IntelliArb with Powersim Profile

User's Manual

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1   OVERVIEW

IntelliArb with Powersim profile produces low voltage AC waveforms to simulate AC voltage and current for electricity meters. It requires a small amount of modification to the connected meter to have the low voltage signals appear full scale. It provides a wide array of communications interfaces to allow either manual of automated control of the waveforms.

It is designed to be a semi-autonomous. Waveforms are specified by amplitude phase shift, and harmonics. This allows complicated tests to be created and downloaded to the device to be run without constant intervention by a PC (or even any intervention at all in the case of event mode after a test is kicked off).

This manual describes all behavior accessed through the PC application. All of this behavior can be accessed through the automation as well (see the automation section). The PC application is designed

primarily for benchtop use, and for generating configurations, and getting familiar with behavior. Most of the advanced features really shine when the automation interface is integrated into your automated test system.

2   MODES OF OPERATION

There are three primary modes of operation: static output mode, waveform test mode, and event test mode.

2.1   STATIC OUTPUT MODE

In this mode, a single waveform is defined for continuous output. This is primarily the benchtop mode to verify that the meter handles a particular input correctly. From the PC application, this is run from the Static Output pane:

The amplitude and phase for all the base waveforms are selected, then up to 15 harmonics (each with a selectable harmonic number) can be layered on top. All phase shifts are relative to phase A voltage, so the phase shift for phase a voltage is always defined to be zero. A powersim must be connected (just hit the connect button at the top) prior to controlling a waveform. The waveform is enabled and disabled by the enable and disable buttons. The output can be updated by changing it, and hitting the enable

button (it does not have to be disabled first). If the configuration results in an overflow, the signal will not be clipped. An overflow error will be indicated in the status bar at the bottom, and the output will be shut off. The behavior applies to all the operating modes.
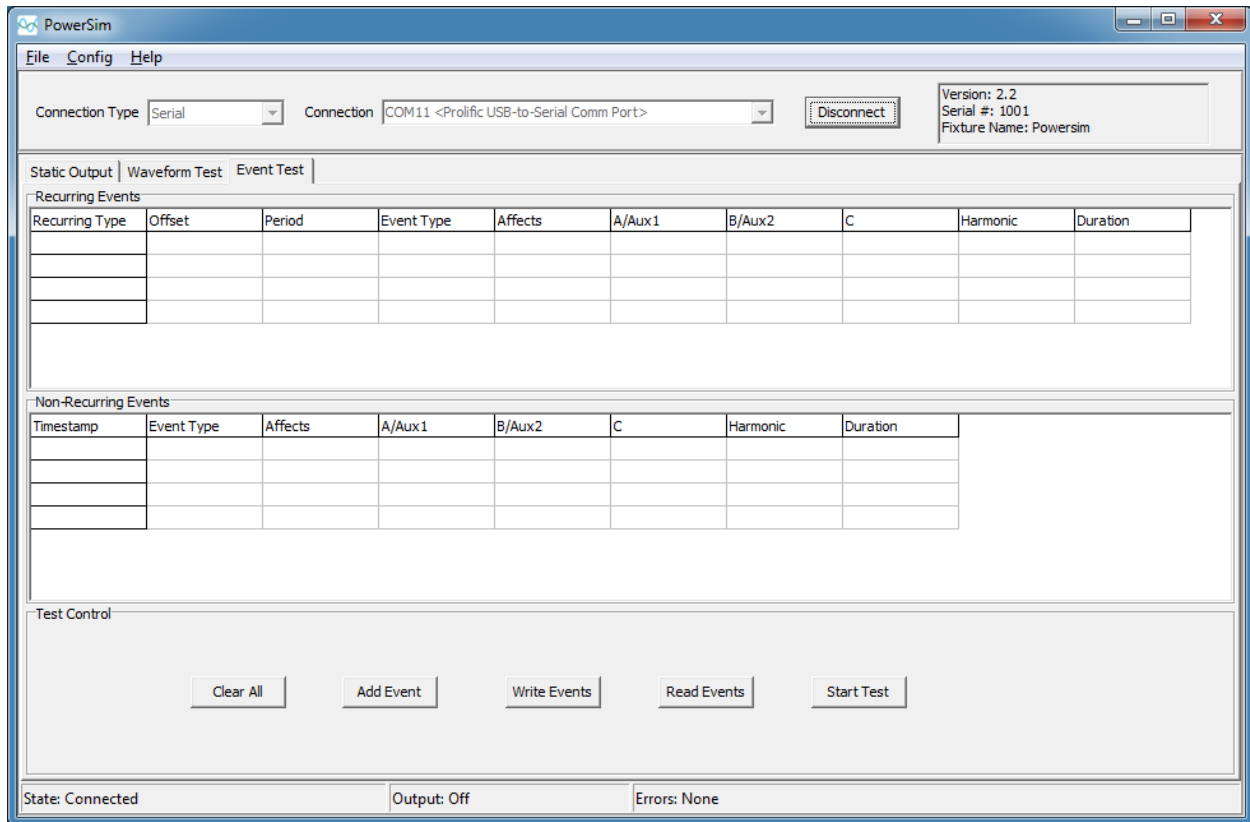
2.2 WAVEFORM TEST MODE

