**Short Description**

- Fast preamplifier electronics for Hamamatsu High UV Sensitivity CCD Image Sensors S11155 and S11156 and Carl Zeiss CGS Spectral Sensors
- Designed for use with tec5 spectrometer electronics components with 16 bit A/D conversion and various computer interface types
- Pixel frequency up to 1 MPixel per second
- Sensor chip socket for direct insertion on the PCB
- Device output: tec5 16 bit Front End Electronics with sensor interface type ‘Sensor_U2’ (FEE-1M /CCD-8)
- PCB dimensions: 29.5 mm x 79.6 mm

**General**

The preamplifier electronics S1115x serves as an interfacing component between the Hamamatsu CCD image sensor and the Front End Electronics board of a tec5 operation electronics. Typically, the CCD array is plugged into the DIL-24 socket on the soldering side of the PCB.

The preamplifier has to be supplied by six DC operating voltages applied to the power connector. These external voltages are basically required for operation of the CCD sensor. The tec5 DZA-S7030-4-P board with tec5 ADAP-PWR1 board and CAB-MM 14 cable may be used to provide the required operating voltages from a single 12 VDC input.

The interface to the Front End Electronics complies to the tec5 specification ‘Sensor_U2’ (MICS-18 pin header connector for PDA control signals and for differential video signal) for direct interconnection to the FEE-1M.

Based on the CLK and START input signals from the FEE, the preamplifier board generates all signals required to read out the sensor chip. The analog video signal from the sensor array is primed and processed for differential signal output. A synchronous A/D trigger output is provided to indicate the best sampling instant (rising slope of the A/D trigger signal). At the end of the readout sequence, the electronics provides an /EOS signal pulse.

**Technical Data**

- **Diode array:** Hamamatsu S11155 or S11156
- **Number of pixels:** 2068
- **Master clock frequency \( f_{CLK} \):** max. 8 MHz (from FEE)
- **Pixel readout rate:** max. 1 MHz (\( f_{CLK}/8 \))
- **Readout time:** 2.1 ms (\( f_{CLK} = 8 \) MHz)
- **Minimum integration time:** approx. 0.2 ms
- **Intensity resolution:** 16 bits

**Analog Output:**
- **Output range:** 0 ... 3 V (differential)
- **Maximum load:** 600 Ohm / 1 nF

**Digital Input Control Signals (HCT level):**
- **START:** Initiates a readout cycle for the CCD (active high, minimum length: one CLK period).
- **CLK:** Master clock for CCD readout (frequency \( f_{CLK} \)), has to be applied continuously. Used to derive all internal clocking and the output pixel rate.
- **A/D TRIGGER:** Pulse chain, signaling the sampling instant for the video signal for each pixel during readout (active high, duration: one CLOCK pulse). The video signal level is held throughout the duration of the pulse.

**Digital output signals (HCT level):**
- **/EOS:** EndOfScan pulse output (active low, duration: minimum one CLK pulse) to signal the end of the array readout.

**I²C Interface:**

The DZA-S11071 is equipped with an I²C interface addressing the on-board components EEPROM, temperature sensor and a generic 4-bit output port for remote configuration control (not used dynamically).
**Current consumption:**
+5V from FEE-1M: typically < 25 mA
-5V external power: typically < 20 mA
-8V external power: typically < 30 mA
+6V external power: typically < 20 mA
-12V external power: typically < 35 mA
+12V external power: typically < 40 mA
+15V external power: typically < 10 mA

**Environmental conditions (for electronics only):**
Operating temperature range: 0 °C ... 65 °C
Storage temperature range: -40 °C ... 70 °C
Humidity (@25°C, non condensing): 10 % ... 90 %

* refer to the CCD data sheet for sensor environmental specs

**Board Layout**

**Mechanical Interfaces**
Board dimensions: 79.6 mm x 29.5 mm
Connector CCD array: 2x12 pin sockets on soldering side of the board
Mounting of board: 2 holes symmetric to sensor

**Electronic Interface**
Type: tec5 specification, Sensor_U2
FEE-Interface: Lumberg type MICS
18 pin connector
External Power: Würth type WR-MM
14 pin low profile connector

