

JP·EnerG Pro

# FIELD MASTER 7



## Instruction Manual

## CAUTION - BEFORE YOU START

This is a sophisticated unit which will be an important tool in your electric powered model program. Please be careful with it! And please read this instruction manual thoroughly before operating.

Do not disassemble, modify or subject the unit to force impact.

Keep the Field Master 7 well away from dirt or water.

High power electrical systems pose dangers independent of devices like the Field Master 7 and it is the user's responsibility to be familiar with these dangers and take any necessary action to ensure safe use. Shorting a rechargeable battery or a Field Master 7 connected to a rechargeable battery or battery charger can supply huge currents and have serious consequences including explosions, causing fire, damage to equipment and personal injury.

There are risks associated with the potentially high currents measured by the Field Master 7. These include, but are not limited to, fire, burns and personal injury. The user must be familiar with the relevant methods, procedures and connection components before using or making any connection.

Do not exceed a maximum of 60 volts for the main power pack (MPP)

Keep proper distance from propeller during measurement process.

## WARRANTY

J. Perkins Distribution Ltd. guarantee this product to be free of manufacturing or assembly defects for a period of one year from time of purchase. This does not affect your statutory rights. This warranty is not valid for any damage or subsequent damage arising as a result of a misuse, modification or for damage or consequential damage arising as a result of failure to observe the procedures outlined in this manual. Operation of this product is carried out entirely at the risk of the operator. Please note that, whilst every effort is made to ensure the accuracy of instructions and material included with this product, mistakes can occur and neither J. Perkins Distribution Ltd nor its distributors will be held liable for any loss or damage arising from the use of this product or for any loss or damage arising from omissions or inaccuracies in the associated instructions or materials included with this product.

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## EU REGULATIONS

J Perkins Distribution Ltd declares that this product is in compliance with the essential requirements and other relevant provisions of Directive 2204/108 EC on Electromagnetic Compatibility. A copy of the declaration(s) of conformity can be obtained from J Perkins Distribution Ltd, Ashford rd, Lenham, Kent. UK ME17 2DL. This system complies with the EU directive on Waste Electrical and Electronic Equipment. Do not dispose of this product in household waste. At the end of the products' life, dispose of it at a designated collection point for the recycling of waste electrical and electronic equipment. Please contact your supplier for any advice required on disposal.



## INTRODUCTION

Thank you for purchasing the JP EnErG Pro Field Master 7. The JP EnErG Pro Field Master 7 can carry out an enormous range of functions related to Electric Powered models and has been designed with ease of use as a prime objective. This Instruction Manual describes the scope of Field Master 7 and how to make it work for you.

## PRODUCT SPECIFICATIONS

- ▶ Max input voltage: 60V
- ▶ Voltage measurement range: 2-8S LiPo/LiFe/Lilon
- ▶ Voltage display resolution: 0.001V
- ▶ Volt Port: 2.54mm pitch pins, 9 pins
- ▶ Max current: 100A
- ▶ Shunt resistance: 0.001ohm
- ▶ Displayed resolution A: 0.01
- ▶ Temperature resolution: 1 Celsius / 1 Fahrenheit
- ▶ PPM signal output: 750uS – 2150uS
- ▶ Number of propeller measurable : 1 to 5
- ▶ Propeller rotating range: 1-60000RPM
- ▶ Dimension: 95.3x72.8x21.5mm
- ▶ Net Weight: 85g

## BOX CONTENTS

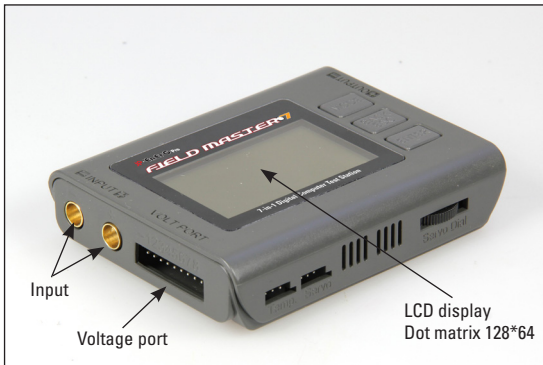
1. Field Master 7
2. Temperature Probe
3. Input Cable
4. Battery Internal Resistance Cable
5. Output Cable



