SPEC – Power and Performance

Power and Temperature

Hardware Setup Guide

Standard Performance Evaluation Corporation

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1 Introduction

This practical guide will explain how to set up and run power analyzers and temperature sensors to communicate with SPEC's Power/Temperature Daemon (PTDaemon). This document is a companion to the SPECpower_ssj2008 User Guide.

Be sure to read, understand, and follow all of the safety rules that come with your power analyzer and system under test (SUT).

2 Initial Device Setup

The first step in setting up any measurement device is to get the device communications functioning using the vendor-supplied software. Follow the manufacturers' instructions for hardware connection, device driver, and software installation.

If the device cannot be controlled using the manufacturer's software, do not proceed to the next step. Instead, contact the manufacturer for technical support.

Most power analyzers must be manually configured for the most appropriate voltage and current ranges for the SUT. Doing so will ensure that readings are not missed as the power analyzer does "auto-ranging" to find the best range. Characteristics of power meters vary widely. Please see this URL: http://www.spec.org/power_ssj2008/docs/device-list.html for a list of power and temperature measuring devices that have been tested by SPEC and that are accepted for use in the measurement of "compliant results". Compliant results are those that meet all the requirements specified in the SPECpower_ssj2008 Run and Reporting Rules.

This document will NOT cover the electrical connections required for proper power measurement. Please refer to the documentation supplied with your device, and contact the manufacturer if additional information is needed.

3 Hardware Connection Types

3.1 Serial Ports

Standard RS-232 connections are one of the most common analyzer interfaces. The DB-9 connector on many computers may be connected directly to a DB-9 or DB-25 serial connection on the analyzer. Some devices require a cross-over or "null modem" cable. Refer to manufacturers' instructions or the device-specific instructions below.

Serial port naming standards for popular operating systems:

- Windows: COM1, COM2, … COM9
- Linux: /dev/ttyS0, /dev/ttyS1, …
- Solaris: /dev/ttya, /dev/ttyb, …

3.2 USB Ports

Power analyzers available with USB data communications capability typically plug into a USB port. However, the manufacturer supplied drivers are likely to use a USB port access method known as VCP, Virtual COM Port Driver. The USB port is referenced as a COM port such as COM7.

With Microsoft Windows, use the Device Manager to display “Ports (COM & LPT)” to find the port your analyzer uses. Documentation provided by the power analyzer manufacturer should provide more detailed instructions and information if problems arise.

Many Linux distributions also include an “usbserial” driver that has similar functionality.

3.3 USB-Serial adapters

Standard RS-232 serial ports are becoming less common due to space constraints. However, there are many inexpensive USB-serial adapters on the market today. Windows drivers available for those devices allow the user to see additional “virtual” serial ports, such as COM7.

Many of these same adapters will also work on Linux. If the Linux distribution includes the “usbserial” driver, it is likely to autodetect and enable the adapter. Typically the device name will be created as /dev/ttyUSB0.

USB-Serial converters under 64-bit versions of Windows: USB-Serial converters may not ship with 64-bit drivers. Some users have reported success using the 64-bit drivers found at the following website: http://www.serialgear.com/USB-Serial-adapter-drivers-windows-mac-linux.cfm. This website is not affiliated with SPEC, and SPEC will not provide support related to these drivers. Use at your own risk.

3.4 GPIB adapters

Many instruments have a GPIB / IEEE488 interface option available. Several vendors sell adapters that allow PC connections to GPIB, either via USB, PCI, PCIe or other hardware interface.

PTDaemon has been tested with National Instruments’ NI488.2 GPIB-USB-HS adapter and NI-488.2 software. If the NI software and drivers are installed correctly, PTDaemon can access GPIB devices through the “gpib-32.dll” interface. It is likely that PTDaemon will also work with NI adapters other than the USB version, as long as they are supported by NI-488.2 drivers, but no others have been tested.

The SPEC PTDaemon GPIB device support is currently only available with Microsoft Windows operating systems.

See section 5.1 for an example of how to configure a power analyzer to use GPIB with PTDaemon.

4 Multiple SUT and Power Analyzer Information

When utilizing multiple SUT’s with one or more power analyzers, the procedure for connecting each SUT and power analyzer is similar to connection a single SUT/single power analyzer configuration. PTDaemon should be running on only one system, and all SUTs and power analyzers should be connected to that system: SUT’s via network connections and power analyzers via the communications interface supported by the power analyzers.

5 Device-Specific Setup Information

5.1 Power Analyzers

A list of power analyzers and temperature sensors which are accepted for SPECpower_ssj2008 submissions can be found at the following URL:

http://www.spec.org/power_ssj2008/docs/device-list.html

Serial Connections: If you will be using a serial connection on the power analyzer, please see the corresponding power analyzer section below for specifics regarding required serial settings such as baud rate, etc.

