FMA limited warranty

FMA, Inc. warrants this product to be free of manufacturing defects for the term of one year from the date of purchase. Should any defects covered by this warranty occur, the product shall be repaired or replaced with a unit of equal performance by FMA or an authorized FMA service station.

Limits and exclusions

This warranty may be enforced only by the original purchaser, who uses this product in its original condition as purchased, in strict accordance with the product's instructions. Units returned for warranty service to an FMA service center will be accepted for service when shipped postpaid, with a copy of the original sales receipt or warranty registration form, to the service station designated by FMA.

This warranty does not apply to:

- Consequential or incidental losses resulting from the use of this product.
- Damage resulting from accident, misuse, abuse, neglect, electrical surges, reversed polarity on connectors, lightning or other acts of God.
- Damage from failure to follow instructions supplied with the product.
- Damage occurring during shipment of the product either to the customer or from the customer for service (claims must be presented to the carrier).
- Damage resulting from repair, adjustment, or any alteration of the product by anyone other than an authorized FMA technician.
- Installation or removal charges, or damage caused by improper installation or removal.

Call (301) 668-7614 for more information about service and warranty repairs.

050110

Flight System Whatt Meter

Model FSWM1 — voltage and current sensor for Flight System Flight Recorder

Features

The Flight System Whatt Meter measures key electrical characteristics of the propulsion system battery in an electric-powered RC aircraft.

- Measures current (Amps), capacity (Amp-hours), voltage, power (Watts) and energy (Watt-hours).
- Connects between battery and electronic speed controller (ESC) using standard Deans connectors.
- Connects to the Flight System Flight Recorder, which records Whatt Meter data during flights, and provides real-time data during bench testing.
- Review data in the Flight System Viewer Software, which graphically displays electrical measurements during flights.

Note: Whatt Meter requires other FMA Flight System components to operate (see "Components you will need"). It cannot operate by itself, or with non-Flight System RC electronics.

Components you will need

You must supply the following items:

- FS8 Co-Pilot (FMA part number FS8CP).
- FS Flight Recorder (FMA part number FSFR90).
- FS Viewer Software (supplied with FS8 Co-Pilot).
- FS PC Interface (FSIM1).
- A Windows®-compatible PC.

FMA, Inc. ● 5716A Industry Lane ● Frederick, MD 21704

Sales: (800) 343-2934 ● Technical: (301) 668-7614 ● www.fmadirect.com

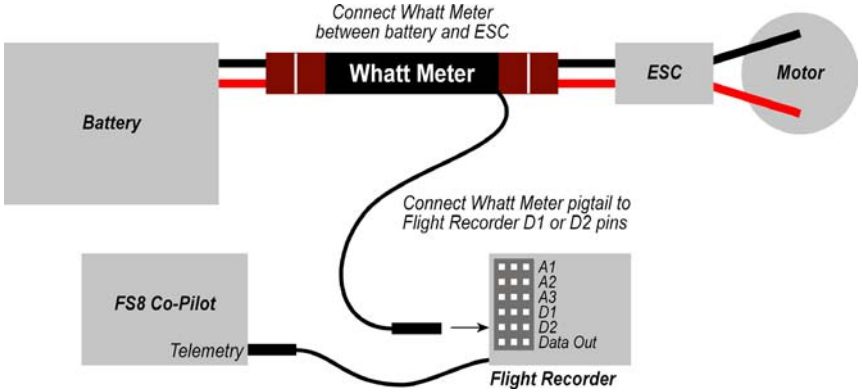
Installing Whatt Meter

1. If you intend to use Whatt Meter to evaluate more than one battery pack, you can code data for each different pack (up to 10 packs). To code data for a pack, set the Whatt Meter switches to a number unique to that pack. The following table shows how to set the switches, and provides a column where you can describe the pack associated with a code:

		Whatt Meter Switches			
Pack description	**Code**	**S1**	**S2**	**S3**	**S4**
	1	**ON**	off	off	off
	2	off	**ON**	off	off
	3	off	off	**ON**	off
	4	off	off	off	**ON**
	5	**ON**	off	off	**ON**
	6	off	**ON**	off	**ON**
	7	off	off	**ON**	**ON**
	8	**ON**	off	**ON**	**ON**
	9	off	**ON**	**ON**	**ON**
	10	**ON**	**ON**	**ON**	**ON**

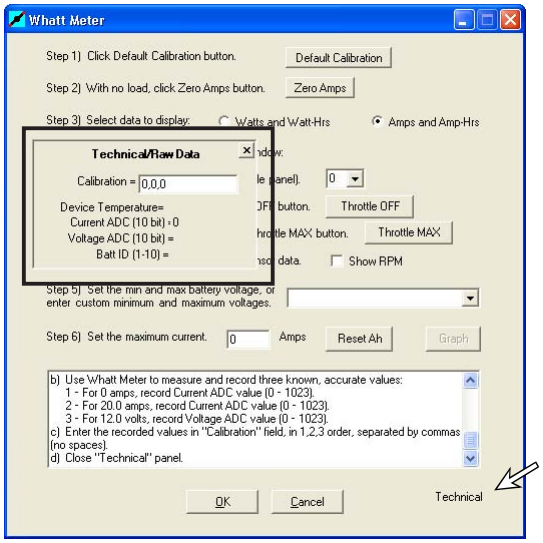
2. Connect the components as shown below.

