medusa research Inc.

POWER ANALYZER PRO

SAFETY FIRST

CAUTION CURRENT HANDLING LIMITATIONS
The Power Analyzer PRO is designed and built for safe use in systems carrying currents up to 100 Amps. Exceeding 100 Amps could result in damage to the equipment and possible personal injury.

CAUTION INPUT VOLTAGE LIMITATIONS
The Power Analyzer PRO is designed and built for safe use in systems with less than 60 Volts. Exceeding 60V can permanently damage the Power Analyzer PRO.

CAUTION HARDWARE AND CONNECTIONS
Follow proper assembly and ratings for wires and connectors. The user is responsible for attaching connectors rated to handle the voltage and current that will be applied in the user's application. Ensure that all wiring and connections are rated to handle the input or output current, and are assembled appropriately for each application. High current connections should be made by those experienced to do so.

CAUTION APPLYING POWER
Before connecting a battery to the Power Analyzer PRO, make certain there are no exposed wires or connectors that may short circuit. Connectors with exposed male conductors should never be used on batteries, use female connectors for batteries. Both the "SOURCE" and "LOAD" leads of the Power Analyzer PRO are hot when a battery is connected to either side. A shorted Power Analyzer connected to a battery can supply massive amounts of current, causing fire, explosions, personal injury, and damage to the equipment.

E-FLIGHT 101 – MEASUREMENTS OF THE PRO

BASICS OF ELECTRICITY

Our Power Analyzer PRO can measure all of the necessary electric properties of your setup that you will need to know to get the most out of your model. In addition, it can also measure other properties including RPM, thrust, and temperature. This provides the user with a complete data acquisition system that not only has electric measurements, but all the important dimensions of your e-flight system. What follows in this section is a basic description of the electric measurements.

Electricity in a wire is often compared to water flowing through a hose.
Like water flowing through a hose, current is a measure how *fast* electricity flows through a wire. To get the water to *flow* through the hose, there needs to be a relatively high *pressure* at the faucet end of the host to push the water out the open end where there is relatively little pressure. It is this difference in *pressure* that creates the *flow* in the hose. For electronics, this difference in pressure is known in electronics as voltage. The battery pack is analogous to the garden faucet, because it creates the voltage to make current flow through a wire and into your motor where it is converted from electricity into mechanical rotation.

MEASURING POWER WITH WATTS

The combination of the pressure of electric voltage and the flow of current is what produces a flow of power. Power in electronics is usually measured in watts. The Power Analyzer PRO will display the amount of power flowing though it in watts. Wattage can also be calculated by multiplying the current by the voltage.

Watts = Amps X Volts

The power flowing into the motor can be compared to the power flowing out of the motor and into the propeller. The difference between the power going into the motor and power going out is known as *efficiency.* The goal of the modeler is to optimize the setup to get the highest efficiency possible. The Power Analyzer PRO can measure electric power in with watts, and power out using the Thrust Cell and RPM sensor.

MEASURING CAPACITY WITH AMP-HOURS

The Amp-Hour is a standard measure of capacity for electric battery packs. This measurement is useful when charging battery packs to determine if they are taking a full charge, if the should be re-conditioned, or if they should be recycled and replaced. The Amp-Hour specification for a battery is usually printed on the pack.

Amp-Hours = Average Amps X Hours

Thinking back to the water example, a discharged battery is like an empty bucket. The faucet is like a bucket charger that creates pressure and flow to fill the bucket back up with water. For example, if the bucket is 2 gallons, and the faucet fills the bucket at 2 gallons an hour it will take one hour to fill the bucket. When a discharged 2 Amp-Hour (usually printed as 2000mAh for milliamp hours) battery pack is charged at 2 Amps for 1 Hour the battery will be fully charged, just like the bucket is full of water.

MEASURING WORK WITH WATT-HOURS

Similar to Amp-Hours, Watt-Hours measures power multiplied by time to determine how much "work" capacity is in a battery. The difference is that Watt-Hours incorporate the average voltage as well as the average amperage. Watt-Hours are calculated by:

Watt-Hours = Average Watts X Hours

While Amp-Hours are the standard for measuring battery capacity, Watt-Hours can be useful for comparing power capacities between batteries with different number of cells and therefore different voltages. Measuring watt-hours allows you to see and compare the power capacity of your batteries.

RPM, VOLTS, AMPS, KV, TORQUE AND MORE…

A motor's RPM or speed is directly related to the voltage applied to it and the KV of the motor. The KV of a motor is how many RPMs per Volt and it is usually found printed on the motor or in the motor's instructions. For example, a 2000Kv motor with a 12v battery pack should run about 2000KV X 12V = 24,000RPM unloaded.

