

RR-PCSuite

Control Software for Radian Research Dytronic Standards

User Manual

July, 2010

Table of Contents

1.0 Introduction.....	4
1.1 Overview.....	4
1.2 Hardware Requirements.....	4
1.2.1 Computer Requirements	4
1.2.2 RJ-45 Port Pinout (RD-2x family).....	5
1.2.3 DB-9 Port Pinout (RD-3x family).....	5
2.0 Software Configuration.....	6
2.1 Communication Ports.....	6
2.2 USB to RS-232 Converters.....	6
3.0 User Guide	8
3.1 Initialization	8
3.2 Navigating Menu's.....	8
3.2.1 View.....	8
3.2.2 Run.....	9
3.2.3 Setup	10
3.3 Configure Device	10
3.3.1 Model Information	10
3.3.2 BNC Input Configuration	11
3.3.3 BNC Output Configuration.....	14
3.3.4 BNC Constant Configuration.....	16
3.3.5 Service Selection Configuration	17
3.4 Metrics	19
3.4.1 Instantaneous Metrics	19
3.4.2 Minimum and Maximum Metrics.....	20
3.4.3 Metric Accumulator	21
3.4.4 Metric Options	21
3.5 Harmonic Analysis.....	23
3.5.1 Harmonic Data	23
3.5.2 Total Harmonic Distortion.....	24
3.5.3 Waveform Analysis	24
3.5.4 Bar Chart Analysis.....	25
3.6 Trend Chart	26
3.7 Vectors	28
3.8 Run Meter Test	29
3.9 Standards Test.....	33
3.10 CT Burden and Ratio Testing	38
3.11 Analog Sense Test.....	44
3.12 Power Quality	47
3.12.1 Sag.....	48
3.12.2 Swell	49
3.12.3 V-Transient	49
3.12.4 V-THD (%)	49
3.12.5 Noise (V).....	49
3.12.6 Freq	49
3.12.7 Imbalance.....	49
3.12.8 I-Transient.....	50

- 3.12.9 I-THD (%)..... 50
- 3.13 Flicker-Meter 50
 - 3.13.1 Short Term Pst 51
 - 3.13.2 Long Term Plt..... 52
 - 3.13.3 Demodulated Flicker Signal 53
 - 3.13.4 Flicker Signal 53
 - 3.13.5 PDF 54
 - 3.13.6 Cumulative PDF..... 55
- 3.14 Site Automation 55
 - 3.14.1 Automation Setup 55
 - 3.14.2 Automation Flow Diagram 56

1.0 Introduction

1.1 Overview

The RR-PCSuite software package is a powerful, but yet easy to comprehend and use, set of tools to facilitate the full array of testing and analysis the Radian Research Dytronic Standards are capable of performing. RR-PCSuite allows the user to easily configure the Dytronic Standard, execute meter and standard testing, and perform power analysis routines.

Application areas of the RR-PCSuite software include:

- Device Configuration
- Metrics Measurement
- Harmonics Analysis
- Data Logging
- Vector Analysis
- Meter Testing
- Standards Testing
- CT Testing
- Analog Transducer Testing
- Power Quality Analysis
- Flicker Analysis
- Automated Site Verification

1.2 Hardware Requirements

The RR-PCSuite software connects to a Radian Research Dytronic Standard through a RS-232 cable or RR-BT Bluetooth Communications Link. Communications must follow the following protocol.

Communications Protocol

- Half duplex RS-232
- 57.6k Baud
- 1 start bit, 1 stop bit, no parity
- DTR line high
- The Computer or other controlling device (host) operates as the master and the Dytronic Standard operates as the slave.

1.2.1 Computer Requirements

- **Operating system**
Microsoft Windows® 98 Second Edition, Windows 2000, Windows Millennium Edition, Windows XP Home Edition, or Windows XP Professional
- **Processor**
A 233 megahertz (MHz) processor, such as an Intel Pentium II or Advanced Micro Devices (AMD)

- **RAM**
64 megabytes (MB)
128 MB, recommended
- **Free hard disk space**
100 MB, Data storage capabilities limited to hard disk size.
- **Video adapter and monitor**
VGA (800 x 600) or higher resolution

1.2.2 RJ-45 Port Pinout (RD-2x family)

On single phase RD-2x Dytronic Standards, communications are interfaced via an 8-pin RJ-45 connector. Through this port, the PCSuite software package can be utilized, and the standard can be recalibrated. Additionally, the flash memory storage for both the DSP and Xilinx programs is accessible through this terminal making the RD-2x field upgradeable.

Signal	Description	RJ-45 Pin	DB9 Pin	Wire Color	Used by RD-xx
RTS	Request To Send	1	7	Blue	Yes
DTR	Data Terminal Ready	2	4	Orange	Yes
GND	Signal Ground	3	5	Black	Yes
TX	Data Transmit	4	3	Red	Yes
RX	Data Receive	5	2	Green	Yes
DCD	Data Carrier Detect	6	1	Yellow	No
DSR	Data Set Ready	7	6	Brown	No
CTS	Clear To Send	8	8	White	No
RI	Ring Indicator	N/C	9	Blank	No

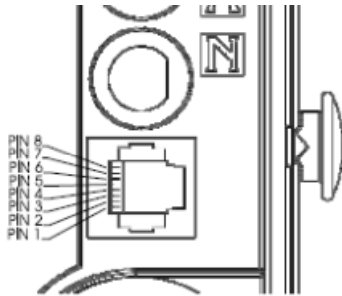


Figure 1.2.2.1

Figure 1.2.2.2

1.2.3 DB-9 Port Pinout (RD-3x family)

On three phase RD-3x Dytronic Standards, communications are interfaced via a DB-9 connector. Through this port, the PCSuite software package can be utilized, and the standard can be recalibrated. Additionally, the flash memory storage for both the DSP and Xilinx programs is accessible through this terminal making the RD-3x field upgradeable.

Signal	Description	DB9 Pin	Used by RD-xx
RTS	Request To Send	7	Yes
DTR	Data Terminal Ready	4	Yes
GND	Signal Ground	5	Yes
TX	Data Transmit	3	Yes
RX	Data Receive	2	Yes
DCD	Data Carrier Detect	1	No
DSR	Data Set Ready	6	No
CTS	Clear To Send	8	No
RI	Ring Indicator	9	No

Figure 1.2.3.1

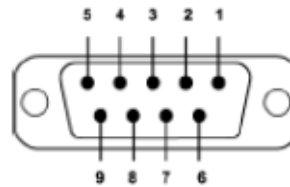


Figure 1.2.3.2

2.0 Software Configuration

2.1 Communication Ports

The PCSuite software allows connection and communication to a Dytronic Standard on any one of the 20 comm ports. When the software is launched it will automatically scan the computer’s hardware to verify if a Dytronic Standard connected. If a device is detected, the software will automatically initiate communications. If multiple devices are connected, by default, the first communication port available will be initialized for communications. If it is required to communicate to a different device, other than the first available, you must select the ‘Setup’ and ‘Comm Ports’ options in the toolbar. From the ‘Select Comm Ports’ menu screen, you must deselect the undesired communication ports and select the desired communication port, as seen in figure 2.1.1.

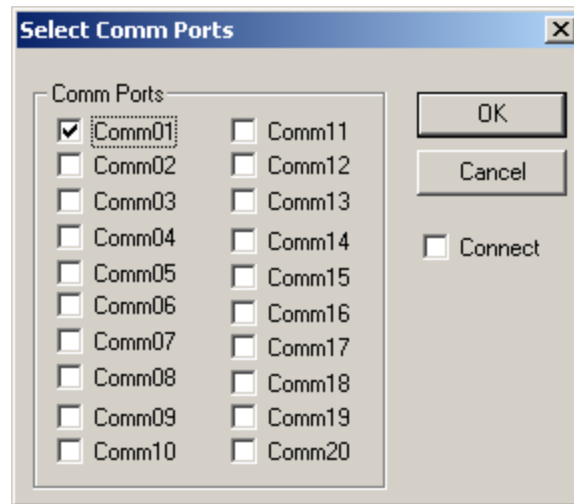


Figure 2.1.1

2.2 USB to RS-232 Converters & Bluetooth Adapters

Computers manufactures are increasingly eliminating the DB-9 RS-232 port on newer model computers and laptops. If the control computer does not include a DB-9 connection, a USB to RS-232 Converter is required.

Note:

Not every USB to RS-232 converter is designed the same. Each has a different communication delay associated with the device. To adjust for each device you must manually add an entry into the computer's registry, to allow the software to communicate to the standard.

To add the entry, open the computer's registry by selecting 'Run...' in the 'start' menu. From the 'Run' command window, type "regedit" and press 'OK' button. Select the 'HKEY_LOCAL_MACHINE' folder, the 'SOFTWARE' folder, the 'Radian' folder, and the 'RadCommApp' folder. From the Registry Editor window toolbar, select 'Edit', 'New', 'DWORD Value'. See Figure 2.2.1 below, for example.

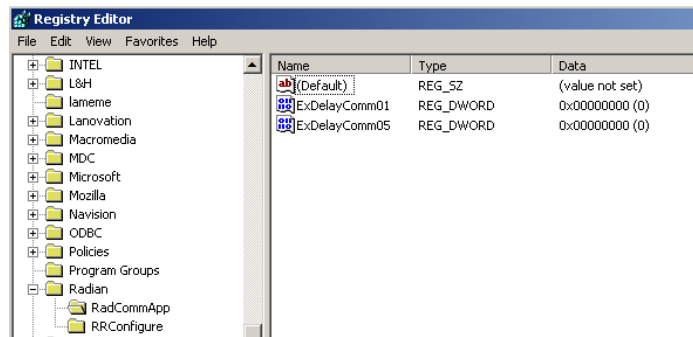


Figure 2.2.1

The name of the entry needs to follow the format as seen in the example below.

ExDelayComm01

**Example for Communication port 1*

ExDelayComm02

**Example for Communication port 2*

If another communication port is desired then follow the format and create the DWORD Value to match the examples above.

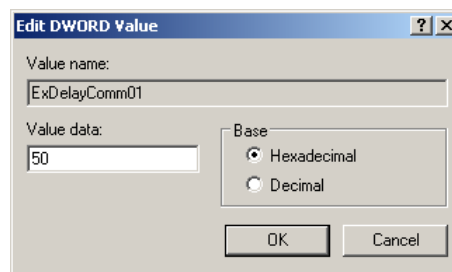


Figure 2.2.2

The Value data entry can be changed by double clicking on the entry, this will open the 'Edit DWORD Value' screen, as seen in figure 2.2.2 above. The initial 'Value data:' should be set to "50" (hexadecimal), and a higher number may be required, depending on USB to RS-232 converter used.

3.0 User Guide

3.1 Initialization

Add verbiage for COMM MANAGER application

Once the Dytronic Standard is powered, launch the PCSuite software. The software will automatically connect and initialize, as seen below in figure 3.1.1.

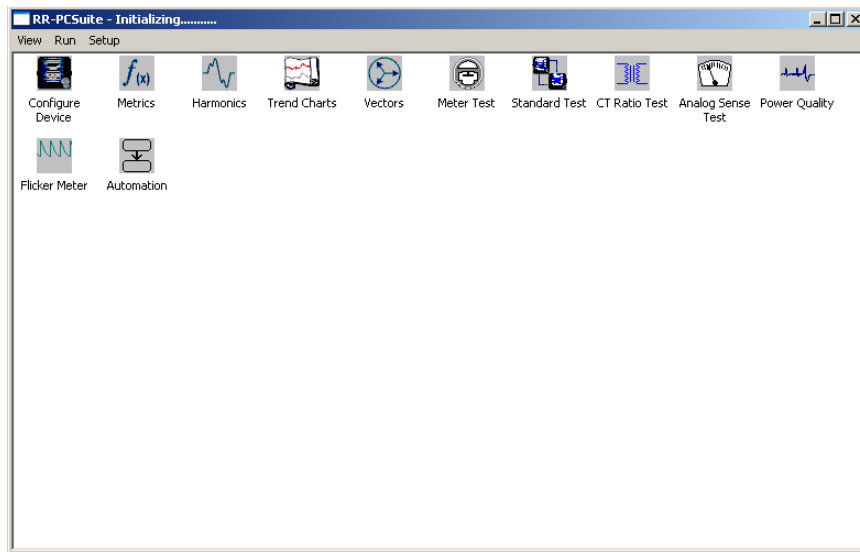


Figure 3.1.1

Once the PCSuite software is initialized, the full model number and serial number of the Dytronic Standard appears above the toolbar in the top portion of the PCSuite start-up window. A single mouse click on any of the icons automatically launches that specific application, and only one test or measurement application can run at a time.

3.2 Navigating Menu's

In addition to the icons, the various applications can be accessed from the toolbar menu.

3.2.1 View

The Metrics, Vectors, Harmonics, Trend Chart, Power Quality, Flicker Meter and Site Automation applications can be launched from the 'View' menu. The 'View' menu affords the operator the same functions as if they had opened the corresponding icon in the PCSuite start-up screen. In addition to the applications, the 'View' menu also includes the 'About' and 'Exit' options.

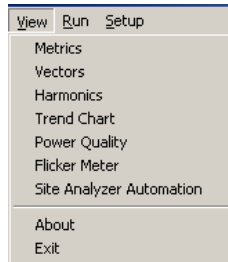


Figure 3.2.1.1

The 'About' screen provides pertinent information, including the version and Radian Research contact information. See figure 3.2.1.2 below.



Figure 3.2.1.2

3.2.2 Run

The Meter Test, Standard Test, CT Ratio Test, and Analog Sense Test applications can be launched from the 'Run' menu. The 'Run' menu affords the operator the same functions as if they had opened the corresponding icon in the PCSuite start-up screen. In addition to the applications, the 'Run' menu also includes the 'Firmware Initialization', 'Reset', and 'Diagnostics' options.

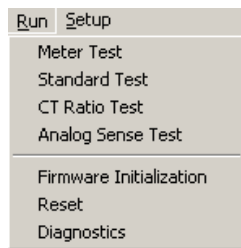


Figure 3.2.2.1

The 'Diagnostics' option will display the current status of the standard, including any errors that may be present. If any errors are present, please contact Radian Research's customer support team, who can provide additional commands to be entered in the Diagnostics window that will help further diagnose the problem occurring on the Dytronic. To enter the commands, type the information into the text box, located at the bottom of the Diagnostic window, as seen in Figure 3.2.2.2 below, and select the 'Submit' button.

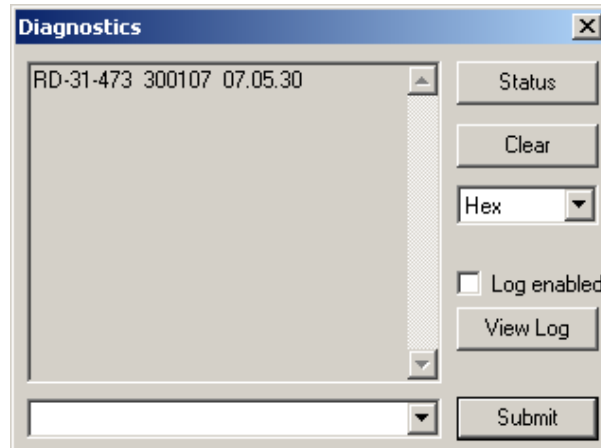


Figure 3.2.2.2

3.2.3 Setup

The Device Configuration application can be launched from the 'Setup' menu. See figure 3.2.3.1 below. The 'Setup' menu affords the operator the same functions as if they had opened the corresponding icon in the PCSuite start-up screen. In addition to the Device Configuration application, the 'Setup' menu also includes the 'Comm Ports' and 'Connect' options.

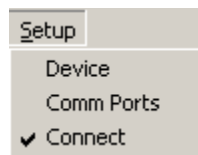


Figure 3.2.3.1

If the 'Connect' option has a check next to it, the computer is currently connected to a device.

Section [2.0 Software Configuration](#) details the communication port setup.

3.3 Configure Device

The 'Device Configuration' application facilitates the general configuration of the standard and includes the 'Model', 'BNC Input', 'BNC Output', 'BNC Constant', and 'Service' tabs.

3.3.1 Model Information

The 'Model' tab contains information regarding the connected standard. The model number, serial number, firmware version, calibration date, and manufacture date are all displayed in the 'Model' tab, see figure 3.3.1.1 below.

