

# PowerPROview

# Power Analyzer Pro

## Software Users Guide

26 January, 2008

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## Power Analyzer PRO Software Users Guide

### **Introduction**

This manual deals with a Power Analyzer Pro connected to the PowerPROview software. For information on operating the PowerPROview software see the PowerPROview Users Manual.

### **Toolbars**

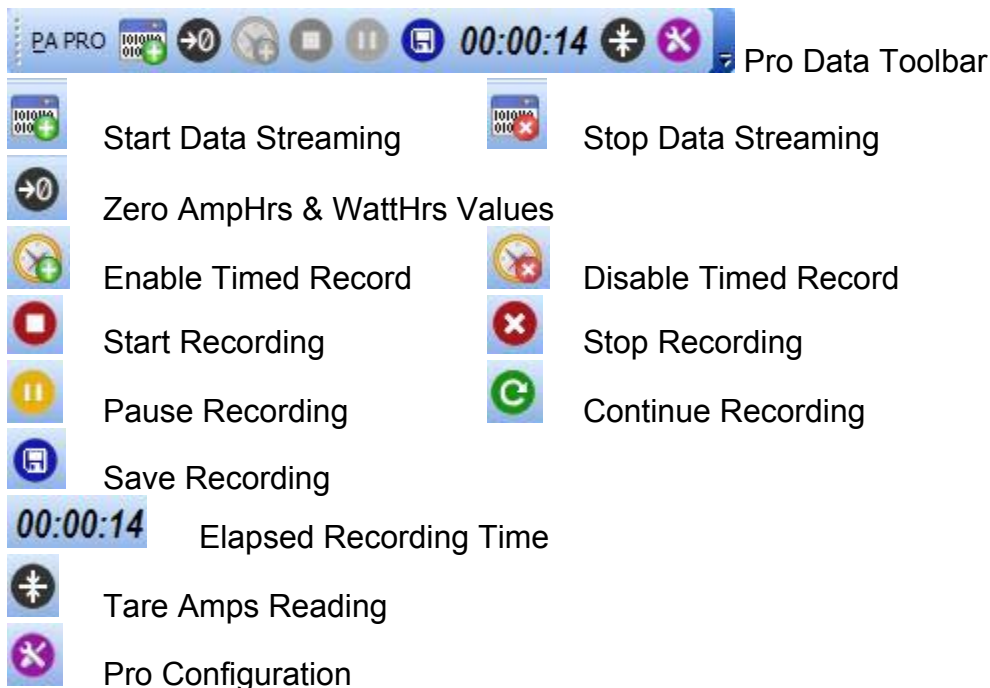
The toolbars and menu options for the Power Analyzer Pro will not appear until PowerPROview connects to a Pro device. When disconnected the toolbars and menu options will disappear.

### **Power Analyzer PRO Toolbars**

The Power Analyzer Pro, when connected, will have two (2) toolbars displayed. One for the Pro's data control and one for the Pro's ESC control.

### **Power Analyzer PRO Data Toolbar**

The Pro Data Toolbar gives you control over data streaming, recording, configuration, and other misc. functions of the Pro.



### **Pro Data Streaming**

Data will only be displayed in the data objects in the data views when data streaming is on. While data streaming is on the Pro sends data to the computer. If data streaming is off then data is not transmitted from the Pro to the computer.

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### Zero AmpHrs & WattHrs Values

This function zeros the AmpHrs and WattHrs accumulators. This function can be automatically executed when recording starts if the system option “Auto Clear” is enable.

### Time Limited Recording

Under system options you can set a maximum limit that recording will continue. With Timed recording enabled, recording will stop once that limit is reached.

### Recording Pro Data

You need to record data to be able to use it on a graph. The graph object on a data view is a special object that only displays recorded data. It will display the data as it is recorded. You can also load and display previously recorded data into the graph for comparisons. Once you have recorded data, save it to disk. Once the data has been saved to disk it can then be loaded into a graph for analysis and comparison. During recording the elapsed time is displayed in the toolbar recording time indicator. You can pause and resume recording at any time. Pausing a recording does not remove any data previously recorded. Resuming recording will append new data to the previously record data.