CAUTION: Observe polarity for all connections! Note that the Whatt Meter pigtail plugs into the Flight Recorder with the black wire toward the outside. Incorrect polarity may damage components. Failure to observe correct polarity voids product warranties.



Specifications

Current	60A maximum, with 100mA resolution
Voltage	36V maximum, with 30mV resolution
Noise filter	1 second, 1000 point averaging
Operating temp.	0º to 200ºF
Dimensions	82mm x 14mm x 8mm
Weight	18 grams

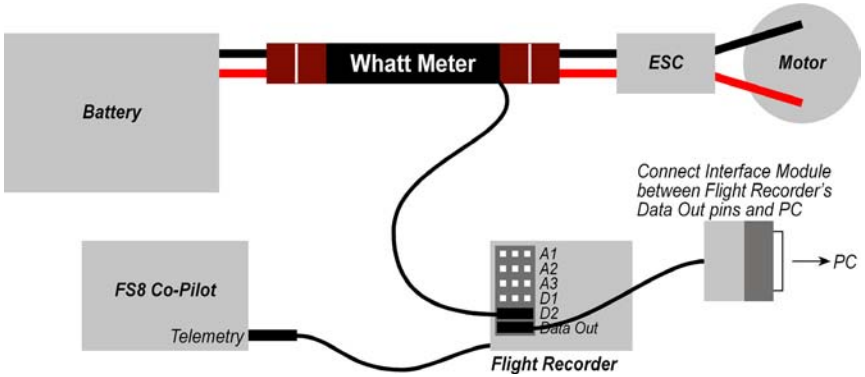


Other information

- Amp-hour (or Watt-hour) data applies to a single charge for a single battery. If you charged the battery, or switched to a different battery:
  a. Stop data playback at the point where you charged or switched.
  b. In FS Viewer, open the **Whatt Meter** window.
  c. Click the **Reset A-h** button to reset the Amp-hours (or Watt-hours) total.
  d. Click **OK** to close the **Whatt Meter** window.
  e. Resume playback.
- For bench testing, you can record and view data at the same time by keeping Flight Recorder connected to your PC.
- Whatt Meter's factory default calibration provides ±5% measurement uncertainty. If you have an accurate voltmeter and ammeter, you can calibrate Whatt Meter to reduce uncertainty to as little as ±1%. Here is the general procedure (details are left to those with calibration experience):
  a. Connect Flight Recorder to your PC using the FS Interface Module.
  b. Turn on your transmitter, then turn on the FS8 Co-Pilot receiver.
  c. In FS Viewer, open the **Whatt Meter** window.
  d. In the lower right corner of the **Whatt Meter** window, click **Technical**. This opens the **Technical/Raw Data** panel (shown on opposite page).
  e. Connect Whatt Meter and an accurate ammeter in series to measure current between a power supply and a 20A load.
  f. With no current flowing (0.00A), record the **Current ADC** value displayed in the **Technical/Raw Data** panel. This is value #1.
  g. Adjust current to 20.0A, then record the **Current ADC** value displayed in the **Technical/Raw Data** panel. This is value #2.
  h. Connect Whatt Meter and an accurate voltmeter in parallel to measure voltage output from an adjustable power supply.
  i. Adjust voltage to 12.0V, then record the **Voltage ADC** value displayed in the **Technical/Raw Data** panel. This is value #3.
  j. In the **Technical/Raw Data** panel, in the **Calibration** field, enter values #1, #2 and #3 separated by commas (no spaces).
     Example calibration format: 12,1009,998
  k. Close the **Technical/Raw Data** panel.
  l. Click **OK** to close the **Whatt Meter** window.
  m. Turn off the receiver, then turn off the transmitter.

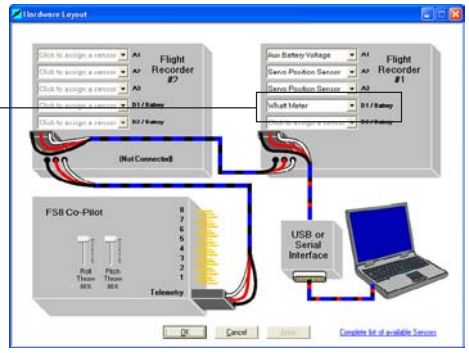
Setting up Whatt Meter

1. If you haven't already installed the FS Viewer Software, do so now. Follow the instructions provided in the FS Viewer Software manual.
2. Connect Flight Recorder to your PC as shown here (details are in the Flight Recorder manual).