## FEATURES

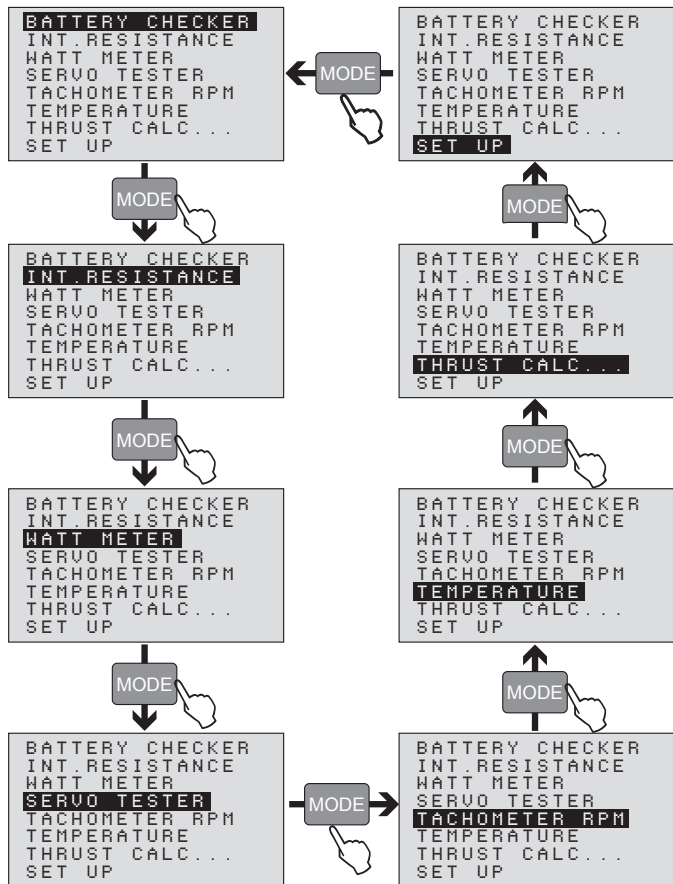
1. Battery Checker
2. Battery Internal Resistance
3. Watt Meter
4. Servo Tester
5. Optical Tachometer
6. Temperature Gauge
7. Thrust Calculator

## CONTROLS



## MAIN MENU

The Main screen displays all the available functions. Scroll through the functions using the 'MODE' button, press the 'ENTER' button to select the required function.



## BATTERY CHECKER

A balanced battery provides a safer environment when flying. If you know that your cell balance is out you can address the issue. The prevention of deteriorating cells over time, will improve the efficiency and stability of the Lithium battery.

The Field Master 7 allows you to check the individual cell voltages of a 2-8cell Lithium battery. The Field Master 7 individually measures & diagnoses the cell voltages of the multiple cells, the result is displayed on the large LCD screen. The Field Master 7 replaces all of the tedious measurement and calculations required in the past to determine the overall voltage of the LiPo, LiFe & Lilon pack and the individual cell voltages that determine the balance of the Lithium pack.

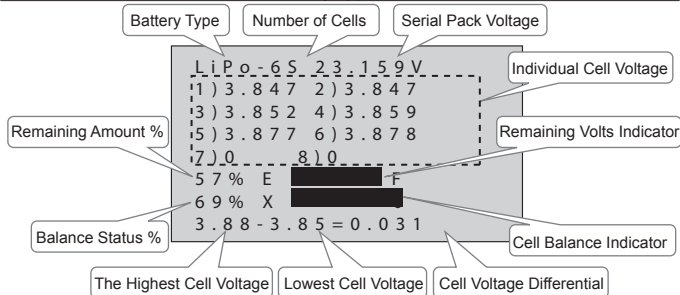
The Field Master 7 now makes it possible to determine and verify the detailed state of the Lithium battery.

When you connect the balance lead to the Field Master 7 you must ensure correct polarity is observed, connect the negative pin of the battery to the negative pin of the Volt Port, displayed above the socket.