If a propeller is attached to the motor, the motor must put power into turning the propeller to generate thrust. The battery's voltage remains constant, so to put power into the propeller, the motor must draw more current. (remember, Watts = Volts X Amps). Just like voltage is related to RPM, *torque* is directly related to the current going into the motor. In a perfect world the motor would

maintain its RPM under any load. In the real world increasing current will increase power losses in the battery, wiring, ESC and motor causing a drop in RPM.

Using the Power Analyzer PRO RPM sensor is a key piece to measuring the approximate efficiency of the electric flight system. This information can provide an approximate measure of the motor's power output that can be compared to the motor's power input.

THE MEDUSA RESEARCH THRUST CELL

Thrust is important in assessing the performance of an airplane. Knowing the RPM and thrust provide crucial insight into how the model airplane will behave while flying. The Thrust Cell provides an easy method to automate analyzing and recording the thrust produced by different setups so the user can quickly determine the best setup.

SETUP

STOP! READ THE FOLLOWING
Due to the wide variety of applications the Power Analyzer PRO may be used in, the Power Analyzer PRO is supplied without connectors. Please read the SAFETY FIRST section before continuing.

ATTACH CONNECTORS

Before using the Power Analyzer PRO, connectors need to be installed on the SOURCE and LOAD leads. When installing gender specific connectors, the male type should be installed on the SOURCE side and the female type should be installed on the LOAD side. Ensure the connectors are rated to carry the amount of current that the Power Analyzer PRO will be used to monitor. PAY ATTENTION TO POLARITY!

Carefully insulate the connector with shrink tube or electrical tape. Make sure the positive and negative leads on both sides are insulated from each other, or a dangerous short circuit may occur.

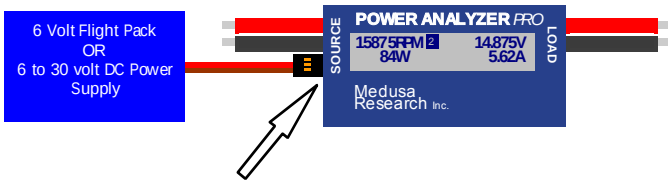
APPLYING POWER

The Power Analyzer PRO can be powered 3 different ways.

- Through the USB port.
- By the battery connected to the SOURCE side
- Through the PWR/EXT port on the SOURCE side of the case

The battery connected to the SOURCE side should have at least 6 volts to properly power the Power Analyzer PRO. A NiCd or NiMH pack will need at least 5 cells to do this, a Lithium pack will need 2 cells.

If the battery connected to the SOURCE side has fewer cells or the measured voltage is lower than 6 volts, connect an external power supply to the EXT/PWR port. The EXT/PWR port is designed to accomidate the connector from a standard flight pack, a nickel cell flight pack will need at least 5 cells to power the Power Analyzer PRO.

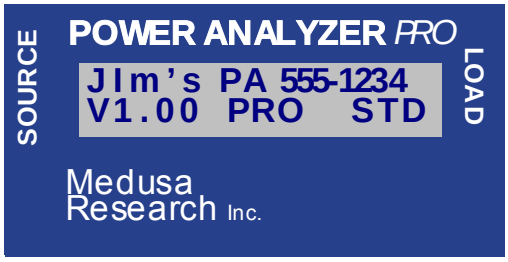


External/Power
port location

DISPLAY

POWER-UP SCREEN

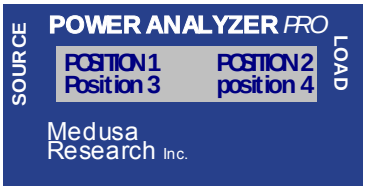
Upon applying power the Power Analyzer PRO will boot up, briefly showing our logo, then the PRO version. Optionally, the PowerPROview software can add a customized 16-letter string above the version to personalize your PRO.



MEASURMENTS ON THE DISPLAY

The Power Analyzer PRO is able to display 10 separate measurements but because of limited space on the display, only 4 measurements are shown simultaneously. The PRO can change the measurements shown on the display at a user-defined interval; see the Screen Configuration section for more details. Each measurement may occupy 1 position on each screen. The 10 different measurements are:

- *Voltage* 0 to 60 Volts
- *Current* –30 to 100 Amps
- *Aux port* 0.1 to 2.6V analog input
- *Temperature* 1 0°C to 130°C
- *Temperature* 2 0°C to 130°C
- *Power* –1800 to 6000 watts
- *Amp-Hours* +/- 999.999
- Watt-Hours +/- 9999.9
- *RPM* 60,000 for 2 to 7 blades
- *Thrust* 0 to 5000g



VOLTAGE

Voltage indicates the voltage present at the SOURCE leads and has a range of 0 to 60 volts.