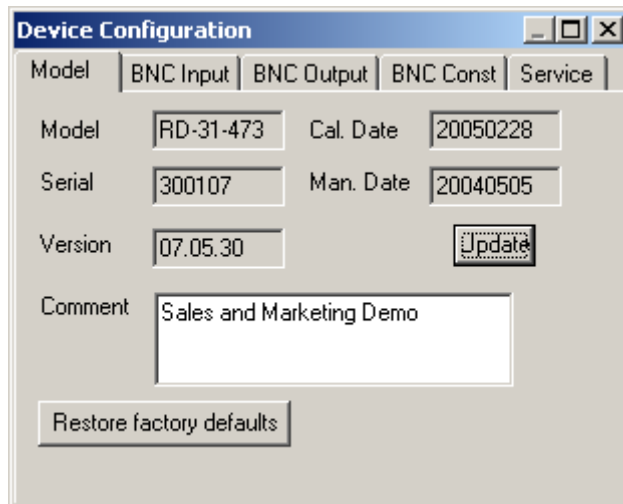


Figure 3.3.1.1

In addition to the device information, the 'Model' tab includes the 'Restore factory defaults' button and a field to enter comments. The 'Restore factory defaults' button resets all configurable fields to their factory default state. The 'Comment' field allows the factory or user to enter applicable text. This text can be saved by selecting the 'Update' button.

3.3.2 BNC Input Configuration

The 'BNC Input' tab allows the user to configure the device's responses to input signals. The pulse gated accumulators can be configured to respond in either a **Start/Stop/Clear** or a **Clear-Start/Stop** pattern, seen in figure 3.3.2.1 below.

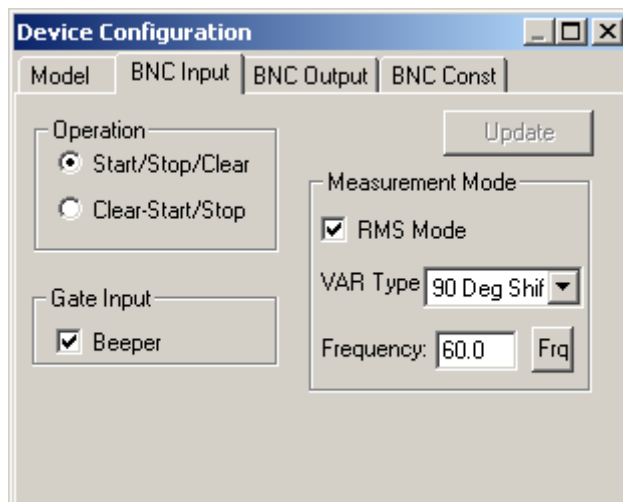


Figure 3.3.2.1

The Gate Input Beeper is an indicator that meter sensors have been aligned correctly for a meter test and can be activated/deactivated. The beeper will not actually begin to beep until the test is started.

RMS and AVG measurement modes are selected by checking and un-checking the 'RMS Mode' check box, respectively. The measurement mode selection is only supported on Dytronic models that support AVG mode. All changes must be saved by selecting the 'Update' button.

A VAR measurement type selection can be made from the drop down box.

The VAR types available are defined as:

VAR 0 = Voltage 90 Degree Shifted

$$VAR_i = \frac{1}{kT} \int_{\tau}^{\tau+kT} (I_i V_i(t+90^\circ)) dt \quad \text{and} \quad \text{net } VARh = \sum_{i=1}^3 VARh_i$$

VAR 1 = Integral VAR

$$VAR_i = \frac{\omega}{kT} \int_{\tau}^{\tau+kT} I_i \left[\int V_i dt \right] dt \quad \text{and} \quad \text{net } VARh = \sum_{i=1}^3 VARh_i$$

VAR 2 = Integral VAR 50 Hz

$$VAR_i = \frac{2\pi 50}{kT} \int_{\tau}^{\tau+kT} I_i \left[\int V_i dt \right] dt \quad \text{and} \quad \text{net } VARh = \sum_{i=1}^3 VARh_i$$

VAR 3 = Integral VAR 60 Hz

$$VAR_i = \frac{2\pi 60}{kT} \int_{\tau}^{\tau+kT} I_i \left[\int V_i dt \right] dt \quad \text{and} \quad \text{net } VARh = \sum_{i=1}^3 VARh_i$$

VAR 4 = RMS VAR

$$\|V_i\| = \sqrt{\frac{1}{kT} \int_{\tau}^{\tau+kT} V_i^2 dt} \quad \text{and} \quad \|I_i\| = \sqrt{\frac{1}{kT} \int_{\tau}^{\tau+kT} I_i^2 dt}$$

$$WATT_i = \frac{1}{kT} \int_{\tau}^{\tau+kT} V_i I_i dt \quad \text{and} \quad VA_i = \|V_i\| \cdot \|I_i\|$$

$$VAR_i = \sqrt{VA_i^2 - WATT_i^2} \quad \text{and} \quad \text{net } VARh = \sum_{i=1}^3 VARh_i$$

VAR 5 = Fundamental VAR

$$\|\tilde{V}_i\| = \sqrt{\frac{1}{kT} \int_{\tau}^{\tau+kT} \tilde{V}_i^2 dt} \quad \text{and} \quad \|\tilde{I}_i\| = \sqrt{\frac{1}{kT} \int_{\tau}^{\tau+kT} \tilde{I}_i^2 dt}$$

$$VAR_i = \|\tilde{V}_i\| \cdot \|\tilde{I}_i\| \sin(\theta_i) \quad \text{and} \quad \text{net VAR} = \sum_{i=1}^3 VAR_i$$

TERMINOLOGY USED

Index “i” represents the ith phase in the poly-phase network.

\tilde{V}_i = Potential component fundamental (1st harmonic order)

\tilde{I}_i = Current component fundamental (1st harmonic order)

V_i = Generalized potential waveform (fundamental and all harmonics).

I_i = Generalized current waveform (fundamental and all harmonics).

θ_i = Phase angle between the potential and current.

Δt = VAR-hour and VA-hour integration interval.

T = Fundamental period.

k = Number of fundamental periods.

ω = Fundamental frequency = $2\pi f_0$, where f_0 is the fundamental.

τ = Start time of integration.

$\|\ \|$ = Generally represents the norm of the wave function:
1-norm (Average) or 2-norm RMS

The base frequency is modified within the ‘Frequency’ field, but will return to the factory default value, once the standard is power-cycled.

3.3.3 BNC Output Configuration

The 'BNC Output' tab allows the user to configure the device's output terminals. The 'BNC Output' tab will look different, depending on the standard's model number. See Figure 3.3.3.1 and Figure 3.3.3.2 below. For three phase Dytronic standards (i.e. RD-30, RD-31, and RD-33) the three output ports may be configured to output pulses for the accumulated energy measured at Input 1, Input 2, or Input 3. The output ports may also be configured to output pulses the total energy, measured at all three inputs. In other words, the standard may be configured to execute a poly-phase test, with each port output corresponding to a single phase energy value, or a single phase test, with each port corresponding to a total energy value.

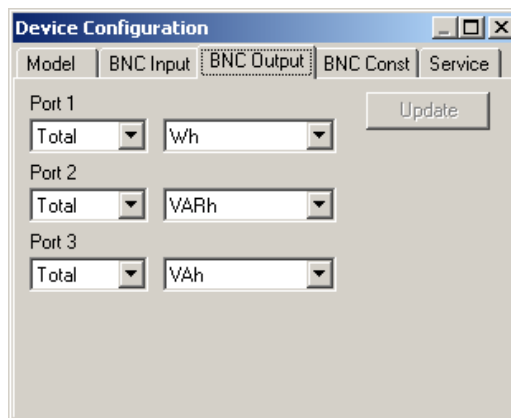


Figure 3.3.3.1, Three Phase Dytronic

For single phase Dytronic standards (i.e. RD-20, RD-21, RD-22, and RD-23) the function of each output port is configurable. Port 1 can be configured for use with a remote reset switch to respond in either a **Start/Stop/Clear** or a **Clear-Start/Stop** pattern. Port 1, like Port 2, can also be configured to output any of the measurement parameters (i.e. wathours, varhours, qhours, etc.) the standard supports. Port 3 can be set to Sync In or Sync Out. The synchronization setting allows three single phase Dytronic standards to be utilized for true three phase testing. Any changes to any of the settings in the 'BNC Output' tab must be saved via the 'Update' button.

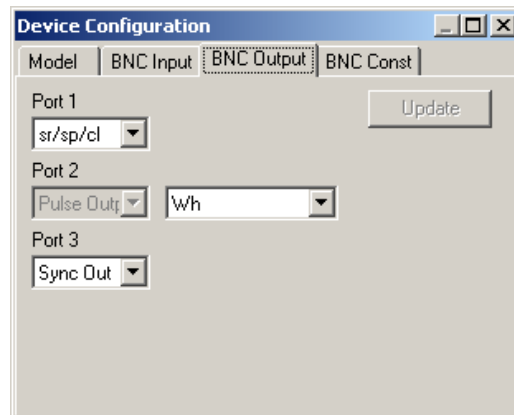


Figure 3.3.3.2, Single Phase Dytronic

3.3.4 BNC Constant Configuration

The 'BNC Const' tab allows the user to configure the measurement parameter constants. See Figure 3.3.4.1, below. To change the pulse constant, select and edit the constant and select the 'Update' button.

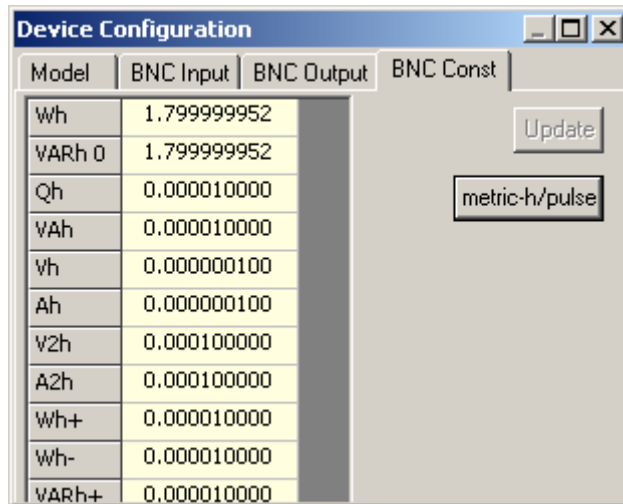


Figure 3.3.4.1

Dytronic standards are loaded with default pulse constants. These default values are listed below. To change how the pulse constant is displayed, select the 'metric-h/pulse' button, and it will invert to 'pulse/metric-h'.

Radian Research Pulse Constants:

Wh	0.000010 Watthours
VARh	0.000010 Voltampere Reactive hours
Qh	0.000010 Reactive hours
VAh	0.000010 Voltampere hours
Vh	0.000010 Volt hours
Ah	0.000010 Ampere hours
V2h	0.000100 Volt ² hours
A2h	0.000100 Ampere ² hours
Wh+	0.000010 Watthours positive
Wh-	0.000010 Watthours negative
VARh+	0.000010 Voltampere Reactive hours positive
VARh-	0.000010 Voltampere Reactive hours negative
Wh Delta	0.000010 Watthours Delta
Time	0.000010 Time (s)
VAh Delta	0.000010 Voltampere hours Delta
VARh Delta	0.000010 Voltampere hours Delta
VARh X Delta	0.000010 Voltampere Reactive hours (Delta, X Connect)
VARh X WYE	0.000010 Voltampere Reactive hours (WYE, X Connect)
Wh+ Delta	0.000010 Watthours positive Delta
Wh- Delta	0.000010 Watthours negative Delta
VARh+ Delta	0.000010 Voltampere Reactive hours positive Delta
VARh- Delta	0.000010 Voltampere Reactive hours negative Delta
VARh+ X Delta	0.000010 Voltampere Reactive hours positive Delta (Delta, X-Connect)
VARh- X Delta	0.000010 Voltampere Reactive hours negative Delta (Delta, X-Connect)
VARh+ X WYE	0.000010 Voltampere Reactive hours positive Delta (WYE, X-Connect)
VARh- X WYE	0.000010 Voltampere Reactive hours negative Delta (WYE, X-Connect)

Note: Pulse constant availability is dependant on the model number.

3.3.5 Service Selection Configuration

The 'Service' tab, which is only available when connected to a three phase Dytronic standard, enables the unit to emulate how a meter would perform the voltage and current calculation. In addition, the 'Service' tab allows the user to enter calibration factors or ratio factors. To create a new service, select 'New Service' from the 'Selection' drop-down menu. This action will cause the 'Service Selection' area of the screen to change to include fields for the new service's title and two lines of descriptive text, see Figure 3.3.5.1 below. This area also includes the 'Diagram:' drop down menu, which allows the user to select a diagram that best fits the new service. All selections are saved by selecting the 'Save' button.

To start the service, select the ‘Start-Service’ button. Once the service has been started, all metrics will be scaled to the service definitions. To stop the service, select the ‘Stop-Emulation’ button.

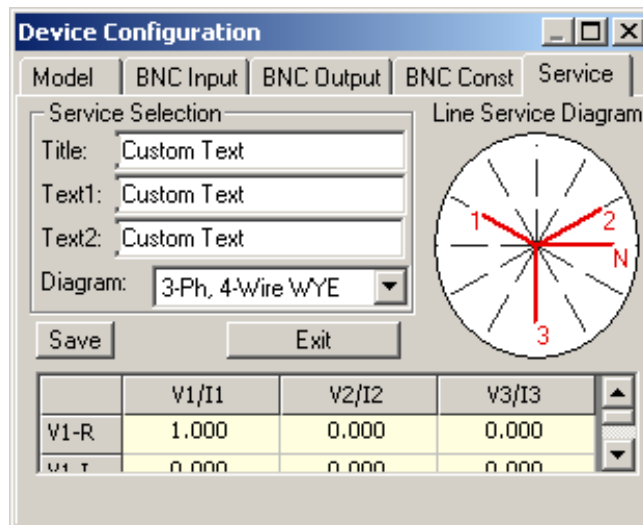


Figure 3.3.5.1

The Service’ tab allows the user to perform a general complex linear transformation on the three phases of input potential and current.

This complex linear transformation is defined as follows:

$$V_1 = C_{11} * V_1 + C_{12} * V_2 + C_{13} * V_3$$

$$V_2 = C_{21} * V_1 + C_{22} * V_2 + C_{23} * V_3$$

$$V_3 = C_{31} * V_1 + C_{32} * V_2 + C_{33} * V_3$$

$$A_1 = K_{11} * A_1 + K_{12} * A_2 + K_{13} * A_3$$

$$A_2 = K_{21} * A_1 + K_{22} * A_2 + K_{23} * A_3$$

$$A_3 = K_{31} * A_1 + K_{32} * A_2 + K_{33} * A_3$$

Note: There is a real and imaginary input for each potential and current input.

Where “V1”, “V2”, and “V3” are the standard’s complex three phase potentials, “A1”, “A2”, and “A3” are the standard’s complex three phase currents, “C” is the 3x3 complex coefficient matrix for the potential transformation, “K” is the 3x3 complex coefficient matrix for the current transformation, “V₁”, “V₂”, “V₃” are the transformed complex three phase potentials, and “A₁”, “A₂”, and “A₃” are the transformed three phase currents.

Example 1: Electricity Meter, Z-Coil, form 6

V1-R = 1, 0, 0 ---- Real
 V1-I = 0, 0, 0 ---- Imaginary
 V2-R = 1, 0, 1
 V2-I = 0, 0, 0
 V3-R = 0, 0, 1
 V3-I = 0, 0, 0

 I1-R = 1, 0, 0 ---- Real
 I1-I = 0, 0, 0 ---- Imaginary
 I2-R = 0, -1, 0
 I2-I = 0, 0, 0
 I3-R = 0, 0, 1
 I3-I = 0, 0, 0

The real coefficients change the magnitude and the imaginary coefficients change the phase of the waveform. As seen in the example above, the imaginary coefficients have been zeroed. With the “Z-Coil, form 6” service enabled the standard will read power exactly like a meter with a Z-coil. The metrics measurement for voltage on input 2 will be the sum of input 1 and input 3 and the current on input 2 will show negative.

Note: When the service selection is active, the voltage and current readings will not be actual measurements, but will depend on the coefficients entered.

3.4 Metrics

The ‘Metrics’ application allows the user to view all the instantaneous, minimum, maximum, and accumulated measurement parameters. This application also facilitates the configuration of the metrics display, and includes the ‘Inst’, ‘Min’, ‘Max’, ‘Accum’, and ‘Options’ tabs.

Note: Minimum and maximum measurement availability are model number dependant.

3.4.1 Instantaneous Metrics

Instantaneous metrics are displayed in the ‘Inst’ tab, see figure 3.4.1.1.