**Note: Different Balance leads have different wiring configurations and some are coloured. The Field Master 7 has 2.54mm pin intervals. If the connector on your battery does not fit do not force the connector, obtain a suitable adaptor lead from your local hobby shop.**



- ▶ Connect the balance lead to 'VOLT PORT'
- ▶ Press 'ENTER' to enter main function screen
- ▶ Press 'ENTER' to select BATTERY CHECKER function
- ▶ Press 'MODE' to select battery type
- ▶ Press 'ENTER' to confirm battery type (LiPo, Life or Lilon)



## SERIAL VOLTAGE

Pack voltage of the whole battery (total voltage of all cells) is indicated

## THE NUMBER OF SERIAL CELLS

The total number of cells in the battery pack is indicated (6S as indicated in the picture 6 serial cells). This is the same as the cell quantity.

## REMAINING VOLTAGE INDICATOR

The remaining amount indicator gives you a graphical bar graph display of the status of the battery by graph and the balance of the cells by graph. When the battery is fully charged the graph extends to "F" on the right hand side of the LCD. As in the example you can see that the battery is about 50% used. There are times when differences occur between the remaining amount and the actual remaining amount.

These differences can be associated with the quality and use of the battery and its cells. A battery that has always been charged with a reputable balancer is likely to reproduce accurate readings on the Field Master 7. A battery that has had a hard life full discharge and recharge with no balance charging is more likely to have discrepancies between actual and shown results.

## CELL BALANCE INDICATOR

The Cell balance indicator measures the difference between all cells that are connected to the Field Master 7.

The difference is shown graphically between the cell that is showing the highest cell voltage to the cell that is showing the lowest cell voltage (largest cell voltage difference) indicated on the graph. When the cell voltages read equal, the bar extends all the way to the right (0). This indicates that the cells are all balanced to a satisfactory level. When the cells have a difference in voltage the bar shortens and indicates towards the left (X). In order to maintain

long lasting battery life if the balance gauge does not show a satisfactory cell balance then a cell balancer should be applied to the pack before use. If the cell balance indication is low after the battery has been used this can be normal and charging should occur with a balance charger.

## BATTERY INTERNAL RESISTANCE

The Battery internal resistance feature included in the Field Master 77 will provide you with true cell and pack ratings by providing a useful measure, the cell internal resistance.

- ▶ Connect battery via Voltage Port to power on the Field Master 7
- ▶ Using supplied cable (pitch 2.54mm) to measure individual internal resistance
- ▶ Press 'MODE' to select 'INT. RESISTANCE' function
- ▶ Press 'ENTER' to confirm selection



Once we have an idea of the internal resistance of a cell we can then use that to determine how efficient our power setup is as well as knowing how much power is being turned to heat in the battery pack and additionally know how much the voltage can potentially drop under load.

```
BATTERY CHECKER
INT. RESISTANCE
WATT METER
SERVO TESTER
TACHOMETER RPM
TEMPERATURE
THRUST CALC...
SET UP
```

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Int. Resiatance
Res: 39 mohm
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Let it be stated that there is no perfect test for cell internal resistance. Due to the nature of batteries, cells exhibit characteristics of resistance, capacitance and inductance of which all contribute to the measured internal resistance. Internal resistance can vary considerably even within the same cell, this makes the task of determining the internal resistance a lot harder.

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**FACTORS EFFECTING RESISTANCE READINGS:****Contact corrosion**

While not actually part of the cell itself, having dirty contacts to the cells can make a noticeable difference in the resistance. Wiping clean the contacts can improve contact resistance by 10 or more milliohms.

**Cell temperature**

For many cell chemistries the resistance of the pack decreases initially from room temperature to a certain level (perhaps 45C) after which the resistance of the pack will increase again. Lithium cells in particular suffer poor cell resistance near 0C.

**Cell charge**

Generally the closer to a full charge a cell is the lower the internal resistance.

**Cell age**

As cells become older their internal resistance tends to increase.

The Field Master 7 has been built to allow cells to be tested under a known set of loads which will facilitate comparisons.

**PRECAUTIONS!**

1. Do not leave a cell connected to the Field Master 7 for more than 5 minutes.
2. Be aware that although the Field Master 7 only takes small samples from the battery pack, the voltage will be reduced. Make sure you check your pack balance.
3. Do not plug the cell in reverse polarity.
4. Do not connect more than 5V to the cell inputs.

