**SPECIFICATIONS:**

**Pre-Amplifiers:**

<table>
<thead>
<tr>
<th>PL-3150-1</th>
<th>PL-3170</th>
<th>PL-3180-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Video Input Load:</td>
<td>1 KΩ</td>
<td>10 KΩ</td>
</tr>
<tr>
<td>Capacitance:</td>
<td>&lt;20 pF</td>
<td>&lt;20 pF</td>
</tr>
<tr>
<td>Video Signal BW (Min, -3 dB):</td>
<td>DC - 200 MHz (0.5, 1, 2, 4x)</td>
<td>DC - 100 MHz (0.5, 1, 2, 4x)</td>
</tr>
</tbody>
</table>

**Video Input Signal:**

- Signal Type: Single-ended or Differential, jumper select
- Signal Amplitude: 4.0 Vpp
- Global Offset: ±3 Volts
- Input Connector: 16 bit resolution
- Gain Accuracy: ±0.2 dB, DC to 5 MHz
- Gain: 0.5x - 18x
- Gain: 1x - 252 and 1 MHz to 25 MHz
- Gain: 0.5 - 64x
- Gain: 2x - 16x

**Video Output Signal:**

- Signal Type: 2.0 Vpp/50 Ω
- Connector: 50 MHz
- Gain: 0.5x - 18x
- Gain: 1x - 64x
- Gain: 2x - 16x
- Gain: 0.5 - 64x
- Gain: 2x - 16x

**Video Signal Processing:**

- **Firmware settings:**
  - Open
  - 1 MHz
  - 10 kHz
- **SNR:**
  - 14 bit/10 MHz
  - 14 bit/100 MHz
  - 14 bit/100 MHz
  - 14 bit/100 MHz
- **A/D Conversion:**
  - Resolution: 14 bit
  - Max. Sample Rate: 10 MSamples/sec
  - Min. Sample Rate: >DC

**A/D Conversion with USB Acquisition Interface Module:**

- PL-3100-USB Acquisition Interface Module (AIM)
  - Number of AIMs/System: 1 - 8
  - ADC channels/AIM: 1 - 4
  - Analog inputs: SMA connectors, 50 Ω
  - Timing Signal Connectors: 9 pin Micro-D, Molex #83611-9006
  - Input Timing Signals: Frame Sync, Line Sync, Pixel Clock, and CDS clock, TTL levels
  - Range/Resolution: 0 - 100 mVs for >300 msamples/sec, 0 - 100 mVs for >300 msamples/sec, 0 - 100 mVs for >300 msamples/sec
  - Digital Control & Data Lines: Isolated for both signal and ground
  - Number of Muxed Channels: Programmable, 1:1, 2:1, 3:1, 4:1
  - Maximum Output Rate: 10 MHz (up to 4 channels @ 20 MHz each, or an 80 MHz channel in 1:1 mode).
  - Digital Outputs: 8-bit bits plus frame, line and pixel clock.
  - Monitor Signals: Voltage, Current, Stride and CDS, rear-panel BNC connectors.

**Memory Size:**

- 4 GB

**Data Inputs:**

- 2 input ports, configurable as:
  - One 16-bit wide input
  - One 16-bit wide input
  - One 32-bit wide input

**Maximum Acquisition Rate:**

- 80 MHz (320 MB/sec), 2 channels
- 120 MHz (240 MB/sec), 1 channel

**Timing Signals Required:**

- Frame & Line Sync, Pixel Clock, Frame & Line Sync, Pixel Clock, either via SMA connector (Micro-D) or via header connector (LVDS)

**Data Input Signals:**

- LVDS

**Output Signals:**

- Internal Clock Connector: 40 pin header connector, AMP #104069-6
- External Clock Connector: TTL/50 Ohms
- Arms I/O: TTL/50 Ohms
- Arms Connector: SMA

**Performance:**

- **Low-noise architecture**
- **Scalable from 1 to 32 data channels**
- **14-bit, 10 MHz ADCs**
- **16-bit, 50 MHz ADCs**
- **Correlated Double Sampling (CDS) option**
- **Aggregate data rate up to 2.5 GB/sec**
- **Up to 32 GB total on-board memory**
- **Prog. gain, offset, filter, & converters**
- **Array size up to 64K per side**
- **Real-time correction and imaging**
- **Real-time or automated operation**

**Applications:**

- Visible or infrared devices
- CCD, FPA, CMOS imagers
- R&D/Device characterization
- Production test
- Incoming device inspection
- Camera development
- Sensor visualization

**Introduction:**

The PI-3105 is a scalable, high-performance data acquisition subsystem designed for acquiring analog or digital video outputs from CCDs, IR FPAs, and CMOS image sensors. This highly flexible system is suitable for testing a wide variety of imaging devices, from astronomy and medical devices with micro-volt outputs, to military and machine-vision devices with GB/sec data rates. The system can be reconfigured easily by swapping out low-cost pre-amp and A/D modules.

The included software controls gain, offset, filtering, and strobe timing, while video monitor outputs and real-time display provide immediate feedback on your sensor’s performance. When integrated with our popular electronic stimulus products, the PI-3105 complements Pulse Instruments’ 3rd-generation of fully-integrated imaging test stations. The PI-3105 can also be integrated with 3rd-party products and software.

**High-Performance Architecture:**

The PI-3105 is electrically separated into analog and digital sections. Fig. 1 shows the analog electronics—Preampers, Acquisition Interface Module (“AIM”), Analog Power Supply and DUT Interface—enclosed by the dashed line. All control and signal lines passing between the analog and digital sections are optically or galvanically isolated at the AIM. The digital components (Digital Acquisition Card, and CPU) are housed in a CompactPCI mainframe.