### Tare Amps Reading

This function will zero out any current reading offset due to quiescent currents from the load. This should only be used when you are not running a motor or load on the Pro. If you are seeing a small current reading while there is no load or the load is off, then execute this function to zero out that current.

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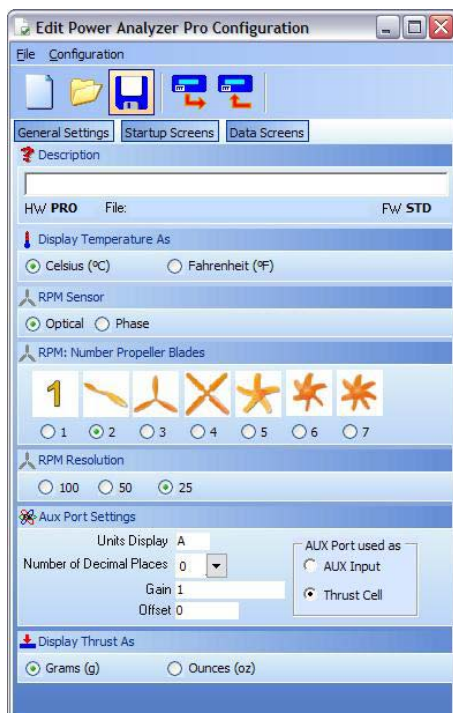
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### Pro Configuration

You can configure various parameters of the Power Analyzer Pro. Configurations can be saved, deleted, edited, read from or written to a Power Analyzer Pro. When you click on the Configuration toolbar item the Configuration editor will appear with the current configuration information read from the Pro. You can then modify and write the configuration back to the Pro, save that configuration to disk, or read a previously saved configuration from disk and then save it to the Pro.

### Pro Configuration Editor

There are three groups of configuration settings for the Pro: General Settings, Startup Screens, and Data Screens.



New Configuration

Open Configuration File

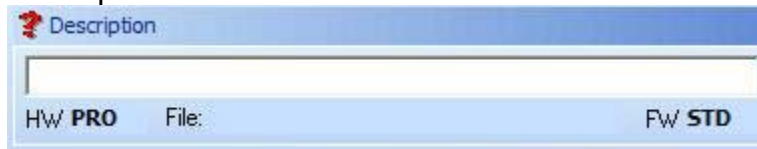
Save Configuration

Read Configuration From Pro

Write Configuration To Pro

### Pro Configuration General Settings

### Description



The description field is where you can enter a short description for the configuration file. A description is only needed when saving a configuration to disk and is not written to the Pro.

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### Temperature



Display Temperature As

☒ Celsius (°C)    ☐ Fahrenheit (°F)

Select either Celsius or Fahrenheit scaling for data display and output.

### RPM

The RPM input can use either an Optical RPM (P/N MR-RPM-001) sensor or a RPM Phase Sensor (P/N MR-RPM-002). The Pro Standard and Deluxe kits come with the RPM optical sensor. Set the sensor type to the sensor being used.



RPM Sensor

☒ Optical    ☐ Phase

RPM: Number Propeller Blades

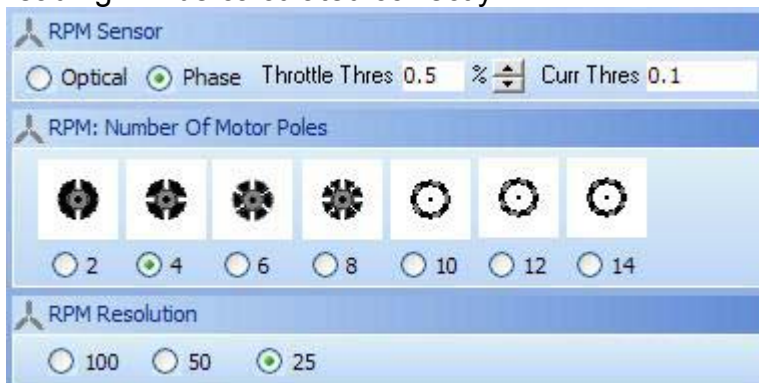
      

☐ 1    ☒ 2    ☐ 3    ☐ 4    ☐ 5    ☐ 6    ☐ 7

RPM Resolution

☐ 100    ☐ 50    ☒ 25








For The optical sensor you need to select the number of blades so that the RPM reading will be calculated correctly.



