Instruments That Advance The Art

Pixie-Net XL Quick Start Guide

Introduction

Thank you for using our products. This document contains the most important information to get started with the Pixie-Net XL system. Please read the entire document and keep it nearby as you go through the installation of hardware and software and the initial setup of the detector system. Please also read at least the first 3 chapters of the Pixie-Net XL User Manual provided with the software distribution

System Requirements (Section 1.3 of the User Manual)

- Windows PC (for initial setup). See manual for Linux options.
- Local network connection

Setup (Sections 2.1/2.2 of the User Manual)

1. Download and extract/install Silicon Labs CP210x USB-to-UART driver from https://www.silabs.com/products/development-tools/software/usb-to-uart-bridge-vcp-drivers See microzed.org/sites/default/files/documentations/CP210x_Setup_Guide_1_2.pdf for details.
2. Download and install Tera Term (or other suitable terminal program) from http://ttssh2.osdn.jp/
3. Connect
   - DC power plug from the AC adapter to the "12VDC" power input on the Pixie-Net XL
   - USB cable between Pixie-Net XL ("UART 1") and PC (any USB port)
   - CAT 5 network cable from Pixie-Net XL ("LAN 1") to local network
4. From the Silicon Labs installation, run CP210xVCPInstaller_x64.exe to create a COM port and find the new COM port's number in device manager
5. Open Tera Term.
   - Connect via the serial port showing the COM number above
   - Select Setup > Serial port. Defaults are ok, except baud rate must be 115200.
   - type <enter> in the terminal prompt
   - Login with default credentials **root/xia17pxn**
6. Once logged on via the Linux terminal, the following steps must be performed:
   - Find IP address: ifconfig (if no IP address is assigned, contact your network admin)
   - Change to working directory: cd /var/www
7. On the PC, open a web browser and type the Pixie-Net XL's IP address into the search/address field. Firefox is the recommended browser. Here you can monitor ADC input signals, view run statistics and spectra, and access results from data acquisition.
8. On the PC, open Windows Explorer and type \\<IP address>\PNvarwww in the address field. Login with default credentials **root/xia17pxn**
   The folder shows the working directory of the Pixie-Net XL, including settings files and results.

Getting Started (Section 3 of the User Manual)

Adjusting Settings

The FPGA settings and processing parameters must be adjusted (once) to match the detector characteristics. This includes analog settings such as gain and offset, and pulse processing parameters such as decay time and trigger threshold.

All settings are stored in the file settings.ini located in /var/www (shared over the network as as PNvarwww). The default settings file is configured for the Pixie Net XL internal pulser. Examples of other settings files are on the SD card. An easy way to test operation is therefore to connect the "PULSE" output to one of the analog inputs. For a description of the parameters, please see the Pixie-Net XL User Manual. To modify a parameter, edit the .ini file and then execute `./progfippi` to apply the changes to the FPGA. Editing can be accomplished with a built-in Linux editor through the terminal (for example VI) or by opening the file with a text editor in Windows through the network file sharing (item 8 above).

To verify that analog settings are correct (signal in range, pulses start with rising edge, no clipping), open/refresh the Pixie-Net XL ADC page in the web browser, or execute `./gettraces` and view the resulting file ADC.csv. You can also execute `./runstats` to read the output parameters in the resulting file RS.csv. The current input count rate, out of range fraction, temperatures, and FPGA system time will update even when no run is in progress. The function `./findsettings` can assist in finding parameters such as DC offset.

Data Acquisition to local SD card

1. In the terminal, type `./startdaq` to start a run with current settings. The screen will print updates of runtime etc. (An alternative is to execute the equivalent functions from the web operations webpage, using/creating settings and data files in /var/www/webops).
2. In the browser, navigate to the MCA page ("view spectra") or the Run Statistics page ("view run statistics") under DAQ Monitoring. Refresh these pages with the browser button to see updates during the data acquisition
3. < wait for run to finish >
4. When the data acquisition finishes in the terminal, the final MCA, the run statistics, and the list mode data files have been created.
5. In the browser, the data files can be viewed or downloaded (under "DAQ Results")
6. In the terminal, the data files can be copied to local USB drive or network drive
7. In a Windows Explorer window pointing to \\...\PNvarwww, the data files can be copied or opened with Windows tools and programs.

Important Notes

- Remember to change the default password for root SSH or serial login (root/xia17pxn) using `passwd`.
- Remember to change the default password for root SMB (root/xia17pxn) using `sudo smbpasswd -a root`.
- Remember to change the default password for web operations (webops/xia17pxn) using `vi webopspasswords`
- Remember to make a backup copy of the Pixie-Net SD card. This must be a byte-by-byte copy using a program like Win32DiskImager.