**Pin assignment of the FEE interface connector:**

<table>
<thead>
<tr>
<th>Pin</th>
<th>Designation</th>
<th>Pin</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Trigger – AD-Convert</td>
<td>2</td>
<td>START – Start of Scan</td>
</tr>
<tr>
<td>3</td>
<td>PH12 (not used)</td>
<td>4</td>
<td>CLK - Master Clock</td>
</tr>
<tr>
<td>5</td>
<td>I_RES (not used)</td>
<td>6</td>
<td>EOS - End of Scan</td>
</tr>
<tr>
<td>7</td>
<td>0V – Digital Ground</td>
<td>8</td>
<td>-5V – Supply (not used)</td>
</tr>
<tr>
<td>9</td>
<td>0V – Digital Ground</td>
<td>10</td>
<td>+5V – Supply</td>
</tr>
<tr>
<td>11</td>
<td>DOT (not used)</td>
<td>12</td>
<td>DOT2 (not used)</td>
</tr>
<tr>
<td>13</td>
<td>I2C-SDA currently unused</td>
<td>14</td>
<td>I2C-SCL currently unused</td>
</tr>
<tr>
<td>15</td>
<td>0V – Analog GND</td>
<td>16</td>
<td>Video Out (inverted)</td>
</tr>
<tr>
<td>17</td>
<td>Video Out (non inverted)</td>
<td>18</td>
<td>0V – Analog GND</td>
</tr>
</tbody>
</table>

**Pin Assignment Standard External Power Connector:**

<table>
<thead>
<tr>
<th>Pin</th>
<th>Designation</th>
<th>Pin</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+24V (not used)</td>
<td>2</td>
<td>+20V (not used)</td>
</tr>
<tr>
<td>3</td>
<td>+15V –</td>
<td>4</td>
<td>+12V –</td>
</tr>
<tr>
<td>5</td>
<td>+6V –</td>
<td>6</td>
<td>5V –</td>
</tr>
<tr>
<td>7</td>
<td>-6V –</td>
<td>8</td>
<td>-12V –</td>
</tr>
<tr>
<td>9</td>
<td>Uvar – (not used)</td>
<td>10</td>
<td>Digi I/O – (PowerOk)</td>
</tr>
<tr>
<td>11</td>
<td>0V – Digital Ground</td>
<td>12</td>
<td>0V – Digital Ground</td>
</tr>
<tr>
<td>13</td>
<td>0V – Digital Ground</td>
<td>14</td>
<td>0V – Digital Ground</td>
</tr>
</tbody>
</table>

**Configuration Solder Gaps**
J300 open: Use shutter (default)
J300 closed: Shutter open
J301 open: Non-MPP-Mode (default)
J301 closed: MPP-Mode

The default configuration is recommended for operation with tec5 spectrometer electronics and software.

**System Operational Specifications**
DZA-S1115x with tec5 16 bit Operating Electronics, FEE-1M / CCD-8 and S11155 sensor:

- Single pixel dark readout noise: < 7 counts rms*
- Linearity error: < 1% of FS*
- Dynamic range at full scale: shot noise limited*
- System sensitivity: approx. 4 e⁻ / count*

* Measurement conditions: fₘ = 8 MHz, 16 bit A/D conversion, ambient temperature 25 °C

**User Information**

**General**
The information in this data sheet has been checked carefully. However, no responsibility is assumed for inaccuracies. tec5 reserves the right to make changes to any portion of this document without notice.

Each product is tested carefully before being shipped. If, however, problems should occur while initial operation or during later operation, please first check your specific settings and correct installation (connectors).

**Warranty**
The warranty period for this product is 12 months. The warranty begins on the day of delivery. Within the warranty period, tec5 will repair free of charge any faulty functioning of the product resulting from faulty design or defective material. All other claims are excluded, in particular consequential damage.

**Handling**
The electronics is partly constructed in CMOS technology and thus sensitive against electrostatic discharge. Take appropriate precautions whenever handling the component. Please switch off the power before connecting or disconnecting the product.