RPM Sensor

☐ Optical    ☒ Phase    Throttle Thres 0.5 %    Curr Thres 0.1

RPM: Number Of Motor Poles

☐ 2    ☒ 4    ☐ 6    ☐ 8    ☐ 10    ☐ 12    ☐ 14

RPM Resolution

☐ 100    ☐ 50    ☒ 25

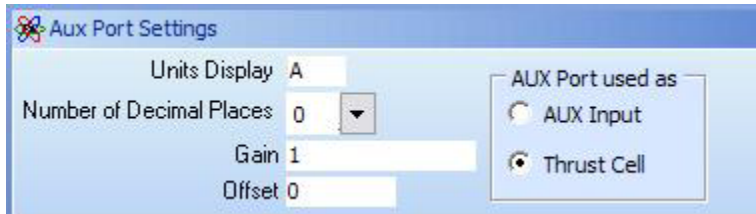
For the RPM Phase sensor you need to select the number of poles of the motor so that the RPM reading will be calculated correctly.

Select the RPM resolution setting that best fits your setup. Note that the higher the resolution the slower the readings will be updated.

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### Aux Port



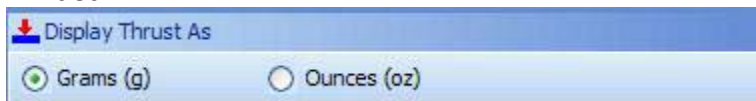
The Aux port can be used to connect to a Thrust Cell for measuring thrust or for reading an analog input. If using a Thrust cell then select the Thrust Cell setting. The other settings are only used for AUX Input mode. In AUX Input mode the data can be scaled by the Gain and Offset parameters and will be display on the Pro's LCD screen using the character defined in the Units field. You can also set the number of decimals displayed.

In AUX Input mode the Pro will read an analog voltage in the range of 0.1V to 2.5V. Any input must be scaled to fall within that range. Typically an instrumentation op-amp is used to provide scaling and buffering of your input signal.

#### Aux Input Example:

Say you had an air speed meter that outputs a 0 to 5V signal for a wind speed of 0 to 100MPH. You would use an Op-Amp configured for a gain of 0.5 so that its output would be 0 to 2.5V for a wind speed of 0 to 100MPH. If you set the Aux Gain to 40 (100/2.5), then the display will show 100 when the Aux input is at 2.5V. With this setup the display will read in MPH.

### Thrust



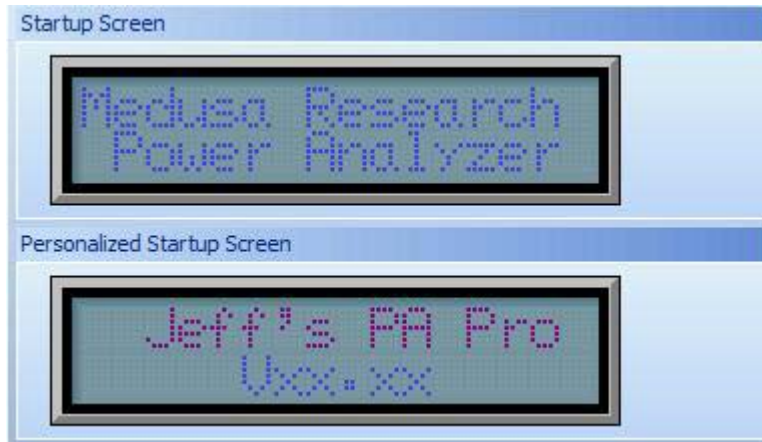
Select either Grams or Ounces for data display and output.

