

the 'chopped' supply to the motor and show a voltage much lower than is actually being supplied, giving an erroneous voltage and power reading.

Q. When using the FPM I sometimes get 'No Data being received' message when the model is relatively close. Why is this?

A. The most probable cause is either the FPM aerial on the model being shielded by other wiring or metal objects. Try repositioning this aerial. The aerial on the FPM hand unit may similarly be affected by radio reflections and shielding from metal objects within a few metres including cars, folding chairs, R/C transmitter aerials etc. Try moving the unit a short distance away from these things.

Enjoy your Flying!

Notes

Operating Guide Flight Power Meter FPM-P7501

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and wood will not noticeably affect the range of the FPM.

Q. You say that the range of the FPM is up to 300 mtrs. Is this enough?

A. Yes, this is based on the radio module manufacturers' data; however with an air to ground line of sight path a much greater range is normally seen. Assuming there are no problems due to, say, the aerial being masked by batteries or wiring and the hand unit is clear of cars or other metal objects the range is much greater than one would ever fly a model in normal use.

Q. How do I switch off the FPM in the model if it is not being used?

A. The current drawn by the FPM is only a few milliamps and would have no noticeable effect on a battery pack. For example, with a 2700 mAh pack it would take more than 200 hours for the FPM to discharge it.

Q. After switching on the R/C, model, and the FPM I notice that there is current drawn and power used even though the motor is switched off. Why is this?

A. The FPM measures the power being supplied by the battery pack. Some power is used by the R/C system, particularly servos, and this shows on the FPM. Note that a servo can draw a peak of as much as one amp; hence three servos can draw three amps. With a battery pack voltage of, for example, 10 volts this represents 30 watts drawn just by the servos. Normally this would be the peak power drain by the servos, not the normal power, unless there is a fault with the R/C installation and a servo is being stalled.

Q. Why must the FPM be installed between the battery and the ESC, and not between the ESC and the motor?

A. The FPM cannot be installed between the ESC and the motor, because when the motor is off there would be no power for the FPM. Similarly, at part throttle the FPM would smooth

Q. What would happen to the FPM if the motor stalls and the current goes above 50 amps?

A. The FPM is designed to measure up to 50 amps; however it is unlikely to be damaged by current even considerably above this provided the duration is not too great. The other equipment, battery pack, ESC, motor, is more likely to be damaged than the FPM.

Q. I have accidentally connected the FPM with the wrong polarity to the battery pack. Is this likely to have damaged it?

A. No. Although it is not at all advisable to connect the FPM incorrectly we have found that damage is unlikely due to this. Note that the unit will not work at all if connected with the wrong polarity.

Q. I am receiving data from the FPM unit in the model, but no current or power is displayed when the motor is running. Why is this?

A. Ensure the FPM is connected correctly. Battery connections connected to the battery and ESC connections connected to the ESC. If this has been transposed the current will flow the 'wrong way' through the unit and not be measured. No damage will occur due to this.

Q. Where should I position the FPM aerial wire in the model?

A. The aerial should be positioned as far as reasonably practicable from other metal components in the model and, ideally, at right angles to other wires or equipment such as batteries, motors, receivers and servos. Clearly it cannot be very far from these; however practical experience has shown that this is not normally much of a problem.

Q. Does the aerial wire need to be outside the model like the R/C aerial wire?

A. The FPM aerial wire is very short, so simply position as far from other metal containing objects such as wires, motors, speed controllers, receivers as practicable. Foam, fibreglass

Introduction

The Flight Power Meter P7501 is designed to measure the current, voltage and power being supplied to the motor of an electrically powered aircraft whilst in flight, in real time. The P7501 is in two parts; the transmitter/sensor unit which is installed in the aircraft, and the handheld receiver unit which remains with the pilot or assistants. The power, current and voltage are displayed on the LCD in a manner similar to that of an electrical multimeter.

The P7501 has three modes of operation: -

1. Normal display of power, current and voltage in real time.
2. Low Flight Battery Voltage Alert. This warns the pilot that he/she should land immediately. This is of particular use for LiPo battery powered models where the battery voltage must not be allowed to drop too low (resulting in damage to the pack), and also on larger models where the motor(s) may be operated at reduced throttle and the flight pack becomes discharged to a dangerous level, unknown to the pilot. The Low Voltage Alert mode may be enabled mid flight.
3. Record Mode. The data can be recorded for replay and examination at a later date. This is of particular use where the pilot(s) are busy and cannot safely observe the readings whilst flying. A recording may be started mid flight.

A low internal battery alert warns the user that the internal 9v battery needs replacing. **Note** : *This is the internal battery, not to be confused with the aircraft flight battery.* A rechargeable battery may be used here if desired.