**Preampers:**

Preampers are designed for placement adjacent to the DUT, both to minimize cable capacitance and to minimize noise. The inputs have BNC input connectors, designed for connection to a DUT interface or Dewar via a short length of coaxial cable. The preamplifier outputs can drive several feet of coaxial cable, allowing them to be positioned as close as possible to the DUT while allowing other components of the system to be kept in the rack or on the optical bench.

Three preampfer models are available, with bandwidths up to 200 MHz and gain up to 64X, depending on model.
Acquisition Interface Module (AIM): The Acquisition Interface Module (PI-3100-USB) houses the signal conditioning (Gain/Filter) stages and the A/D converters for up to 4 acquisition channels. The AIM also provides the electrical isolation for data and control lines for these channels. The AIM is powered by an analog power supply and distributes power to the preamplifiers and the A/D channels. The video signal, convert strobe, CDS strobe, and reference clock signals are available at four BNC connectors. The four channels’ monitor signals are multiplexed into these connectors and are selectable in software.

The size of the Acquisition Interface Module package is approximately 3.5” H x 10.5” W x 1” D. The unit can be located several feet from the outputs of the preamplifiers. Each analog power supply will power up to two A/Ds and their associated acquisition channels.

Gain/Filter Stage: The video output from the preamp drives a 50 Ω input load on the Gain/Filter stage. Additional gain of 1× to 15× is available on selected models. Combined with the preamp gain, the total gain can be up to 420×.

Gain/Filter stage follows the selectable filter stages for anti-aliasing. One stage provides maximum bandwidth without any filtering. The remaining stages are -3 dB cut-offs at frequency intervals (e.g. 50 MHz, 10 MHz, 1 MHz, 100 kHz and 10 kHz, depending on model).

A/D Converters: The A/D convertors are plug-in modules in the AIM. The digitizers are built around monolithic ADCs in small, swappable modules with various resolution and sample-rate options. ADC modules with the optional CDS feature have two ADC chips, and modules without CDS have D/A converters instead.

A/D conversion is timed by one or two independent strobes per video channel, supplied by the pattern generator. One strobe triggers the video ADC and the other triggers the optional CDS ADC. This strobe is generated within the pixel period (1 μs maximum delay) with a resolution of 100 ps. In CDS mode the digital output from the second ADC is digitally subtracted from the output of the primary video ADC. By using a digital CDS method, the PI-3105 system permits CDS operation over the entire range of sampling frequencies supported by the ADC modules.

The analog video signals are also connected to separate buffer stages for monitoring purposes. The monitor signals from each ADC channel—video, converter strobe, and CDS strobe—have their relative time positions preserved from the ADC to the monitor outputs. By monitoring these signals on an oscilloscope the user can set the strobe position at the desired point relative to the video signal.

Digital Electronics: The digital section of the acquisition subsystem consists of the Pattern Generator, Digital Acquisition card, and CPU card. As described above, all data and control lines from/to the digital electronics are isolated within the AIM.

Pattern Generator and AIM: Each AIM receives TTL timing signals (pixel clock, line sync and frame sync) and fans them out to each of the 4 acquisition channel. The clock inputs must be generated externally by a pattern generator, such as the PI-2005. The ADC strobes are passed through programmable delays to set their time positions with respect to the video signal. Each of the 16 video/ CDS strobes' delays is independently programmable. The line and frame sync signals follow the same timing path as the A/D strobes through the AIM and acquisition card to ensure data alignment.

USB controls set the gain, offset, and filter parameters on each of the preamplifiers and the A/D channels in up to 8 AIMS.

Multiplexer Card: Digitalized data inside the AIM can be passed through an optional 4:1 multiplexer card before being output to the digital acquisition card. The mux can be configured in software as a 2:1, 3:1 or 4:1 mux and will operate up to a 80 MHz total data rate. The card can also be configured in 1:1 mode as a scanner or switch. AIMS with the multiplexer feature have model number PI-3100-USBM.

Digital Acquisition Card: The Digital Acquisition Card (PI-41000) has two 16-bit wide inputs with 4 GB of draw-down memory. The maximum data rate at each input is 80 MHz, meaning that data can be collected at up to 320 MB per second per card until the on board buffers are full. Once data acquisition is complete, data are transferred to the CPU via DMA. Memories onboard the acquisition cards decouple the data acquisition from the PCI bus, allowing for data acquisition rates far higher than the bandwidth of the PCI. Data acquisition is continuous and un-interrupted, regardless of the loading on the PCI bus or operating system. The PI-41000 also requires no horizontal or vertical blanking. The ADC samples a pixel from a pixel, including reference rows and columns from devices that integrate during readout.

With the use of AIMS in 4:1 mux mode, each PI-41000 can handle up to 8 video channels. Up to 8 cards can be deployed in parallel to handle up to 32 channels at a total data rate of up to 2.5 GB per second into 32 GB of RAM.

CPU Card: The CPU card controls the acquisition subsystem and displays and processes the acquired data. The CPU runs Pulse Instruments or custom applications under Windows 7.

A variety of CPU cards is available to meet your acquisition and computing requirements, with 386 processors running at currently available speeds, and up to 32 GB of RAM. As CPU cards have on-board video, USB, and Gigabit Ethernet connectors, and the CompactPCI mainframe supports a variety of fixed and removable storage devices. An optional GPIB interface permits the entire subsystem to be slaved to an external PC running Pulse Instruments or custom applications.

Compatibility: The PI-3105 can be used stand-alone, or in conjunction with other FPGA test equipment, including pattern generators, clock drivers, and low-noise DC bias supplies from Pulse Instruments.

Uncompressed and Corrected Images Acquired by PI-3105