Metrics View					
Inst	Min	Max	Accum	Options	
		Input 1	Input 2	Input 3	Net
V	0.023836	0.021472	0.021465	N/A	
A	4.505610E-006	2.847467E-006	7.115511E-006	N/A	
W	-1.984717E-009	-2.431967E-009	2.470588E-008	2.281746E-008	
VA	1.075046E-007	6.113457E-008	1.531084E-007	3.249012E-007	
VAR	-9.888447E-010	2.855502E-011	-9.136324E-009	-7.748512E-009	
Hz	74.393036	74.854401	72.922882	N/A	
oP	153.516159	-179.327301	20.294577	N/A	
PF	-0.018462	-0.039781	0.161362	N/A	
ASn	N/A	N/A	-1.289771E-010	N/A	
doP	0.000000	-32.025669	-3.106720	N/A	
V Delta	0.020342	0.019772	0.020107	N/A	
W Delta	-2.702855E-010	0.000000	-1.679731E-009	1.323714E-009	
VA Delta	9.167081E-008	0.000000	1.431790E-007	1.514060E-008	
VAR Delta	-4.644064E-010	0.000000	-1.864143E-008	-1.508263E-008	
VAR X WYE	-1.579924E-010	2.444217E-010	1.729956E-009	4.197361E-009	
VAR X Delta	2.495513E-009	0.000000	5.089104E-008	5.502862E-008	

Figure 3.4.1.1

Single phase Dytronic standards only display one input. Entries defined as “N/A” suggest that the particular measurement is not supported on the associated phase. The table below includes the definitions of the different measurements.

Metrics Definitions:

V	Volts
A	Amperes
W	Watts
VA	Voltamperes
VAR	Voltamperes Reactive
Hz	Frequency
phase	Degrees Phase (Phase angle between voltage and current)
PF	Power Factor
ASn	Analog Sense
Ph_V (V1 Ref)	Phase
V (Line-Line)	Volts (V1-V3, V1-V2, V2-V3)
W Delta	Watts (Delta)
VA Delta	Voltamperes (Delta)
VAR Delta	Voltamperes Reactive (Delta)
VAR X WYE	Voltamperes Reactive (WYE, X-Connected)
VAR X Delta	Voltamperes Reactive (Delta, X-Connected)

Note: Not all Dytronic standards support ever measurement listed. Metrics availability is model dependent.

3.4.2 Minimum and Maximum Metrics

Minimum and Maximum metrics are displayed in the ‘Min’ and ‘Max’ tabs. Within these two tabs, the display will record and hold the max or min measurement values. There is no start or stop for the min or max measurements, because the minimum and maximum metrics start accumulating and updating when the unit is powered on. To reset the minimum and maximum measurements see section [3.4.4 Metric Options](#).

Note: Not all Dytronic standards support minimum and maximum measurements.

3.4.3 Metric Accumulator

Accumulated metrics are displayed in the ‘Accum’ tab. The metric accumulator is supported by all Dytronic Standards, see figure 3.4.3.1. Each model will support different accumulator measurement functions. The accumulator is configured, started, and stopped via the ‘Options’ tab, see section [3.4.4 Metric Options](#).

Metrics View				
Inst	Min	Max	Accum	Options
	Input 1	Input 2	Input 3	Net
Wh	0.000000	0.000000	0.000000	0.000000
VARh	0.000000	0.000000	0.000000	0.000000
Qh	0.000000	0.000000	0.000000	0.000000
VAh	0.000000	0.000000	0.000000	0.000000
Vh	0.000000	0.000000	0.000000	N/A
Ah	0.000000	0.000000	0.000000	N/A
Yzh	0.000000	0.000000	0.000000	N/A
Azh	0.000000	0.000000	0.000000	N/A
Wh+	0.000000	0.000000	0.000000	0.000000
Wh-	0.000000	0.000000	0.000000	0.000000
VARh+	0.000000	0.000000	0.000000	0.000000
VARh-	0.000000	0.000000	0.000000	0.000000
Wh Delta	0.000000	0.000000	0.000000	0.000000
Time	0.000000	0.000000	0.000000	N/A
VAh Delta	0.000000	0.000000	0.000000	0.000000
VARh Delta	0.000000	0.000000	0.000000	0.000000
VARh X Delta	0.000000	0.000000	0.000000	0.000000
VARh X WYE	0.000000	0.000000	0.000000	0.000000
Wh+ Delta	0.000000	0.000000	0.000000	0.000000
Wh- Delta	0.000000	0.000000	0.000000	0.000000
VARh+ Delta	0.000000	0.000000	0.000000	0.000000
VARh- Delta	0.000000	0.000000	0.000000	0.000000
VARh+ X Delta	0.000000	0.000000	0.000000	0.000000
VARh- X Delta	0.000000	0.000000	0.000000	0.000000
VARh+ X WYE	0.000000	0.000000	0.000000	0.000000
VARh- X WYE	0.000000	0.000000	0.000000	0.000000

Figure 3.4.3.1

3.4.4 Metric Options

The ‘Options’ tab allows the user to configure the several metric measurement features, see Figure 3.4.4.1. The refresh rate and the

integration interval can be changed in the 'Update Interval' field. The interval is in seconds, and once it is modified, the user must select the 'Set' button to save the setting.

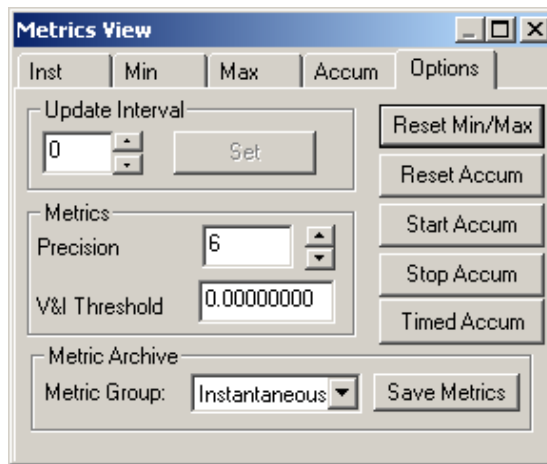


Figure 3.4.4.1

The minimum and maximum metric measurements can be reset by selecting the 'Reset Min/Max' button.

The number of displayed decimal places are adjusted in the 'Precision' field.

The 'V&I Threshold' field may be used to filter out low level measurements. The threshold function allows the user to configure the Dytronic to display only data that is greater than the threshold value, filtering out noise when there is no voltage or current active. When the threshold is in effect, it will also filter measurements that result from the voltage or current measurement.

The accumulators can be manually started, stopped, and reset by selecting the 'Start Accum,' 'Stop Accum,' and 'Reset Accum' buttons, respectively. To run the accumulators for an exact period of time, select the 'Timed Accum' button and enter the required time period.

To save the metric data, select the required metric group and then select the 'Save Metric' button. Once the button is selected, the standard will automatically open a 'Save As' pop-up screen. From this screen, select an appropriate location and file name to save the data.

Note: Three (3) phase Dytronic Standards require that input port 3 is use to start and stop the metric accumulators.

3.5 Harmonic Analysis

The RD family of standards and PC Suite include outstanding harmonic analysis capabilities. Dytronic Standards that have the harmonic analysis option are capable of analyzing harmonics up to the xxxth order at 50Hz and up to the xxxth order at 60Hz.

3.5.1 Harmonic Data

The 'Harmonics' application allows the user to view and save the harmonic measurement data. This application also facilitates the configuration of the harmonic measurement, and includes the 'Data', 'Waveform', and 'Bar Chart' tabs.

Harmonics measurement is accessed by selecting the 'Harmonics' icon. The 'Data' tab displays the magnitude and phase of each harmonic, see figure 3.5.1.1, in relation to the fundamental.

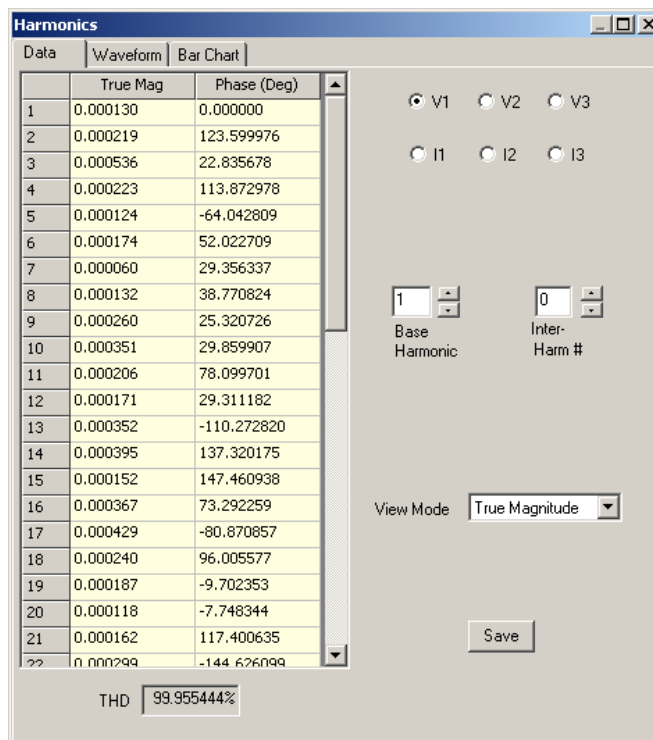


Figure 3.5.1.1

The harmonic data is organized by voltage and current inputs. Each input can be analyzed by selecting the associated input designator, V1, V2, V3 and I1, I2, I3. The 'V' represents the voltage axis and the 'I' represents the current axis. Fifty harmonic orders can be view at one time. To view orders higher than 50, increase the 'Base Harmonic' field.

The 'View Mode' option allows the user to select the harmonic measurement mode. To change the mode, simply select appropriate mode from the drop down list. The following options are available: 'True Magnitude,' '% of Fundamental,' and '% of RMS.' The '% of Fundamental' mode displays the normalized harmonic amplitude in respect to a percentage of the fundamental amplitude. The '% of RMS' mode displays the normalized harmonic amplitude in respect to a percentage of the RMS amplitude.

The 'Inter-Harm #' option allows the user to display the inter-harmonics between each fundamental. The Dytronic Standards allow up to 9 inter-harmonics.

To save the harmonic data, select the 'Save' button. Once the button is selected, the standard will automatically open a 'Save As' pop-up screen. From this screen, select an appropriate location and file name to save the data.

3.5.2 Total Harmonic Distortion

Total Harmonic Distortion is the ratio of the sum of the powers of all harmonic frequencies above the fundamental frequency to the power of the fundamental frequency. The default formula that Radian Research uses for %THD is:

$$\%THD = 100 \sqrt{\frac{\sum_{k=2}^{N-N} I_k^2}{\sum_{k=1}^{N-N} I_k^2}}$$

3.5.3 Waveform Analysis

The 'Waveform' tab displays a waveform representation of the signal being measured, see Figure 3.5.3.1. The display may look different if connected to a single phase Dytronic standard.

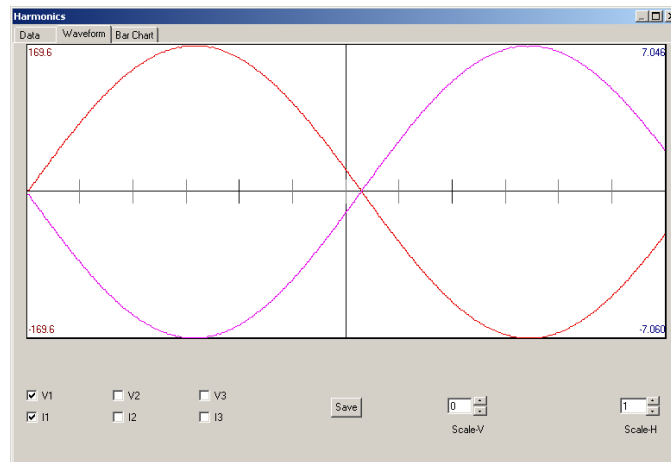


Figure 3.5.3.1

Similar to an oscilloscope, the waveform screen allows the user to adjust the display to increase the number of waveform cycles by increasing the 'Scale-H' value and change the magnitude of the waveform by changing the 'Scale-V' value. The peak voltage is shown at the top and bottom left of the display and the peak current is shown in the top and bottom right of the display.

The data on the waveform plot is color coordinated with the six available inputs of a three phase Dytronic Standard: V1 = Red, V2 = Yellow, V3 = Blue, I1 = Purple, I2 = Orange, I3 = Green.

To save the harmonic waveform data, select the 'Save' button. Once the button is selected, the standard will automatically open a 'Save As' pop-up screen. From this screen, select an appropriate location and file name to save the data.

3.5.4 Bar Chart Analysis

The 'Bar Chart' tab displays a bar chart representation of the harmonics, see Figure 3.5.4.1. The data is plotted as percent of fundamental.

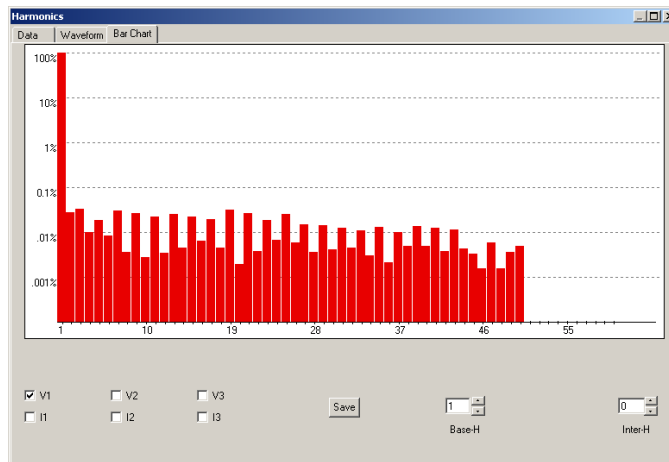


Figure 3.5.4.1

A lot of fifty different harmonic orders can be view at one time. To view orders higher than 50, increase the 'Base-H' number.

The 'Inter-H' number allows the user to show the inter-harmonics between each fundamental. The Dytronic Standards allow up to nine inter-harmonics.

The data on the chart is color coordinated with the six available inputs of a three phase Dytronic Standard: V1 = Red, V2 = Yellow, V3 = Blue, I1 = Purple, I2 = Orange, I3 = Green.

To save the bar chart data, select the 'Save' button. Once the button is selected, the standard will automatically open a 'Save As' pop-up screen. From this screen, select an appropriate location and file name to save the data.

3.6 Trend Chart

The Trend Chart application, see figure 3.6.1, of the PCSuite software plots measurement recordings over time. This application also facilitates the configuration of the trend charts, and includes the 'Input-1,' 'Input-2,' 'Input-3,' 'Total,' and 'Setup' tabs. A unique feature of the PCSuite Trend Chart is its ability to record all measurement functions for all available phases. It has the ability to automatically adjust its scale to optimize the viewing of the data, and its sample rate can be adjusted to meet various data logging requirements, see section [3.4.4 Metric Options](#) to adjust the update interval.

The trend chart application includes a zoom feature. To zoom on any particular point, single click on the graph over the selected location. It is possible to zoom several times. To return to the original scale, double click on the graph.

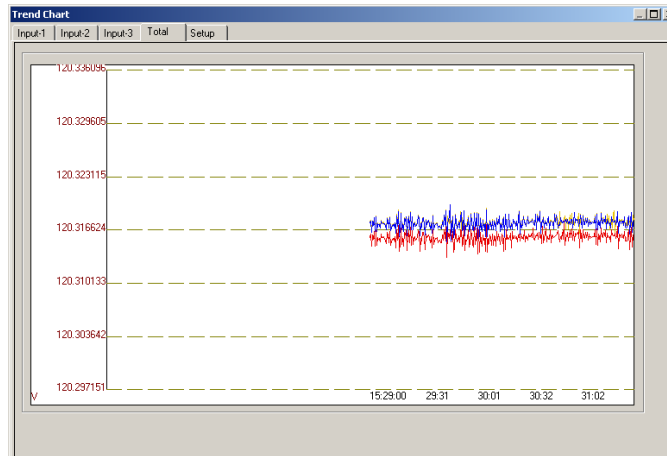


Figure 3.6.1

The data on the chart is color coordinated with the three available inputs of a three phase Dytronic Standard: Input 1= Red, Input 2 = Yellow, and Input 3 = Blue.