CURRENT

Current indicates the current flowing through the negative lead of the Power Analyzer PRO. It can read up to 100 amps in the forward direction, and up to –30 amps in the reverse direction from LOAD to SOURCE.

ANALOG AUX PORT

The Aux port, if it is not used for the Thrust Cell, can be configured as a generic analog input with a linear input range of 0.1V to 2.6V. Using PowerPROview software, the user can configure gain and offset factors to apply to the reading shown on the display. THE MAXIMUM INPUT RANGE IS –0.1V to 5.0V. VOLTAGE OUTSIDE OF THE MAXIMUM RANGE WILL CAUSE ERRONEOUS READINGS ON OTHER CHANNELS AND POSSIBLE DAMAGE TO THE POWER ANALYZER PRO!

TEMPERATURE

Temperature on both channels can be displayed in Centigrade or Fahrenheit with a range of 0 to 130 °C or 32 to 266 °F. On the display, a reverse color 1 or 2

character will appear after the temperature to indicate if it is channel 1 or channel 2. The PowerPROview software is necessary to configure the temperature scale.

POWER

Power is shown in watts and indicates the power as positive when flowing from the SOURCE to the LOAD and negative to indicate the power is flowing from the LOAD to the SOURCE. The range for power is –1800 to 6000 watts

AMP-HOURS

Amp-hours indicates the amount of current times time that has flowed through the Power Analyzer PRO. The Amp-Hours indication will count up for positive current flow, and down for negative current flow.

WATT-HOURS

Amp-hours indicates the amount of power times time that has flowed through the Power Analyzer PRO. The Watt-Hours indication will count up for positive current flow, and down for negative current flow.

RPM

The RPM reading can display 0 to 60,000 RPM for propellers and fans with 2 to 7 blades using the optical RPM sensor. The brushless motor RPM sensor can measure the same RPM range for motors with 2 to 14 poles. The user can also configure the RPM resolution to 100, 50, and 25 RPM resolution with the tradeoff being that higher resolution requires a slower sample rate. RPM settings can only be configured though the USB port with the appropriate PC software. See the table below for the sample rates of each configuration.

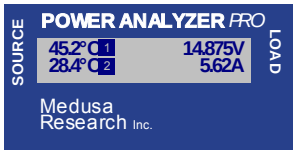
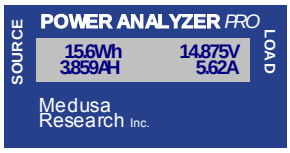
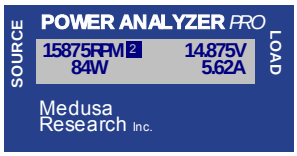
RPM Sample rates in seconds, by Resolution and blade/motor pole count			
Blade/Motor poles	100 RPM Res.	50 RPM Res.	25 RPM Res.
1 blade or 2 poles	0.60s	1.20s	2.40s
2 blades or 4 poles	0.30s	0.60s	1.20s
3 blades or 6 poles	0.20s	0.40s	0.80s
4 blades or 8 poles	0.21s	0.30s	0.60s
5 blades or 10 poles	0.21s	0.24s	0.48s
6 blades or 12 poles	0.21s	0.21s	0.40s
7 blades or 14 poles	0.21s	0.21s	0.34s

THRUST

The *Thrust* value is selectable between grams and ounces and has a range of 0 to 5000kg or 0 to 176oz (11lbs). The PowerPROview software is necessary to configure the PRO for grams or ounces mode.

DISPLAY CONFIGURATION

To overcome the limited screen size, the PRO can have up to 5 different screen layouts that will rotate at a user defined speed. The PRO ships from the factory with 3 screens that switch every 2 seconds. The layout for each configuration is shown in the table below.