Waveform test mode allows the user to create a set of waveform definitions, a set of harmonic definitions, and list of test sequences that combine a waveform definition with a harmonic definition, and specify how long it should run in terms of line cycles. Typically, this would be used in an automated functional test fixture to precisely test meter functionality.
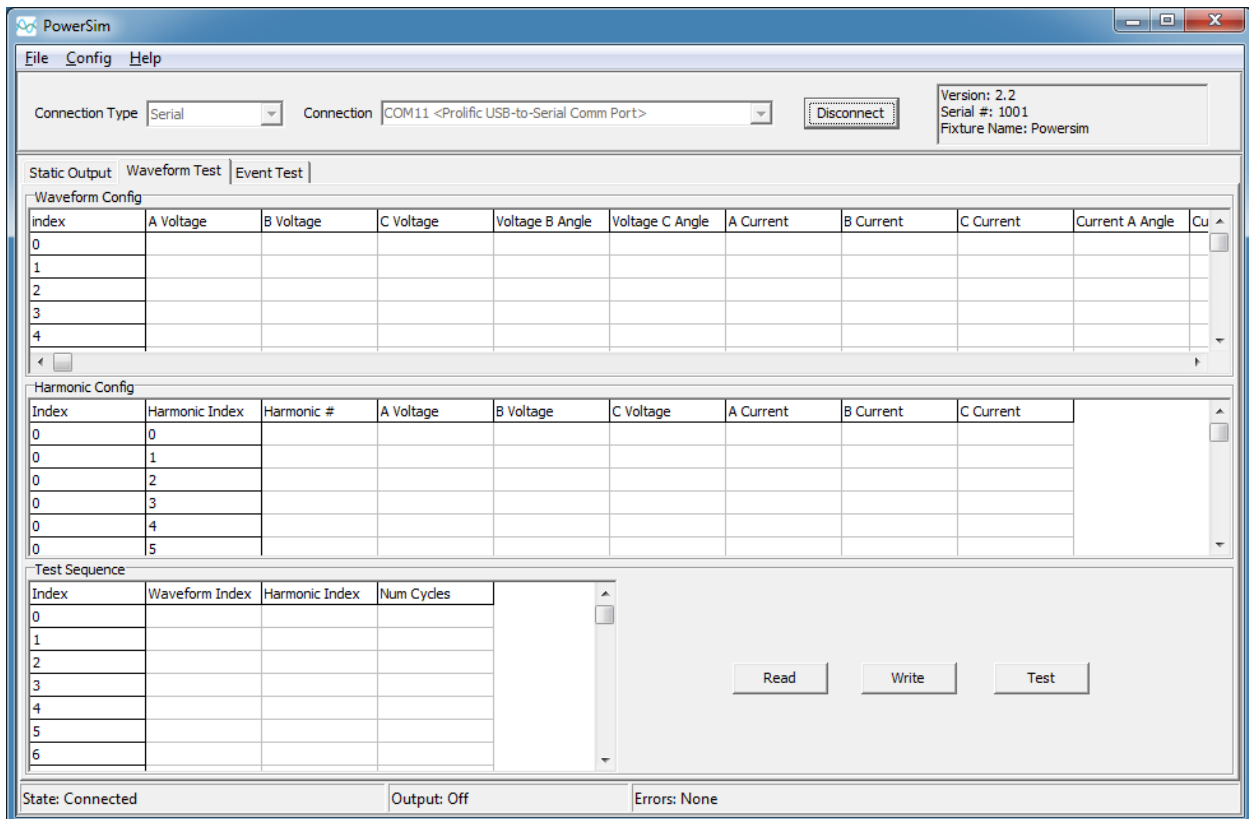
The configuration for the waveform test can be entered and run from the waveform test pane. Additionally, when this pane is selected, you can load and save this config to file. These configurations can also be loaded and started by the automation interface. This mode is used to create a sequence of waveform changes to simulate various different power situations. If the Num Cycles field is zero, that test sequence will run until a new test is kicked off. If it is non-zero, the output will disable at the end of the test. When a sequence is running, a new configuration can be loaded without affecting that waveform. Typically, the last sequence is set to zero to leave it running constantly so that a new test sequence can be loaded.