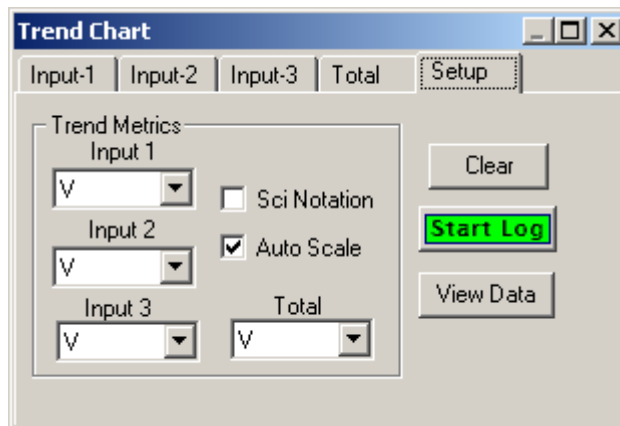


Figure 3.6.2

The 'Setup' tab allows configuration of the the trend chart data and display. The 'Auto Scale' option will optimize and scale the trend data, and the 'Scientific Notation' option will display the chart data in scientific notation. The 'Input 1,' 'Input 2,' 'Input 3,' and 'Total' fields allow the user to select which parameter to be displayed on each chart. The default parameter is voltage.

To view existing logs, select the '**View Data**' button. Once this is selected, the software will display the 'Trend Log Query' screen. This screen includes the 'Query' and 'View' tabs. From the 'View' tab, select the appropriate file in the 'File' field, see Figure 3.6.3. Once the file is selected, use the remaining fields to select the required time period, metric, and phase. The requested data will now be available in the 'View' tab.

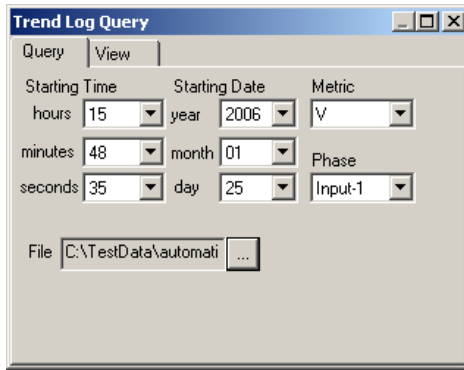


Figure 3.6.3

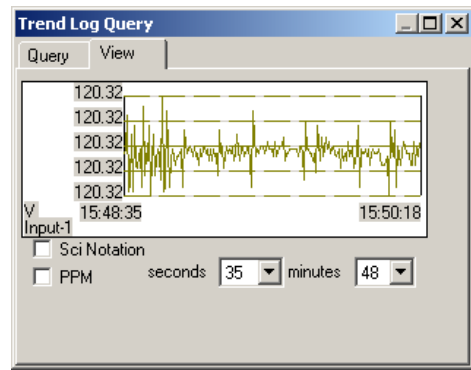


Figure 3.6.4

The 'Sci Notation' and 'PPM' check boxes allow the user to change the display format.

To save the logging of measurements, select the 'Start Logging' button in the 'Setup' tab, see Figure 3.6.4. Once this button is selected, the standard will automatically open a 'Save As' pop-up screen. From this screen, select an appropriate location and file name to save the data.

3.7 Vectors

The 'Vectors' application allows the user to view a vector representation, see Figure 3.7.1, of the voltage phase relationships and power factors.

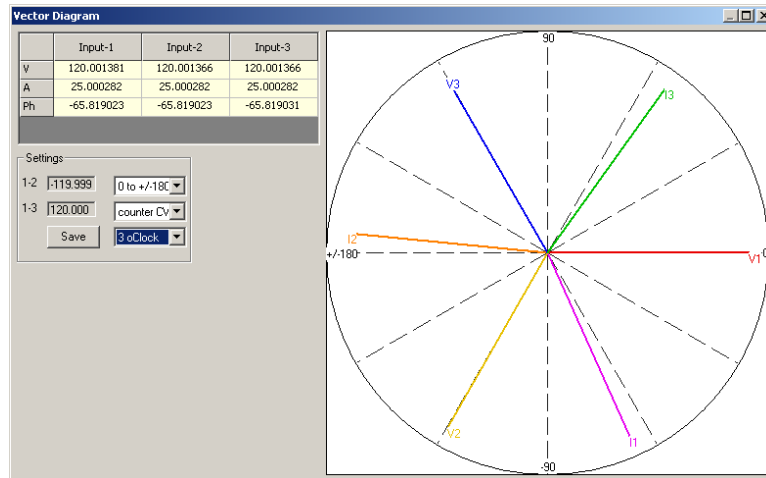


Figure 3.7.1

The data on the chart is color coordinated with the six available inputs of a three phase Dytronic Standard: V1 = Red, V2 = Yellow, V3 = Blue, I1 = Purple, I2 = Orange, I3 = Green. The 'Settings' options allow the user to select a different scale, select the direction of rotation, and move the position of the origin. When any changes are made the graph will automatically change, along with the data being displayed.

3.8 Run Meter Test

The 'Meter Test' application, see Figure 3.8.1, allows the user to configure and perform a test on a watt-hour meter. This application also facilitates the configuration of the test results. When connected to a three phase Dytronic standard, this application will include the 'DUT 1,' 'DUT 2,' 'DUT 3,' 'Run,' and 'View Results' tabs. When connected to a single phase Dytronic standard, this application will include the 'DUT 1,' 'Run,' and 'View Results' tabs.

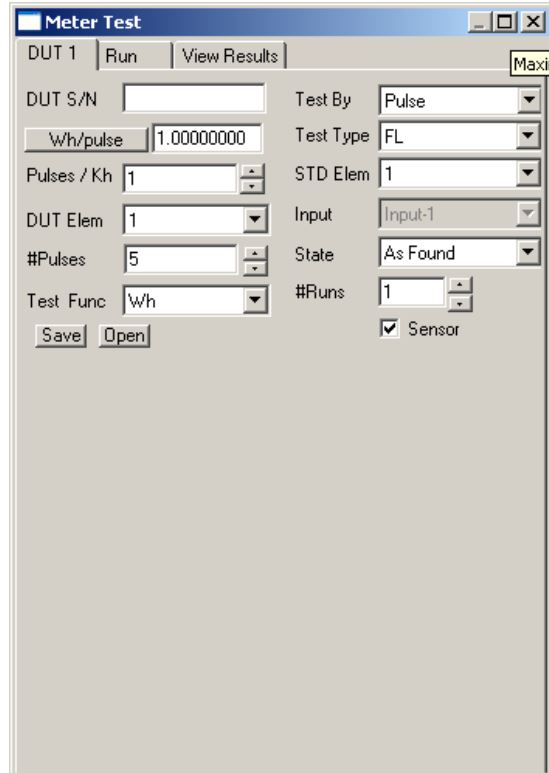


Figure 3.8.1

The user can configure and perform a new test or select a pre-saved test. To select a pre-saved test, select the 'Open' button. Once the button is selected, the standard will automatically open an 'Open' pop-up screen. From this screen, browse to the appropriate directory and select the required test.

To configure and run a meter test, enter the necessary information into the appropriate 'DUT' tab. The 'DUT 1,' 'DUT 2,' and 'DUT 3' tabs are associated to the BNC, potential, and current input ports, respectively. For example, the 'DUT1' tab sensor pulses must be counted on BNC input port 1.

In the DUT tab, the user defines the type of meter test to run.

- The **DUT S/N** is the meter under test's serial number.
- The **Whr / Pulse** value is the amount of energy each pulse represents. The metric function changes as the test function changes.
- The **Pulses / Kh** is the number of pulses for an equivalent revolution.
- The **DUT Elem** is the number of elements that are being tested. This is only valid if performing a series-parallel test.
- The **# Pulses** is the number of pulses required for completion of the test.
- The **Test Func** is the measurement function to be tested.
- The **Test By** selects how the meter will be tested, either by pulses, time length, or demand.
- The **Test Type** is a label for the test data. Options include: FL – Full Load, PF – Power Factor, PF – Power Factor +, PF – Power Factor -, LL – Light Load, In Service, Customer Load and Other.
- The **STD Elem** is the number of elements used, and it is valid with single phase Dytronic Standards. It is used when performing series parallel testing.
- The **Input** defines the test as either three-phase or single-phase.
- The **State** is a label for the test data. Options include “As Found” and “As Left.”
- The **# Runs** sets the number of repetitions of the test.
- The **Sensor** check box configures the standard for either a manual test or sensor based test.

To save the test set, select the ‘Save’ button. Once this button is selected, the standard will automatically open a ‘Save As’ pop-up screen. From this screen, select an appropriate location and file name to save the test.

Once a new test is configured or a saved test is opened, a test can be executed in the ‘Run’ tab. To run a test, select the DUT by checking the associated check box at the bottom of the screen, see figure 3.8.2, and then select the ‘Run’ button.

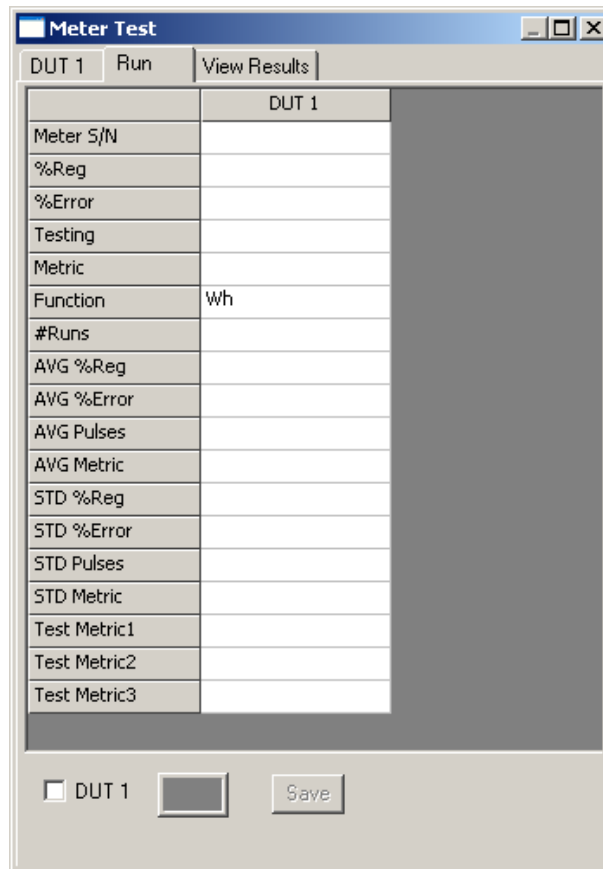


Figure 3.8.2

The various fields in the 'Run' tab allows the user to verify the meter serial number and the function to be tested, before the test is started. At the conclusion of the test, the window is compiled with the following data:

- Meter S/N
- Percent Registration
- Percent Error
- Test Status
- Metric Value
- Function Tested
- Number of Runs
- Average Percent Registration
- Average Percent Error
- Average Pulses
- Average Metric
- Standard Deviation of Percent Registration
- Standard Deviation of Percent Error
- Standard Deviation of Number Pulses
- Standard Deviation of the Metrics
- Test Metric 1 is the metric for phase 1
- Test Metric 2 is the metric for phase 2

- Test Metric 3 is the metric for phase 3

The Average and Standard Deviation values are only populated when the test has multiple runs. When multiple runs are defined, the test results will automatically save. If multiple runs are not defined, the test results must be manually saved.

To view meter test results, select the 'View Results' tab and select the 'View Results' button. Enter the serial number range of the meters of interest and select the 'View' button, see figure 3.8.3. If no serial number or date range is entered, then all the results will be displayed.

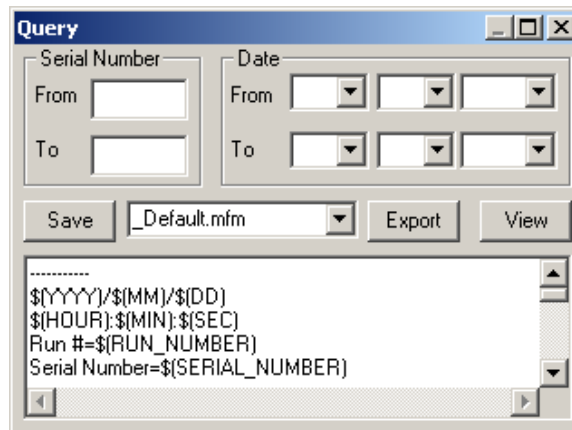


Figure 3.8.3

To change how the results are displayed, select a new option from the drop down menu. The menu includes the following options: `_Default.mfm`, `CSV_No_Quotes.mfm`, and `CSV_Quotes.mfm`. The two CSV formats are commonly used when exporting information to a third party software. To create a new file format, enter the new file name in the file name box and select the 'Save' button. The file name must have a *.mfm file extension. The following is a list of variables available:

Year	\$(YYYY)
Month	\$(MM)
Day	\$(DD)
Hour	\$(HOUR)
Minute	\$(MIN)
Second	\$(SEC)
Run Number	\$(RUN_NUMBER)
DUT Serial Number	\$(SERIAL_NUMBER)
DUT Kh Constant	\$(DUT_KH)
DUT Pulses per Revolution	\$(DUT_PULSES_PER)
DUT Elements	\$(DUT_ELEMENTS)
Num of Standard Cur Inputs	\$(STD_CURRENT_INPUTS)
Sensor Uses	\$(STD_SENSOR_USED)
Standard Phase used for Test	\$(STD_PHASE)

Test Function	\$(TEST_FUNCTION)
Test	\$(TEST)
Test Type	\$(TEST_TYPE)
Test Revolutions	\$(TEST_REVS)
Demand Minutes	\$(DEMAND_MINUTES)
Test Volts	\$(TEST_VOLTS)
Test Amps	\$(TEST_AMPS)
Meter Demand Test	\$(METER_DEMAND)
Metrics Accumulated	\$(STANDARD_READING)
Percent Registration	\$(PERCENT_REG)
Percent Error	\$(PERCENT_ERROR)
Minimum Accumulated Metrics	\$(MN_STANDARD_METRIC)
Minimum Standard pulses	\$(MN_STANDARD_PULSES)
Minimum Percent Registration	\$(MN_PERCENT_REG)
Minimum Percent Error	\$(MN_PERCENT_ERROR)
Standard Deviation Accum Metrics	\$(SD_STANDARD_METRIC)
Standard Deviation Standard pulses	\$(SD_STANDARD_PULSES)
Standard Deviation Percent Reg	\$(SD_PERCENT_REG)
Standard Deviation Percent Error	\$(SD_PERCENT_ERROR)
Phase1 Metric	\$(TEST_METRIC1)
Phase2 Metric	\$(TEST_METRIC2)
Phase3 Metric	\$(TEST_METRIC3)

The results viewer has common characters for indicating a header. The header text must be inside brackets (“[” and “]”). Below is a sample header:

```
[Meter Testing Results]
[]
[]
[Year, Month, Day, Hour, Min, Sec, # Runs, S/N, DUT kh]
```

To export the results to a flat file, select the format and select the ‘Export’ button. The saved data can be limited by using the search conditions. Once this button is selected, the standard will automatically open a ‘Save As’ pop-up screen. From this screen, select an appropriate location and file name to save the test. It is recommended that the data is saved as a *.txt file. If the file is saved as a *.txt file, the data can be viewed in a text editor.

3.9 Standards Test

The ‘Standards Test’ application, see Figure 3.9.1, allows the user to configure and perform a test on a watt-hour standard. This application also facilitates the configuration of the test results. When connected to a three phase Dytronic standard, this application will include the ‘DUT 1,’ ‘DUT 2,’ ‘DUT 3,’ ‘Run,’ and ‘View Results’ tabs. When connected to a single

phase Dytronic standard, this application will include the 'DUT 1,' 'Run,' and 'View Results' tabs.

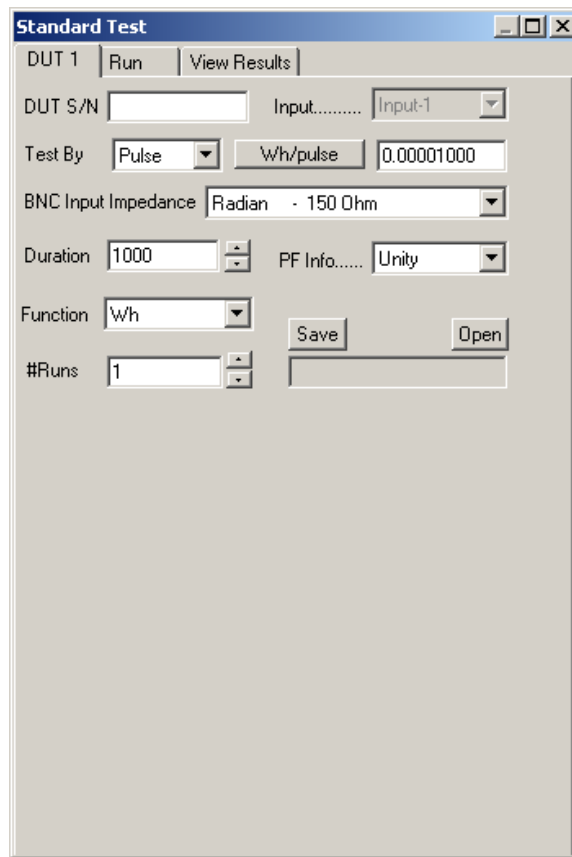


Figure 3.9.1

The user can configure and perform a new test or select a pre-saved test. To select a pre-saved test, select the 'Open' button. Once the button is selected, the standard will automatically open an 'Open' pop-up screen. From this screen, browse to the appropriate directory and select the required test.