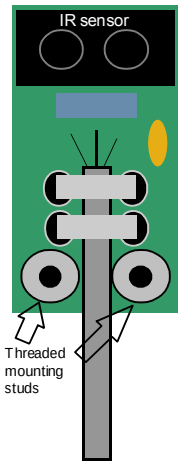
Factory Default Screen Configuration		
Screen 1		• Position 1 Temperature 1 • Position 2 Voltage • Position 3 Temperature 2 • Position 4 Current (amps)
Screen 2		• Position 1 Watt-Hours • Position 2 Voltage • Position 3 Amp-Hours • Position 4 Current (amps)
Screen 3		• Position 1 RPM (2 blades) • Position 2 Voltage • Position 3 Power (watts) • Position 4 Current (amps)

Using our PowerPROview software, the layouts of the screens can be arranged in any configuration. As shown by the voltage and current display in the default configuration above, it is possible to have the same measurements on 2 or more screens so important data will always be visible. It is also important to note that though the PRO ships with only 3 screens enabled, the user may enable up to 5 unique screens. The user can also change the speed at which the screens change.

EXTERNAL SENSORS

The temperature, RPM, and Thrust Cell sensor are all available as accessories or purchased as part of a Power Analyzer PRO package. Visit our website for more information, or to buy additional sensors for your Power Analyzer.

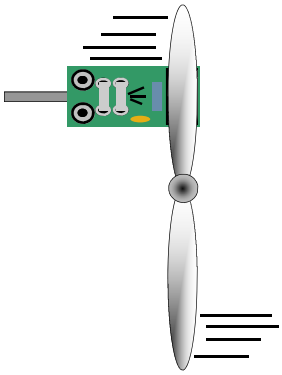
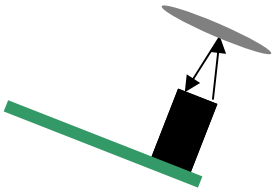
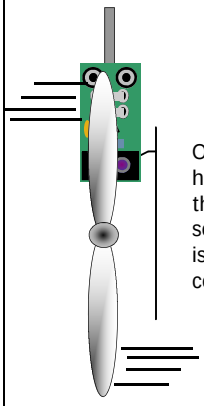
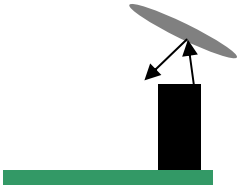
OPTICAL RPM SENSOR



The RPM sensor accessory is an advanced reflective type of sensor. Instead of relying on ambient light or a flashlight, the sensor has both an infrared emitter to bounce light off of the propeller or fan blades and infrared filtered sensor detects the reflected light. This allows the sensor to be used under normal room lighting without the kind of interference from fluorescent light sources that plague other tachometers. The threaded holes on the sensor use 4-40 thread screws.

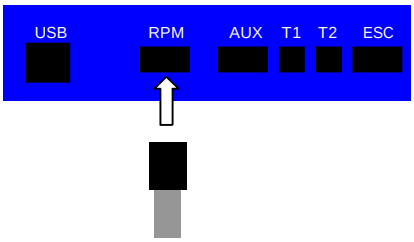
The RPM sensor should be mounted to a test stand no more than 7/8" away from the propeller of the system under test. Some experimentation may be necessary to determine the best distance and position before permanently mounting the sensor. The sensor can be affected by the color of the propeller or fan because it is a reflective type sensor. If there is a poor reading from the RPM sensor and the target propeller is a dark color, we recommend either painting white stripes on the target area, or backlighting the sensor as described below.

On a narrow propeller target, the sensor can also be sensitive to how it is oriented in relation to the propeller. For best results, when the prop blade crosses the path of the IR sensor (shown below) it should cross the path of both the emitter and receiver at the same time. The sensor should also be mounted at the same angle as the propeller blade, otherwise the IR light beam will not return to the sensor as effectively.

<table>
<tr><th colspan="4">Orienting the sensor to the propeller</th></tr>
<tr>
<td>  </td>
<td>Light reflected back to the sensor
  </td>
<td> 
</td>
<td>Light NOT reflected back to the sensor
  </td>
</tr>
<tr><td colspan="2">Optimal orientation to propeller</td><td colspan="2">Bad orientation to propeller</td></tr>
</table>

DO NOT ATTEMPT TO HOLD THE SENSOR BY HAND WHILE TESTING! Instead, use the mounting studs to securely mount the sensor to your test stand.

Connecting the optical RPM sensor to the Power Analyzer PRO



Observe and align the arrows engraved on the black connector and Power Analyzer case. Connect the cable to the RPM port

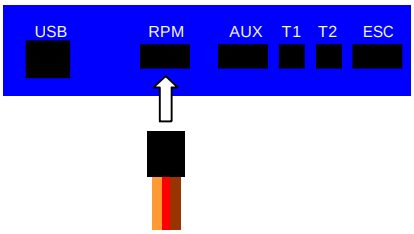
If the sensor's operating range is too short, the range can be dramatically extended to 12" and beyond by backlighting the sensor with a DC incandescent light source such as a flashlight. Incandescent bulbs emit a broad range of light that will penetrate the infrared filter if the beam is directly focused on the sensor. The sensor can also pick up false signal from room lights ONLY if they are focused on the sensor. If you notice false readings, try re-orienting the lighting, sensor, or both.