2.3 EVENT TEST MODE

Event test mode is typically used for longer term system type tests. It can be configured and viewed in the event test pane.

4

PowerSim

File   Config   Help

Connection Type: Serial   Connection: COM11 <Prolific USB-to-Serial Comm Port>   [Disconnect]

Version: 2.2
Serial #: 1001
Fixture Name: Powersim

Static Output | Waveform Test | Event Test

Recurring Events

Recurring Type	Offset	Period	Event Type	Affects	A/Aux1	B/Aux2	C	Harmonic	Duration

Non-Recurring Events

Timestamp	Event Type	Affects	A/Aux1	B/Aux2	C	Harmonic	Duration

Test Control

[Clear All]   [Add Event]   [Write Events]   [Read Events]   [Start Test]

State: Connected   Output: Off   Errors: None

The standard voltage and current are configured beforehand in the service configuration (see below), and the outputs can be changed by a list of events with recurring or non-recurring events. All the events can be defined as referenced to the start of the test, or actual time (configurable in the service config). If more than one parameter needs to be changed at a time, then multiple events can be set to the same event time, and they will all be applied simultaneously. To add events, hit the add event button to open the event dialog.

Add Event ✕

OK
Cancel

◉ Recurring Event   ○ NonRecurring Event

Offset   Period

[Period Since Ancho ▾]   [0]   [0]

Event Type

[Set Voltage ▾]

Items Affected
☐ Phase A   ☐ Relay Closed
☐ Phase B   ☐ Aux 1
☐ Phase C   ☐ Aux 2

Values
Phase A Voltage   Duration
[0]   [0]

Phase B Voltage   Harmonic
[0]   [0]

Phase C Voltage
[0]

In the event dialog, define the event time as a recurring or non-recurring time. Then select the parameter to change, as well as which phases to apply it to. Then set the value per phase. If the change is to be permanent (until the next event), then leave the duration to 0. If it needs to be applied for a short time, then reverted to the previous value (like a short sag), then set the duration as the number of line cycles the change should be active. Once all the parameters are correct, selecting OK will add it to the test. The type of timestamp (recurring or non-recurring) will determine which set of events it is applied to.

Once the test has been completed, it can be written to the connected device by hitting the Write Events button, or saved to a file by selecting the menu item File->Save Test. The test can also be loaded (overwriting any existing config) by hitting the Read Events button to read from the connected device, or from a previously saved file by selecting the File->Load Test menu item.