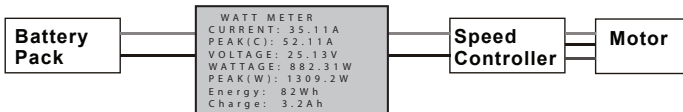
## WATT METER

The precise measurements provided by the Watt meter function will help you fine tune your model to set it up for optimum performance.

This function measures Current (Amps), Peak current, Voltage (Volts), Power (Watts), Energy (Watt-Hours) and Charge (Amp-Hours) values for you, in real-time, for the circuit in which you connect it.

Determine things like:

- ▶ Flight time
- ▶ Current through an ESC and motor
- ▶ ESC, BEC and motor efficiencies
- ▶ Charge put into and removed from a battery and the performance of battery chargers
- ▶ Battery health
- ▶ Why power is lost during acrobatics or extreme conditions
- ▶ Effect of gearing and propeller size and shape on power consumption and battery currents
- ▶ Effects of modifications, age and damage on many electrical system components
- ▶ Clever hobbyists will discover new applications to further improve electric model performance.

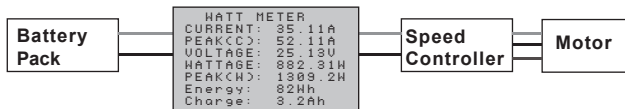


The Field Master 7 is activated when the battery is connected to the unit.

- ▶ Press 'MODE' to select 'WATT METER' function
- ▶ Press 'ENTER' to confirm selection

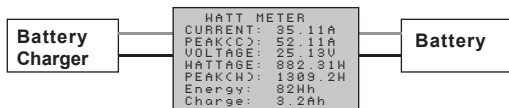
The following are some examples of meter connections. Many other arrangements and uses are possible

### TESTING LOADS (E.G. MOTORS)



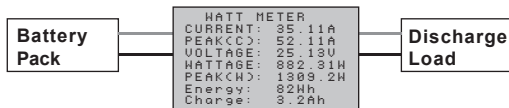
Battery on SOURCE side, Electronic Speed Controller (ESC) and motor on LOAD side, with ESC on, the meter shows the current into the motor, voltage and power at the battery and accumulates the charge (Ah) while the motor is running.

### BATTERY CHARGING



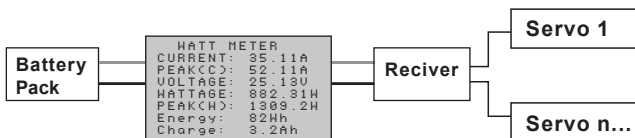
With a battery charger on the SOURCE side and battery pack on the LOAD side, the meter shows the charging current into the battery, the voltage and charging power at the battery and accumulates the charge (Ah) into the battery.

### BATTERY DISCHARGING



When the battery is discharged, the meter indicates the total charge (Ah) the battery delivered to the load as well as current, voltage and discharging power.

### RECEIVER & SERVO TESTING



## SERVO TESTER

Servo testers are very useful for testing your servos and Electronic Speed Controller (ESC) without the need to turn on your transmitter or receiver. The servo tester will put out a signal just like the signals normally sent by your receiver to the servos or ESC. The dial on the servo tester will change the signal just like moving your transmitter stick would change the signal going to an ESC.

### TO USE THE TESTER TO EVALUATE A SERVO

Connect a battery to the Field Master 7 volt port. Plug a servo into the servo port. The servo can be controlled with the adjustment dial under Manual Mode. Press 'MODE' button once to set the PPM signal to auto. The servo tester will use 1520us as centre and automatically output a cycling signal to move the servo arm back and forward.



### TO USE THE SERVO TESTER TO OPERATE AN ESC AND MOTOR

Connect a battery to the Field Master 7 volt port. Plug the ESC lead into the servo socket that normally goes to the receiver. Connect the ESC to motor leads. When you connect the battery to the ESC it will power up. It should react the same way it does when powered up using the radio gear with the throttle stick in the minimum power position. You can now spin up the motor by turning the servo tester dial. No receiver or transmitter is needed. This is a great way to test motors on the bench.