BRUSHLESS RPM PHASE SENSOR

This RPM sensor measures RPM by monitoring the voltage in one phase of brushless motor. This sensor does away with the need for any sort of optical sensor on the propeller and simplifies RPM measurement.

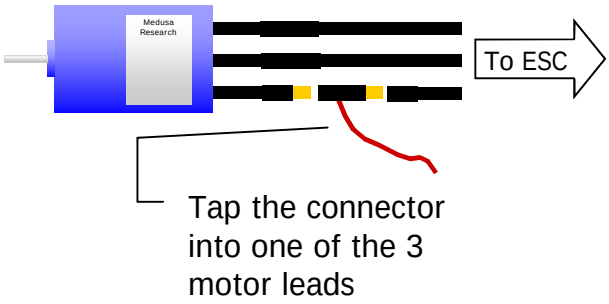
To use the sensor, a single wire connects to any one of the 3 wires going to the brushless motor under test. A tap-in 3.5mm bullet-type connector is provided that plugs into your existing 3.5mm motor connectors without soldering, splicing, or piercing the wire insulation. If the motor under test does not use the 3.5mm connectors, splice the single red wire into one of the 3 phase wires or connector. Connect the output to the RPM port of your Power Analyzer PRO or Oracle. Use the *Configuration* menu in PowerPROview to setup the RPM sensor type and the number of "poles" in the motor under test. See the drawings on the next page.

Connecting the Brushless Phase RPM sensor to the Power Analyzer PRO



Connect the RPM sensor to the RPM port, with the brown wire on the right and the orange wire on the left.

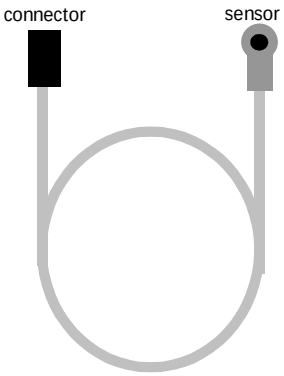
Connecting the Brushless Phase RPM sensor to a motor

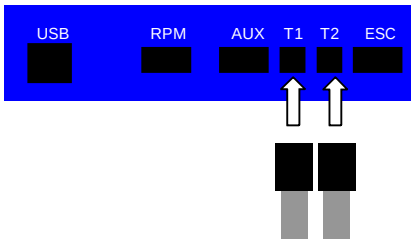


Connect the 3.5mm bullet connector tap-in to one of the 3 motor leads. If your system uses a different type of connector, we suggest making a similar tap in with your preferred connector type. Cut off the 3.5mm tap-in and splice the single red lead of the RPM sensor into one lead of the motor under test.

TEMPERATURE PROBE

The temperature probe accessory allows the user to monitor temperature of vital parts during testing. A ring type mounting is provided on the sensor end for bolting to motors or other surfaces. Alternatively, it is also possible to secure the sensor with tape for measuring ESCs, batteries or other devices. For best results, the sensor should be shielded from heavy airflow (such as from the propeller wash) and a thermal grease compound will improve sensor accuracy.



Connecting temperature probe sensor to the Power Analyzer PRO

Observe and align the arrows engraved on the black connector and Power Analyzer PRO case. Connect 1 or 2 sensors to the T1 and/or T2 locations in the Power Analyzer PRO.

AUX PORT

The Aux port can be used in two modes. It will either function as a generic analog input for a user-defined sensor, or as a communications port for the Medusa Research Thrust Cell. The Power Analyzer is shipped from the factory in Thrust Cell mode

AUX PORT AS AN ANALOG INPUT

It the AUX port is not used for the Thrust Cell, it can be configured as a generic analog input with a linear input range of 0.1V to 2.6V. Using PowerPROview software, the user can configure gain and offset factors to apply to the reading shown on the display.

THE MAXIMUM INPUT RANGE IS –0.1V to 5.0V. VOLTAGE OUTSIDE OF THE MAXIMUM RANGE WILL CAUSE ERRONEOUS READINGS ON OTHER CHANNELS AND POSSIBLE DAMAGE TO THE POWER ANALYZER PRO!