To kick off a test that has been written, hit the Start Test button.

3 SETUP

3.1 SOFTWARE

Install the included windows installation package on a Windows 7 or later PC. At the end of the installation you will be prompted to install the FTDI drivers for the USB interface.

3.2 SERIAL/NETWORK CONNECTION

Powersim has three different methods of communication: RS232 Serial, USB, and Ethernet. Each interface operates the same from the software perspective (speeds are different), and the Ethernet interface adds a basic web interface.

The RS232 interface connects to a standard PC serial port or USB converter. To use this interface select Serial from the connection type, and the specific PC serial port from the dropdown (all available serial ports will be enumerated).

The USB interface will enumerate as an FTDI virtual com port. If you did not install the FTDI drivers during the software installation, you will need to install them when the USB port is first plugged in if they cannot be found through windows update. To use this interface, select Serial from the connection type, and the serial port labeled USB Serial port.

The Ethernet port can be configured for a static or dynamic IP (see network configuration in the configuration section). It should be configured while connected to the serial or USB interfaces. To use this interface, select Socket from the connection type, and input the IP address in the connection field. After initial use, the application will maintain a list of recent IP addresses.

After selecting a communications interface, click the connect button to establish a connection. The software will verify the connection, and will read out and display the version, serial number, and fixture name.

3.3 POWER

Connect the supplied power supply to the 12V input on the back panel. If the included power supply includes multiple blades, attach the blade that works for your location. With the power connected, and the switch on the back switched on, the LED indicator on the front should be red if the output is disabled, or green if the output is enabled

3.4 CONNECTING TO A METER

The outputs on the front panel are as follows: Ch1 = Phase A Voltage, CH2 = Phase A Current, CH3 = Phase B voltage, CH4 = Phase B Current, CH5 = Phase C Voltage, CH6 = Phase C Current. Channels 7 and 8 can be used for DC outputs for test control. For best results, each output with its common connection should be connected to the meter via twisted pair wire.

Powersim outputs AC waveforms at a much lower level than normal line levels. This allows for safe operation on a benchtop or test fixture, but requires minor modifications to the meter. Reference the

example metering front end below for the changes that need to be made. Your meter design may be different, but the key changes should be similar.

1) Remove connection from AC power supply to the voltage input – The low-level signals outputted from powersim cannot power the AC supply of the meter. The connection between the power supply, and the point at which the line to powersim is connected must be severed. The meter must then be powered by a DC supply. In the example provided, removing R2 isolates the voltage input to the ADC from the power supply. The powersim outputs are then fed across R3 and R4.

2) Adjust the voltage divider across R3 and R4 for the voltage inputs - In order for the meter to sample the line voltage, there is a very large voltage divider in the resistor network between the lines and the ADC. Change this divider so that the range of powersim (typically the +- 10V range is used) matches the input range of the ADC (or the portion of the input range you want to use). The total resistance should be between 5k-50k;

3) Create a voltage divider for the current inputs – Usually, the current is measured across a burden resistor connected to the CTs. If the smallest range of powersim (+-2.5V) is too large for your ADC input (in most cases it will be), you will need to add a resistor divider to this circuit. As long as you have a series element in the path between the CT and the burden resistor, you can change that out for a resistor, and change the burden resistor value to create the correct range. In the example provided, the resistor divider would be across R7 and R9, and R8 would be shorted out. The total resistance should be between 5k and 50k. If there is no series element, you will need to add one in the feed between powersim and the CT connector.

Notes:

• While the signal common is isolated from the supply ground, all the commons are tied together. If your current inputs are differential, and your voltage inputs are ground referenced, you will only be able to cover half of the input range. This can typically be overcome by adjusting the PGA to cover the whole ADC range, or a gain constant on the other side. If you need to run the inputs in their native differential mode, you can put a 1:1 or 1:X transformer between the powersim, and the inputs.