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### Pro Configuration Startup Screens

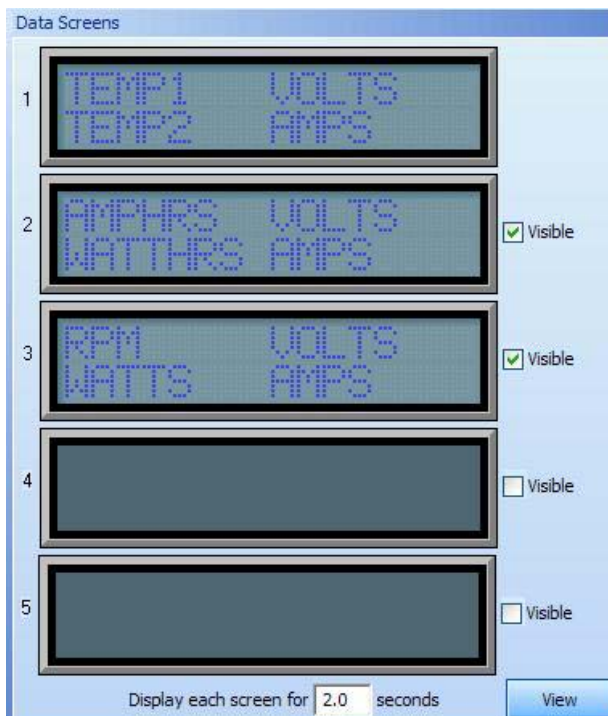
You can customize a message that is display when the Power analyzer Pro turns on. There is one line of 16 characters that can be customized with your name, favorite phrase or any message you want.



Double click on the first line and enter the text of your message and click ok. Right click to select options for: Center Justify, Left Justify, Right Justify, Upper Case, Lower Case, and Proper Case.

### Pro Configuration Data Screens

The data that is displayed on the Pro's LCD screen can be configured to show just the data that you want. There are five (5) available screens that can be configured to display any value in any one of four positions. The rate of change from one display to the next can also be set in 0.1 second increments. Used or unused screens can be disabled as needed.



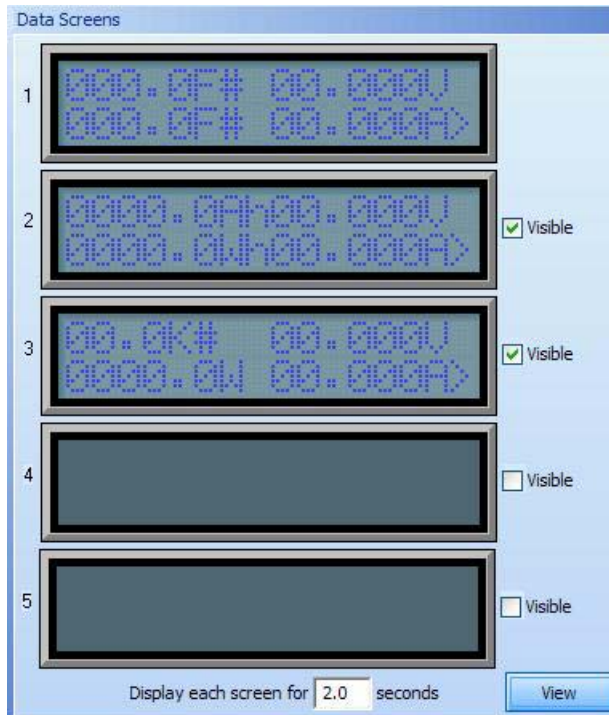
Right click on one of the four positions in a display to select the data that is displayed in that position.

You can have the same data displayed in any number of positions and in any number of screens. This example displays the Amps and volts in all screens in the same position on the right where the other positions rotate the other data values.



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Click on the view button to switch between data name view and data format view.

The rate at which the screens change can be set in 0.1 increments.

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### **Power Analyzer PRO ESC Toolbar**

The Pro ESC Toolbar allows you to control an ESC connected to the Pro's ESC port. This gives you the ability to run repeatable tests controlled by the computer and your settings. When using an ESC to run data analysis tests it is best to use one that has as many throttle steps as possible. Consider an ESC with only 64 throttle steps versus one that has 128 steps. With 128 steps you get finer control and better test results.



