

# Getting Started with EPICS Instruments



This Getting Started Guide is designed to help you quickly get up and running with your EPICS oscilloscope. For additional information about the EPICS implementation and instrument configuration, including details about all process variables (PVs), refer to the *EPICS Interface* manual included electronically with the installer. For detailed information about all other aspects of the digital oscilloscope, refer to the *M-Class Digital Storage Oscilloscope Instrument Manual*.

The *EPICS Interface* manual and other files mentioned in this guide can be found within the following default installation directory (EPICS Installation):

Windows: C:\Program Files\ZTEC Instruments\Mclass\Scope\EPICS  
Linux: /usr/local/share/ZScopeM/EPICS

## 1. Configure Instrument for LAN/Ethernet communication

- a. Follow steps #1 and #2 from the printed M-Class LXI Quick Start Guide, which was supplied with the instrument
  - i. Note: two sets of directions – one side for Windows and one side for Linux
- b. Record your instrument's serial number and IP address below for future reference.

Internal Name	Serial Number	IP Address	MAC Address	PV Prefix
<i>(Example)</i>	<i>20799</i>	<i>192.168.0.30</i>	<i>00:E0:4B:1B:4F:A0</i>	<i>ztec: (default)</i>

## 2. Confirm EPICS communication

Note: if you have changed your instrument's PV prefix to something other than the default 'ztec:' please change the commands below accordingly

- a. First try pinging the instrument (e.g., *ping 192.168.0.30*)
  - i. If you cannot ping the instrument, refer to the Instrument Configuration section in the *EPICS Interface* manual and the printed Quick Start guide.
- b. Query the instrument's ID string via EPICS:
  - i. *caget ztec:UtilID* (example return: "ZTEC,ZT4611LXI,20799,4.20")
  - ii. If you cannot query the instrument, check the Channel Access (CA) settings. CA server and client settings are discussed later in this document ('Communicating with multiple EPICS oscilloscopes' section) and in the *EPICS Interface* manual.

## 3. Run the Getting Started Instrument Configuration Script

Running the configuration script is optional. It is not needed to properly run the instrument. It is only provided as a resource to help quickly configure the instrument and to provide an example of how the PVs can be used to configure and run the instrument. The configuration script, *epics\_ca\_config.sh*, is located in the EPICS Installation's *script* directory.

#### 4. Configure acquisition time, number of acquisition points, and sample rate

Note: instrument settings are interrelated based on the following equation:

Number of acquisition points [Samples] = Acquisition (Horizontal) time [seconds] x Sampling (Horizontal) Rate [Samples/second]

- a. Users can set the number of acquisition points and the acquisition time; the sampling rate is then automatically coerced to the next fastest sampling rate possible given the number of points and the acquisition time. [Note: sample rates are available as discrete steps and the acquisition time will be coerced based on these steps.]
- b. Example settings:  
(Refer to the EPICS Interface manual for detailed information about all PVs)
  - i. Set acquisition points to 1k: `caput ztec:setHorzPoints 1000`
  - ii. Set acquisition time to 1ms (100us/div): `caput ztec:setHorzTime 1.0e-3`
  - iii. Confirm sample rate of 1MSamples/sec: `caget ztec:HorzRate` (returns 1e+6)

#### 5. Loading and installing EDM and MEDM example display panels

ZTEC<sup>®</sup>'s EDM and MEDM panels are run from the launcher scripts, ZTEC\_EDM.sh and ZTEC\_MEDM.sh, located in the EPICS Installation's *script* directory

- a. Launch the EDM or MEDM panel:
  - i. `./ZTEC_EDM(or MEDM) -p <pv prefix> -c <number of instrument channels>`
    1. E.g., `./ZTEC_EDM -p ztec -c 4` (instrument has the default pv prefix of *ztec* and it is a four channel instrument)

#### 6. Updating waveforms

To update waveforms at a regular interval, you must set the SCAN field of the appropriate waveform PVs. There are 3 ways to set the SCAN rate.


- a. Using the EDM or MEDM panels
  - i. Select the 'Misc' button at the bottom of the main panel
  - ii. Press the scan buttons for the wave and time for any channels you want to update at a regular interval (e.g., INP1, INP2, CALC1, ...)
  - iii. The default update rate is set to 0.5 second. Modify the panels if you want slower or faster update rates
- b. Manually set SCAN rates from a terminal window
  - i. Set the SCAN rate for the OpAutoLoad PV and the 'time' PV for all waveforms you want to update regularly
    1. ex: `caput ztec:OpAutoLoad.SCAN 7`
- c. Permanently set the SCAN rate for PVs by modifying the EPICS PV database file
  - i. The default SCAN value for all waveform PVs is "passive". The PV database can be modified so that the SCAN rates are automatically set to a specified value upon instrument turn-on (e.g., change "passive" to "10 second" to set the PV to automatically update every 10 seconds)
  - ii. Details about modifying the EPICS PV database are contained in the sections below
  - iii. Modify FLNKs and Fanouts to allow less SCAN changes.