Voltage Input

Current Input
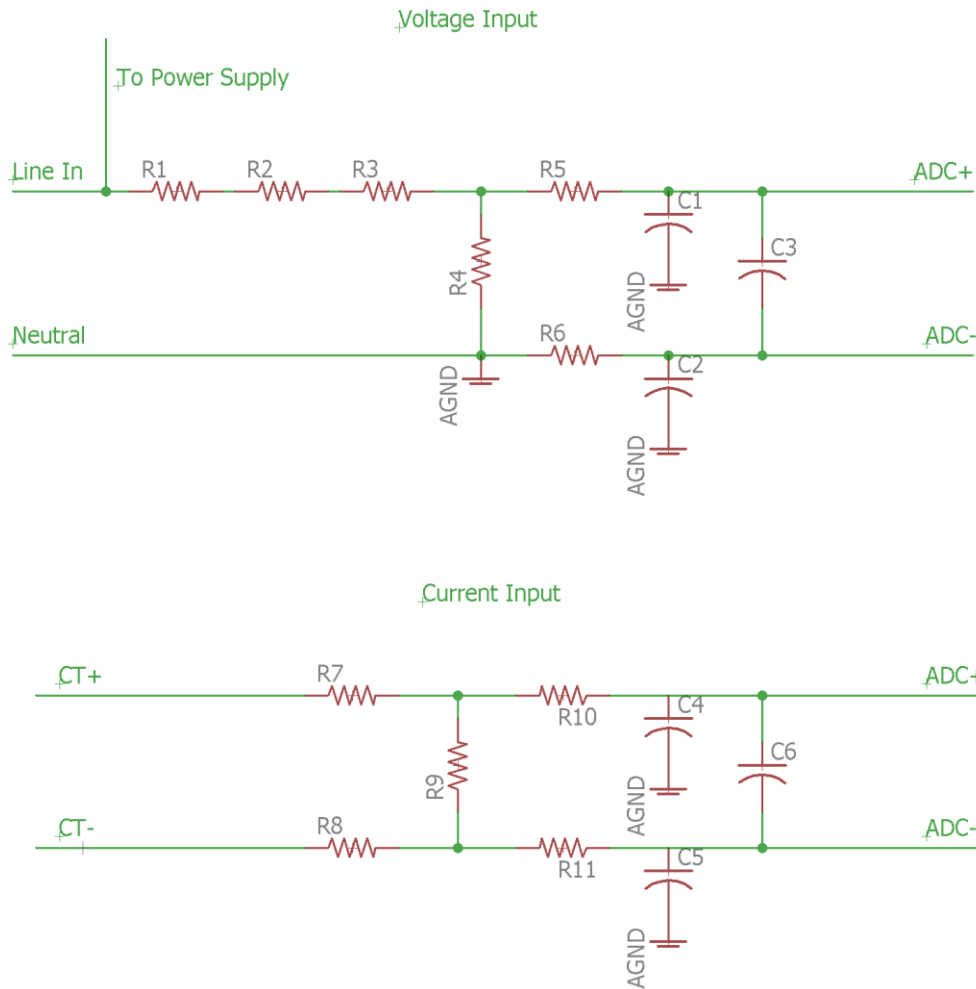
4 CONFIGURATION

4.1 CALIBRATION

To calibrate powersim you will need to know what the full-scale voltage should be (taking into account your voltage divider, and the full-scale input to the ADC), and what the meter should measure at that value. The software will use that to determine the starting point for the calibration. It will then output voltages and current in that range, and the user will indicate what the meter is seeing (this process can be done through the application software, or automation interface).