GPIB Connections: Regardless of which power analyzer you are using, if you will be using a GPIB interface, please refer to the general GPIB setup instructions listed for the Yokogawa WT210 in section 5.1.1. Note that there may be slight differences in the GPIB configuration steps for the other power analyzers.

5.1.1 Christ Elektronik CLM3000

With CLM3000 up to three phases can be measured. Use the device #20 (Christelektronik CLM3000:1-Ch) for measurements of one phase and device #21 (Christelektronik CLM3000:3-Ch) for measurements of three phases. The maximum current range per phase is 16A.

5.1.1.1 Hardware Configuration

After connecting and turning on the CLM3000 according to the manufacturer's manual you have to do the following manual configuration on the analyzer's display:

1. Press the "door" on the touch screen
2. Press "Menu"
3. You may change the language to English by pressing "language" and selecting "En" and return
4. Press "Setup"
    a. Configure the serial interface to "block mode", this means the analyzer itself sends measurement data. Press "save" and return. Notice that this configuration setting is permanent over Power ON/OFF.
5. Press "User power values and measurement time"
    a. Press delete and return
6. Press the "door"

Now the analyzer is correctly configured and you should see reasonable power values on the display.

When starting the PTDaemon you may have problems with connecting to the CLM3000 because of missing synchronization in rare cases. It may help to just restart the PTDaemon for several times. If it still doesn't work, try to turn the analyzer off and on and to disable and enable the Com port via the device manager.

5.1.1.2 Configuration via PTDaemon

PTDaemon's range setting and uncertainty calculation are not available.

5.1.2 Chroma 66202

5.1.2.1 Hardware Configuration

For SPECpower_ssj2008, measurement results from the Chroma 66202 are valid only if the following requirements have been satisfied:

- Analyzer firmware version must be v1.20 or higher

- Low shunt ranges must be one of the following: 0.01, 0.1, 0.4, 2.0 ARMS. All other low shunt ranges will result in invalid benchmark runs.
- Wattage readings must be at least 41.25% of the selected wattage range.

5.1.3 Infratek 101A, 107A-1Channel, 107A-3Channel

The 107A-3Channel analyzer can only be used as a single-channel analyzer with PTDaemon. Only channel 1 is evaluated.

5.1.3.1 Hardware Configuration

The Infratek's RS232 interface is configured to the correct parameters by default (Baud:9600, Parity:None, Terminator:CR, Handshake:None, IEEE_address:n/a). Only the interface parameters of the Infratek 107A can be changed by the user. Instructions are described in the manufacturer's manual (chapter 6.4 Setting Interface Parameters).

Use the input channel which best fits your measurement environment to connect your system to the analyzer.

To avoid bad samples due to auto ranging, set up the analyzer for the voltage and current ranges expected during the test. Be careful in selecting the correct ranges which best fit to your measurement environment.

For SPECpower_ssj2008, measurement results from the Infratek 107A are only valid for load currents less than half the selected current range in order to satisfy the required minimum crest factor value of 3. Instructions how to configure the range setting are described in the manufacturer's manual (chapter 5.2.1 for Infratek 101A or chapter 5.2.2 for Infratek 107A: Range Selection, Auto Range Selection).

The 107A's display is locked when the PTDaemon is started. After stopping the PTDaemon you have to turn the analyzer off and on to reuse it.

5.1.3.2 Configuration via PTDaemon

The 101A supports range setting via PTDaemon command interface and PTDaemon input parameters. The 107A only supports range setting via PTDaemon input parameters as after being started, it is no longer configurable. So there is no possibility to configure the range setting for every individual load level of the SPECpower_ssj2008 benchmark. If the electrical power differs between every load level in a larger range, this may cause problems to get valid measurement data.

Both analyzers provide uncertainty checking by the PTDaemon.

5.1.4 Instek GPM-8212

5.1.4.1 Hardware Configuration

For SPECpower_ssj2008, measurement results from the Instek GPM-8212 are only valid for load currents less than 10A in order to satisfy accuracy requirements.

5.1.5 Voltech PM100

5.1.5.1 Hardware Configuration

The PM100's RS232 interface should be configured for 9600 baud before use with PTDaemon.

To avoid bad samples due to auto ranging, set up the analyzer for the voltage and current ranges expected during the test.

5.1.6 Voltech PM3000

5.1.6.1 Hardware Configuration

The PM3000's RS232 interface should be configured for 9600 baud before use with PTDaemon.

To avoid bad samples due to auto ranging, set up the analyzer for the voltage and current ranges expected during the test.

5.1.7 Xitron 2802

5.1.7.1 Hardware Configuration

The Xitron 2802 should be preconfigured using the keypad buttons before using the device for benchmark testing. Only one of the channels may be used at a time with PTDaemon. In order for results from the Xitron 2802 to be valid, autoranging cannot be used for the current or voltage range settings. Current and voltage settings must be manually selected.