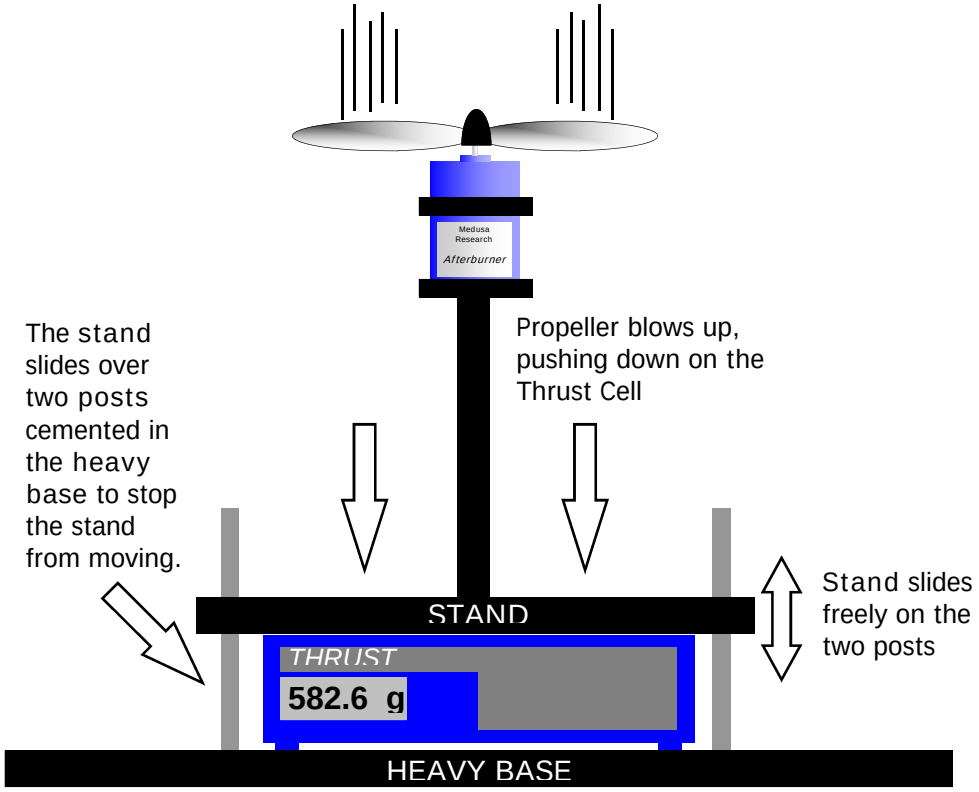
The port will accept a standard 3-pin female inline connector with 0.100” pin spacing. A standard 3 wire servo cable will fit into the port as well. The pinout, from left to right is:

Pin 1: Signal (engraved arrow); Pin 2: No Connect Pin 3: Ground

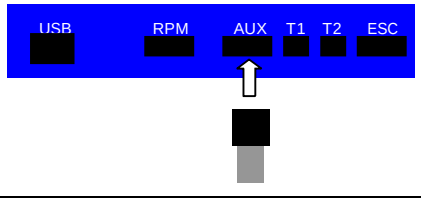
The AUX port ground (pin 3) should not be connected in a way that it would share a common ground with the LOAD side ground. Doing so may cause errors in the current reading.

PIN 2 MUST BE LEFT UNCONNECTED, DO NOT CONNECT THIS PIN TO GROUND!

AUX PORT AS A THRUST CELL INPUT

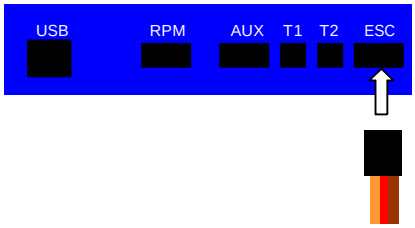


The Thrust Cell is used to measure thrust using a fixture like the one shown in the picture below. The Thrust Cell was designed in the format of a common tabletop scale because that is what many hobbyists currently use to measure thrust. For accuracy, the stand should be tall enough that the moving air does not generate a significant pressure difference between the top and bottom of the stand. The user is responsible for all measures necessary to conduct tests safely! Medusa Research *strongly* recommends that the above fixture be enclosed in a wire mesh or "chicken wire" cage to contain the fixture should parts come loose while testing.

Connecting Thrust Cell to the Power Analyzer PRO

Observe and align the arrows engraved on the black connector and Power Analyzer PRO case. Connect the Thrust Cell cable to the AUX port

ESC PORT

The Power Analyzer PRO can control your ESC for automated testing with the ESC port. In combination with the PowerPROview software, the user can manually control the ESC through the PC, or even create custom throttle profiles to make perfectly repeatable tests for comparing different setups.