Specifications

Flight Power Meter P7501. General: -

Operating Voltage Range

6 – 20 volts (6 - 16 cells NiCd / NiMh) (2-5 cells LiPo)

Radio Range:

Approx 300 mtrs (1000 ft) - greater than normal flying range

Operating Power Range:

0 - 1000 Watts

Temperature Range:

-10 to + 40 deg C

Humidity Range:

Up to 95% non-condensing

Power Requirements:

Tx Unit (Airborne section) 12 mA from Flight Pack

Rx Unit (Ground section) ~ 25mA when receiving, ~15 mA

when replaying (Internal Rx is switched off) from internal 9 volt battery (PP3 type)

Low Voltage Warning:

Preset by user, the Rx Unit (Ground section) will sound an alert when the airborne battery drops below this voltage (selectable 6 - 20 volts)

Flight Pack Cell Capacity:

Minimum of 300 mAh recommended. No maximum limit

Measurement Range:

Voltage 6 – 20 Volts, Current 0 – 50 Amps,

Power 0 – 1000 Watts

Frequently Asked Questions

FPM P7501 Frequently Asked Questions

Q. Why should I range check after fitting the FPM?

A. Whilst it is very unlikely that the FPM will introduce any new problems, it is always wise to ensure the integrity of the R/C model control after making any modifications.

Q. How do I carry out a range check?

A. A range check is best carried out with an assistant to hold the model. Beware that the motor may start unexpectedly and the propeller can then become a hazard. Always check with the motor off, at half power, and at full power. Switch on both the R/C transmitter and the model. With the transmitter aerial retracted, test the controls. Increase the distance from the model until the controls no longer operate smoothly. This distance should be at least approximately 25 metres. If in any doubt of the R/C link do not fly until any queries have been answered.

Q. With what battery packs and motors can I use the FPM?

A. The FPM can be used with any motor or battery pack combination, LiPo, NiMh, NiCd, brushed or brushless motors etc as long as the maximum voltage and current do not exceed the specifications for the FPM.

Q. I have a multi-engined model. Can I use the FPM with this?

A. Yes. If the motors are running from one battery pack, position the FPM between the battery and the ESC(s). The FPM will show the total current and power supplied by the battery. With two or more battery packs the FPM must be installed in line with one pack at a time. After determining the data needed, move it to the next pack. Generally, if identical packs, ESCs, props and motors are used, the data pertaining to one pack will apply to the other.

Instantaneous Recording

To make an Instantaneous Recording during a flight: -

- Press 'Rec' (●). The message 'Instantaneous Recording' will be seen, then 'Recording File #05'. The display will revert to the normal data screen.

A flashing 'R' will be seen on the LCD, at the bottom left of the screen.

To stop a recording during a flight: -

- Press 'Stop' (■). The message 'End of Recording' will be seen.

A new recording may then be started if required.

Measurement Rate: 2 full data readings per second

Accuracy:

Voltage 0.5% Or 1 LSD, whichever is greater

Current 1.0% Or 1 LSD, whichever is greater

Power 1.5% Or 2 LSDs, whichever is greater

Display:

LCD Display – 16 x 2 line reflective

Data Storage:

128k Non-volatile EEPROM. Greater than 45 minutes of data may be recorded, arranged as up to 24 files. The data may be replayed at any time after a flight.

Installation

The Flight Power Meter P7501 is in two parts. The Transmitter unit is installed in the aircraft by connecting it between the flight battery pack and the ESC. Take care to ensure the correct polarity and correct orientation. (Motor side to motor. Battery side to battery.) Due to the low current requirement of the FPM and, normally, the large capacity of flight packs, no switch is included. The time to significantly discharge a flight pack is likely to be tens of hours. The FPM can be in any position within the plane; however it is best to arrange the aerial wire to be away from wiring or metal work as this can 'shield' the aerial and result in reduced range. The aerial wire does not generally need to be routed outside the aircraft.

Note that the current for the BEC (as supplied by your ESC) circuit will be carried through the FPM, including the current supplied to the servos. When in use, operation of the servos can sometimes be seen but it is generally smoothed out by the circuitry in the FPM; however to avoid errors in calibration do not move the sticks whilst auto-zeroing is happening.

Do Not fit between the motor and ESC; it will not work in this position. This is because when the motor is shut down, there would be no power to supply the FPM! This would result in 'No Data Being Received' messages along with the loss of the auto-zero settings.

For models with multiple battery packs (generally larger models with multiple motors), simply install between one pack and the associated ESC.

The ground, or handheld unit does not have any particular installation requirements. Avoid 'shielding' the aerial with metal work such as the bodywork of cars etc. Due to the radio frequency used, occasional effects resulting in loss of received signal may occur ('No Data Being Received' messages). These

File #05' will be seen.

- 'Select File #05' Press ◀ or ▶ to choose the file to replay. When the chosen file is selected press 'Yes' or 'Sel'. The message 'Ready to Replay Data' will be seen.
- 'Ready to Replay Data?' Press 'Yes' or 'Sel'. The data will start to replay.

During replay a short 'tick' will sound to denote each data packet and a flashing 'P' will be seen on the LCD, at the bottom left of the screen.