To avoid bad samples due to auto ranging, set up the analyzer for the voltage and current ranges expected during the test.

The analyzer should also be configured to use the correct port (GPIB or RS232) depending on which option is available.

Instructions are provided below for RS-232 connections.

For RS-232 connections, a cable with DB9 Female and DB25 Male connectors and null modem capability are required. The analyzer's serial communications settings should be configured as follows:

1. Press the "menu" key
2. in display window use the Up/down arrow keys to select "Setup System"; Press enter
3. In display window use the Up/down arrow keys to select "RS232 Baud Rate"; Press enter
4. In display window use the Up/down arrow keys to select "9600"; Press enter
5. Press the "menu" key
6. In display window use the Up/down arrow keys to select "Channel Configuration"; Press enter
7. In display window use the Up/down arrow keys to select your wiring configuration. Options are 1, 2, or 3 phases, 3 wire. Press enter
8. Press the "menu" key twice to return to the main display

5.1.8 Yokogawa WT110 & WT210

5.1.8.1 Hardware Configuration

The WT110 & WT210 should be preconfigured using their keypad buttons prior to use with the PTDaemon software.

First, reset the analyzer to factor default.

To avoid bad samples due to auto ranging, set up the analyzer for the voltage and current ranges expected during the test.

The analyzer should also be configured to use the correct port (GPIB or RS232) depending on which option is available.

Instructions are provided below for RS-232 and GPIB connections.

For RS-232 connections, a cable with DB9 Female and DB25 Male connectors and null modem capability are required. The analyzer's serial communications settings should be configured as follows:

1. Press the "local" key
2. in display window "C" use the Up/down arrow keys to select 488.2; Press enter
3. In display window "A" use the Up/down arrow keys to select "hand 0"; Press enter
4. In display window "B" use the Up/down arrow keys to select "For 0"; Press enter
5. In display window "C" use the Up/down arrow keys to select "b 9600"; Press enter
6. In display window "C" use the Up/down arrow keys to select "CR". Press enter

Note that the Yokogawa provided software requires the line terminator character to be "LF" (in #6 above).

For GPIB connections with a virtual COM port driver, do the following:

1. Connect the converter to the GPIB interface of the analyzer, and connect the controller system to the converter with a standard USB cable.
2. Download the driver at this URL, http://www.ftdichip.com/Drivers/VCP.htm, and install it onto the controller system. This driver will map the Prologix device to a virtual com port in windows. (for example, com3).
3. Open a Windows Hyperterm session with the Prologix device (com3) with settings of 9600,8,no,1,no.
4. Send the command "++addr" to see what GPIB address the Prologix device is currently set to control. For the purpose of these instructions, a returned value of 5 (which is usually the case) will be used.
5. On the display of the WT210, press Local, scroll to 488.2 with the up and down arrows, and press Enter. It should now show what GPIB address the WT210 is currently set to listen on. For the purposes of these instructions, a returned value of 10 will be used.
6. Now, make sure the GPIB addresses of both the WT210 and the Prologix device are the same. You can use either of the following:
    a. Change the address of the Prologix device to match that of the WT210 by sending the command "++addr 10" or
    b. Change the address of the WT210 to 5 by using the arrow keys on the front display, and then press Enter.
7. Close the hyperterm session, press Local on the WT210 to get out of the menus.

Now PTDaemon can connect to the WT210 through the virtual com port.

5.1.9 ZES LMG95, LMG450, LMG500

There are three types of ZES LMG power analyzers which are supported for SPECpower PTDaemon. The LMG95 provides one-channel measurements, while LMG450 and LMG500 can be used for one-channel measurements (configuring channel 1) and 4-channel measurements (configuring channel 1-4).
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5.1.9.1 Hardware Configuration

After connecting and turning on the ZES LMG according to the manufacturer's manual the analyzer has to be configured correctly.

5.1.9.1.1 RS232

The ZES LMG's RS232 interface has to be configured for "57600 Baud, <lf>, Echo off" before use with PTDaemon. Instructions how to configure the interface are described in the manufacturer's manual (chapter 4.4.2 IF/IO).

5.1.9.1.2 GPIB

Not available

5.1.9.1.3 Input Channel

Default

5.1.9.1.4 Firmware Version

There are no restrictions to any firmware versions.

5.1.9.2 Range Setting and Uncertainty Calculation

Be careful in selecting the correct ranges which fit best to your measurement environment to avoid inaccurate or even invalid values. Uncertainty calculation for ZES LMGs by PTDaemon is only available if the measured values during the benchmark lie in between 10% and 110% of the configured range, so these limits have to be kept for conforming measurements.
Selecting the volt range is quite easy as the voltage depends on your power source and doesn't change anyway. Selecting the ampere range is more complex, because it differs with the SUT's power consumption during the benchmark run. A high difference between different load levels may require individual ampere range settings for each level.