New Waveform



Open Waveform



Edit Waveform



Save Waveform



Start Waveform



Stop Waveform

Note: Pressing the Escape key acts as an emergency stop and will stop a waveform that is running and set the throttle to zero.



Current Waveform Type (hover over for waveform description)  
Display an image of the current waveform type



Open Real-Time Control



Close Real-Time Control



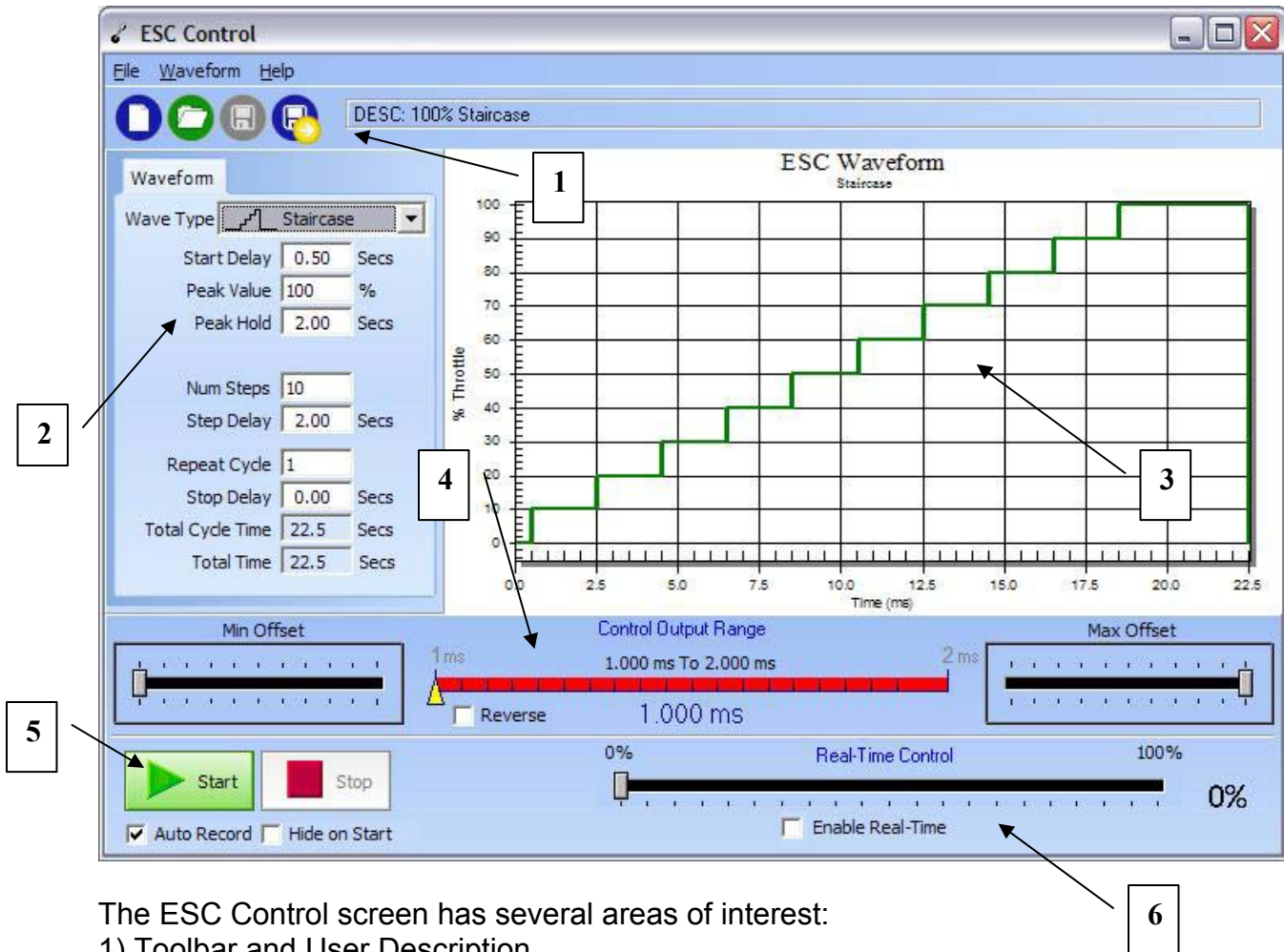
Waveform Repeat Count. Shows the number of times a waveform has played.