To configure and run a standards test, enter the necessary information into the appropriate 'DUT' tab. The 'DUT 1,' 'DUT 2,' and 'DUT 3' tabs are associated to the BNC, potential, and current input ports, respectively. For example, the 'DUT1' tab sensor pulses must be counted on BNC input port 1.

In the DUT tab, the user defines the type of standards test to run.

- The **DUT S/N** is the standard under test's serial number.
- The **Test By** selects how the meter will be tested, either by pulses or time length.

- The **Duration** is the number of pulses or amount of time to test the standard
- The **Function** is the measurement function to be tested.
- The **# Runs** sets the number of repetitions of the test.
- The **Whr/pulse** value is the amount of energy each pulse represents. This is also a button that can be selected to change to **pulses/Whr** if needed. The name will change with the test function.
- The **Input** defines if the test is a three phase or a single phase test.
- The **BNC Input Impedance** is needed to determine the proper pullup resistor that should be used. If **Radian** is selected then an internal 150 ohm pull-up resistor is used. If **Non-Radian** is selected then an internal 1000 ohm pull-up resistor is used.
- The **PF Info** is a label to indicate the type of test being performed

To save the test set, select the 'Save' button. Once this button is selected, the standard will automatically open a 'Save As' pop-up screen. From this screen, select an appropriate location and file name to save the test.

Once a new test is configured or a saved test is opened, a test can be executed in the 'Run' tab. To run a test, select the DUT by checking the associated check box at the bottom of the screen, see figure 3.8.2, and then select the 'Run' button.

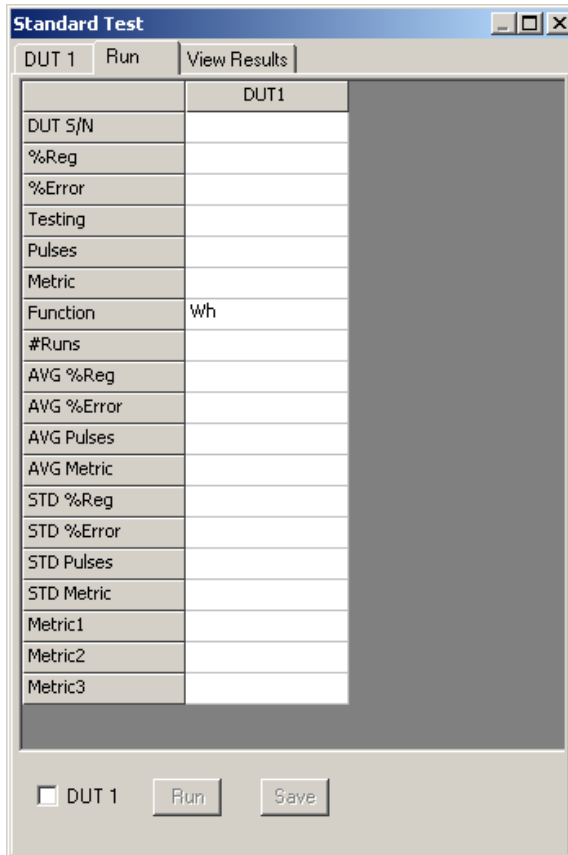


Figure 3.9.2

The various fields in the 'Run' tab allows the user to verify the standard's serial number and the function to be tested, before the test is started. At the conclusion of the test, the window is populated with the following data:

- DUT's Serial Number
- Percent Registration
- Percent Error
- Test Status
- Number of Pulses
- Metric Value
- Function Tested
- Average Percent Registration
- Average Percent Error
- Average Percent Pulses
- Average Percent Metric
- Standard Deviation of Percent Registration
- Standard Deviation of Percent Error
- Standard Deviation of Number Pulses
- Standard Deviation of the Metrics
- Test Metric 1 is the metric for phase 1
- Test Metric 2 is the metric for phase 2

- Test Metric 3 is the metric for phase 3

The Average and Standard Deviation values are only populated when the test has multiple runs. When multiple runs are defined, the test results will automatically save. If multiple runs are not defined, the test results must be manually saved.

To view standard test results, select the 'View Results' tab and select the 'View Results' button. Enter the serial number range of the standards of interest and select the 'View' button, see figure 3.8.3. If no serial number or date range is entered, then all the results will be displayed.

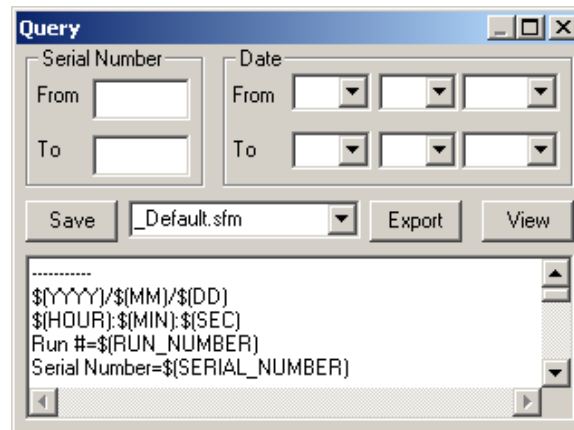


Figure 3.9.3

To change how the results are displayed, select a new option from the drop down menu. The menu includes the following options: `_Default.mfm`, `CSV_No_Quotes.mfm`, and `CSV_Quotes.mfm`. The two CSV formats are commonly used when exporting information to a third party software. To create a new file format, enter the new file name in the file name box and select the 'Save' button. The file name must have a `*.mfm` file extension. The following is a list of variables available:

Year	<code>\$(YYYY)</code>
Month	<code>\$(MM)</code>
Day	<code>\$(DD)</code>
Hour	<code>\$(HOUR)</code>
Minute	<code>\$(MIN)</code>
Second	<code>\$(SEC)</code>
Run Number	<code>\$(RUN_NUMBER)</code>
Serial Number	<code>\$(SERIAL_NUMBER)</code>
DUT Kh	<code>\$(DUT_KH)</code>
DUT Device Type	<code>\$(DUT_DEVICE_TYPE)</code>
Standard phase Input	<code>\$(STD_PHASE)</code>
Test Function	<code>\$(TEST_FUNCTION)</code>
Test By	<code>\$(TEST_BY)</code>
Test Duration	<code>\$(TEST_DURATION)</code>

Test Volts	\$(TEST_VOLTS)
Test Amps	\$(TEST_AMPS)
Total Accumulated Metric	\$(STANDARD_METRIC)
Standard Pulses	\$(STANDARD_PULSES)
Percent Registration	\$(PERCENT_REG)
Percent Error	\$(PERCENT_ERROR)
AVG Standard Metric	\$(MN_STANDARD_METRIC)
AVG Standard Pulses	\$(MN_STANDARD_PULSES)
AVG Percent Registration	\$(MN_PERCENT_REG)
AVG Percent Error	\$(MN_PERCENT_ERROR)
Standard Deviation Standard Metric	\$(SD_STANDARD_METRIC)
Standard Deviation Standard Pulses	\$(SD_STANDARD_PULSES)
Standard Deviation %Reg	\$(SD_PERCENT_REG)
Standard Deviation %Error	\$(SD_PERCENT_ERROR)
Phase1 Metric	\$(TEST_METRIC1)
Phase2 Metric	\$(TEST_METRIC2)
Phase3 Metric	\$(TEST_METRIC3)

The results viewer has common characters for indicating a header. The header text must be inside brackets (“[” and “]”). Below is a sample header:

```
[Standard Testing Results]
[]
[]
[Year, Month, Day, Hour, Min, Sec, # Runs, S/N, DUT kh]
```

To export the results to a flat file, select the format and select the ‘Export’ button. The saved data can be limited by using the search conditions. Once this button is selected, the standard will automatically open a ‘Save As’ pop-up screen. From this screen, select an appropriate location and file name to save the test. It is recommended that the data is saved as a *.txt file. If the file is saved as a *.txt file, the data can be viewed in a text editor.

3.10 CT Burden and Ratio Testing

With the use of clamp on Current Transformers, RD Burden Analyzer Module and the internal measurement capability of the Dytronic Standard PCSuite allows a **CT Burden and Ratio Test**, see figure 3.10.1.

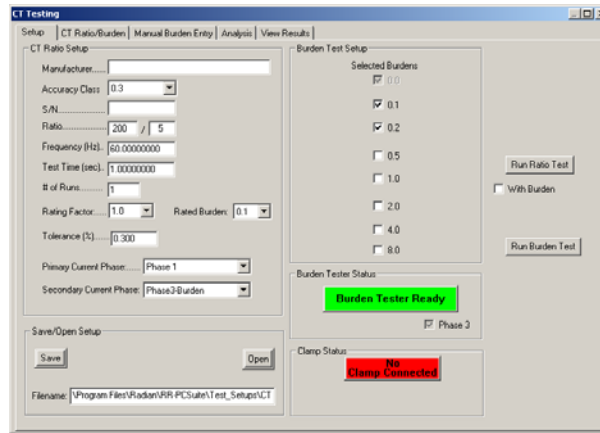


Figure 3.10.1

The CT Burden and Ratio Test will allow the Dytronic Standard to fully test the Current Transformer for VA output capabilities along with the primary to secondary ratio. For the burden test it will synchronize the zero crossings of the current signal with the insertion of the selected burden resistor(s) and compares the measurements. For the ratio test it compares the current sensed on a selected primary input verse the current sensed on the selected secondary input for the test time duration. For the CT Setup enter the following information.

Manufacture	The manufactures name of the CT under test.
Accuracy Class	The accuracy of the CT.
S/N	The Serial number of the CT under test.
Ratio	This defines the Ratio of the CT under test.
Frequency (Hz)	This defines the Frequency in which the test is performed.
Test Time (Sec)	This defines how long to test the CT. The Dytronic will average the measurements over this period.
# of Runs	This defines how many times to repeat the test.
Rating Factor	This defines the current rating factor of the CT under test

- Rated Burden** This defines the amount of burden that the CT should accurately drive and still meet the accuracy specification.
- Tolerance (%)** This defines the error allowed for the test. If the tolerance is exceeded then the test will indicate failed.
- Primary Current Phase** This defines the input to use as a primary current measurement
- Secondary Current Phase** This defines the input to use as a secondary current measurement

The test setup can be saved for future use by selecting the **Save** button. After the button is selected it will prompt to enter in the name and location to save the test. If a test setup has already been completed it can be loaded prior to the test by selecting the **Load** button and choosing the setup file.

After the information has been entered select the user has multiple Run options. To only run a ratio test select **Run Ratio Test** or to run a Burden test select the **Run Burden Test** and as a final option to run a Ration with Burden Check the **With Burden** box and select **Run Ratio Test**. When the Test proceeds the screen will automatically change to the CT Ratio/Burden Tab, see figure 3.10.2

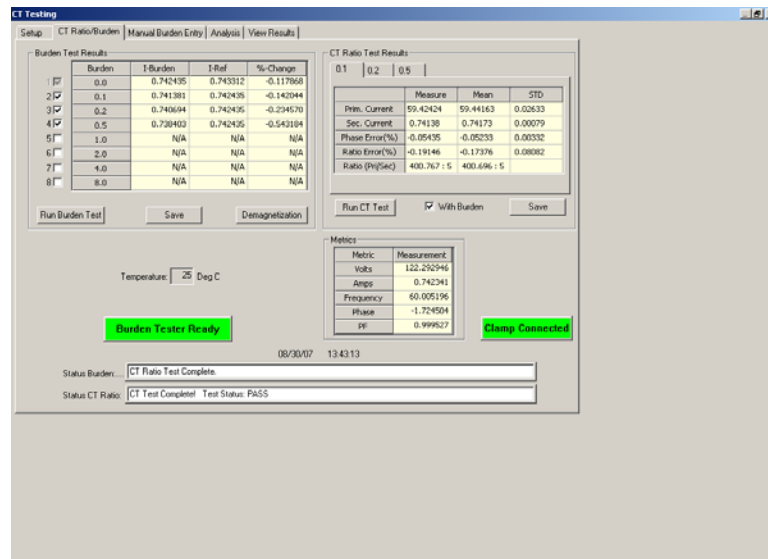


Figure 3.10.2

When the test is complete the screen will show the measured primary current, measured secondary current, error sensed for phase, Ratio error and CT Ratio. The mean average along with the standard deviation is given for each measurement. If a burden and ratio test was performed

select the tab above the CT Ratio Test box to select the appropriate burden result to view.

If a burden test was selected then the screen will show the current reading with and without the burden inserted and then provide a percent change comparing the two measurements.

To save any of the results, select the **Save Report**. After the button is selected it will prompt to enter in the name and location to save the test.

A graphic representation of the data is available in the Analysis tab. An Accuracy parallelogram, figure 3.10.3, Amplitude accuracy graph, figure 3.10.4, Phase accuracy graph, figure 3.10.5, Burden Accuracy, figure 3.10.6, and Burden Amplitude graph, figure 3.10.7 are available. The Graphs can be saved by selecting the **Save** button. After the button is selected it will prompt to enter in the name and location to save the test. The data along with a screen capture will be saved.

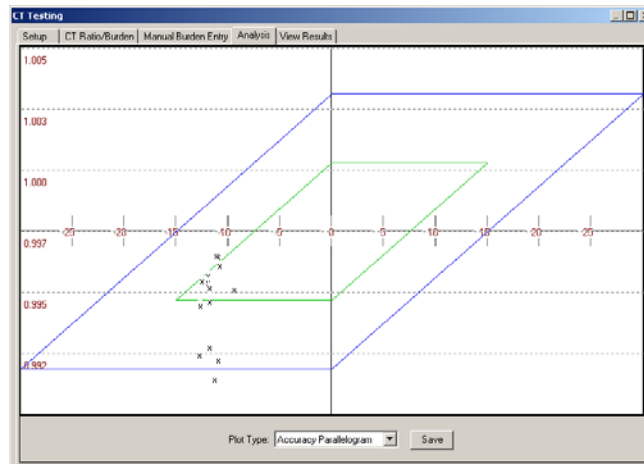


Figure 3.10.3

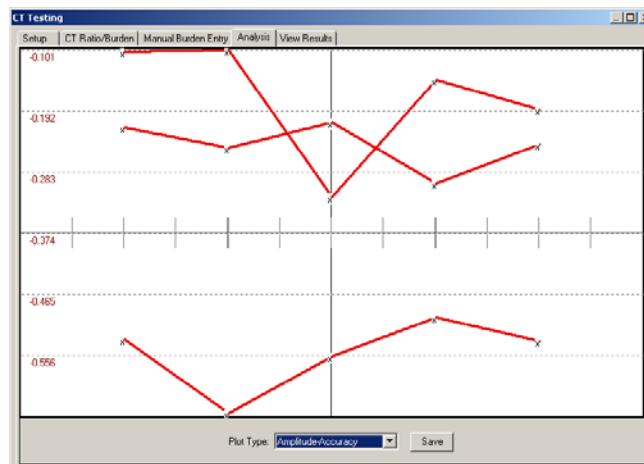


Figure 3.10.4

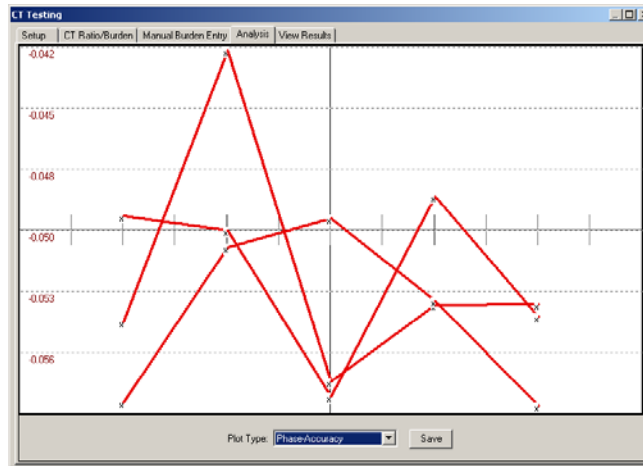


Figure 3.10.5

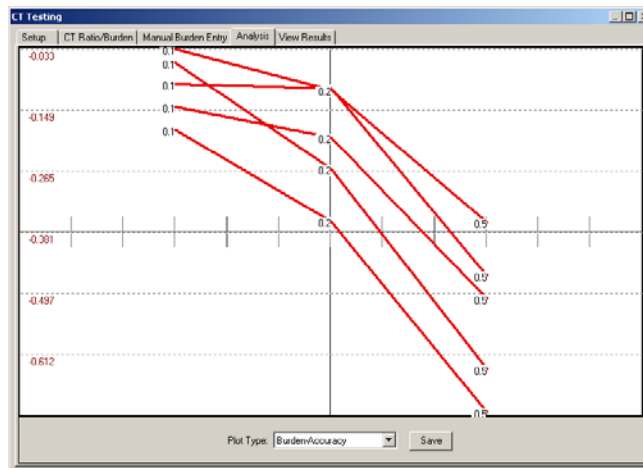


Figure 3.10.6

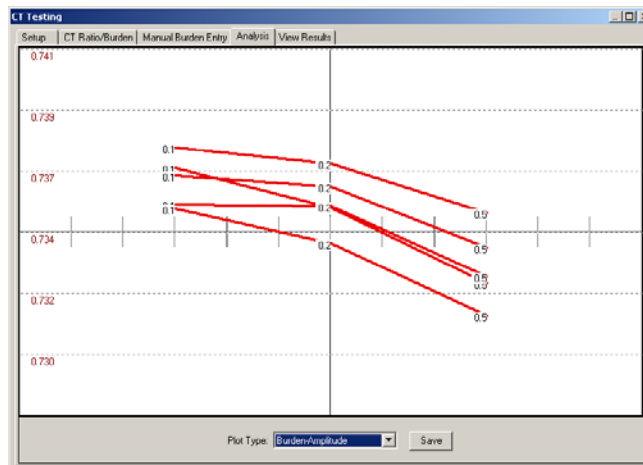


Figure 3.10.7

To view Test results, select the **View Results** tab and select the **View Results** button. Enter the serial number range of interest and select **View**, see figure 3.10.8. If no serial number or Date range is entered then all the results will be displayed.