To Use the Delete Data mode

The Delete Data mode will delete **All** data stored in the FPM P7501. It is not possible to delete only selected files.

- 'Record, Replay or Delete Data?' Press 'Yes' or 'Sel'.
- 'Record Data?' Press 'No' or 'Stop' (■). The message 'Replay Data?' will be seen.
- 'Replay Data?' Press 'No' or 'Stop' (■). The message 'Delete All Data?' will be seen.
- 'Delete All Data?' Press 'Yes' or 'Sel'. All data will now be deleted.

During a flight (or to save switching off / on), should the Record Mode be required:

- Press 'Sel'. The FPM asks 'Use Low Voltage Alert?'
- 'Use Low Voltage Alert?' Press 'No' or 'Stop' (■) to skip past this mode (unless you wish to use it at this time). The message 'Record, Replay or Delete Data?' will then be seen.
- 'Record, Replay or Delete Data?' Press 'Yes' or 'Sel'. The required mode may then be selected as above.

Record and Playback of data

The data received during a flight may be recorded for replay and examination at a later time. This is a user selectable function, and the user may then select which of the modes to use; these being to record, replay, or to delete stored data.

To select this mode: -

- 'Record, Replay or Delete Data?' Press 'Yes' or 'Sel'
- *Now select the required function -*
- 'Record Data?' Press 'Yes'/'Sel', or 'No'/'Stop' (■).
- 'Replay Data?' Press 'Yes'/'Sel', or 'No'/'Stop' (■).
- 'Delete All Data?' Press 'Yes'/'Sel', or 'No'/'Stop' (■).

The FPM will now move on to the Data Receiving mode.

To use the Record Data mode:

- 'Record, Replay or Delete Data?' Press 'Yes' or 'Sel'.
- 'Record Data?' If you would like to record flight data press 'Yes' or 'Sel'.
- '45 mins. available' Press 'Yes' or 'Sel'. The file number will be displayed, e.g. 'Recording File #05'.
- 'Recording File #05' Press 'Yes' or 'Sel'. The data will now be recorded once auto-zeroing is completed.

To indicate that the Record Mode is switched on, a flashing 'R' will be seen on the LCD (at the bottom left of the screen) whilst the FPM is receiving data.

To use the Replay Data mode

- 'Record, Replay or Delete Data?' Press 'Yes' or 'Sel'.
- 'Record Data?' Press 'No' or 'Stop' (■). The message 'Replay Data?' will be seen.
- 'Replay Data?' Press 'Yes' or 'Sel'. The message 'Select

are often caused by reflection of the signal from metal work, which may include objects such as folding chairs, the aerial of an R/C transmitter etc. Should this happen, simply move the unit one or two metres to one side.

Avoid getting the unit wet.

Always carry out a range check prior to flying after making any alteration to the control system of a model aircraft. This includes removing the FPM or making any significant component change to the aircraft.

Operation

Install the FPM as detailed in the Installation section of this manual.

Connect the flight battery pack and ready the aircraft for flight as normal.

When the aircraft is ready for flight, switch on the handheld unit, select Low Flight Pack Alert Mode or Recording Mode as required (see relevant sections of this manual) and wait for the Auto-zeroing to complete. Whilst the FPM is auto-zeroing **do not** move the sticks on the R/C transmitter; this would cause the servos to move and the current drawn might cause zero errors in the FPM. If this happens accidentally, switch off the FPM handheld unit and switch back on again. Wait whilst the unit again auto-zeros.

Upon completion of auto-zero the display will show the Power, Current and Voltage supplied to the motor by the Flight Battery Pack.

During a flight, if one wishes to start using either the Low Voltage Alert or Record Mode this can be done. See the relevant sections of this manual. Do not start these modes by switching off and then switching back on, as the auto-zero will need to be carried out again and this cannot be done if either the motor or the servos are being operated.

Low Flight Pack Voltage Alert

The Low Flight Pack Alert (Low Voltage Alert) is a user selectable function to warn if the flight battery voltage drops below a preset point.

This mode can be selected at switch-on by pressing the 'Yes' key when the message 'Use Low Voltage Alert?' is seen. To select this mode: -

- 'Use Low Voltage Alert?' *Press Yes.*
- 10.00 Volts *Press either ◀ or ▶ keys to change the voltage or*
- When the correct voltage is displayed *Press 'Yes' or 'Sel'.*
- The 'Low Flight Pack Alert = 10.00v' message will be seen.

If this mode is not required, when the message 'Use Low Voltage Alert?' is seen.

- 'Use Low Voltage Alert?' *Press No.*

The FPM P7501 will move onto the Record Selection Mode.

Whilst flying (or to save switching off then back on again), if the Low Flight Pack Alert (Low Voltage Alert) is required:

- *Press 'Sel'.* Then the mode can be selected as above.

To indicate that the Low Voltage Alert is engaged, a flashing 'L' will be seen on the receiver display, at the bottom left of the screen, whilst the FPM is receiving data.