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### ESC Waveform

An ESC waveform is just a pattern that the throttle position will follow. You can define various parameters for different waveform types to customize a waveform for your testing. Clicking on the New or Edit toolbar item will open the ESC Waveform Control and Editor:



The ESC Control screen has several areas of interest:

- 1) Toolbar and User Description
- 2) Waveform Settings
- 3) Waveform
- 4) Throttle Settings
- 5) Waveform Control
- 6) Manual Throttle Control

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### ESC Toolbar and User Description



New Waveform



Open Waveform



Save Waveform



Save Waveform As



User Description for the waveform. Double click to edit.

### ESC Waveform Settings

You can select a waveform type of Step, Ramp, Dual Ramp, Staircase, or Dual Staircase. For each type of waveform there will be different parameters available to configure that waveform.

Waveform

Wave Type Step

Start Delay  Secs

Peak Value  %

Peak Hold  Secs

Repeat Cycle

Stop Delay  Secs

Total Cycle Time  Secs

Total Time  Secs

Waveform

Wave Type Ramp

Start Delay  Secs

Peak Value  %

Peak Hold  Secs

Ramp Time  Secs

Repeat Cycle

Stop Delay  Secs

Total Cycle Time  Secs

Total Time  Secs

Waveform

Wave Type Dual Ramp

Start Delay  Secs

Peak Value  %

Peak Hold  Secs

Ramp Time  Secs

Repeat Cycle

Stop Delay  Secs

Total Cycle Time  Secs

Total Time  Secs

Waveform

Wave Type Staircase

Start Delay  Secs

Peak Value  %

Peak Hold  Secs

Num Steps

Step Delay  Secs

Repeat Cycle

Stop Delay  Secs

Total Cycle Time  Secs

Total Time  Secs

Waveform

Wave Type Dual Staircase

Start Delay  Secs

Peak Value  %

Peak Hold  Secs

Num Steps

Step Delay  Secs

Repeat Cycle

Stop Delay  Secs

Total Cycle Time  Secs

Total Time  Secs

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### ESC Waveform Parameters

Start Delay	Delay after the starting before the actual waveform begins.
Peak Value	Max value the throttle will achieve.
Peak Hold	Delay after waveform reaches its peak before continuing.
Ramp Time	Time for throttle to go from 0 to peak value.
Num Steps	Number of step between 0 and peak value.
Step Delay	Time that each step holds until next step.
Repeat Cycle	Number of times to repeat the waveform.
Stop Delay	Delay after waveform is done before recording stops.
Total Cycle time	Total time for one waveform.
Total Time	total time for all waveform repeats and delays.

### ESC Waveform

This is a visual representation of the waveform.



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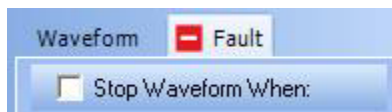
### ESC Fault Settings

While a waveform is running there can be several conditions that arise that you would want to stop the waveform from continuing. This could be the current too high for the ESC, the battery voltage getting too low, or even too high an RPM. The ESC Fault settings allow you to check for conditions that would stop the waveform to prevent damage or unsafe conditions.



There are Three (3) main conditions that can be set that when met will stop a waveform that is currently running. Each fault condition has three parameters: data channel, test, and value. Select the parameters for each condition that will define the fault condition that you desire. A fourth test (AND/OR) is used to further define a more complex condition. This can be used to specify three separate conditions (OR) where any one of them will stop a waveform or a combination of conditions where two conditions or all three conditions have to be met to stop the waveform.

The check box at the top of the faults will enable and disable the fault checking.



The fault settings will be saved with the waveform settings when you save a waveform.