SCAN rates are defined in the EPICS file menuScan.dbd:

SCAN 0 – passive	SCAN 4 – 5 second	SCAN 8 – 0.2 second
SCAN 1 – event	SCAN 5 – 2 second	SCAN 9 – 0.1 second
SCAN 2 – I/O Intr	SCAN 6 – 1 second	
SCAN 3 – 10 second	SCAN 7 – 0.5 second	


## 7. Communicating with multiple EPICS oscilloscopes


When multiple units with the same PVs are available on the network, Channel Access will not discriminate between instruments. To ensure that the correct instrument is being accessed, or to prevent undesired access, do one or more of the following steps.

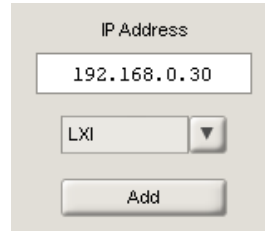
- a. Set the server (instrument) Channel Access environment variables through the webLXI interface
  - i. Open your web browser and enter the instrument's IP address in the address line: e.g., 192.168.0.30. Alternatively, the instrument's web page can be opened by selecting the desired instrument in ZFind™ by clicking the  button.
  - ii. Click on the Configuration tab and select the EPICS Configuration bullet on the left side of the page
  - iii. The default values listed here will allow communication, but you may want to change the Address List and/or the Automatic Address List fields to prevent broadcasts to the entire network. Information about the other settings is contained in the *EPICS Interface* manual.
  - iv. Click 'Apply' when finished.  
[Note that the instrument should be power cycled in order for Channel Access to start with the new settings]
- b. Set the client (PC) Channel Access environment variables  
Note: changing address list variables is optional unless you have more than one unit on the network with the default 'ztec:' prefix for the process variable (PV) names
  - i. Disable the auto address list to make sure you are communicating with the desired instrument if you have more than one ZTEC® EPICS oscilloscope on the network. This will also expedite communication with the desired instrument:
  - ii. `export EPICS_CA_AUTO_ADDR_LIST=no`
  - iii. Add the target instrument to the EPICS client channel access list. This will ensure that you are able to communicate with your instrument:
  - iv. `export EPICS_CA_ADDR_LIST=192.168.0.30`
- c. *Change the PV prefix names on the instrument. See step 8.*


## 8. Change the PV prefix name in the EPICS PV database file

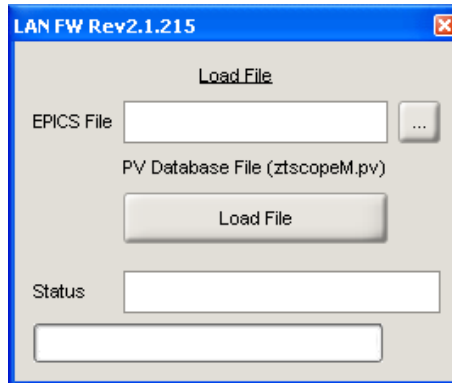
Channel Access will not be able to talk to the desired instrument if multiple versions of a process variable (PV) are available. Changing the PV prefix allows the instrument to have a unique set of PVs. Changing the instrument's PV prefix is optional unless you have more than one unit on the network with the default 'ztec:' prefix and you have not set the address list Channel Access variables to filter out the other instruments.

- a. Save existing PV database file to PC for modification (Note: a default PV file, preloaded onto the instrument, is also provided in the EPICS Installation's *dat* directory)
  - i. Open your web browser and enter the instrument's IP address in the address line: e.g., 192.168.0.30. Alternatively, the instrument's web page can be opened by selecting the desired instrument in ZFind™ by clicking the  button.
  - ii. Click on the Configuration tab and select the EPICS Configuration bullet on the left side of the page
  - iii. View the current PV file by clicking 'PV File' at the top of the page
  - iv. To save the PV file: right click on 'PV File' → Select 'Save Link As...' and save the PV file to a convenient location on your PC.
- b. Modify the PV file
  - i. Open the saved PV file, preferably using a tool that offers the find and replace functions (e.g., WordPad). Change the default or existing prefix to the desired prefix

1. E.g., Find “ztec:” (ztec is the default prefix) and replace with “oscilloscope1:” [note the “:” after each prefix name]
- ii. Save the modified PV file.
- c. Load the modified PV file
  - i. Run the ZTEC® ZFind™ application
  - ii. Add the instrument you are loading the modified PV file onto is not listed as a resource in ZFind:
    1. Click ‘Add’ icon, , in the toolbar or press Ctrl+A
    2. Enter IP address. E.g.:



3. Select ‘LXI’ from the drop-down menu and click ‘Add’
- iii. Select the desired instrument in the resource list by clicking on it and then click on the EPICS icon, , in the ZFind™ toolbar (or press Ctrl+E). This will open the Load File window.



- iv. Click on the “...” button to the right of the EPICS File field to open the Select Source File window.
- v. Browse to the location where you saved the modified PV file, select it, and click ‘Open’
- vi. Click the ‘Load File’ button and wait until the Status window displays ‘Upload Successful’ (this may take a few minutes)
- vii. Close the Load File window
- d. Confirm proper loading of the modified PV file such that the PV names now begin with the new desired prefix
  - i. View current PV file by repeating steps a. i-iii above
 

Note: you may have to clear your browser’s temporary internet files to view the new PV file.

    1. For Internet Explorer: Tools → Internet Options → Browsing history: Delete... → Select Temporary Internet Files and then Delete.
    2. For Mozilla Firefox: Tools → Options → Privacy: Private Data → Select Settings to configure, Select Clear Now to clear the data.