Connecting and ESCl to the Power Analyzer PRO

The ESC port has markings to match the wire colors to. O/W should line up with the Orange or White wire, R with the red wire, and B with the Black/Brown wire. These colors vary with manufacturer.

USB PORT

Minimum System Requirements
400mHz Pentium II or equivalent, 128mb RAM, 50 mb free disc space
800x600 minimum graphics resolution, USB v1.1 compatible port
Operating systems supported: 98SE, 2000, or XP

BEFORE CONNECTING THE POWER ANALYZER PRO TO YOUR COMPUTER:
Download and install the latest Power Analyzer PRO compatible software from
http://www.medusaproducts.com

USING THE POWER ANALYZER

MEASURING THE CAPACITY OF A BATTERY

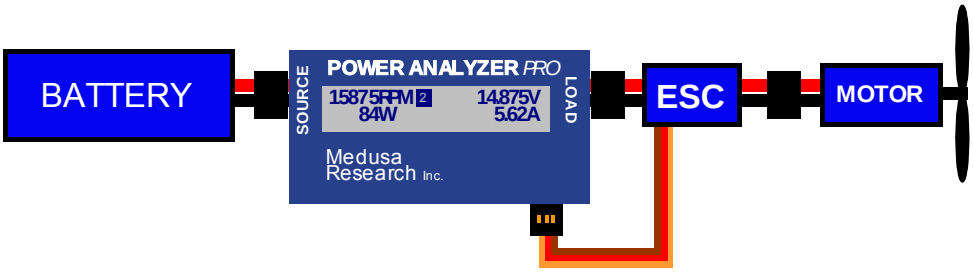
The capacity of a battery can be measured by completely discharging a fully charged battery. In order to do this, first connect a load to the LOAD side of the Power Analyzer PRO. A load may a battery charger with a discharge feature, or an ESC and motor. Second, connected a battery to the SOURCE side of the Power Analyzer PRO. Run the motor or discharge until the battery is at its discharged voltage. When the battery is discharged, the final battery capacity (in Amp Hours) will be displayed.

MEASURING CHARGE PUT INTO A BATTERY

The Power Analyzer PRO can also be used to monitor the charge being put into a rechargeable battery. In this configuration, the battery charger is putting current into the battery instead of drawing it out like a motor. Therefore, the battery becomes the load and the current flows in reverse, from the LOAD to the SOURCE. It is unnecessary to swap the battery to the LOAD side like some other power meters on the market, the Power Analyzer PRO will read current flow in both directions. The current will show up as negative to indicate the reverse direction. Follow your battery charger's instructions, and charge the battery as you normally would. At the end of the charge cycle, the amount of charge put into the battery will be displayed in amp-hours on the display.

NOTE: Always follow the charging procedure recommended by the battery manufacturer to safely charge the battery

MEASURING MOTOR LOAD



Measuring motor load is critical in finding the optimal propeller size and gearbox ratio.

To control the ESC from your computer and measure motor load, you will need to install PowerPROview to control the ESC port. Connect the ESC to the ESC port of the Power Analyzer PRO. Then connect the LOAD side of the Power Analyzer PRO to an ESC and connect the ESC to a motor. Finally, connect a fully charged battery to the SOURCE lead. This step will energize your ESC, so make sure you follow your ESC's instructions and safety procedures for connecting a battery. It is now possible to control the ESC through the PC with the PowerPROview software.

SPECIFICATIONS

Technical Specifications		
Input Specifications	Minimum	Maximum
Input Voltage	5 Volts	60 Volts
	0 Volts*	
Current	-30 Amps	100 Amps
Display Range		
Voltage	60 Volts	
Current	-30 to 100 Amps	
Power	9999 Watts	
Amp-Hours	±999.999 AH	
Watt-Hours	±9999.9 WH	
Temperature Channels 1 & 2	0°C to 130°C or 32°F to 266°F (user selectable)	
RPM	60,000 (up to seven blades)	
Thrust	5,000g	
Auxiliary Analog Input**	0.1V - 2.6V, User configurable display value	
Display Resolution		
Voltage	0.005 V	
Current	0.010 A	
Watts	1 W	
Amp-Hours	0.001 AH	
Watt-Hours	0.1 WH	
Temperature Channels 1 & 2	0.1°C or F	
RPM	25, 50, or 100 (user selectable)	
Thrust	0.5g	
Auxiliary Analog Input	160µV	