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### Example 1:

An ESC has a max rating of 40 Amps.  
The motor has a max temp of 160 degrees.

The settings would look like this:

The screenshot shows the 'Fault 1' and 'Fault 2' configuration windows. 'Fault 1' is set to 'Amps' with a value of 40 and a greater-than sign (>). 'Fault 2' is set to 'Temp1' with a value of 160 and a greater-than sign (>). The 'OR' dropdown menu is visible between the two fault settings.

### Example 2:

In doing a battery test the current should not exceed 20A and the min voltage should not drop below 9.6V.

The screenshot shows the 'Fault 1' and 'Fault 2' configuration windows. 'Fault 1' is set to 'Amps' with a value of 20 and a greater-than sign (>). 'Fault 2' is set to 'Volts' with a value of 9.6 and a less-than sign (<). The 'OR' dropdown menu is visible between the two fault settings.

### Example 3:

When using the AND/OR keep in mind that when the AND is used it always refers to the condition above it.

Here are the possible combinations:

- (Fault 1) OR (Fault 2)
- (Fault 1) AND (Fault 2)
- (Fault 1) OR (Fault 2) OR (Fault 3)
- (Fault 1) AND (Fault 2) OR (Fault 3)
- (Fault 1) OR (Fault 2) AND (Fault 3)
- (Fault 1) AND (Fault 2) AND (Fault 3)

Of course not all faults have to be defined. Select the '????' channel to disable that fault.

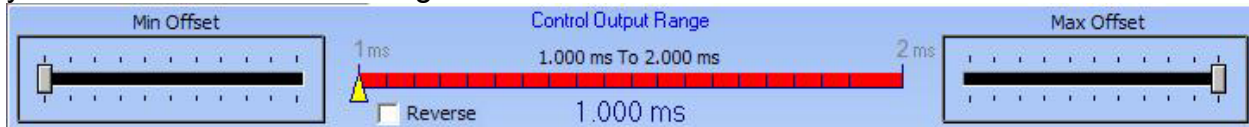


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### ESC Throttle Settings

Not all ESC's respond to the same range of control signal. The Min and Max offset allow you to fine tune the control signal to the ESC.



Using the manual real time throttle control set to zero, increase the Min offset until the output starts to change, then back it off a little bit. Next, set the throttle to full on and decrease the max offset until the output starts reducing, then increase it a little bit. You now have the control output range calibrated for the ESC. Remember that if you change ESC's you will probably have to recalibrate the control signal.

NOTE: With some ESC's you will need to bring the throttle up about 1/4 to 1/3 to activate the ESC and then return it to zero before calibrating the control signal.

NOTE: The Power Analyzer output to the ESC will shut off after a few seconds if it does not receive a throttle command from the computer. While in manual real time throttle control mode the throttle position is continually sent to the ESC. When off, throttle commands are only sent while a waveform is playing.

### ESC Waveform Control

You can start (i.e. play) a waveform from the toolbar, the ESC waveform window or from the real time control window. On you start a waveform you can stop it by click on the stop button on the toolbar, the waveform window, or on the real time control window.



**Auto Record**                      If checked, recording will start when the waveform starts.

**Hide on Start**                      If checked, the waveform window will hide while the waveform is playing.

### ESC Manual Throttle Control

The real time control provides manual throttle control. When enabled the slider controls the throttle position.



**Enable Real-Time**                      When checked, enables manual throttle control.

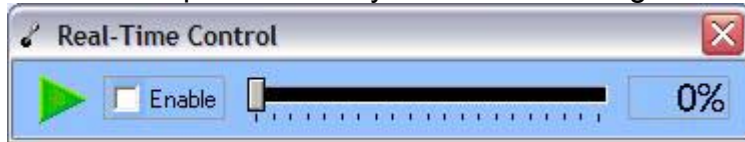


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### **ESC Real-Time Control Window**

The Real-Time Control window allows you to manually control the throttle as well as start and stop the currently loaded and configured waveform.



Start Waveform



Stop waveform

Enable

When checked, enables manual throttle control using the slider.