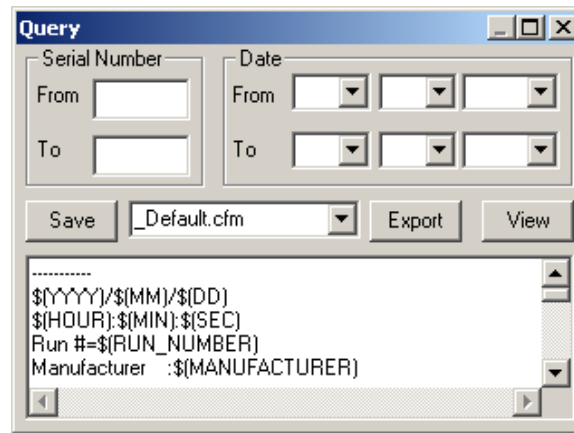


Figure 3.10.8

To change how the results are displayed use the dropdown menu. The options of _Default, CSV_No_Quotes or CSV_Quotes are available. CSV is defined as Comma Separated Variable. These two formats are commonly used when information is exported to third party software. To create or save a new file format enter the new file name in the file name box and select the save button. The file name must have .cfm as the file extension or PCSuite will not recognize the new file. The following is a list of variable available if you wish to create a custom file.

Year	\$(YYYY)
Month	\$(MM)
Day	\$(DD)
Hour	\$(HOUR)
Minute	\$(MIN)
Second	\$(SEC)
Run #	\$(RUN_NUMBER)
Manufacturer	\$(MANUFACTURER)
Accuracy Class	\$(ACCURACY_CLASS)
Serial Number	\$(SERIAL_NUMBER)
Ratio	\$(RATIO)
Test Frequency	\$(FREQUENCY)
Error Tolerance	\$(TOLERANCE)
Test Duration	\$(TEST_TIME)
Primary Current	\$(PRI_CURRENT)
Mean Primary Current	\$(MEAN_PRI_CURRENT)
Standard Dev Primary Current	\$(STD_PRI_CURRENT)
Secondary Current	\$(SEC_CURRENT)
Mean Secondary Current	\$(MEAN_SEC_CURRENT)
Standard Dev Secondary Current	\$(STD_SEC_CURRENT)
Phase Error	\$(PHASE_ERROR)
Mean Phase Error	\$(MEAN_PHASE_ERROR)
Standard Deviation Phase Error	\$(STD_PHASE_ERROR)

Ratio Error	\$(RATIO_ERROR)
Mean Ratio Error	\$(MEAN_RATIO_ERROR)
STD Ratio Error	\$(STD_RATIO_ERROR)
Measured Ratio	\$(MEAS_RATIO)
Measured Ratio Mean	\$(MEAS_RATIO_MEAN)
Burden Value (0-9)	\$(BURDEN_VALUE0)
I_None (0-9)	\$(I_NO_BURDEN0)
I_With Burden (0-9)	\$(I_WITH_BURDEN0)
Percent Change (0-9)	\$(PERCENT_CHANGE0)

To enter a header the Results Viewer has common characters for indicating a header. The header text must be inside brackets “[” and “]”. Below is a sample header.

```
[CT Testing Results]
[]
[]
[Year, Month, Day, Hour, Min, Sec, # Runs, S/N]
```

To export the results to a flat file, select the format and then select the **Export** button. The user can limit the saved data by using the search conditions. When selecting the Export button PCSuite prompts the user to provide a name to save the data. It is recommended to save the data as a .txt file. If the file is saved as a .txt file then the Windows system can view it using a text editor.

3.11 Analog Sense Test

Dytronic Models that support Analog Sense Test can utilize the PCSuite Analog Sense Test feature, see figure 3.11.1. The **Analog Sense Test** allows Dytronic Standard to test Transducer and Analog sense enabled meters. It does this by comparing the current sensed on the analog sense input to the metric on Input 3 over a period of time.

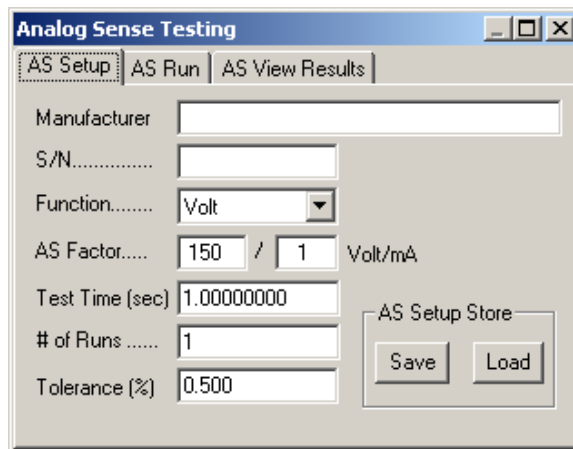


Figure 3.11.1

For the AS Setup enter the following information.

Manufacture	The manufacture's name of the Meter/Transducer under test.
S/N	The serial number of the Meter/Transducer under test.
Function	This defines which metric the Analog Sense is tested against.
AS Factor	This defines the Ratio of the Metric to Analog Sense Current.
Test Time (Sec)	This defines how long to test the Meter/Transducer. The Dytronic will average the measurements over this period.
# of Runs	This defines how many times to repeat the test.
Tolerance (%)	This defines the error allowed for the test. If the tolerance is exceeded then the test will indicate failed.

The test setup can be saved for future use by selecting the **Save** button. After the button is selected it will prompt to enter in the name and location to save the test. If a test setup has already been completed it can be loaded prior to the test by selecting the **Load** button and choosing the setup file.

After the information has been entered select the AS Run tab and select Run Test to perform the test, see figure 3.11.2.

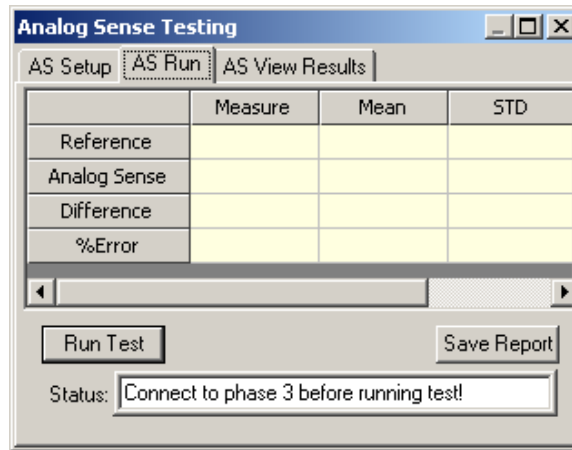


Figure 3.11.2

When the test is complete the test will show the measured Reference, measured Analog sense Current, Deference and the error. The mean average along with the standard deviation is given for each measurement. Select the save button to save the test results.

To view the Analog Sense Test results, select the **AS View Results** tab and select the **View Results** button. Enter the serial number range of

interest and select **View**, see figure 3.11.3. If no serial number or Date range is entered then all the results will be displayed.

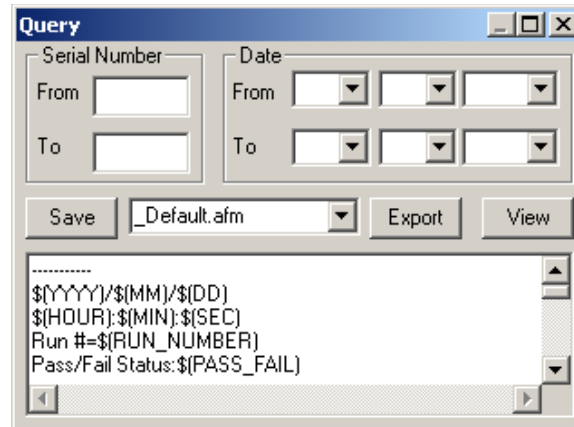


Figure 3.11.3

To change how the results are displayed use the dropdown menu. The options of `_Default`, `CSV_No_Quotes` or `CSV_Quotes` are available. `CSV` is defined as Comma Separated Variable. These two formats are commonly used when information is exported to third party software. To create or save a new file format enter the new file name in the file name box and select the save button. The file name must have `.afm` as the file extension or PCSuite will not recognize the new file. The following is a list of variables available if you wish to create a custom file.

Year	\$(YYYY)
Month	\$(MM)
Day	\$(DD)
Hour	\$(HOUR)
Minute	\$(MIN)
Second	\$(SEC)
Run #	\$(RUN_NUMBER)
Pass/Fail Status	\$(PASS_FAIL)
Manufacturer	\$(MANUFACTURER)
Serial Number	\$(SERIAL_NUMBER)
Function	\$(FUNCTION)
Factor	\$(FACTOR)
Error Tolerance	\$(TOLERANCE)
Test Duration	\$(TEST_TIME)
Reference	\$(REFERENCE)
Mean Reference	\$(MEAN_REFERENCE)
STD Reference	\$(STD_REFERENCE)
DUT	\$(DUT)
Mean DUT	\$(MEAN_DUT)

Standard Deviation DUT	\$(STD_DUT)
Difference	\$(DIFF)
Mean Difference	\$(MEAN_DIFF)
Standard Deviation Difference	\$(STD_DIFF)
Error	\$(ERROR)
Mean Error	\$(MEAN_ERROR)
Standard Deviation Error	\$(STD_ERROR)

To enter a header the Results Viewer has common characters for indicating a header. The header text must be inside brackets “[” and “]”. Below is a sample header.

```
[Analog Sense Testing Results]
[]
[]
[Year, Month, Day, Hour, Min, Sec, # Runs, S/N]
```

To export the results to a flat file, select the format for the export data and then select the **Export** button the user can save the data, using the search conditions. When selecting the Export button PCSuite prompts the user to provide a name to save the data. It is recommended to save the data as a .txt file. If the file is saved as a .txt file then the Windows system can view it using a text editor.

3.12 Power Quality

The Power Quality Test allows the Dytronic Standard to test for power quality on the electrical line. It does this by comparing the Thresholds defined in the setup to the sensed voltage and current.

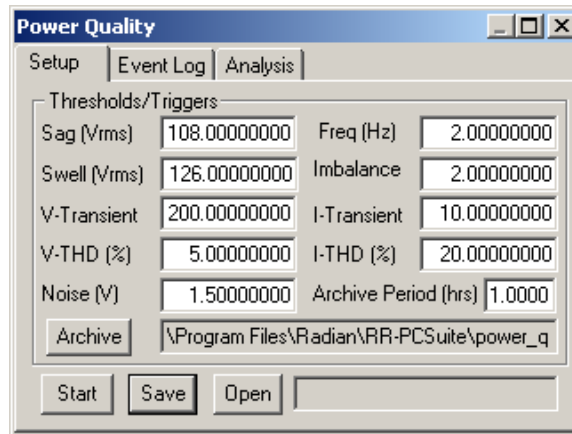


Figure 3.12.1

For the Power Quality Setup enter the following information.

- Sag (Vrms)** Threshold for a Voltage Sag.
- Swell (Vrms)** Threshold for a Voltage Swell.
- V-Transient** Threshold for a Voltage Transient.

V-THD (%)	Threshold for Voltage Harmonic Distortion.
Noise (V)	Threshold for Noise on the voltage axis.
Freq (Hz)	Threshold for Frequency deviation.
Imbalance	Threshold for Current Imbalance between phases.
I-Transient	Threshold for a Current Transient.
I-THD (%)	Threshold for Current Harmonic Distortion.

The test setup can be saved for future use by selecting the **Save** button. After the button is selected it will prompt to enter in the name and location to save the test. If a test setup has already been completed it can be loaded prior to the test by selecting the **Load** button and choosing the setup file.

After the information has been entered select the **Start** button to perform the Analysis. The analysis will continue until the stop button is selected. During the test the user can select any other icon for testing or viewing Metrics.

When a threshold has been exceeded the Event log, see figure 3.12.2, will capture the event. When an even occurs the event log will register the Time, Magnitude, Duration and Event type. Each phase can be view independently to maximize the result window. The Event log can be saved by selecting the **Save** button. After the button is selected it will prompt to enter in the name and location to save the test.

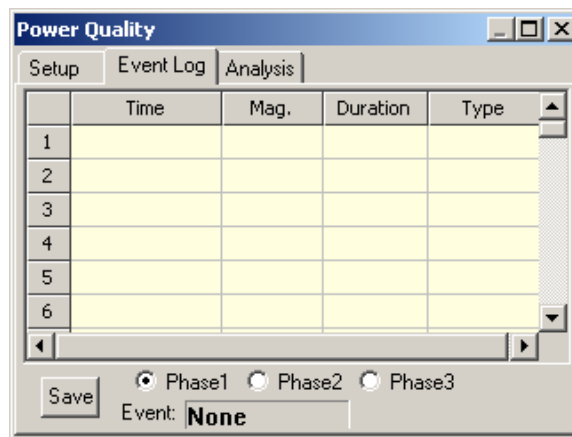


Figure 3.12.2

After the event has taken place the Analysis tab will show the event data. Each phase and event can be selected individually to maximize the screen space.

The Event Analysis can be saved by selecting the **Save** button. After the button is selected it will prompt to enter in the name and location to save the test. The data along with a screen capture will be saved.

3.12.1 Sag

A short-term decrease in voltage lasting anywhere from milliseconds up to a few seconds. Sags starve a machine of the

electricity it needs to function, causing computer crashes or equipment lock-ups. Usually caused by equipment start-up—such as elevators, heating and air-conditioning equipment, compressors, and copy machines—or nearby short circuits on the utility system.

3.12.2 Swell

A short-term increase in voltage, lasting up to a few seconds. They are due either to customer equipment operation, such as air conditioners or motors switching on and off, or to utility activities, such as capacitor switching.

3.12.3 V-Transient

A very brief (nanoseconds to milliseconds) change in voltage. Can be produced by utility and customer equipment operations, nearby lightning strikes, falling tree limbs on power lines, and even static discharges.

3.12.4 V-THD (%)

Continuous or sporadic distortions of the voltage sine waveform, usually caused by microprocessor based loads in the building such as computer power supplies, lighting ballasts, and electronic adjustable speed drives. Harmonics can also be transmitted from an energy user down the block. These can cause telecommunications or computer interference; overheating in motors, transformers, or neutral conductors; decreased motor performance; deterioration of power factor–correction capacitors; or erratic operation of breakers, fuses, and relays.