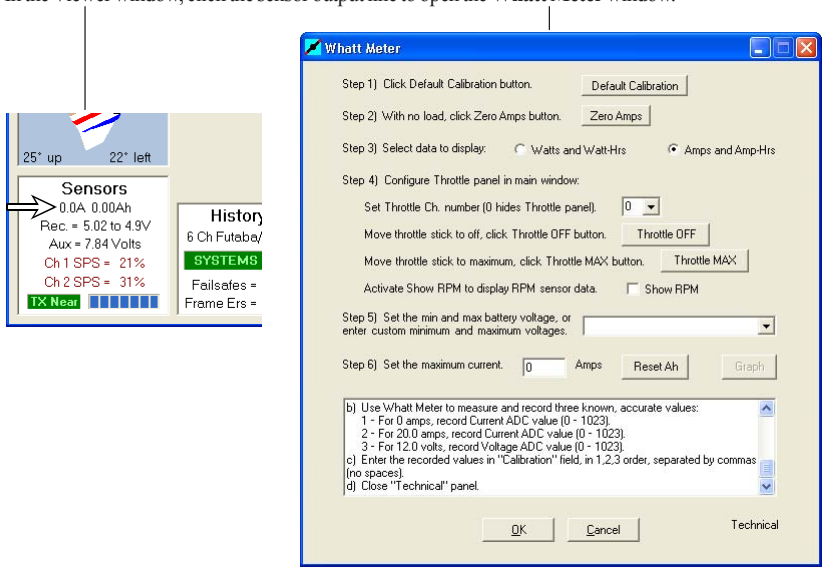
3. Launch the Viewer Software. Check for updates using the **Help > Update Software** command in the Viewer.
4. Open your default aircraft template (usually named "My Aircraft"). You will store Whatt Meter setup data in the default template.
5. **View > Hardware Layout** to open the **Hardware Layout** window. Then:
   - If you are using only one Flight Recorder:
     a. In Flight Recorder #1, open the list corresponding to the port (D1 or D2) that Whatt Meter is connected to.
     b. In the list, click **Whatt Meter**.
     c. Click **Apply**.

     If Whatt Meter were connected to Flight Recorder's D1 port, the **Hardware Layout** window would look like this, with the D1 list set to **Whatt Meter**:



   - If you are using two Flight Recorders:
     a. In the Flight Recorder #1 or #2 (as appropriate), open the list corresponding to the port Whatt Meter is connected to.
     b. In the list, click **Whatt Meter**.
     c. Click **Apply**.

6. In the **Hardware Layout** window, click **OK**.
7. Turn on your transmitter, then turn on the FS8 Co-Pilot receiver.
8. Move the transmitter sticks to make sure you are seeing real-time data in the Viewer window.
9. In the Viewer window, click the sensor output line to open the **Whatt Meter** window.



10. Follow the instructions in the **Whatt Meter** window:

Step 1) Click the **Default Calibration** button to begin setup.

Step 2) Click the **Zero Amps** button to set the zero current.

Step 3) Select the data you want to display: **Watts and Watt-Hrs** or **Amps and Amp-Hrs**.

Step 4) Configure the Throttle panel (which is displayed in the main window):

a. Open the **Throttle Ch.** list, then click the throttle channel number (usually channel 3).

b. On the transmitter, move the throttle stick to its full off position, then click the **Throttle is OFF** button in the **Whatt Meter** window.

c. Firmly hold the aircraft (or disconnect the motor, or remove the propeller), move the throttle to its full on position, then click the **Full Throttle** button in the **Whatt Meter** window.

Notes: If **Throttle Ch.** is set to 0, the Throttle panel will not appear in the main Viewer window. The **Show RPM** option applies to the Flight System RPM Sensor, available separately.

Step 5) Set the minimum and maximum battery voltage:

- Open the list and click the appropriate value.
  or
- Open the list and click **Custom**, then enter voltage range in the following format:

  xx.xx to xx.xx (for example, 10.75 to 16.5)

When battery voltage drops below the minimum you set here, the voltage alarm in the main window turns red. This step also scales the voltage and current bars in the throttle panel.

Step 6) Enter the maximum current you expect to draw from the battery. When current exceeds this amount, the current alarm in the main window turns red.

11. Click **OK** to close the **Whatt Meter** window.
12. **File > Save** to save the default aircraft template. (Whatt Meter does not store settings. Settings are saved in templates.)
12. Turn off the receiver, then turn off the transmitter.
13. Disconnect the PC Interface Module from the Flight Recorder.

Viewing Whatt Meter data

After collecting data during one or more flights...

1. Connect the Flight Recorder to your PC using the PC Interface Module.
2. Download data from the Flight Recorder, then play it back (see instructions in the FS Flight Recorder manual).
3. You can view electrical data with bar graphs in the **Throttle** panel of the main Viewer window (below, right). Close the **Throttle** panel, and electrical data appears in the **Sensors** panel (below, left).

Note: You must play back all flights for one pack to see its Amp-hour or Watt-hour total.