## TACHOMETER RPM

There is an optical tachometer within Field Master 7. An optical tacho sensor is fitted to the right side of the case and is activated by pointing Field Master 7 towards the propeller at a distance of 10 and 20cm from the propeller.

- ▶ Connect battery via Voltage Port to power on the Field Master 7
- ▶ Press 'MODE' to select "TACHOMETER RPM"
- ▶ Press 'ENTER' to confirm the function
- ▶ Press 'MODE' again to change the range of 1-5 blades
- ▶ Press 'ENTER' to start RPM measurement



The fluctuating light caused by the rotation of the propeller is sensed and counted over a period of either 1 or 2 seconds. Allow a couple of seconds for readings to steady.

With a geared motor, the motor RPM will normally be higher than the prop RPM, but it is the prop RPM which is being measured and quoted, so the gear ratio is not really relevant.

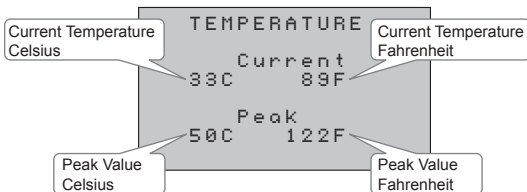
Please DON'T use optical tachometer with fluorescent lighting which will give false readings, such as 3000 or 3600 RPM.

The optical RPM sensor will function over a large range of propeller sizes, RPM and lighting conditions. It is even able to measure 40mm diameter model boat props spinning in the air. Experiment with different sensor positions. In some cases, best results may be achieved by testing in the shade. With the motor running, move the optical sensor to about 10~20 cm from the propellers, taking all due care. Small propellers may require closer positioning. The number of propeller blades should also be set. Wrong settings will affect RPM readings for the optical tachometer. For example, fitting a three bladed propellers, but leaving the Field Master 7 blade figure at 2 would cause the optical tachometer to read 50% high.

## TEMPERATURE

There is a temperature sensor available, so you can monitor the temperature of battery, motor, electronic speed controller, etc. When no sensor is connected, display will indicate 0.0°C and 32°F

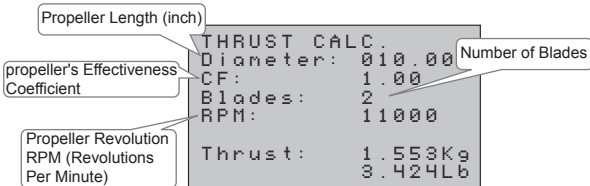
- ▶ Connect temperature probe to Field Master 7
- ▶ Press 'MODE' to select "TEMPERATURE"
- ▶ Press "ENTER" to confirm selection



## THRUST CALCULATOR

The thrust calculator can estimate the thrust of an airplane, there are many variances and some known factors.

Lets assume we have an airplane and this is its first flight. We know the size of the propeller and we can do a static full throttle rpm check with a tachometer on the ground. We can now add these known figures into Thrust Calculator. By the fact that you can verify thrust it becomes possible, to estimate the general power of the airplane in advance. This will give you more knowledge about your plane and the power characteristics to make your first flight less challenging and safe, after all you may have other flight characteristics to deal with. This should help you to estimate flight take off distances, recovery from a stall. For more experienced pilots this will enable them to calculate if the plane is going to be able to hover. It can show you what changes to the power calculation will be affected by a different size propeller.



## CF (Propeller's Effectiveness Coefficient Table)

<b>Manufacturer</b>	<b>CF</b>
Standard propeller	1.00
APC propeller	1.06
APC SF	1.50
APC W propeller	1.09
MenzS propeller	1.03
Bambula clubman	1.02
Bolly clubman	1.04
Cox	1.10
GWS HD	0.75
GWS RS (SF)	1.10
Smart	1.02
Zinger Wood	1.00

The static thrust calculation is taken from the October 86 AMA magazine, air density is based on 29.92 in Hg, and propeller pitch is not used in this calculation. Practical tests revealed very little if any change in thrust due to pitch variation at the same RMP.

It is believed that this is partly due to any increase in thrust being negated by blade stalling and a more turbulent influx area with increased pitch.

This obviously only applies to static conditions, not flying conditions.

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