3.12.5 Noise (V)

Sporadic voltage changes consisting of frequencies higher than the normal power frequency due to any number of causes, including arc welders, loose wiring, and nearby radio and TV transmitters.

The PCSuite software will monitor the nominal noise level and trigger an event if the noise level exceeds, plus or minus, the nominal noise level by the threshold set.

3.12.6 Freq

The PCSuite software will monitor the nominal Frequency and trigger an event if the frequency exceeds, plus or minus, the nominal Frequency level by the threshold set.

3.12.7 Imbalance

The PCSuite software will monitor the Current level on each phase and trigger an event if the Current level on any phase exceeds, plus or minus, the Current levels by the threshold set.

3.12.8 I-Transient

A very brief (nanoseconds to milliseconds) change in current. Can be produced by utility and customer equipment operations, nearby lightning strikes, falling tree limbs on power lines, and even static discharges.

3.12.9 I-THD (%)

Continuous or sporadic distortions of the current sine waveform, usually caused by microprocessor based loads in the building such as computer power supplies, lighting ballasts, and electronic adjustable speed drives. Harmonics can also be transmitted from an energy user down the block. These can cause telecommunications or computer interference; overheating in motors, transformers, or neutral conductors; decreased motor performance; deterioration of power factor–correction capacitors; or erratic operation of breakers, fuses, and relays.

3.13 Flicker-Meter

Flicker meters are used to measure fluctuations in voltage that cause visible changes in lighting. The purpose of the flicker meter is to assess the level of severity of light flicker by measuring voltage fluctuations and then by predicting the level of irritation based on known characteristics of incandescent lamps, the human eye, and the brain.

The Flicker-Meter, figure 3.13.1, allows the Dytronic Standard to test for flicker on the electrical line.

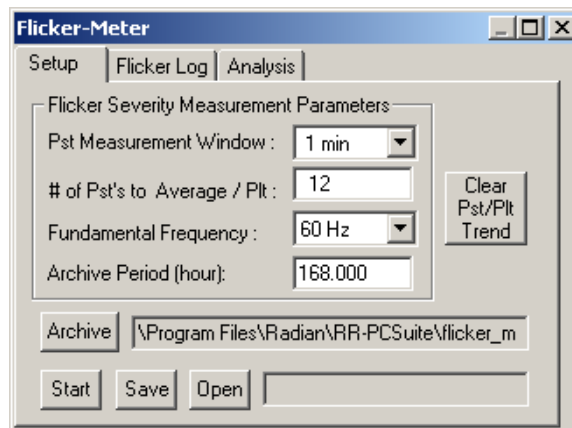


Figure 3.13.1

For the Flicker Setup enter the following information.

Pst Measurement Window

Short term Flicker Severity
Analysis time: 1 min, 5 min,
10 min, 15 min

# of Psts to Average for Plt	The number of short term Flicker points to average for Long term Flicker Severity
Fundamental Frequency	Frequency of Operation
Archive Period (hour)	Time Length for period Data Saving

The test setup can be saved for future use by selecting the **Save** button. After the button is selected it will prompt to enter in the name and location to save the test. If a test setup has already been completed it can be loaded prior to the test by selecting the **Load** button and choosing the setup file.

After the information has been entered select the **Start** button to perform the Analysis. The analysis will continue until the stop button is selected. During the test the user can select any other icon for testing or viewing Metrics.

The Pst and Plt data will be logged at the Pst interval, see figure 3.13.2. Each phase can be view independently to maximize the result window. The Flicker log can be saved by selecting the **Save** button. After the button is selected it will prompt to enter in the name and location to save the test.

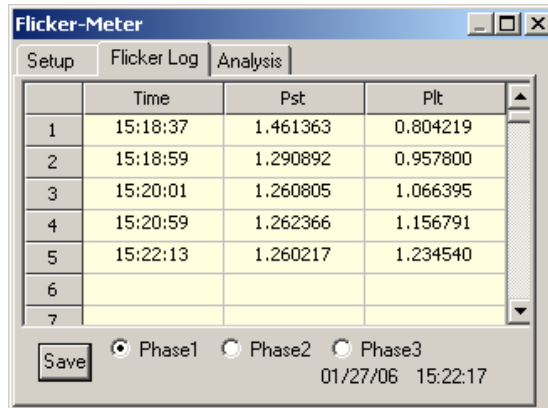


Figure 3.13.2

3.13.1 Short Term Pst

The short term flicker severity Pst, figure 3.13.1.1, is calculated in 1, 5, 10 or 15-minute interval. This time is sufficiently long that high flicker levels have no significant effect on the measurement result, and short enough to characterize a disturbing load of a relatively short duty cycle.

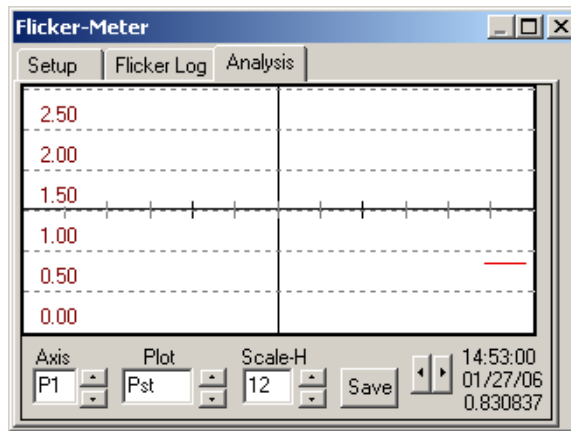


Figure 3.13.1.1

To change which phase data is displayed use the **Axis** up and down buttons to toggle between each phase. To adjust how many points to plot on the graph use the **Scale-H** up and down buttons to increase or decrease the plot data. The Left and Right arrow buttons allow the user to scroll the data to the left and the Right. The Flicker data can be saved by selecting the **Save** button. After the button is selected it will prompt to enter in the name and location to save the test. The data along with a screen capture will be saved.

3.13.2 Long Term Plt

Long term severity index Plt, figure 3.13.2.1, describes a combined disturbance resulting from several disturbing loads with short duty cycles, or from a disturbing load with long and variable operating cycle. Long term severity Plt is determined according the number of Pst to average together.

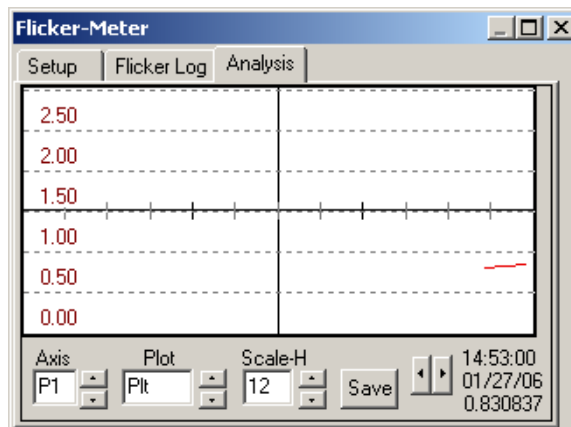


Figure 3.13.2.1

To change which phase data is displayed use the **Axis** up and down buttons to toggle between each phase. To adjust how many points

to plot on the graph use the **Scale-H** up and down buttons to increase or decrease the plot data. The Left and Right arrow buttons allow the user to scroll the data to the left and the Right. The Flicker data can be saved by selecting the **Save** button. After the button is selected it will prompt to enter in the name and location to save the test. The data along with a screen capture will be saved.

3.13.3 Demodulated Flicker Signal

The demodulated Flicker signal, figure 3.13.3.1, is processed in a weighting filter, which represents the eye-brain system reaction to flicker effect.

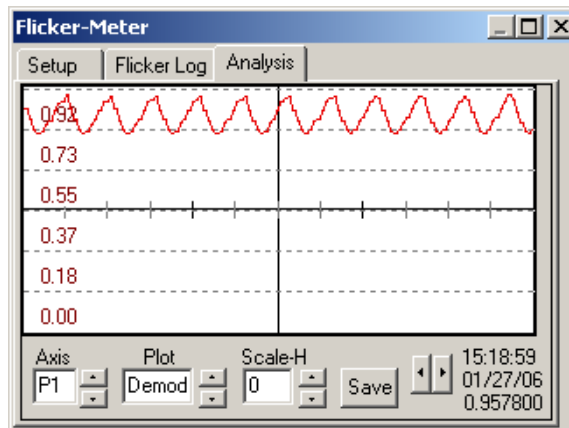


Figure 3.13.3.1

To change which phase data is displayed use the **Axis** up and down buttons to toggle between each phase. To adjust how many points to plot on the graph use the **Scale-H** up and down buttons to increase or decrease the plot data. The Flicker data can be saved by selecting the **Save** button. After the button is selected it will prompt to enter in the name and location to save the test. The data along with a screen capture will be saved.

3.13.4 Flicker Signal

The Flicker Signal is a measure of voltage changes, weighted by the sensitivity of lamp-eye-brain chain, and represents the instantaneous flicker level. The value of this signal greater than 1 indicates that voltage fluctuation will result in exceeding the agreed standard level of flicker perception.

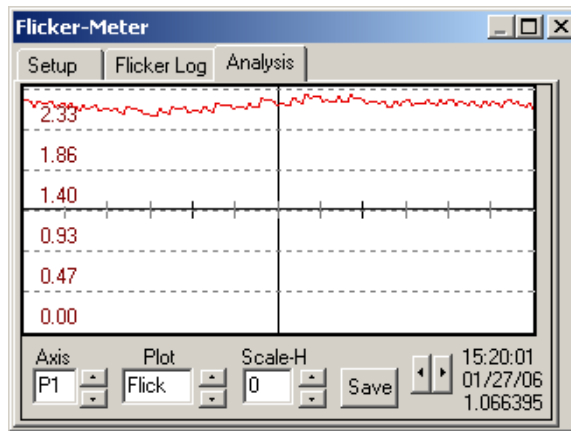


Figure 3.13.4.1

The Flicker data can be saved by selecting the **Save** button. After the button is selected it will prompt to enter in the name and location to save the test. The data along with a screen capture will be saved.

3.13.5 PDF

The probability function, figure 3.13.5.1, determines the samples classification. It shows the probability of a flicker measurement to occur at the level indicated.

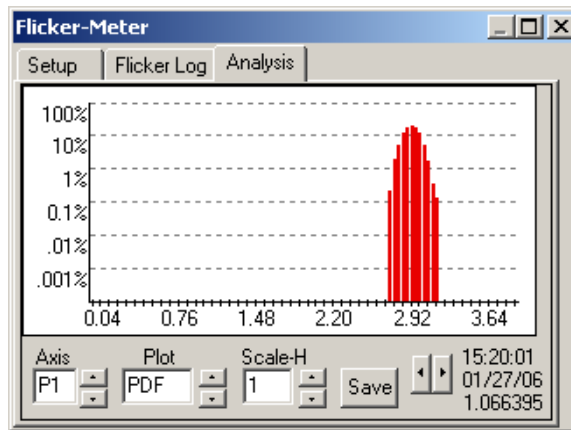


Figure 3.13.5.1

To change which phase data is displayed use the **Axis** up and down buttons to toggle between each phase. To adjust how many points to plot on the graph use the **Scale-H** up and down buttons to increase or decrease the plot data. The Flicker data can be saved by selecting the **Save** button. After the button is selected it will prompt to enter in the name and location to save the test. The data along with a screen capture will be saved.

3.13.6 Cumulative PDF

The cumulative probability function, figure 3.13.6.1, determines the process of samples classification. From the cumulative probability function, significant statistical values can be obtained such as mean, standard deviation, flicker level being exceeded for a given percentage of time or, alternatively, the percentage of time that an assigned flicker level has been exceeded.

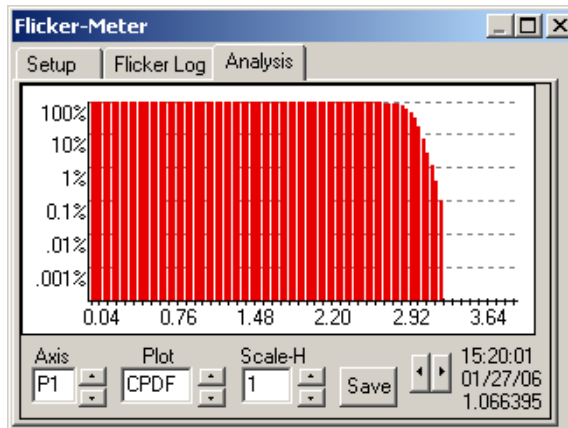


Figure 3.13.6.1

To change which phase data is displayed use the **Axis** up and down buttons to toggle between each phase. To adjust how many points to plot on the graph use the **Scale-H** up and down buttons to increase or decrease the plot data. The Flicker data can be saved by selecting the **Save** button. After the button is selected it will prompt to enter in the name and location to save the test. The data along with a screen capture will be saved.

3.14 Site Automation

3.14.1 Automation Setup

The Site Automation, figure 3.14.1.1, is an advanced feature that provides the ability to automate all the testing functions available in the PCSuite Software.

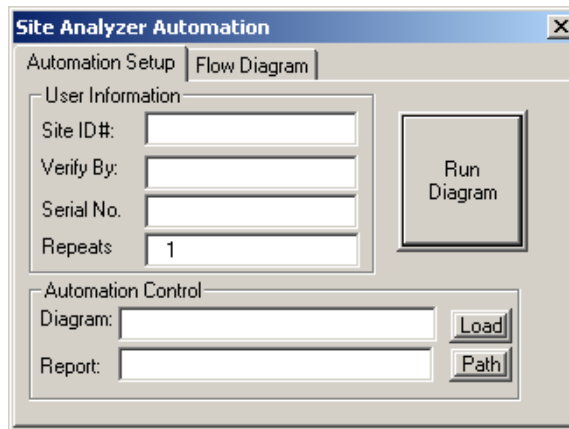


Figure 3.14.1.1

At the end of the automation sequence a report will be generated and saved. In addition to the automated test data, the report also has detailed site information including the Site ID, Verifier Name and Serial Number. The report name is defined by the serial number entered. The report location can be selected using the **Path** button. To load a saved Automation Diagram select the **Load** button and select the diagram file.

3.14.2 Automation Flow Diagram

The Flow Diagram defines the automation sequence. To create a new flow diagram select the Flow Diagram tab, figure 3.14.2.1.

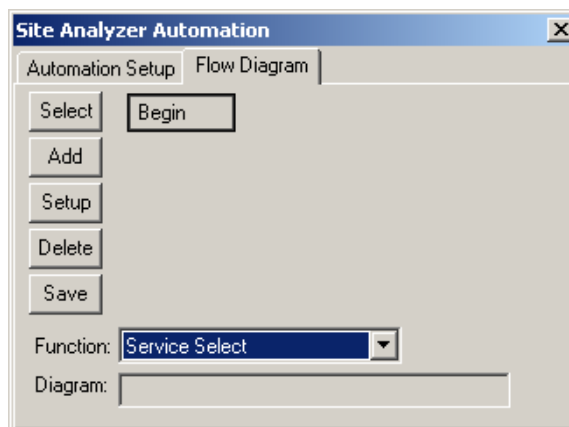


Figure 3.14.2.1

Each Automation Sequence must be saved before you can run the automation. To save the sequence select the **Save** button and select a file name and location.

There are 14 different functions that you can choose to add onto the flow diagram. To add a function, select the function from the list and select the **Add** button.

To edit the function setups use the **Select** button to toggle to the function you wish to edit and select the **Setup** button.

To insert a function in-between two functions use the **Select** button to choose the function, click **Add** and the added function will go above your selected function.

To delete a function from the automation sequence, use the **Select** button to toggle to the correct function and select the **Delete** button.

Several functions require a setup:

1. Service Selection Setup, figure 3.14.2.2

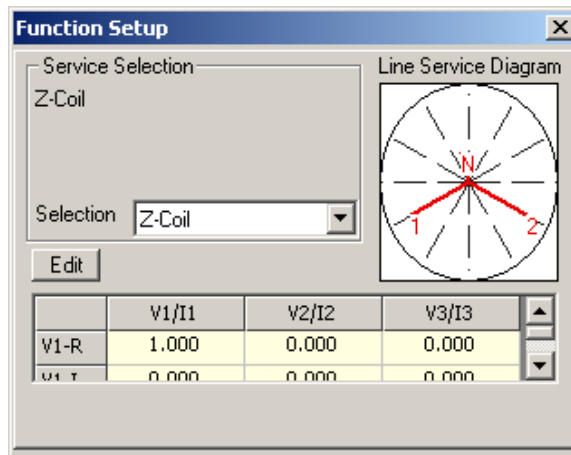


Figure 3.14.2.2

For three (3) phase Dytronic Standards, PCSuite allows the unit to be configured similar to how a meter would perform the voltage and current calculation see section [3.3.5 Service Selection Configuration](#). When the Automation is started the service selection will automatically be configured and started based on the Automation Service Selection Setup.