Accuracy	
Offset	±1 count
Voltage	±0.1% of reading ±1 count
Current	±0.1% of reading ±1 count
Temperature Channels 1 & 2	±1°C or ±1.8°F
RPM	±0.1% of reading ±1 count
Thrust	±0.1% of reading ±1 count
Auxiliary Analog Input	±0.1% of reading ±1 count
Auxiliary Power Connector Requirements	
Voltage	6-30 Volts
Current	30 mA

APPENDIX A—BATTERY CELL VOLTAGES

NiMH and NiCD cells			
Cells	Discharged Voltage	Normal Voltage	Max Voltage
5	3.75	6.00	6.75
6	4.50	7.20	8.10
7	5.25	8.40	9.45
8	6.00	9.60	10.80
9	6.75	10.80	12.15
10	7.50	12.00	13.50
11	8.25	13.20	14.85
12	9.00	14.40	16.20
13	9.75	15.60	17.55
14	10.50	16.80	18.90
15	11.25	18.00	20.25
16	12.00	19.20	21.60
17	12.75	20.40	22.95
18	13.50	21.60	24.30
19	14.25	22.80	25.65

Lithium Cells			
Cells	Discharged Voltage	Normal Voltage	Max Voltage
1	3.0	3.7	4.3
2	6.0	7.4	8.6
3	9.0	11.1	12.9
4	12.0	14.8	17.2
5	15.0	18.5	21.5
6	18.0	22.2	25.8
7	21.0	25.9	30.1
8	24.0	29.6	34.4
9	27.0	33.3	38.7

NOTE: The “Discharged Voltage” column shows the voltage for a battery pack under load. When discharging a battery through the Power Analyzer PRO, the “Discharged Voltage” is the recommended voltage at which the discharging should be stopped. Consult your battery datasheet for more detailed information.

SUPPORT

If you are still having difficulties, or have questions that aren't covered in this manual, you can contact Medusa Research for support.
Our contact information is:

World Wide Web
http://www.medusaproducts.com

E-Mail
support@medusaproducts.com

Telephone Support
Hours: Monday-Friday 10am to 5pm eastern time, excluding business holidays
Phone Number: 508.675.0200 (in Fall River, Massachusetts)

WARRANTY

LIMITED WARRANTY

Medusa Research Incorporated warrants all Power Analyzers PRO to be free of manufacturing defects in material and workmanship for a period of 12 months from the original date of purchase. Should any defects covered by this warranty be found, the Power Analyzer PRO shall be repaired or replaced with a unit of equal performance by Medusa Research Incorporated.
In the event of a product defect during the warranty period, see the directions in the "Returns and Return Authorization" section.

LIMITS AND EXCLUSIONS

Only the original purchaser, who uses the Power Analyzer PRO in strict accordance with the information provided in this operation guide, may enforce this warranty.

This Warranty does not apply to:
1. Damage resulting from failure to follow instructions provided in this operations guideline
2. Damage resulting from misuse, reverse polarity on input or output wires, abuse or neglect.

3. Damage occurring as a result of poor solder joints, connector incompatibility, or mechanical failure of user installed input and output connections.
4. Damage resulting from any repair or alteration performed by someone other than Medusa Research Inc.

LIMITATION OF LIABILITY

(i) UNDER NO CIRCUMSTANCES WILL MEDUSA RESEARCH, INC. BE LIABLE FOR ANY INDIRECT, THIRD PARTY, SPECIAL, INCIDENTAL, CONSEQUENTIAL OR EXEMPLARY EXPENSES, COSTS, LIABILITY, LOSS, OR DAMAGE WHATSOEVER IN ANY CONNECTION WITH THE USE OR MISUSE OF, OR INABILITY TO USE THIS PRODUCT;
(ii) that Medusa Research, Inc. shall not be liable for any harm, loss, damages, expenses, costs, suit, claim or demand whatsoever against the user of this product;
(iii) that neither Medusa Research, Inc., nor any of its representatives, employees, officers, directors, agents, distributors, affiliated corporations or any other person, shall be responsible for nor shall incur, any liability, damages, loss, obligations or responsibility whatsoever (whether in equity, contract, tort or otherwise) for any harm, loss, reliance, or damages, whatsoever, that may arise in any connection with or result from any promise, advice, arrangement, agreement, statement, technical support or maintenance, representation, warranty, or information whatsoever, that may have been made to by Medusa Research, Inc.;

RETURNS AND RETURN AUTHORIZATION

For warranty and repair returns, please download a *returns form* from our website.

Instructions for packaging and shipping returns are also on our website.
If you do not have access to the Internet, please call or fax us at the number below.

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