Instructions how to configure the range setting manually are described in the manufacturer's manual (chapter 5.2 Measuring ranges(Range)).

The following tables show the capabilities of all accepted ZES LMG analyzer types to configure the analyzer via PTDaemon.

Power Analyzer Range Setting Capabilities via PTDaemon				
Analyzer	**PTD-ID**	**Ampere Range Settings**	**Fixed Range Setting via PTDaemon parameters (static setting for complete benchmark run)**	**Dynamic Range Setting by PTDaemon commands (individual setting for each target load)**
ZES LMG450:1-Channel	16	0.6, 1.2, 2.5, 5, 10, 16	yes	yes
ZES LMG500:1-Channel	18	0.02, 0.04, 0.08, 0.15, 0.3, 0.6, 1.2, 2.5, 5, 10, 20, 32	yes	yes

ZES LMG95	22	0.15, 0.3, 0.6, 1.2, 2.5, 5, 10, 20, 120, 240, 480, 960	yes	yes

Power Analyzer Uncertainty Calculation Capabilities via PTDaemon and Autorange Compliance				
Analyzer	**PTD-ID**	**Range Reading by PTDaemon commands**	**Uncertainty Calculation by PTDaemon commands**	**Autorange Compliance for SPECpower_ssj2008**
ZES LMG450:1-Channel	16	yes	formulas	no
ZES LMG500:1-Channel	18	yes	formulas	no
ZES LMG95	22	yes	formulas	no

All accepted ZES LMG power analyzers support range setting via PTDaemon command interface or PTDaemon input parameters. Further information how to configure the SPECpower_ssj2008 benchmark run for range setting for every individual load level is given in the SPECpower_ssj2008 user manual.

Additional all accepted ZES LMG power analyzers provide uncertainty checking by the PTDaemon.

Note: During the measurement via PTDaemon the analyzer is locked. If PTDaemon is not stopped via "X" command, the analyzer has to be turned "off" and "on" for reuse.

5.1.9.3 Multi-Channel Measurements

The ZES LMG450 and ZES LMG500 can also be used as 4-channel analyzers by PTDaemon, when selecting the PTDaemon-ID 17 (LMG450) or 19 (LMG500). The values of the individual channels and the sum channel can be measured. Multi-channel measurements with LMG ZES analyzers are not yet accepted for SPECpower_ssj2008 submissions.

Note: Currently only simultaneous range setting of all 4 channels is available. In this case the range setting of the individual channels can only be done manually.

5.2 Temperature Sensors

5.2.1 Digi Watchport/H

5.2.1.1 Hardware Connection

The Watchport/H is only available as a USB device. Plug the USB connector into an available USB port. Make sure to locate the temperature sensor in front of the SUT air intake as specified in Run and Reporting Rules.

5.2.1.2 Windows Software Configuration

The “find new hardware wizard” should detect the Watchport/H device, and find the drivers if the driver CD is installed. The drivers allow applications to access the Watchport device on a virtual serial port. Use Windows device manager to locate the virtual serial port in the “COM and LPT ports” section, and use that serial port number as the port argument to PTDaemon.

The Watchport Manager application can be also used to test and communicate with the device.

The available Windows drivers are for 32-bit Windows only.

5.2.1.3 Linux Software Configuration

Linux kernels with the io_ti and usbserial drivers will autodetect the Watchport device. The name of the virtual serial port can usually be found by looking at the system log output, for example using the “dmesg” command.

5.2.2 Temperature@lert

5.2.2.1 Hardware Connection

The Temperature@lert is only available as a USB device. A USB extension cable will probably be necessary to situate the sensor in the appropriate location in front of the SUT as specified in the Run and Reporting Rules. Plug the USB connector into an available USB port.

5.2.2.2 Windows Software Configuration

“Virtual Serial Port” drivers for most Windows versions may be downloaded from http://ftdichip.com/Drivers/VCP.htm. Once the driver is installed, a virtual serial port will be found in Windows’ Device Manager. The COM port number found in Device Manager should be used as the port argument to PTDaemon.

5.2.2.3 Linux/Other Software Configuration

Linux kernels 2.6.9 and beyond already include “Virtual Serial Port” drivers that support the Temperature@lert. Drivers for other Linux versions, as well as for MacOS, are available at http://ftdichip.com/Drivers/VCP.htm. Once the driver is installed, the name of the virtual serial port can usually be found by looking at the system log output, for example using the “dmesg” command.

6 Troubleshooting

For further help with troubleshooting specific issues, please refer to the FAQ at the following link: http://spec.org/power_ssj2008/docs/SPECpower_ssj2008-FAQ.html