2. Metrics Setup, figure 3.14.2.3.

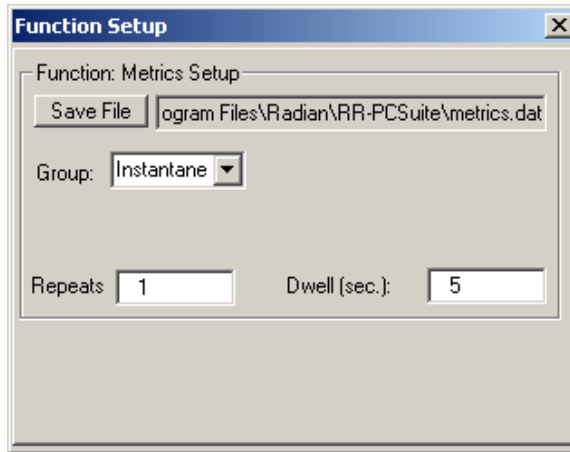


Figure 3.14.2.3 – Metrics Setup

In the Automation Metrics Setup, the user can select a Metrics **Group (Instantaneous, Min, Max, Accumulators)** see section [3.4 Metrics](#), a **Dwell** time length to keep the metrics data open and a **Save File** name and location for the data. To save the data multiple times, increase the **Repeats** number.

3. Harmonic Setup, figure 3.14.2.4

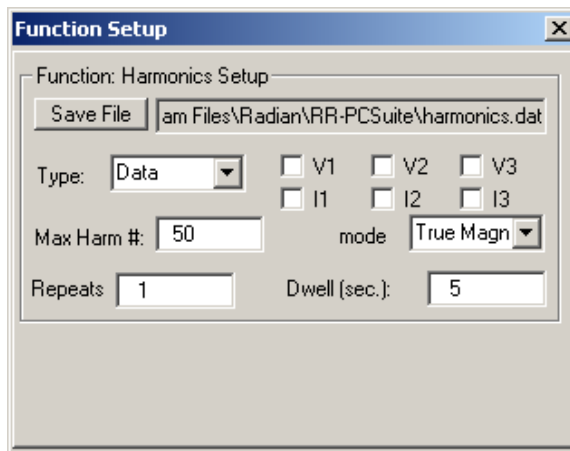


Figure 3.14.2.4

In the Automation Harmonics Setup, the user can select the **Type** of data to be captured. (**Data, Waveform, Bar Chart**) see section [3.5 Harmonic Analysis](#), a **Dwell** time length to keep the harmonic data open and a **Save File** name and location for the data. To save the data multiple times, increase the **Repeats** number. The **Max Harm #**, the **phase check boxes** and the **Mode** allow the automation to capture the harmonic data according to the setup.

4. Trend Setup, figure 3.14.2.5

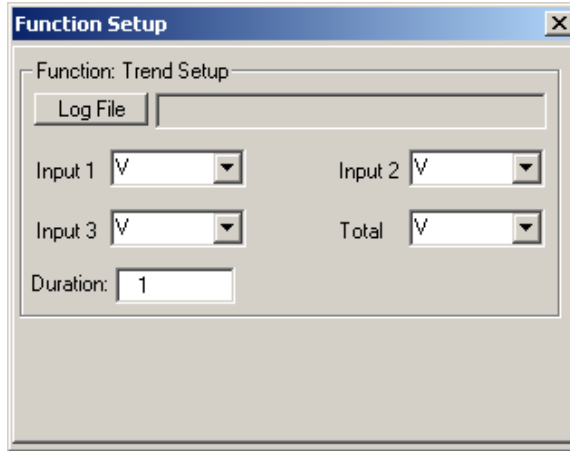


Figure 3.14.2.5

The Trend Chart takes recordings of measurements using the Dytronic Standard, see section [3.6 Trend Chart](#). The Automation Trend Setup defines the **Log File** name, which **metrics** are shown on each phase as the trend is started and the time **Duration** for the automated trend sequence.

5. Vector Setup, figure 3.14.2.6

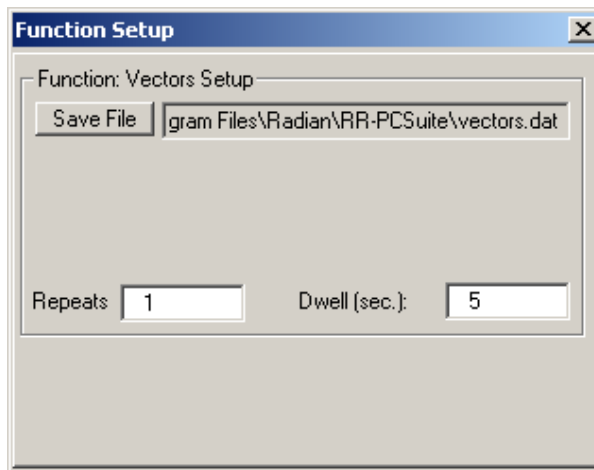


Figure 3.14.2.6

A vector representation of the voltage phase relationships and power factors are readily available in the Vectors screen, see section [3.7 Vectors](#). The Automation Vectors Setup allows the user to setup a **Dwell** time length to keep the Vectors data open and a **Save File** name and location for the data. To save the data multiple times, increase the **Repeats** number.

6. Meter Test Setup, figure 3.14.2.7

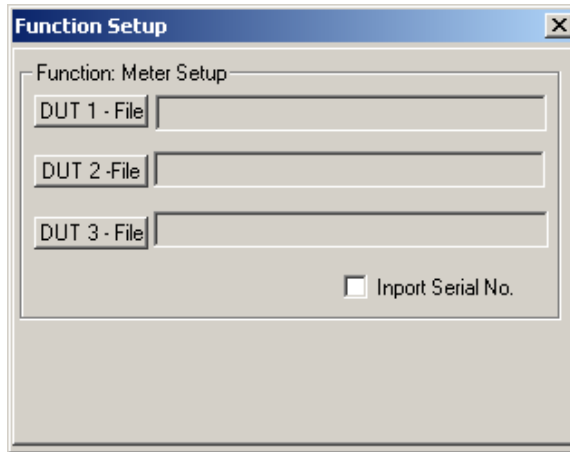


Figure 3.14.2.7

The Automation Meter Test Setup allows the user to preload a Meter Test Setup file for any DUT, see section [3.8 Run Meter Test](#). The **Import Serial No.** check box allows the Serial number from the Automation Information to be set as the meter serial number for the test.

7. Standard Test Setup, figure 3.14.2.8

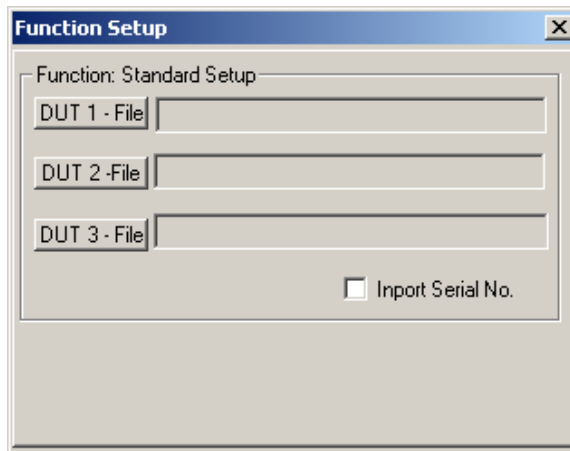


Figure 3.14.2.8

The Automation Standard Test Setup allows the user to preload a Standard Test Setup file for any DUT, see section [3.9 Standards Test](#). The **Import Serial No.** check box allows the Serial number from the Automation Information to be set as the Standard serial number for the test.

8. CT Ratio Test Setup, figure 3.14.2.9

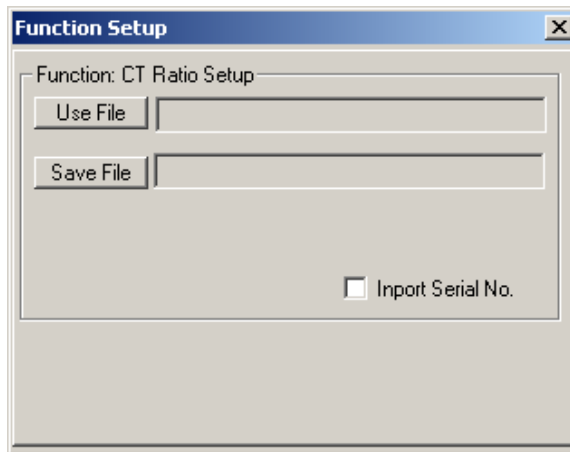


Figure 3.14.2.9

The Automation CT Ratio Test Setup allows the user to preload a CT Ratio Test Setup file, see section [3.10 CT Ratio Testing](#). The CT Ratio Testing Data can also be stored to another file by selecting the **Save File** button, selection a name and location for the data. The **Import Serial No.** check box allows the Serial number from the Automation Information to be set as the CT serial number for the test.

9. Analog Sense Setup, figure 3.14.2.10

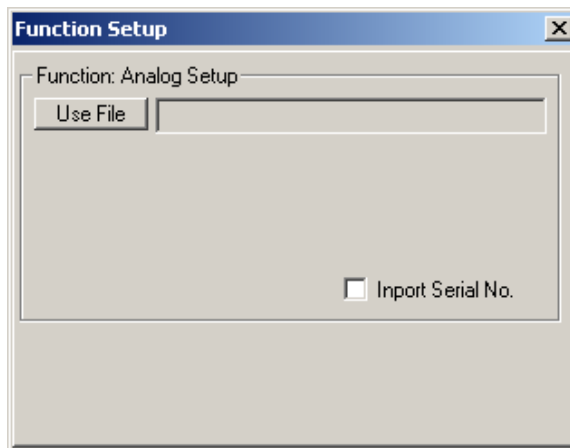


Figure 3.14.2.10

The Automation Analog Sense Test Setup allows the user to preload an Analog Sense Test Setup file, see section [3.11 Analog Sense Test](#). The **Import Serial No.** check box allows the Serial number from the Automation Information to be set as the device serial number for the test.

10. Power Quality Setup, figure 3.14.2.11

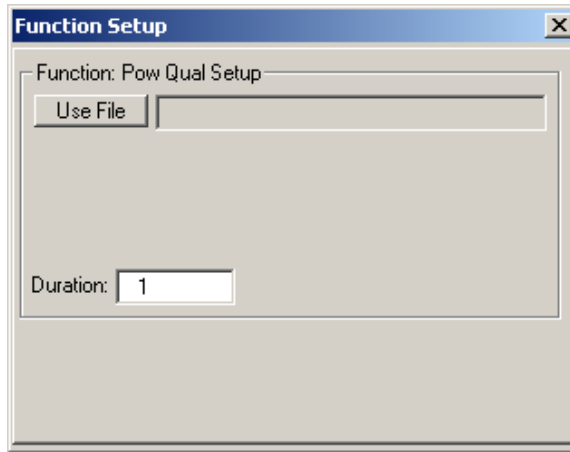


Figure 3.14.2.11

The Automation Power Quality Setup allows the user to preload a Power Quality Setup file, see section [3.12 Power Quality](#). The **Duration** defines the length in which the data is shown. The test will continue until the flow diagram comes to an end. To save the data use the Archive period located in the Power Quality Setup file.

11. Flicker Meter Setup, figure 3.14.2.12

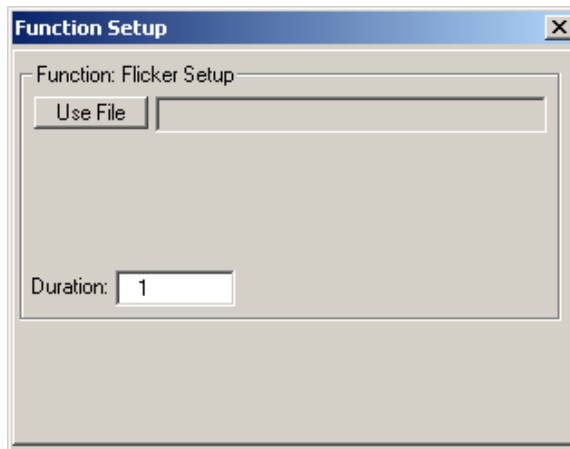


Figure 3.14.2.12

The Automation Flicker Setup allows the user to preload a Flicker Setup file, see section [3.13 Flicker-Meter](#). The **Duration** defines the length, in second, in which the data is shown. The Flicker Meter will continue to run until the flow diagram comes to an end. To save the data use the Archive period located in the Flicker Meter Setup file.

12. Delay Setup, figure 3.14.2.13

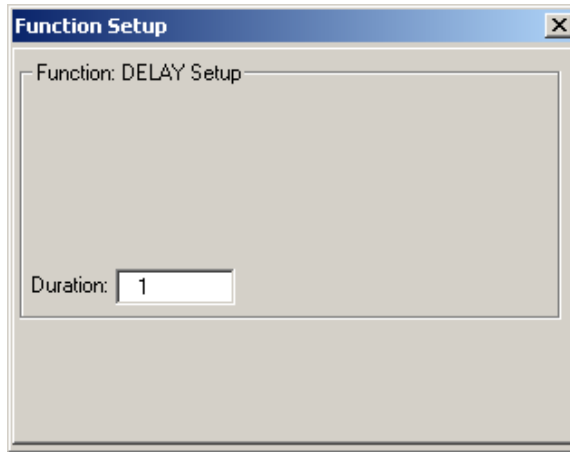


Figure 3.14.2.13

The Automation Delay allows the user to add a delay to the automation sequence. The **Duration** defines how long the delay should run. The Delay function does not capture any data. Once the delay is complete it will continue to the next automated function. When the delay is running a screen will appear, figure 3.14.2.14, to indicate that the delay is running.

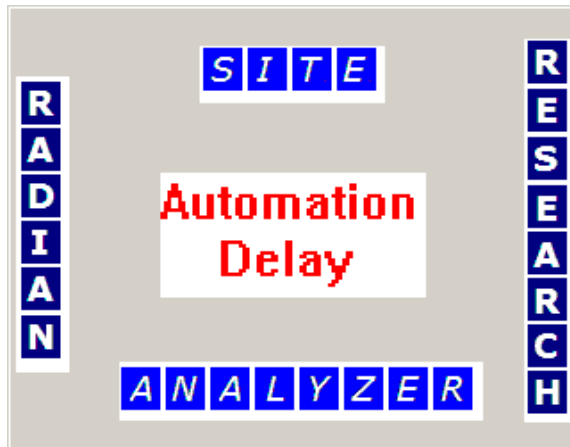


Figure 3.14.2.14

13. Pause Setup, figure 3.14.2.15

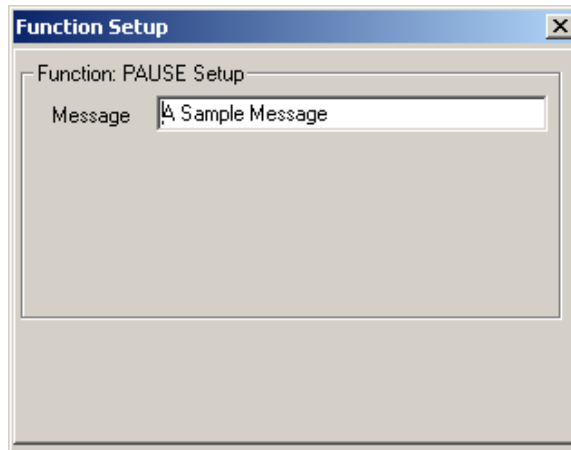


Figure 3.14.2.15

The Automated Pause setup provides a pause, which can show a custom **Message**. The Pause feature is crucial for testing of different Meter Elements, multiple CT's or if any hardware configuration needs to change before the automation continues. When the Pause is ran a prompt will open, figure 3.14.2.16, displaying your custom message. To continue the **OK** must be selected.

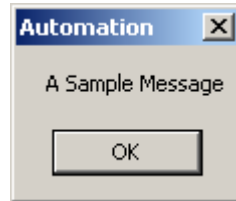


Figure 3.14.2.16

14. End Block

Every Automation Sequence requires an End Block to complete the sequence. The End Block will terminate the automation process, in addition, if opened it will stop the power quality function and the flicker function.