Follow the following steps to calibrate you unit using the powersim application:
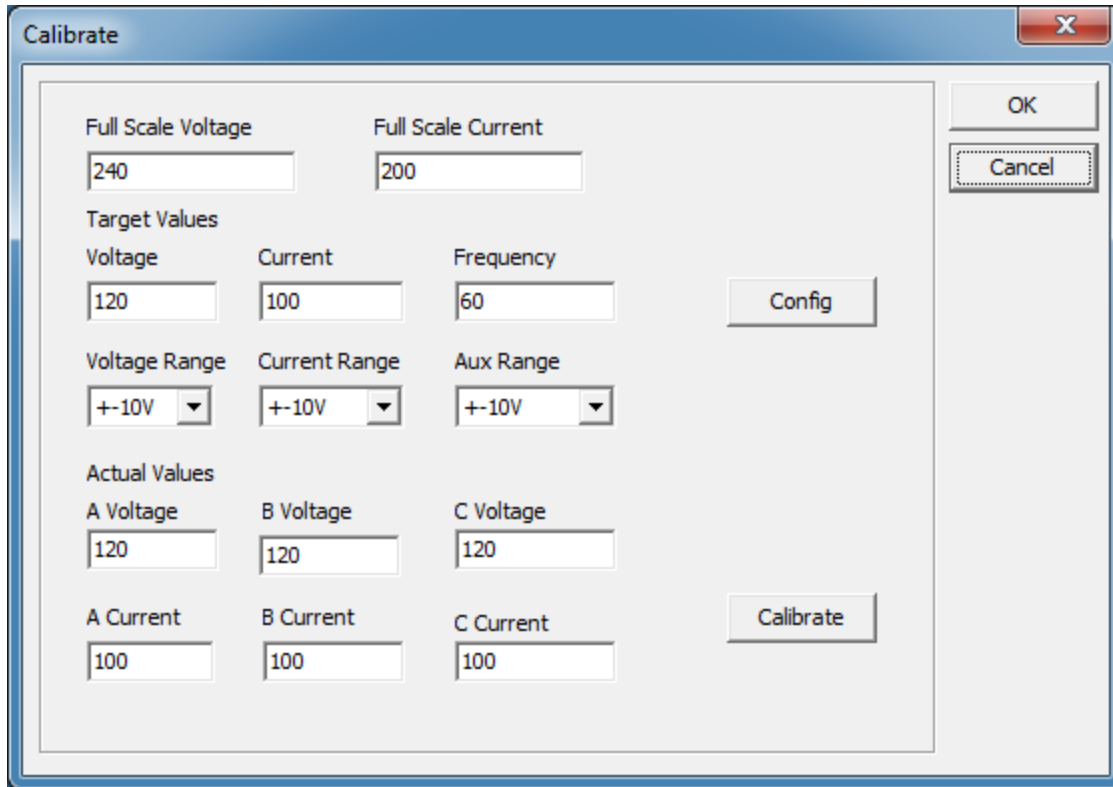
1. Open the calibration dialog under the Config->Calibrate Menu Item
2. Set the full-scale voltage and current values that your meter should be reporting when the powersim output are at their max.
3. Select the output range for powersim to use. NOTE: these are DC output ranges.
4. Set the voltage, current, and frequency in which to run the calibration. The voltage and current should be mid-scale values. The frequency should be the default frequency for the meter (50 or 60 hz normally).
5. Hit the config button to write the starting point calibration values, and to enable the outputs.
6. Read the voltage and current values out of your meter, and fill in the actual values section.
7. Hit the calibrate button to calculate the calibration values, and write them to powersim.
8. Repeat steps 6-7 until the meter is showing the target values to sufficient precision.

4.2 NETWORK CONFIGURATION

To configure the network interface, you must be connected to a powersim (preferably via serial or USB), and select the menu item Config->General Config.

Use the address config to select whether it is a static IP or dynamic one. If it is static, fill in the IP info. Additionally, you can configure the hostname, the ports for the web and direct communications interface (used by the software), as well as the time server. If a time server is configured and enabled, the device will stay time synched. This is primarily important when running in event mode.

The network status field will display the current IP address for the device. If the configuration is changed, the OK button will have the be hit, and the dialog relaunched to see the updated status.