Further Information

Downloads:	http://support.xia.com
Support:	support@xia.com

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Pixie-Net XL Network Data Setup

Overview

The Pixie-Net XL can output data directly from the pulse processing FPGAs as UDP packages. The packages can be captured by a "receiver PC" on the same network. This allows for much higher data output rates that the (default) slow debug mode that saves list mode data to the SD card.

Physical Connections and Network Configurations

- Connect CAT-5 cable to port LAN 1.
  This is the controller network with the Pixie-Net XL on-board Linux OS for setup and run control. The Linux OS runs DCHP and should automatically configure its network connection. Its IP address can be found from the router or by logging on with the USB/UART and typing ifconfig in the terminal (see manual for details).
- Connect copper or optical SFP cable to ports SFP 0 and SFP 1.
  This is a 1G or 10G port for list mode data output as UDP packages, depending on the option purchased.
  - For 1G:
    A SFP to CAT-5 adapter can be used to connect to a 1G capable port on the local network.
    The Pixie-Net XL's MAC address for these connections are defined from on-board nonvolatile memory. This memory can be updated via the Linux OS' other UART port (type minicom in terminal to connect, see White Rabbit manual for details).
    The destination MAC, source/destination IP, and source/destination ports for UDP packages are specified in the settings file.
  - For 10G:
    A 10G capable SFP cable is required and must be connected to a 10G port on the local network. SFP modules must be rated < 1W.
    The source/destination MAC, IP, and ports are specified in the settings file.
- The data network can use a switch (e.g. the WR switch) or it can be a direct connection to a "receiver PC". When using a switch, care must be taken to set IP addresses without conflict. When using a direct connection, specify the same destination IP address in the settings file and on the receiver PC, e.g in Windows go to Network Connections > Local Area Connection > properties > Internet Protocol Version 4 > Properties.

Pixie-Net XL settings

In settings.ini, the following parameters are relevant for network data output

- DATA_FLOW: most commonly one of the following values (see manual for full range)
  2 for diagnostic DAQ with data saved to SD card (slow)
  3 for UDP packet flow controlled by DAQ program on Linux OS (faster)
  4 for UDP packet flow directed by FPGA itself (fastest)

- RUN_TYPE: For UDP 10G output, it must be 0x110 or 0x111 for Pixie-16 style list mode format, 0x410 for Pixie-4e style format or 0x411 for Gammasphere compatible format. For UDP 1G output or output to SD card, it must be 0x100, 0x105, or 0x400.
- UDP_PAUSE: minimum separation of UDP packets (in units of 64ns). This can be used to slow down data output to reduce packet loss.
- DEST_MAC0,1: MAC address of the receiver PC
- DEST_IP0,1: IP address of the receiver PC
- DEST_PORT0,1: port address of the receiver PC. XIA's sample UDP receiver listens to data from any source port on destination port 61002
- WR_RUNTIME_CTRL (1G, White Rabbit only): set to 1 to start/stop runs at 10s rollover of the White Rabbit system time.
- SRC_MAC0,1: The Pixie-Net XL comes with 3 unique MAC addresses (see stickers on box). The first is the MAC for the Zynq controller. The other 2 should be specified in the settings file as SRC_MAC0,1 (default is a "locally assigned number" starting with 22:…).

Data Acquisition over Network (DATA_FLOW = 3, 4)

1. On the receiver PC, start program to capture UDP packets from port 61002. A code example "udp_receive" is provided by XIA for both Windows and Linux.
2. In the settings file, specify DEST_MAC and DEST_IP of the receiver PC.
3. On the Pixie-Net XL, via the controller network, execute `./startdaq` to start a data acquisition run.

Notes:

- Make sure to execute `./progfippi` after every change in the settings file
- The UDP receiver demo code saves the list mode data to file "LMdata.bin". For a description of the data format, see the user manual
- The Zynq controller on the Pixie-Net XL keeps run statistics and MCA spectra, saved periodically to the SD card.
- Data Acquisition over Network (DATA_FLOW = 3, 4)

White Rabbit operation

The White Rabbit synchronization will start up automatically at boot time (for the 1G, WR version). For best performance, a WR slave compatible SFP module should be used in SFP 0 and 1 (**the blue one**). The optic fiber is then connected to the SFP module of a WR master (**the purple one**), for example a WR-LEN or a WR switch.

To check on the WR status, in the Pixie-Net XL Linux terminal, type `minicom` to open the White Rabbit UART interface. Type `gui` to see the current status. It should show "TRACK_PHASE" when synchronization is fully locked and now is constantly tuned. Type <esc> to exit the gui and then `<ctrl> a q` to return to the normal Linux interface.

Notes:

- The parameter "WR_VALID" in the run statistics is currently not useful to check WR status. This also may produce warnings at run start time. They can be ignored if status is confirmed via UART. The "Link" LED does not indicate WR synchronization status.
- If the WR has problems synchronizing, it may report messages of "TX timestamps unavailable" in the WR UART interface. Usually it is sufficient to unplug the 1G fiber and plug it in again.