Gbps, 1490/1310 nm, Single Fiber Bi-directional SFP.

#### Management

- 1000Base-T Ethernet (Remote)
- USB Mini-B (Local)

#### Back Panel

- USB Mini-B FPGA
- USB Mini-B ARM

#### Input port

- RS232

#### Certification

- ISO-9001, ISO-14001, CE, RoHS, FCC, SE

#### Power Supply

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Input</td>
<td>100-240VAC, 2.0A 50-60 Hz</td>
</tr>
<tr>
<td>Output</td>
<td>12V DC, 6.66A – 80W max</td>
</tr>
</tbody>
</table>

#### Environmental Conditions

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Humidity</td>
<td>0% ~ 90% RH</td>
</tr>
<tr>
<td>Temperature</td>
<td>-10°C ~ +50°C</td>
</tr>
</tbody>
</table>
SNMP set of data is provided to be used by Icinga and integrated with MySQL. Grafana can be added on the top of the monitoring system for extracting the information introduced by Icinga in the database and visualizing in graphical interface.

### Clock performance (10 MHz output)

<table>
<thead>
<tr>
<th>Phase noise (dBc/ Hz)</th>
<th>GM</th>
<th>1 Hz</th>
<th>10 Hz</th>
<th>100 Hz</th>
<th>1 KHz</th>
<th>10 KHz</th>
<th>100 KHz</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-97.1</td>
<td>-105.2</td>
<td>-117.7</td>
<td>-140.00</td>
<td>-145.7</td>
<td>-145.2</td>
<td></td>
</tr>
<tr>
<td>1st hop slave</td>
<td>-92</td>
<td>-100.5</td>
<td>-119.8</td>
<td>-138.9</td>
<td>-145.3</td>
<td>-140.9</td>
<td></td>
</tr>
<tr>
<td>2nd hop slave</td>
<td>-90.2</td>
<td>-98.6</td>
<td>-117.6</td>
<td>-138.6</td>
<td>-143.9</td>
<td>-138.9</td>
<td></td>
</tr>
</tbody>
</table>

### Short term stability (Allan Deviation)

<table>
<thead>
<tr>
<th>Stability (Allan Deviation)</th>
<th>0.1 s</th>
<th>1 s</th>
<th>10 s</th>
<th>100 s</th>
<th>1000 s</th>
<th>10000 s</th>
<th>80000s</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENBW 5 Hz Signal waveform</td>
<td>1.50E-11</td>
<td>2.00E-12</td>
<td>2.30E-13</td>
<td>2.50E-14</td>
<td>3.00E-15</td>
<td>3.50E-16</td>
<td>9.00E-17</td>
</tr>
</tbody>
</table>

### PPS output

#### Stability
30ps

#### Signal waveform
LVTTL, 50 ohm, SMC connector

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### Management

#### OS
Linux (Kernel v3.16.38)

#### Switching
IEEE802.1x protocols (multicasting, spanning tree, GMRP/-GARP)
VLAN Tagging
SNMP switch management

#### Control
CLI & Web-GUI: HTTP(s)

#### Network
TCP/IP, SSH, SNMP, NTP, TFTP, DHCP, ARP, DNS

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### Comparison with standard WR Switch

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**Clock performance (10 MHz output)**

![Phase Noise (dBc/ Hz)](image1)

**Short term stability (Allan Deviation)**

![Allan deviation](image2)

**PPS output**

- Stability: 30ps
- Signal waveform: LVTTL, 50 ohm, SMC connector

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**Technical Specifications / WRS-LJ**