4.3 SERVICE CONFIGURATION
When running in event mode, you need to configure the base serve the device will run in (this has no effect on the static output, or waveform test modes). To configure the service, select the menu item Config->Service Config.
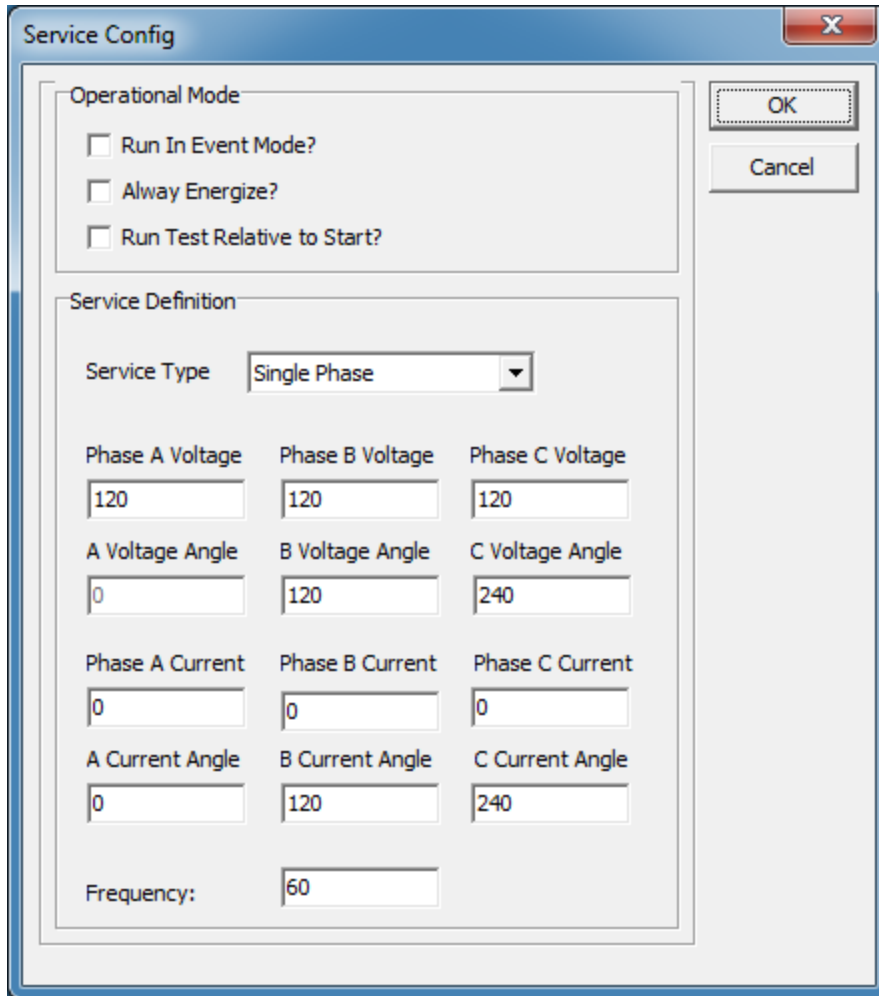
5 AUTOMATION

The automation interface is a COM object that gives you access to everything that you can do within the powersim PC application. While the PC application gives the use a good interface to learn about the functionality, to truly take advantage of all the features in a test environment, the user will need to use the automation interface to integrate into their test system. See the automation interface specification included in the doc section of the install directory, as well as the included scripting samples for how to use the interface.

6 DIRECT DEVICE CONTROL

Powersim supports C12.21 and C12.22 communications protocols, and stores data in C12.19 style tables. If your organization has test tools that use these protocols, and you would like to use your own tools, please contact Harborside Technology, and we will provide you with a data dictionary for the table definitions, as well as a description of the C12.21 and C12.22 modes supported.

7 SUPPORT

For tech support, reporting bugs, or just general feature recommendations, please email: support@harborsidetechnology.com. Please reference the product name, and be as detailed as possible if reporting a bug. We appreciate your feedback!